

Scientific Report 2013

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Cover: The image was used for the announcement poster of the workshop 'Modeling with Measures: from Structured Populations to Crowd Dynamics' that was held at Lorentz Center@Snellius in August 2013.

The image shows an individual-population interaction at lake Niaivasha, Kenya. It is symbolic for the field of measure-valued dynamical systems that the workshop aimed to advance.

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Design: SuperNova Studios, Amsterdam
Printing: Druk.Tan Heck, Delft

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From the Director

The year 2013 was the first full year in which the Lorentz Center organized activities in two venues, Lorentz Center@Oort and Lorentz Center@Snellius. Due to saturation of the Oort venue, the yearly number of workshops organized at the Lorentz Center has been approximately 45 for a couple of years. This number jumped to 65 in 2013: 42 Lorentz Center@Oort workshops and 23 Lorentz Center@Snellius workshops. Especially also given the enthusiastic responses both from organizers and participants of the Lorentz Center@Snellius workshops, we can indeed say that the opening of the Lorentz Center@Snellius venue has been an instant success.

It is interesting to notice that different communities responded differently to the possibility of organizing a Lorentz Center@Snellius workshop. The Snellius venue seemed to be especially suitable for astronomers and mathematicians: together they organized two-thirds of the Lorentz Center@Snellius workshops ($15=7+8$). Of course, one cannot draw any statistically significant conclusions from only one year of organizing Lorentz Center@Snellius workshops, but one certainly can say that the Snellius venue has immediately proved its added value with respect to the 'classical' Oort venue: the smaller and somewhat more intense setting of the Lorentz Center@Snellius workshops clearly stimulates the organization of a different kind of workshop. The two venues are absolutely not in competition: with the Lorentz Center@Snellius venue, the Lorentz Center has broadened its spectrum of activities it may organize - indeed, exactly as planned.

The year 2013 also was the year in which the Lorentz Center organized four inspiring weeks dedicated to stimulating the interactions between academic and industrial researchers, in the form of *Study Groups* - or workshops - *with Industry*. In 1968 the first *Study Group Mathematics with Industry* was organized at the University of Oxford. Inspired by the enthusiasm about these study groups organized in the UK, Canada and Australia, the Dutch mathematics community started to organize annual study groups in the Netherlands in 1998. The basic ideas behind these study groups has not changed since the sixties: representatives from industry present problems on the first day of the study group, and then - mostly young - scientists work together for a week with the industrialists to brainstorm ideas and work towards practical solutions. At the initiative of the Dutch Foundation for Fundamental Research of Matter FOM and the Dutch Technology Foundation STW, the Lorentz Center imported the concept of the study group into physics and organized the first *Physics with Industry* study group/workshop in 2010. It was a great success. Since then, FOM, STW and the Lorentz Center yearly co-organized *Physics with Industry* workshops. This year, the concept of the study group was taken to a next level, again together with STW: the first study groups *Life Sciences with Industry* and *ICT with Industry* were organized at the Lorentz Center in 2013. Since the mathematicians also organized their yearly study group in Leiden, the Lorentz Center indeed hosted a total of four *with Industry*-workshops in 2013! Of course, the Lorentz Center will continue its *with Industry*-activities in the upcoming years.

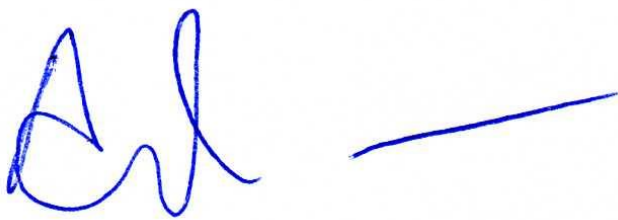
Although it is not part of its core activities, the Lorentz Center is very aware of its possibilities and responsibilities in encouraging the outreach of science and scientists to the general public. This is not at all a simple endeavor, and we are very happy that we have been able to start up a collaboration with the Leiden Boerhaave Science Museum. Since 2013, public lectures are being held at the Boerhaave Museum by participants of (selected) Lorentz Center workshops. The first Boerhaave public lecture on the workshop *The Antikythera Mechanism: Science and Innovation in the Ancient World* was an immediate success, with 160 persons in attendance and extensive national media attention. Other public Boerhaave-Lorentz lectures were organized around the workshops *The Future of Science and Arts Collaborations* and *Cold War Science* - these again attracted large audiences.

Most important of all, 2013 also was a year in which we organized many exciting workshops at the Lorentz Center, with topics ranging over the full Lorentz Center spectrum of scientific themes. Especially the astronomy community was very active in 2013, organizing high impact workshops like *Imaging the Low Frequency Radio Sky with LOFAR* and *Magellanic Cloud Star Formation*. The Lorentz Center organized excellent workshops in theoretical physics, such as *Universal Themes of Bose-Einstein Condensation* and *Hidden Order, Superconductivity, and Magnetism in URu₂Si₂*, and

fundamental informatics workshops such as *Normative Multi-Agent Systems: NorMAS 2013* and *SIMCO - Set-Oriented and Indicator-Based Multi-Criteria Optimization*. Within mathematics, stimulating workshops at the intersection with novel application areas were organized, like *Mathematics of Information-Theoretic Cryptography* and *Statistical Network Science with Applications*. We had a particularly strong evolutionary program in the life sciences, with *Eco-Evolutionary Dynamics in a Changing World* and *Towards an Evolutionary Theory of Nongenetic Effects*. The computational sciences emphasized their relevance within the Lorentz Center program with workshops like *Modeling Kinetic Aspects of Global MHD Modes* and *DFT-Based Multilayer Methods for Nanoscale Systems*. Our NIAS-Lorentz collaboration with the *Netherlands Institute of Advanced Studies NIAS* is more and more developing into one of the pillars of our workshop program, with the workshops *The Antikythera Mechanism* and *Cold War Science*, respectively *Models of Consciousness and Clinical Implications* - by the distinguished NIAS-Lorentz Fellow Henk Barendregt - and *Modelling Meets Infant Studies in Language Acquisition*, as appealing examples of workshops organized at the intersections between the sciences and humanities, respectively the social sciences. Finally, it is good to note that 2013 also is a year in which the scientific spectrum of the Lorentz Center workshop program corroborated its continuous expansion, with workshops such as *Recent Insights in Mitochondrial Evolution Applied to Health and Ageing* and *Clinical Relevance of Circadian Rhythms*, that have a strong focus in the medical sciences, and *Complexity Models for Systemic Instabilities and Crises* and *Econophysics and Networks Across Scales* that entered into the field of economics.

Of course one cannot increase the number of workshops organized at the Lorentz Center by half without increasing its staff. However, since 2011 there only was a marginal increase in the total number of staff members of the Lorentz Center: from 11 to 12, but with an almost negligible associated growth in fte (fraction of full-time employment) from 7.3 to 7.5. The Lorentz Center always has been working with a relatively small staff, but, the recent growth in the workshop program has put this staff under quite some pressure. I'm very thankful that the Lorentz Center has a great team of efficient professionals who can handle this situation - it's truly a pleasure to be part of this.

The Lorentz Center has been doing very well, and this year again several exciting plans for the future evolution of the Lorentz Center have been sketched. Nevertheless, it is obvious that investing in the infrastructure of the Lorentz Center — and especially in its staff - must be a crucial ingredient of those plans.



Arjen Doelman
Director Lorentz Center

April 2014

About the Lorentz Center

The Lorentz Center organizes international meetings - workshops - at the frontiers of science. Scientific progress thrives on diversity and antithesis. We therefore promote an open exchange of ideas, and discussions are central to our workshops. We provide a highly stimulating environment in which scientists can interact within or across fields, topics and levels of training, and where collaborations can bloom.

The Lorentz Center's scientific program is broad in scope, covering all disciplines in the natural sciences and technology. Our workshops may be monodisciplinary or interdisciplinary, bringing together scientists with different perspectives and backgrounds. The interdisciplinary workshops may also bridge with the social sciences and humanities, through our collaboration with the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS). In addition, the NIAS-Lorentz Program includes Distinguished Lorentz Fellows and NIAS-Lorentz Theme Groups, where fellowships at the NIAS campus are combined with a workshop at the Lorentz Center. The Lorentz Center organizes other scientific meetings as well, like summer schools, consortia meetings, or study groups on industrial problems.

The Lorentz Center offers scientists a retreat where they can fully focus on science. Our workshops have proved so popular that we've been able to open a second venue in 2012: the Lorentz Center@Snellius is for groups of up to 25 scientists, whereas Lorentz Center@Oort hosts up to 55. Everything is close at hand at both workshop venues. We have meeting rooms for lectures, plenary or subgroup discussions, and a common room for a drink and a chat. Participants have their own office space to get down to work: exploring ideas, mailing or revising a talk. Both venues are located in the Leiden Bio Science Park, across the street from each other. The campus also hosts the world-renowned research groups of Leiden University's Faculty of Science. As the Netherlands is a compact country, several universities and research institutes are within an hour's drive.

Any scientist from any country – whether academic or from the private and public sectors – can apply to organize a workshop at the Lorentz Center. The application procedure is simple and fast, so you can have your workshop within a year. The applications are peer-reviewed by one or more of our seven scientific advisory boards: Astronomy, Computational Science, Informatics, Life Sciences, Mathematics, Physics and the NIAS-Lorentz advisory board. These assess the quality and relevance of the scientific topic, the prospective key participants as well as the workshop program, including the time allocated for discussion. This approach has resulted in an international reputation for state-of-the-art science performed in a highly interactive and open atmosphere that effectively stimulates collaborations afterwards.

The Lorentz Center has firmly established itself as the coordinator of year-round workshops in the sciences, typically lasting a week. We take care of all the practicalities, before, during and after the workshop, and we can help you pinpoint your goals and designing your workshop program accordingly. The Lorentz Center also provides financial support for its workshops, enabling organizers to stage workshops on a "no-frills" basis. We pride ourselves in a professional service and a welcoming atmosphere, allowing organizers to focus on the scientific content of their workshop and have fun.

Funding and Figures for 2013

The Lorentz Center's total workshop budget in 2013 was near € 1.350,000, of which a third was raised by the workshop organizers from additional funds. We are supported by the Netherlands Organization for Scientific Research (NWO), the Foundation for Fundamental Research on Matter (FOM), the Technology Foundation STW, and Leiden University. Other sponsors include the Royal Netherlands Academy of Arts and Sciences (KNAW) for the NIAS-Lorentz Program and the Lorentz Fund for theoretical physics workshops.

Lorentz Center funding average per week@Oort	€ 16,800
Lorentz Center funding average per week@Snellius	€ 8,600
Funding by organizers average per week@Oort	€ 6,900
Funding by organizers average per week@Snellius	€ 6,100
Weeks of occupancy	66
Weeks@Oort	43
Weeks@Snellius	23
Workshops	59
Schools & training	3
Study groups with industry	4
Participants	2,734
PhD students	1,053
Dutch	995
Auditors	120
Announcees	551
Babies	3
Board members	88
Poster designer	1
Intern students	3
Staff	8
Workshop posters	12,000
Notebooks	6,200
Pens	6,700
Mugs	2,100
Cups of coffee	30,200
Cookies	33,000
Kilograms of cheese	155
Boat trips	38
Conference buses	48
Taxi rides	550
Bicycles	30
Hotel nights	8,194

Scientific Advisory Boards during the year 2013

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Erik Verlinde	University of Amsterdam
Pieter Rein ten Wolde	FOM Institute AMOLF
Wim van der Zande	Radboud University Nijmegen

NIAS-Lorentz Advisory Board

The collaborative NIAS-Lorentz Program promotes innovative research that brings together perspectives from the Social Sciences and Humanities with those of the Natural Sciences and Technologies. The NIAS-Lorentz advisory board oversees the activities of the Program, including the selection of workshops taking place at the Lorentz Center as well as the NIAS Lorentz Theme Groups and Distinguished Lorentz Fellows residing at NIAS.

Chair

Sijbolt Noorda University of Amsterdam

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Rineke Verbrugge	University of Groningen

Lorentz 'This Week's Discovery' Lectures 2013

The 'This Week's Discoveries' lunch colloquia highlight recent breakthroughs by scientists of Leiden University's Faculty of Science. The Dean of the Faculty regularly invites prominent participants of Lorentz workshops to present their discoveries for this multidisciplinary audience.

February 12

Challenges to Move Forward a Predictive Ecology

Stephanie Jenouvrier, *Woods Hole Oceanographic Institution*

March 12

Glass: the Cinderella Problem of Low-Temperature Physics

Anthony Leggett, *University of Illinois*

March 12

Superfluid Atomic Gases - Ultracold, Ultra Dilute

Wolfgang Ketterle, *Massachusetts Institute of Technology*

April 16

Small Contra Large: Implications of Ontogenetic Asymmetry for Fisheries Management

André de Roos, *University of Amsterdam*

May 14

The Murchison Widefield Array: the Hunt for the First Luminous Objects in the Early Universe

Steven Tingay, *Curtin Institute of Radio Astronomy*

May 28

Early Warning Signals of Interbank Collapse

Diego Garlaschell, *Instituut-Lorentz for Theoretical Physics, Leiden University*

September 24

New Types of Stellar Explosions and Their Progenitors

Andy Howell, *University of California*

October 29

Kinetically trapped Dye Aggregates - New Perspectives for Photophysical Investigations and Materials Design?

Frank Wuerthner, *The University of Würzburg*

December 3

Shake, Rattle and Roll: New Discoveries in Fusion Plasma Turbulence

Jonathan Citrin, *FOM Institute DIFFER*

December 17

Testing Bell's Inequality with Cosmic Photons

David Kaiser, *Massachusetts Institute of Technology*

Plasma to Plasma!

07 – 11 January 2013 @Oort

At first sight, it may seem a strange combination, these two kinds of plasma: cytoplasm in a living cell and the plasma in a gas discharge. Gas plasmas are cocktails of active species and fields: free radicals like OH; reactive molecules like NO, O₃; photons from the IR to the UV, electrical fields, etc. All these things can have a big impact on living cells and tissues, and the plasma delivers them to the cell membrane.

Explorative research has demonstrated that gas plasmas can kill bacteria, while leaving human cells intact, even stimulating the latter to proliferate faster. It has also been shown that cancer cells are much less resistant to plasma exposure than healthy cells. Very recently, electrical fields (no plasma present) have been demonstrated to possess the potential to stimulate human cell proliferation. Finally, gram-positive and gram-negative bacteria display differences in the resistance to plasma treatment, and plasmas are also able to tackle spores. The main difference between these two bacterial families is the structure of the cell membrane. Also, the membranes around human cells and around their internal organelles are very different from those around bacteria. This suggests that the cell membrane is the key element: the boundary between the gas plasma and the cytoplasm in the cell.

The findings reported above have led to the emergence and subsequent explosion of a new scientific discipline: Plasma Medicine. This discipline explores the perspectives of the application of plasmas for various medical treatments: skin disinfection, (burn) wound healing, fighting of chronic ulcers, cancer treatment, tooth bleaching, and so on. The clinical results are very encouraging: plasmas indeed seem to offer perspectives for lesions and diseases where other treatments fail.

However, up to now, most research in Plasma Medicine has concentrated on limited medical and biological aspects: studies of cell cultures on the one hand, and (semi-)clinical studies on the other hand. Many aspects of the process have remained largely unstudied:

- The dynamics of the plasma itself: what does it deliver to the cells?
- The 2-way interaction between the plasma and the flow field: how is the flow field modified by the plasma, and how do the flow field and interaction with the cells feed back to the plasma?
- The role of cavitation: is cavitation induced by the plasma, and which role does it play in the whole picture?
- The biophysics of the plasma/cell membrane interface: what are the mechanisms by which the plasma produced species and fields "enter" the cells?
- The modification of the surroundings and the interior of the cell: which species are created and/or eliminated by which plasma "deliverable", and how are the liquids modified?

The answers to these questions will yield a much better understanding of the physics of the plasma-plasma interaction.

Goal of the workshop

The overall objective of this workshop was to set the research agenda for the near future (5-10 years) in the direction of the understanding of the interaction, through the cell membrane, between the plasma of a gas discharge and the cytoplasm in living cells. The focus will not be on advancing medical application, but on fundamental understanding of the processes that make it work.

Conclusion of the workshop

49 people from all over the world attended the workshop. The atmosphere was friendly, with in-depth discussions over the coffee breaks. After each presentation, at least 15 minutes, but sometimes well over 30 minutes of discussion followed. Scientific conclusion is that plasma medicine is dominated by transport, transport and transport: from the plasma to the air flow and the liquid flow to the membrane, which is tickled and then alters its transport properties. This insight has been the basis for a "Vrij FOM-programma", which has been submitted.

Herman Clercx (Eindhoven, Netherlands)

Gerrit Kroesen (Eindhoven, Netherlands)

Vinod Subramaniam (Enschede, Netherlands)

Miles Turner (Dublin, Ireland)

Trends in Arithmetic Geometry

14 – 18 January 2013 @Oort

The workshop focused on recent developments in arithmetic geometry in the broad sense, but with a focused emphasis on two themes: “twisted sheaves” and “singularities in characteristic p ”. The aim was twofold: to bring together specialists from all over the world to share the latest developments, discuss new ideas and start new collaborations, and to make the subject more accessible to PhD students and young postdocs through lecture series and Q&A sessions. Here are some of the highlights.

In the broad area of arithmetic geometry we had inspiring lectures by Laurent Moret-Bailly and Johan de Jong on fundamental questions in algebraic geometry. Moret-Bailly discussed recent work with Ofer Gabber and Philippe Gille around the topology of torsors over valued fields. De Jong talked about ongoing work in homological algebra and its implications on the existence of Quot schemes in large generality.

On the more arithmetic side of the subject we had two brilliant talks with Davesh Maulik sharing his results on the Tate conjecture for K3 surfaces and Olivier Wittenberg explaining his work with Esnault and Levine on the index of varieties over local fields.

The focus area of *twisted sheaves* was mostly covered by Max Lieblich, one of the founders of this area. In a crystal clear, enthusiastic series of 3 lectures he started from the basic theory of twisted sheaves and worked towards the ideas behind some of their spectacular applications. The level and pace were just right, so that the lectures were both useful for the graduate students and postdocs, as well as for the more experienced algebraic geometers in the audience.

The second focus area *singularities* in characteristic p , saw lectures by Kevin Tucker on F-singularities, and by André Chatzistamatiou & Kay Rülling on Witt-rational singularities. Karl Schwede built upon Tucker's lectures to discuss some surprising geometric applications of F-singularities, and Amaury Thuillier showed how one can use Berkovich spaces to understand the combinatorics of resolutions of singularities in arbitrary characteristic.

The unity of the subject of arithmetic geometry was underlined by some of the cross-connections between the various discussed subjects. For example, the lecture of Thuillier formed a bridge between the “singularities in characteristic p ” theme and the lectures on Berkovich spaces by Poineau and Ducros. The “stacky” ideas in Romagny's talk were closely related to the lectures of Lieblich, and the recent developments on rational points over discretely valued fields were central in the talk of Wittenberg and in the results on the period-index problem in the lectures by Lieblich. Frequently, the same problems and objects appeared in different talks throughout the conference, approached from several angles and studied by various techniques. This greatly stimulated discussions between the speakers and participants.

Besides the programmed lectures, we had programmed a rather experimental series of Q&A sessions for the young participants. This was a huge success, in large part thanks to the enthusiasm of both the young mathematicians and the lecturers who took pride and pleasure in answering questions on hugely differing levels. On popular request, an extra session was organized on Friday, for which the students could choose to invite any participating senior mathematician. They decided to nominate Johan de Jong, who gave them a head-start by explaining some of the ideas for his lecture later that day.

The atmosphere was very friendly and stimulating. Both the lectures as the informal discussions were of high quality, as was expressed repeatedly by both senior and junior participants.

Finally, the staff of the Lorentz Center was most helpful and efficient. In particular, when the entire science campus was shut down due to a power incident on the first day of the conference, the Lorentz

Center staff managed to organize an alternative conference location (including lunch and coffee) for about 60 participants in a record-breaking 10 minutes. Thanks to their decisive action we could continue the conference with only minor changes to the schedule.

Organizers:

Johannes Nicaise (Leuven, Belgium)

Lenny Taelman (Leiden, Netherlands)

Scientific committee:

Bas Edixhoven (Leiden, Netherlands)

Hélène Esnault (Duisburg-Essen, Germany)

Ben Moonen (Amsterdam, Netherlands)

Mircea Mustață (Michigan, USA)

Imaging the Low Frequency Radio Sky with LOFAR

14 – 18 January 2013 @Snellius

Scientific Motivation

This workshop brought together 43 astronomers within the LOw Frequency ARray (LOFAR) survey team to exchange expertise and ideas on how to reduce and analyse LOFAR data. LOFAR is a new interferometric array based in the Netherlands, but with international stations, that operates between 10 and 250 MHz, opening a new frequency regime to astronomers. The main challenge with LOFAR imaging is to ensure that high dynamic range thermal noise limited images with a stable point-spread function can be made over the entire accessible sky and over LOFAR's full frequency range. This requires resolution of serious issues that were being addressed by working groups of 4-8 people. The workshop started with a review of the entire status of the system and associated software before breaking into working groups. The entire body of participants reconvened each day for a status update.

Scientific Outcome

The topics of the working groups are listed here along with the results from the work conducted within the scope of this workshop.

- **Long Baseline Observations:** Developed a complete method for how to process long baseline observations.
- **Ionospheric Effects:** Methods of measuring ionospheric effects and subtract its imprint from the scientific data were demonstrated. Possible software implementation of these methods in the data reduction pipeline have been tested.
- **Large Scale Galactic Structures:** Structured a method to effectively test the demixing (removal) of strong sources in the sidebands of observations.
- **Source Flux Recovery:** Tested the new imaging software against the old, and also tested two different types of source extractors. LOFAR appears to be recovering source fluxes very well within the central ± 2 degrees of the field of view.
- **Cookbook Tutorial:** Wrote a tutorial to help new users to the instrument.
- **Deep Field XMM-LSS:** Produced the first images from LOFAR of the XMM-LSS field, showing that low-elevation observations are possible with the High Band Antenna (HBA) component of LOFAR.

Overall, the workshop was a success not only for the individual working groups but for the larger group as well, with discussions on how to proceed and work more effectively towards creating the best images possible of the low frequency radio sky with LOFAR.

Organization/Format

The space provided in the Lorentz Center@Snellius venue worked exceptionally well for the program. The large space for lectures held everyone, yet there were enough offices and smaller working areas for the splinter groups to gather and be productive. Every group utilized (and loved!) the chalkboard/whiteboard walls. In addition, the way the program coordinators responded to an evacuation of the building was wonderful. Within half an hour they had found another venue for the day and arranged lunch and then snacks and drinks for later on. Many participants commented on how well the workshop recovered from being evacuated.

Emanuela Orru' (Dwingeloo, Netherlands)
Leah Morabito (Leiden, Netherlands)
Neal Jackson (Manchester, United Kingdom)
Huub Röttgering (Leiden, Netherlands)
Michael Wise (Dwingeloo, Netherlands)

High-Mass Star Formation: from Large to Small Scales in the Era of Herschel and ALMA

21 – 25 January 2013 @Oort

High-mass stars are key ingredients for a number of astrophysical processes; from stirring the gas in their surroundings to forming the heavy elements. They are key drivers of the evolution of galaxies, and it is their light that we use to study the distant universe. However, to date, we still do not understand how they form. High-mass stars, are those more massive than about 10 times the mass of the Sun. They are rarer than their lower mass counterparts, and their formation timescales are so short that they are already on the main-sequence by the time they are visible at optical wavelengths. Add to this the increasing complexity due to high-mass stars forming in clustered environments, and it is clear that high-mass star formation is a much more complex problem to tackle than isolated low-mass star formation. While great strides have already been made, in order to move the field forward we need to combine detailed studies with understanding of global (Galactic) properties. The unprecedented sensitivities of the Herschel space satellite and the Atacama Large Millimeter/Sub-millimeter Array (ALMA) provide us with the tools to do this properly.

The processes involved in the formation of high-mass stars happen deeply embedded within a dense core of material. Observing these processes requires observing the dust and gas at long wavelengths; from radio to far-infrared. The combination of high spatial resolution and high sensitivity with a fast mapping speed has allowed Herschel to identify and study large numbers of protostars and young stellar objects. Sampling the peak of the spectral energy distribution of these sources, Herschel is revealing the intricate nature of star formation and the impact it has on its environment. With ALMA recently inaugurated and moving rapidly to full operations we will soon be able to probe high-mass star formation (HMSF) at unprecedented resolution and sensitivity. This will provide a wealth of new insights into HMS in our Galaxy and throughout the universe.

During the workshop we discussed future research plans in HMSF. Theorists, modellers and observers came from all over the world, with the majority based in the EU. Our aim was to provide a platform for the whole community to discuss future goals within a collaborative environment. Talks were given about current research being conducted. Topics ranged from individual protostars to the impact of Galactic scale processes, looking at the properties of the gas as well as the dust. Interspersed in these talks was plenty of time for discussions in both large and small groups.

There were productive discussions identifying the important questions about high-mass star formation that ALMA is well suited to address, and avenues which will require large-scale, coordinated effort to push forward. Specifically, we explored the possibility of observing a common species amongst different science cases. For example, methyl cyanide seemed a suitable candidate: its radiatively decoupled K-ladders give an excellent diagnostic of temperature, and there are many transitions available throughout each of the ALMA bands. This will build on the science from each individual study and aid inter-comparison between observations across a wide range of parameters and projects.

We were very pleased with the enthusiastic and constructive discussions held during the workshop. We established a number of open working groups to act as a focus for the exchange of information about ALMA proposals and projects, and to aid in building future collaborations. This will enable the European HMSF community to go forward in a coordinated fashion, and will ensure a greater legacy quality to the data that we will obtain over the next few years.

Gary Fuller (Manchester, United Kingdom)

Lex Kaper (Amsterdam, Netherlands)

Pamela Klaassen (Leiden, Netherlands)

Steven Longmore (München, Germany)

Joseph Mottram (Leiden, Netherlands)

Floris van der Tak (Groningen, Netherlands)

A New View of Accretion onto Sgr A*

21 – 25 January 2013 @Snellius

Although astronomers and cosmologists typically assume we do not occupy a privileged place in the universe, our Milky Way Galaxy appears to be an exception. While most supermassive black holes (SMBH) in the local universe accrete at a small fraction (10^{-7} – 10^{-5}) of the rate of more luminous quasars, Sgr A*, the SMBH in our Galactic center, is the most under-luminous black hole we know of—a factor of 10^{-9} below its canonical maximum luminosity. But what makes Sgr A* so special?

To address this question, in 2012 we performed an unprecedented 3 Megasecond observing campaign with the *Chandra* High-Energy Transmission Grating (HETG) Spectrometer in concert with numerous multiwavelength programs (coverage from radio to gamma rays). This *Chandra* X-ray Visionary Project (XVP) was designed to have a lasting impact on our understanding of our Galaxy and the physics of black holes.

The aim of the meeting at the Snellius Center was to bring together leaders and members of our seven working groups (WG) and various multiwavelength programs. We identified the following goals that, if met, would signal a successful workshop:

- WG leaders are updated on the progress of the entire project and agree with the overall collaboration strategy for science exploitation and output
- individual WGs make significant progress on their science, and come up with a coherent strategy for their science plans, including data products and publication plans
- an updated catalog of all data products and results to date are presented to the larger XVP collaboration, and disseminated via the XVP website
- a coherent strategy for observations of the impact of G2 is developed, utilizing the collaborative structures already in place from the XVP

Each of these goals was indeed accomplished and the collaboration continues to work toward realizing the full potential of this phenomenal data set.

Specifically, the meeting produced several important developments: One of the most crucial was the creation of a flexible database of all available multiwavelength light curves of the Galactic center from 2012. This database is particularly useful for cross-correlation of flares at different energies, which can distinguish between models for the physical mechanisms that drive the flares, and inform the distribution of the flare population (e.g., see Neilsen et al. 2013). This database will also be useful in constraining flare and accretion theory for Sgr A* (e.g., Dibi et al. 2014). Another critical moment came when one WG noticed that Sgr A*'s quiescent emission was mostly consistent with a Poisson process. This realization led to the discovery of a small amount of excess X-ray variability from the black hole. Ultimately we discovered that results from X-ray spectroscopy, timing, imaging, and statistical analyses all converge to tell us that $\sim 10\%$ of the quiescent emission is actually contributed by undetected flares.

In addition, we learned that the X-ray spectrum from *Chandra* would allow us to conclusively refute claims that the extremely faint X-ray source is not actually Sgr A*, but a cluster of active stars (published by Wang et al. in *Science* in 2013). Early discovery of flares from NuSTAR, in one case overlapping with flares detected during the *Chandra* XVP, opened the prospect for using these observatories in concert to perform detailed timing analysis (recent results on NuSTAR's first flare discovery can be found in Barrière et al. 2014). Other exciting multiwavelength developments included hints of spectral evolution in the NIR, resolution of Sgr A*'s spatial scale in the radio, and progress on VLBA capability in anticipation of the Event Horizon Telescope, which aims to resolve the shadow of the supermassive black hole.

The meeting took place over five days. Each day was structured to allow sharing of results and projects, as well as lots of time to work. For those who were not able to attend, we posted nearly

real-time updates from our meeting to the collaboration website. We started on the first day with a basic overview of the collaboration structure and policies, as well as a description of the *Chandra* HETG and multiwavelength campaigns; this was followed by seven individual talks (~25 min each) describing each of the working groups, their mandate, science scope/goals, and recent progress. Days 2, 3, and 4 began with focused WG meetings, followed by plenary discussions. Each of these finished with one or two talks describing multiwavelength monitoring efforts, with particular focus on the infrared, radio, and higher energies (e.g., those probed by HESS and the newly-launched NuSTAR). The final day of the workshop shifted to a discussion of future plans and prospects, with a series of summary talks from the WG leads, as well as future observing campaigns (some focused on the G2 encounter). This format, which emphasized only a few talks and lots of time to work, was far more invigorating than the normal conference schedule.

The Lorentz Center@ Snellius venue was perfect for this workshop, which focused on a combination of group discussion/talks and smaller break-out discussions. The space (the main room, the lounge, and the individual offices) and the staff (Gerda Filippo, in particular) were greatly appreciated by all those who attended. Thank you!

Materials developed during the workshop (proprietary and non-proprietary), as well as developments since the meeting, can be found at the Sgr A* webpage: www.sgra-star.com.

Working Groups: Science Steering Committee; Chandra Data Products; Accretion Flow Quiescent Spectra; Central Parsec Diffuse Spectra; Flares, X-ray Properties; Flares, Multi-wavelength Properties; Flares, VLBI/EHT Observations/Constraints on Geometry; Non-Sgr A* Studies; Theory.

Publications:

1. "Chandra/HETGS Observations of the Brightest Flare Seen from Sgr A*," M.A. Nowak, J. Neilsen, S.B. Markoff, F.K. Baganoff, D. Porquet, N. Grosso, Y. Levin, J. Houck, A. Eckart, H. Falcke, L. Ji, J.M. Miller, Q.D. Wang. *ApJ*, 2012, 759, 95 (NASA ADS, arXiv:1209.6354)
2. "Dissecting X-ray-emitting Gas around the Center of our Galaxy," Q. D. Wang, M. A. Nowak, S. B. Markoff, F. K. Baganoff, S. Nayakshin, F. Yuan, J. Cuadra, J. Davis, J. Dexter, A. C. Fabian, N. Grosso, D. Haggard, J. Houck, L. Ji, Z. Li, J. Neilsen, D. Porquet, F. Ripple, R. V. Shcherbakov. *Science*, 2013, 341, 981 (NASA ADS, arxiv:1307.5843)
3. "A Chandra/HETGS Census of X-ray Variability From Sgr A* During 2012," J. Neilsen, M. A. Nowak, C. Gammie, J. Dexter, S. Markoff, D. Haggard, S. Nayakshin, Q. D. Wang, N. Grosso, D. Porquet, J. A. Tomsick, N. Degenaar, P. C. Fragile, R. Wijnands, J. M. Miller, F. K. Baganoff. *ApJ*, 2013, 774, 42 (NASA ADS, arxiv:1307.5843)
4. "Toward the event horizon—the supermassive black hole in the Galactic Center," H. Falcke, S. B. Markoff. *Classical and Quantum Gravity*, 2013, 30, 4003 (NASA ADS, arxiv:1311.1841)
5. "NuSTAR Detection of High-energy X-Ray Emission and Rapid Variability from Sagittarius A* Flares," N.M. Barri'ere, J.A. Tomsick, F.K. Baganoff, S.E. Boggs, F.E. Christensen, W.W. Craig, J. Dexter, B. Grefenstette, C.J. Hailey, F.A. Harrison, K.K. Madsen, K. Mori, D. Stern, W.W. Zhang, S. Zhang, A. Zoglauer. *ApJ*, 2014, 786, 46 (NASA ADS, arxiv:1403.0900)
6. "Exploring Plasma Evolution During Sagittarius A* Flares," S. Dibi, S. Markoff, R. Belmont, J. Malzac, N. M. Barri'ere, J. A. Tomsick, *MNRAS*, *submitted*

Frederick Baganoff (Cambridge, USA)

Geoffrey Bower (Berkeley, USA)

Charles Gammie (Urbana, USA)

Andrea Goldwurm (Gif-sur-Yvette, France)

Sera Markoff (Amsterdam, Netherlands)

Michael Nowak (Cambridge, USA)

Study Group Mathematics with Industry

28 January – 01 February 2013 @Oort

The Study Group Mathematics with Industry is a combined industrial-academic week where mathematics is used to tackle industrial problems. It is organized annually in The Netherlands, each year by a different university. The format follows the original Oxford model, dating back to 1968, which is used worldwide in similar study groups. The study groups have become an internationally accepted means of technology and knowledge transfer between academic mathematicians and industry.

Six companies have presented problems on Monday: Nedcoffee BV, Heineken, TNO, Fytagoras, Philips and Rijkswaterstaat. About 75 mathematicians and representatives from the companies and organizations have tackled each problem in smaller groups from Tuesday through Thursday. On Friday obtained problem solutions and recommendations for further research have been presented.

The cooperation has been fruitful. Heineken for instance has realized what kind of specialist they need for tackling their problem. Currently a student from Operations research is doing an internship at Heineken, his research topic having been based on the outcome of the recommendations of the study group. Cooperation of mathematicians with people from Fytagoras has been intensified. A simple solution to the problem of Nedcoffee has been implemented.

Reports on the work on the respective problems have been written after the workshop. They will be published as scientific proceedings. For a better dissemination of the aims and work of the study group within society, the reports are being rewritten by a professional for the general public and they will be published in that form as well.

The participants have worked on the problems with enthusiasm: everyone has worked till late in the evenings to push the results as far as possible. The environment of the Lorentz Center has been extremely hospitable and stimulating. Discussions have been facilitated by the fact that discussion and reflection rooms have been grouped per problem. The many social activities organized within the Lorentz Center enhanced continuation and liveliness of the discussions.

The organization of the study group has been facilitated by the professional support of the Lorentz Center Staff. The organizers further wish to thank the staff for their dedication and availability, and the Lorentz Center for their generous financial support. They also acknowledge financial support from NWO, STW, KWG and ECMI.

Markus Heydenreich (Leiden, Netherlands)

Sander Hille (Leiden, Netherlands)

Vivi Rottschäfer (Leiden, Netherlands)

Lotte Sewalt (Leiden, Netherlands)

Floske Spieksma (Leiden, Netherlands)

Frits Veerman (Leiden, Netherlands)

Evgeny Verbitskiy (Leiden, Netherlands)

C⁺ as an Astronomical Tool

04 – 08 February 2013 @Oort

The workshop intended to review, interpret and understand the use of the brightest sub-mm spectral line emission - that of C⁺ - as tracer of gas density and star-formation rate in galaxies. As a tracer for many different conditions in the interstellar medium, C⁺ allows to constrain the cloud microphysics such as the gas heating efficiency, the dust grain size distribution, the abundance of PAHs the electron density, i.e. the ionization degree, and the total gas density. During the workshop two main questions drove most of the discussion: What is the relative contribution of photon-dominated regions (PDRs), HII regions, diffuse clouds, shocks, and CO-dark molecular gas to the global C⁺ emission of a galaxy? And how reliably does the C⁺ emission measure the star-formation rate in the Milky Way and other galaxies?

With more than 50 participants, the workshop brought together experts on C⁺ observations and models with young researchers entering the field. A large fraction of the overall time was covered by 10 review and 23 short talks that were thematically grouped around specific questions. A poster session, time during extended lunch breaks and in three sessions with two parallel splinters was heavily used for discussions to identify questions that can be answered today and to identify the required input to answer the other questions in the future.

These discussions cleared the state in a rapidly evolving field providing a common level to all participants by summarizing the knowns and the unknowns of today. On the modelling side, it was easy to identify the missing pieces of information, mainly in terms of state-to-state reaction rates, the H₂ formation rate including the produced ortho/para ratio, and better constraints on the geometry of the sources. To model specific regions it is moreover required to obtain high-resolution maps of H₂ emission and better constraints on the structure of polycyclic aromatic hydrocarbons (PAHs) in the region. A consensus was also reached in the question of the excitation of C⁺. O and B stars were identified as the main source of energy establishing C⁺ emission as a star-formation tracer with a memory of about 100 million years. On the scales of normal-type galaxies, the different phases provide a convenient statistical mixture so that C⁺ can be used as a direct quantitative measure for the star formation activity unaffected by variations in the local gas conditions. A strong impact of metallicity changes is observed and expected, but a full quantitative model is still lacking for this effect as well as for the line emission deficiency in ultra-luminous galaxies.

More open points became obvious when dealing with the details of the microphysics for individual regions in the Milky Way. The heating efficiency, and consequently the C⁺ brightness, depends strongly on the unknown properties of the PAHs in the clouds. There was still a strong debate on the contribution of the different phases of the interstellar medium to the C⁺ emission, in particular the relative fraction of the CO-dark molecular gas, the contribution of turbulent dissipation regions to the C⁺ formation, and the pressure equilibrium between the different phases. The discussion identified observations of O⁺⁺, N⁺, atomic oxygen, and the total far infrared flux as critical complementary data needed to estimate the role of the different phases. These observations and the need for larger maps of C⁺ ask for new missions and observatories. Prospects and requirements for future possible air-borne and space missions were identified.

Therefore the workshop provided input to the planning of several new proposals, both for scientific missions and new model developments. The future will show how successful they were. The participants appreciated the workshop format that followed the normal Lorentz Center frame with more than one third of the total time available for open and coordinated discussions fed by the input from the reviews, contributed talks, and posters.

The comprehensive support from the Lorentz Center personnel provided a perfect framework to enable discussions focusing on the topic of the workshop. A possible follow-up workshop in the future, e.g. on [OI], should probably use the same concept.

Jonathan Braine (Bordeaux, France)
Maryvonne Gerin (Paris, France)
Simon Glover (Heidelberg, Germany)
Paul Goldsmith (Pasadena, USA)
Michael Kaufman (San Jose, USA)
Suzanne Madden (Gif-sur-Yvette, France)
Bhaswati Mookerjea (Mumbai, India)
Volker Ossenkopf (Köln, Germany)
Floris van der Tak (Groningen, Netherlands)
Thangasamy Velusamy (Pasadena, USA)

Hands-on Workshop on Computational Astrophysics

04 – 09 February 2013 @*Snellius*

Motivation

Over the last several years we have been working on the development of a generalized tool for speeding-up computational astrophysics code development. Our framework, called the Astrophysics Multipurpose Software Environment (AMUSE), enables researchers, but also advanced students, to quickly write production quality codes for performing simulations. Our environment is publicly available via <http://amusecode.org>.

In the workshop we aimed to bring experienced researchers together with graduate students and young postdoctoral level researchers to work together with expert software developers on key problems in multi-scale and multi-physics computational astrophysics. These problems would be implemented as scripts in the AMUSE framework. The AMUSE development team was available to assist in the numerical implementations.

The workshop

The workshop was attended by 22 participants divided into 6 teams with one experienced researcher, a junior researcher or graduate student and a member of the AMUSE development team. As two teams interests overlapped the participants decided to merge the team into one and work on their problem from two different angles.

Program

The main program consisted of a short talk in the morning to assemble all participants in the room. The rest of the day was focused on working on the problems. At the end of each day we had a short plenary session where the progress of each team was reported and discussed.

Impressions

The first day of the workshop we formed the teams and (re-) defined the problems. What follows is a list of the problems we tried to tackle, and the impressions of the team members:

1) Modeling planetary systems in star clusters

We wanted to simulate a planetary system around each star in a small cluster. We used mercury to simulate each planetary system with ph4 to simulate the cluster. We had no previous experience with AMUSE. After some installation problems and with some help from the AMUSE team we were able to write a working script and could show the cluster evolving at the end of the week.

2) Handling of multiples in a stellar cluster evolution

We worked on making the handling of close encounters and binary formation by the multiples module in AMUSE production ready. Sitting together we could quickly implement some new schemes and test the resulting simulation. The multiple module improved significantly during the workshop.

3) The retention of stellar winds in intermediate age star clusters

We combined Evtwin with the Fi sph hydrodynamics code.

4) Ionizing feedback from massive stars in a molecular cloud

5) Dynamics of self gravitating systems

The work done at the Meeting was pursuing two aims: one scope has been preparing a friendly driver to generate initial conditions for N-body simulations from a given density distribution in spherical symmetry. Capuzzo-Dolcetta prepared the mathematical scheme and D. Punzo prepared a Python program to do this, with the collaboration of I. Pelupessy. The final objective of this part of the work is to provide a subroutine available through the AMUSE environment. Another more applicative aim was to recheck some results already obtained by Capuzzo-Dolcetta and Spera (2013, in prep.)

showing that a violent collapse of an N-body system ($N=512$) initially unsegregated in mass leads to mass segregation on the collapse time scale, which is essentially the crossing time scale when starting from "cold" (zero virial ratio) initial conditions sampled in a homogeneous sphere. We used both the HiGPUs code (6th order Hermite's code by Capuzzo-Dolcetta, Punzo and Spera) and the PH4 code (4th order Hcermite's ode by McMillan) both operating in the AMUSE framework. We considered two populations of stars of different mass and the presence of a black hole. We noted the high speed and precision of HiGPUs, which was run on a laptop giving rapidly a set of simulation results which allow us to state that the violent mass segregation effect is a real feature, at least in the case studied. This part of work was mainly done by I. Pelupessy.

Finally we want to highlight the many comments we received about the ease of use and potential of the AMUSE framework. Several of the attending graduate students have continued their work with AMUSE. A number of arrangements were made for future collaborations.

Acknowledgement

The workshop organizers are very grateful to the Lorentz Center team that supported this workshop. Their skill and professionalism showed during all phases of the workshop organization. As scientific organizers organizing the workshop was a "breeze". Further, the new Lorentz Center@Snellius venue provided an ideal environment for productive interactions within and between the different teams.

Simon Portegies Zwart (Leiden Netherlands)

Steve McMillan (Philadelphia, USA)

Arjen van Elteren (Leiden, Netherlands)

Eco-Evolutionary Dynamics in a Changing World

11 – 15 February 2013 @Oort

Scientific background and motivation

Until recently, ecologists and evolutionary biologists mostly believed that the arrows linking their disciplines went one way: from ecology to evolution – at least on timescales of tens to hundreds of years. In recent decades, however, it has become clear that microevolution can in fact be rapid and amenable to study on human timescales, opening up the exciting possibility that evolution 'in action' dynamically affects ecology, and vice versa. This is of more than academic interest: a broad consensus is emerging that evolutionary processes cannot be ignored from a conservation perspective, given that the inability to adapt fast enough to environmental change often lies at the root of extinction, and hence biodiversity loss. Rapid evolution is also known to occur in invasive species and infectious diseases. Deeper understanding of eco-evolutionary mechanisms underpinning population dynamics and range shifts could improve our ability to both conserve the species we care about and control those deemed problematic.

Our Lorentz Center workshop thus aimed to (1) synthesize recent conceptual developments at the interface between ecology and evolutionary biology, (2) bring together theoreticians and empiricists working at this interface and (3) explore how an eco-evolutionary approach can help us better understand how species persist in changing environments.

The workshop

The Lorentz workshop was attended by 40 researchers from 11 countries, representing a good mix of theoreticians and empiricists as well as of "old wisdom" and "young and plastic brains". The first day was dedicated to getting to know each other and to introducing fundamental issues. Andrew Hendry (McGill University) provided a stimulating opening talk, which gave a broad overview of how contemporary evolution shapes ecological dynamics at the population, community, and ecosystem levels. In the afternoon, Jon Bridle (Bristol University) spoke about theoretical and empirical studies of evolution along smooth and patchy ecological gradients. This was followed by a plenary discussion, where the key questions and problems faced by this fledgling field were scoped. The second day delved deeper into conceptual issues, with presentations by Peter van Tienderen (University of Amsterdam) and Hanna Kokko (Australian National University). There were break-out sessions in the morning and afternoon, where small groups gathered to discuss specific topics. These sessions proved to be a fertile ground for discussion, where the real progress was made in moving the field forward. One emerging discussion point was that 'eco-evolutionary dynamics' can be defined in strict or broad terms, and opinions were split as to how broad the definition ought to be. This issue was gradually resolved as the workshop unfolded, through multiple discussions during the break-outs, in the plenary sessions and at the various social events in the evenings.

The third day was dedicated to the topic of 'detecting signatures of eco-evolutionary dynamics'. Talks by Nelson Hairston Jnr (Cornell University) and Fannie Pelletier (University of Sherbrooke) outlined the challenges involved in empirically detecting such signatures in laboratory microcosm experiments and using observational data from wild populations. One key realization was that eco-evolutionary dynamics can often be cryptic, e.g. where the density of the evolving organism remains unchanged despite on-going underlying genetic change, making prediction difficult. A diverse range of topics were discussed in break-out sessions in the morning and afternoon. On the fourth day, the focus was on applying eco-evolutionary theory to understand species' responses to environmental change. Richard Gomulkiewicz (Washington State University) provided a stimulating overview of theoretical models in the morning, while Luc de Meester (University of Leuven) talked about empirical work by him and others on evolution in meta-communities facing a range of human threats. Much discussion followed on the relative roles of evolution within species versus competition among species in determining community responses. During the morning and afternoon, the "Road Map Working Groups" met to discuss their visions for where the field should go next. On the last day, these Road Map Working Groups presented these ideas to everyone in a plenary session, followed by a final group discussion. The overall consensus was that although much more empirical was needed, this young field of study

was in a healthy state and well positioned to mature and probably split into a series of related sub-disciplines, as often happens in science. It was also agreed that a special issue on eco-evolutionary dynamics in a suitable journal would provide a stimulus for encouraging more empirical work, and plans are currently underway to make this happen.

The format of a Lorentz Center workshop proved to be ideal for our goal of bringing together researchers from different disciplines and from theoretical and empirical backgrounds. The unique mix of people facilitated direct interactions between many researchers working in parallel. The idea of having "your own center" for a week and flexible schedules allowed for a wealth of one-on-one interactions, leading to much more fundamental discussions than would be possible at standard international meetings. In addition, during six sessions we broke up the attendance into small groups so that each participant, junior or senior, led a discussion on a topic of her or his own choice. This turned out to be a powerful stimulant of academic exchange. As a consequence, there was general consensus that the meeting has been exceptionally stimulating. In particular, it helped to paint a clearer picture of what the key outstanding questions in the field really are, and hence what the most profitable research directions for the future are. Many participants, particularly the juniors, commented that the workshop gave them a much broader perspective on the various strands of current research in eco-evolutionary dynamics and helped place their own work within this broader, integrative framework. Plans for future meetings were discussed, and it was clear that new collaborations would likely result from the workshop. Participants are also being asked to submit relevant electronic material that can be used as a resource based on the Lorentz Center website. Overall, we are confident that we have gained major impulses for the understanding of the intimately intertwined fields of ecology and evolution and the relevance of eco-evolutionary dynamics for understanding and predicting patterns of biodiversity loss in a changing world.

Acknowledgments

The workshop profited enormously from the wonderful set-up and thoughtful assistance offered at the Lorentz Center. It would not have been possible without its financial support and we gratefully acknowledge this crucial help.

Stephanie Jenouvrier (Woods Hole, USA)

Thomas Reed (Wageningen, Netherlands)

Marcel Visser (Wageningen, Netherlands)

Magellanic Cloud Star Formation: From the Milky Way to Distant Galaxies

18 – 22 February 2013 @Oort

The Magellanic Clouds are unique in that we can study them at all scales: resolved stellar and proto-stellar populations, proto-clusters, HII regions, star-forming complexes, the super star cluster complex of 30 Doradus, and as galaxies. For this workshop, we brought together star formation modelers and observers of all kinds, to explore in concert the optical, IR, and sub-mm populations of young stellar objects and their interactions with the interstellar medium in the Magellanic Clouds. We also created new links with the Milky Way and extragalactic star-formation communities. At the interface of these communities is the question, "What can studying Magellanic star formation tell us about star formation in the Milky Way and other galaxies?"

Many of the interesting discussions focused on the question of scale. The validity of star formation rate indicators depends strongly on both time and spatial scale. The Magellanic Clouds are the perfect laboratory for calibration, as we can compare star formation rates derived from various wavelengths and from individual source counts and reconstructed star formation histories. Galactic and extra-Galactic astronomers and theorists tend to use the term "star cluster" for objects of very different physical scale, leading to confusion in understanding and citing literature across the field. In comparing diverse studies, we must keep in mind consider what scales are being discussed and to what extent physical conclusions are scale dependent. Source multiplicity at the distance of the Magellanic Clouds was another hot topic. Very often, multiple stellar or proto-stellar sources blend together, sometimes as a line-of-sight effect and sometimes as genuine stellar/proto-stellar clusters. This confuses our modeling and mass estimates of "individual" sources. Several people from the workshop are working on this issue and what it means for our understanding of star formation and our ability to compare star formation studies in the Milky Way, the Magellanic Clouds, and beyond. We also had talks and discussion of moving forward on these questions with current and future facilities such as SOFIA and JWST.

Participants were overwhelmingly pleased with the format of the workshop. Allowing ample time for independent discussion, in combination with the office facilities at the Lorentz Center, meant that people could get real collaborative work done. Starting talks later in the morning let people have informal talks over breakfast or come in for some quiet working time in the morning. We kept presentations to a minimum, focusing instead on plenary discussions and time for collaboration. With the deadline for Hubble Space Telescope observing proposals the following week, many participants took advantage of the opportunity and inspiration to work together on proposals, at least two of which were awarded observing time and funding.

Lynn Redding Carlson (Leiden, Netherlands)

John S. Gallagher III (Madison, USA)

Elizabeth Lada (Gainesville, USA)

Margaret Meixner (Baltimore, USA)

Antonella Nota (Baltimore, USA)

Alexander Tielens (Leiden, Netherlands)

System And Operator Realizations of Analytic Functions

18 – 22 February 2013 @*Snellius*

The aim of the workshop was to pay special attention to the analytic properties of “transfer functions” which appear in different guises in different situations. The Titchmarsh-Weyl coefficient from the theory of Schrödinger operators is a well-known example. In the theory of boundary value spaces there appear generalizations of the Titchmarsh-Weyl coefficient in various forms. For instance in the theory of boundary triplets there is a so-called Weyl (operator valued holomorphic) function which carries all the spectral data of the boundary value problem. An extension of the notion of boundary triplet leads to unbounded multivalued Weyl functions. Parallel notions appearing in system theory can be found, for instance, in the recent work by Arov and Staffans.

During the workshop there were 8 main one-hour lectures by Yury Arlinskii, Malcolm Brown, Vladimir Derkach, Birgit Jacob, Hagen Neidhardt, Mark Malamud, Arjan van der Schaft, and Olof Staffans. Furthermore there were 12 half-hour lectures. All lectures were concerned with analytic objects from either boundary value problems involving boundary triplets or relations, or from system theory. The workshop has generated joint work between participants, which will be accessible in forthcoming publications.

The schedule of the lectures provided a substantial opportunity for discussions and joint work. The 25 participants of the workshop, including several PhD students, came from Austria, Finland, Germany, Ireland, the Netherlands, Poland, Ukraine, and the U.K.

The workshop at the Lorentz Center was sponsored by several organizations: the Department of Mathematics of the TU Graz, the Johann Bernoulli Institute for Mathematics and Computer Science of the University of Groningen, the Department of Mathematics of the Jagiellonian University in Krakow, and the Department of Mathematics and Statistics of the University of Vaasa. We thank all these institutions for their support.

The conference at the Lorentz Center@*Snellius* with its unique facilities was very much appreciated by the participants. We thank the Lorentz Center for providing us with this opportunity and their support; and also for helping us with getting the conference in shape. We also want to thank the staff of the Lorentz Center for their impressively smooth professionalism. In particular, we would like to mention the contributions of Gerda Filippo and Mieke Schutte.

Jussi Behrndt (Graz, Austria)

Seppo Hassi (Vaasa, Finland)

Henk de Snoo (Groningen, Netherlands)

Franciszek Hugon Szafraniec (Krakow, Poland)

The PN.S: Future Projects and Ideas

25 February – 01 March 2013 @Oort

The Planetary Nebulae Spectrograph (PN.S) has been a major technological breakthrough in the exploitation of planetary nebulae (PNe) as mass probes in galaxies. It allows their detection through the Oxygen [OIII] emission at 5007 Angstrom at large galactocentric radii, where dark matter (DM) is expected to dominate and the signature of evolutionary phenomena remains imprinted in long-lived kinematic substructures.

In this workshop, we revisited the major accomplishments of the PN.S project, and discussed the synergy with other *halo kinematic tracers*, such as Globular Clusters (GCs) and deep absorption-line spectroscopy (long-slit, slitlets and integral field). The major goal of the workshop was to bring together scientists from the astronomical community that seek to understand the chemodynamic properties of halos. The different observational and theoretical techniques were discussed and common research areas were identified. We have defined joint projects to exploit at best the information from different kinematic tracers.

The workshop was composed of the following sessions:

1) **Planetary Nebulae as kinematic tracers.** In this session, the groups working on PNe presented their surveys with the PN.S and FOCAS@SUBARU, revisited their major accomplishments, and presented new results along the Hubble sequence of galaxies.

2) **Globular Clusters as kinematic tracers.** In this session, the groups working on GCs presented their surveys and achievements. Results arising from different tracers were compared, and analysis techniques aimed at combining data from PNe, GCs, and stellar light (slitless) were presented.

3) **Dynamical modeling.** The results of made-to-measure particle dynamical models, and Jeans models were presented and compared. The dark matter distribution and concentration, orbital anisotropy, were identified as key elements in the comparison to cosmological simulations. By doing so, we will better constrain the formation mechanisms of galaxies.

4) **Mass distribution: alternative tracers.** Results on mass distribution from gravitational lensing and the Kids Survey were presented. Analysis of satellite galaxies to constrain the shape of the DM halo were discussed.

5) **Numerical simulations.** The prediction of halo properties (stellar population gradients, mass distribution and orbital anisotropy) were presented and discussed in light of the observational constraints of studies of PNe and GCs.

6) **Stellar populations** Stellar populations from GCs, the connection with PNe progenitors and host galaxy were presented and discussed. The hot topic of (non)universality of the Initial Mass Function was also presented and discussed. The state-of-the art upcoming MANGA survey was presented.

7) **Spiral galaxies and PNe.** Future projects on how to exploit the kinematic information of PNe on spiral galaxies to resolve the disk/halo degeneracy were presented and discussed.

During this week at the Lorentz Center, we dedicated a lot of time to discussion and comparison between the different strategies, galaxy samples and analysis techniques of the different teams. From the discussion, a few joint projects and strategies emerged. These are outlined below:

1) PNS-team and FOCAS@SUBARU-team will join forces to study the kinematics of edge-on spiral galaxies (NGC 891, NGC 5907) as well as a combined study of the S0 galaxy NGC 5866 (for which they have PNe in common).

2) PNS-team and simulations team will exchange data and models to constrain formation mechanisms of ETGs, and to the identification of kinematics substructures in the halos.

3) PNS-team and GCs-team will join forces to study the ETG galaxy NGC 4697. Once the two surveys will be completed, a joint comparative study will be done.

All this has only been possible thanks to the unique environment and infrastructure provided to us by the Lorentz Center.

Magda Arnaboldi (Garching, Germany)

Ana Chies Santos (Nottingham, United Kingdom)

Lodovico Coccato (Garching, Germany)

Konrad Kuijken (Leiden, Netherlands)

Nicola Napolitano (Naples, Italy)

Formal Methods for the Informal World

04 – 08 March 2013 @Oort

Short description of the workshop

In the field of computer science, the term 'Formal Methods' is used to indicate the application of mathematical structures, languages and techniques for specification and verification of computer systems: formal systems. Stimulated by the increasing availability of computational power, the use of formal models is spreading quickly also for 'informal systems', e.g. those involving human interaction. The aim of this workshop is to explore and reflect with computer scientists, mathematicians, philosophers and social scientists, in which ways formal methods can be useful outside of the formal world, and to contribute to the methodology of applying formal methods in the social sciences.

Outcome

As usual in interdisciplinary settings, discussions arose around central concepts, such as "formal" and "model". These discussions brought general insight into common misunderstandings, for example about the purpose of building models: this varies greatly over and within disciplines, but is seldom made explicit. There was active debate on validation of formal models. Although we did not formally survey the participants, it was evident from the informal interactions over coffee and in the corridors, that many participants left the workshop with new perspectives – sometimes these were in the form of awareness of subfields they had not previously been exposed to, and sometimes these took the form of novel angles on familiar concepts.

Because the discussion threads remained very vivid up to the end of the workshop, we decided to continue the discussion online. We installed a blog for this purpose (www.in-formal.tudelft.nl) to which all workshop participants were invited to contribute. We expect that these continued exchanges will result in a small number of related articles and responses, out of which a special issue of a journal may grow.

Organizational

The backgrounds of the participants were nicely mixed over the spectrum from formal to informal. There was constant interaction within the one-week community that we formed, perhaps surprisingly given the number of plenary talks that were on the more theoretical or formal side of the spectrum. Our program choice to set the stage on Monday with a keynote from psychology, worked well in this respect, and we should give credit to all speakers for striking the right balance for the interdisciplinary audience. Also, the fact that many participants actively came forward with their personal experiences and questions both in the discussion sessions and during the talks, created coherence throughout the program and the group.

As a breath of fresh air, we profited from the sudden (and short-lived) Spring weather for a "cyclic reasoning" discussion, including sea views, for which the interested participants rented bikes from the Lorentz Center. Also we invited a harpist/singer and trombone player for the wine and cheese party, to provide an unexpected intermezzo in the long first day of talking (with the motto: "Music, after silence, comes closest to expressing the inexpressible" – Aldous Huxley). They played two short sets with an eclectic music choice (Bach to Beck), much to the appreciation of the participants.

The facilities of the Lorentz Center contributed markedly to the success of the workshop. Providing access to offices for individual 'quiet time' complemented by the shared common room space is excellent. The lunch arrangements worked very well – encouraging further mixing of the group – and the food quality was good.

Francien Dechesne (Delft, Netherlands)
Frank Dignum (Utrecht, Netherlands)
Virginia Dignum (Delft, Netherlands)
Bruce Edmonds (Manchester, United Kingdom)
Liz Sonenberg (Melbourne, Australia)

Universal Themes of Bose-Einstein Condensation

11 – 15 March 2013 @Oort

The aim of this meeting was to discuss, in a unified manner, the universal themes of Bose-Einstein condensation across all different fields of physics and scales, from the nuclear to the astrophysical scale. Bose-Einstein condensation is a phenomenon associated with the dominant preferential occupation of one energy level of a system, which results in all particles of that state behaving collectively and exhibiting 'super' properties, such as superfluidity (flow without 'friction'). Given that there are certain physical systems where this phenomenon is studied and controlled experimentally in great details (most notably trapped ultracold atoms and polaritons in semiconductors), and others where this is a theoretical prediction (e.g. in neutron stars), it was deemed appropriate to break the boundaries between different physics communities and discuss those systems in a unified manner, using a 'common language', following on a similar very successful conference held in 1993.

The workshop was deemed a great success by all participants. We had two Nobel Laureates (Wolfgang Ketterle (MIT) and Anthony Leggett (Urbana)) who also participated in plenary discussion sessions. In addition the workshop featured renowned key international participants covering the entire spectrum of relevant research themes (Ultracold Trapped Atomic Gases; Superfluids, Superconductors & Permanent Thermodynamic Transitions in Solids; Quasi-Equilibrium Condensates; Nuclear, Particle & Astrophysics; Phase Transitions & Quantum Quenches; Novel Interfaces & Applications), as well as a range of promising young researchers and advanced PhD students, including numerous female speakers. Participants felt that they had learnt significantly about the other systems exhibiting similar effects, overcoming the usual 'technical jargon' boundaries that sometimes restrict progress across active fields.

During the meeting, there were various ideas that appeared to be transferrable from one physical system to the other (mainly, but not exclusively, between atomic and polariton systems), and it is anticipated that the presentations and discussions will indirectly influence selected aspects of the research in those areas in the coming years. One of the plenary discussions focused on creating a participant-based universal table of common and distinct features, benefits and shortcomings of the manifestations of Bose-Einstein condensation and related pairing phenomena in all systems- a resource anticipated to be useful to all researchers in those areas and made available on the workshop website.

An additional direct measure of the success of the workshop is evidenced in the fact that Cambridge University press has expressed an interest to publish a volume based largely on the contributions of the plenary and invited speakers of this workshop (along with selected key researchers who were not present). While still at the planning stage, this option is currently being actively investigated by some of the workshop organizers, and is in keeping with the very successful book published in the previous such meeting 20 years earlier.

The office allocation approach of the Lorentz Center, combined with the constant availability of coffee/tea/biscuits in the common room created an ideal atmosphere for both individual and group discussions (of which there were many), with many participants staying until Friday evening (after the formal workshop closing) to hold post-workshop discussions about potential new interdisciplinary projects. The Lorentz Center staff are extremely helpful and attentive, and this adds to the friendly informal atmosphere for conducting excellent science. Their insistence for free time and plenary discussions really paid off. The photographs nicely document the workshop and the boat cruise is a must for any future workshop organizer.

Keith Burnett (Sheffield, United Kingdom),
Peter Littlewood (Chicago, USA),
Nick Proukakis (Newcastle, United Kingdom),
David Snoke (Pittsburgh, USA),
Henk Stoof (Utrecht, Netherlands)

Obstacles and Catalysts of Peaceful Behavior

18 – 22 March 2013 @Oort

Workshop Goals

Mutually beneficial behaviors such as cooperation, helping and sharing, as well as behaviors that keep aggression in check or re-establish nonviolent relations and tolerance following conflict, are ubiquitous in nature and part and parcel of human nature. Explaining how and why such peaceful behaviors have evolved and persist counts among the greatest challenges for behavioral science. The main goal of this workshop was to provide an international forum for productive cross-disciplinary interaction among researchers in this emerging area.

Workshop Proceedings

The workshop included many formats to facilitate formal and informal interaction among participants including plenary talks, Q & A sessions, topical sessions, poster presentations, break-out group discussion sessions, final précis of the presentations and discussions, and a concluding roundtable discussion. While the plenary talks followed a traditional single speaker format, the jointly presented topical sessions varied in format depending on the ideas and particular goals of the session contributors. Participants also interacted during lunches, coffee breaks, the wine&cheese, and the dinner cruise.

The daily themes were chosen to elicit insights and answers to the guiding questions of the workshop: (1) *What can knowledge about peace in nature tell us about peace in human nature?* and (2) *What social and cognitive factors obstruct or facilitate peaceful behavior?* The majority of the participants (53 % female) were established specialists from universities in the USA, Europe and Asia. Students also actively participated in the program. Disciplines represented included primatology, anthropology, behavioral biology, developmental- and peace psychology, neuroscience and political science.

Workshop Results

The feedback from participants has been very positive. One of the participants captured the synergy of the unique mixture of topics addressed during the workshop well: "*It was very interesting to see how apparently disconnected realities, such as molecular biology, canine ethology, cooperation in primates, oxytocin, and Japan's Article 9, came together and made sense in developing an alternative insight on peaceful behavior.*" In addition to the establishment of new research collaborations there are a number of tangible outcomes of the workshop, including a forthcoming special issue in the journal *Behaviour* and an edited book to be published by John Wiley & Sons, Publishers.

The organizer are grateful for the support received from the NIAS-Lorentz Center Program as well as from the additional sponsors: the Joannes Juda Stichting voor Interdisciplinair Gedragwetenschappelijk Onderzoek (SIGO), JJ Groen Foundation for Interdisciplinary Behavioral Science, Åbo Akademi University, and the Wenner Gren Foundation.

Peter Verbeek (Miyazaki, Japan)

Douglas Fry (Vasa, Finland)

Models of Consciousness and Clinical Implications

Workshop: 02 – 05 April 2013 @Oort

Public Event: 06 April 2013 @Oort

Phenomenal consciousness appears to be continuous and unified, while in cognitive neuroscience theory and experiments suggest that the brain acts in a discrete, distributed, and deterministic manner. This conclusion is also endorsed by trained phenomenology, in the form of insight meditation. Usually consciousness is so well coordinated that the fact that it comes from distributed neural modules/networks is not perceived; neither that it is discrete and deterministic. If by some conditions conscious experience is perceived as discrete, distributed, and deterministic, this may be against our usual perception of ego - in the sense of identity and agency. One can wonder whether, under certain circumstances, this fundamental structure may result in clinical consequences.

The following passages come from the Buddhist tradition:

"There is seeing, but no seer."

"There is thinking, but no thinker."

"There is doing, but no doer."

An imaginary psychiatrist would frown: "Is this person losing ipseity?".
Buddhist texts then are becoming even more 'suspicious'.

"One cannot say that the self does exist, nor that the self doesn't exist."

Then the imaginary psychiatrist would conclude: "This person is schizophrenic or at least schizoid."

But then the meditator states friendly and convincingly:

"To explain this better, the self does exist, not as a stable, 'real' entity, but as a process. Realizing this frees us from (mental) suffering, as we no longer need to pretend (that there is a fixed self); we become more mild and have more compassion. When we know that the self is imagined, we can work with it even better."

Then the psychiatrist starts becoming impressed and begins to meditate. (Actually this happened at the workshop.)

The workshop aimed at putting on the scientific agenda the mentioned observable characteristics of consciousness and the puzzling fact that this may both lead to clinical problems and to increased wisdom. Beforehand it was agreed that the output of the workshop would be a list of questions to be investigated. These questions, coming from three 'Theme-groups' at the workshop, were formulated on the last day of the workshop and are the following.

Group 1 Neural models of consciousness

1. What are our primary assumptions as to the nature of consciousness? What are the consequences of these primary assumptions?
2. What are the degrees and varieties of consciousness. Are states of consciousness unified in time or otherwise, internally or externally?
3. What are the relationships between consciousness and attention, sensory persistence, working memory, and episodic memory, e.g. in relation to the dissolution question?
4. What are the neural mechanisms of coordination and how do they relate to consciousness and meditative practice?

Group 2 States of consciousness

1. What are the relationships between sensory-motor, emotional, and cognitive processes in the brain/body?
2. How are mental states defined, controlled and modulated in the brain? (e.g. what is the role of mindfulness?)

3. What is the role of intrinsic mental/brain activity versus stimulus-response paradigm?
4. What is the relation between art production and appreciation and various mental states.

Group 3 Disorganization of consciousness; clinical consequences

1. What is the description of mindfulness? How does mindfulness meditation relate to disidentification and detachment? How are experiences during mindfulness meditation related to different forms of pathological experiences?
2. Should the self be seen as a social/relational construction?
3. How can our relationship with 'me/self' change through the practice of meditation? How can this changed perspective inform psychopathology?
("What insight meditation perspective on consciousness can contribute to psychopathology, in order to change the perspective on certain phenomena so that they become less threatening?")
4. What are the neural mechanisms of 'dissociation/disidentification' in meditation and psychopathology. What are the differences. What are their functional consequences, e.g. for deconditioning?
5. How does acceptance relate to change?

Following the workshop there was a 'Public Event' at which mindfulness trainers and others were invited.

The workshop was attended by 40 persons (psychologists and psychiatrist, philosophers, technical scientists, some of them meditators or meditation teachers) of whom 10 were PhD students or young scientists. The Public Event was attended by 65 persons, who seemed to be greatly interested in what we had to report. As far as we can tell all participants at the workshop thought it a great success, and a rare opportunity to discuss such apparently nebulous topics with scientific rigor. Many new contacts were firmly established, and serious possibilities for close collaborations involving various combinations of participants were investigated. It is too soon to be able to report on the fruitfulness of those collaborations, but we can at least confirm that those involving us, the organizers, are being actively pursued.

Henk Barendregt (NIAS & Nijmegen, Netherlands)

Fabio Giommi (Milano, Italy)

Bill Phillips (Stirling, Scotland)

Antonino Raffone (Rome, Italy)

Statistical Network Science with Applications

02 – 05 April 2013 @*Snellius*

This workshop brought together quantitative scientists from various fields to deal with the probabilistic aspects of networks as they manifest themselves in society, economics, biology and epidemiology. The question to each of the contributors was to describe in an accessible way how in their field networks are used. The aim was to give an overview of how to problematize, model, interpret and use networks in various fields in order to achieve cross-fertilization.

A tangible output of the workshop has been a joint EU COST proposal on statistical network science. This proposal brings together approximate 100 people from within the EU and the US with the intention to collaborate on cross-disciplinary approaches to sampling, modelling and inferring networks. The proposal will be submitted at the end of March 2015 to the EU.

Since the workshop took place in April 2013, various collaborations have taken place between its participants. The Sheffield and Groningen group have strengthened ties by one member moving from one to the other institution. Ernst Wit and Luigi Augugliaro have published a paper together. Moreover, a study on social networks development within a secondary school in the Netherlands conducted in the group of Christian Steglich is being analysed by the group of Ernst Wit. Other contacts have also emerged, as it became clear to all participants to the workshop that there were more things to bring us together than set us apart. In fact, several "Aha" moments arose, when it became clear that the same model under different names and perspectives were used in different fields.

The format of the workshop worked very well. All participants stayed in the same hotel and walked together to the Lorentz Center in the early morning. This informal contact meant that it was very easy to address each other from the very first day of the meeting, despite the fact that most people did not know each other beforehand. We had an intensive programme in the mornings, followed by long, informal brainstorming sessions in the afternoons. These sessions worked remarkably well, because they were focussed on how to implement particular aspects (research, training, commercialization) of the COST proposal. This focus gave the discussions a meaningful structure, without collapsing into a static speaker-audience set-up. The late afternoons saw another session, which was followed every evening by a joint dinner.

The support from the Lorentz Center in the organization was very effective and smooth. Every participant felt at home and has complemented the organization and the facilities available at the Lorentz Center@Snellius. I would certainly recommend others organizing a workshop at the Lorentz Center. In fact, as Chair of the European Bernoulli Society, we are considering to apply for another meeting at the Lorentz Center in 2015.

Ernst Wit (Groningen, Netherlands)

Veronica Vinciotti (London, United Kingdom)

Complexity Models for Systemic Instabilities and Crises

08 – 12 April 2013 @Oort

The purpose of this workshop was to promote a multi-disciplinary collaboration between economists, physicists, mathematicians and computer engineers in order to develop complex systems based approaches aimed at understanding systemic instabilities and financial economic crises. The main topics discussed during the workshop are: complex systems; interacting networks of heterogeneous boundedly rational agents; behavioral models of economic decision making; theory and laboratory experiments with human subjects; agent-based models of linkages and transmission mechanisms between financial markets and the macro-economy.

About half of the participants is involved in the EU FP7 CRISIS project with the aim to build a detailed agent-based model of the financial-economic crisis. The other half of the participants were external invited speakers, researchers and policy makers. The format of the workshop worked out perfectly for the aim of the meeting. Only a few talks were scheduled per day, and there was a lot of time allocated for discussions. We had group discussions led by a moderator, parallel discussions in smaller groups for the development of joint projects and a panel discussion. Our experience with such an organization of time worked out very well and served the purpose of the workshop and the CRISIS project.

The tangible outcome expected from the workshop is the development of an agent-based model and ICT based policy support tools from complexity modeling. The discussions among the participants and the interaction with computer engineers during the workshop helped to lay out a concrete architecture of an integrated agent-based model of the macro and the financial system.

One important ingredient of the workshop was the interaction with policy makers. Invited participants from policy institutions (e.g., Bank of England, Dutch Central Bank, International Monetary Fund, New York FED, Netherlands Bureau for Economic Policy Analysis) stressed the importance of a new agent-based approach for macroprudential policies and stress testing.

Finally, the interaction with the staff of the Lorentz Center has been very helpful in shaping the program and the organization of the workshop and they have provided excellent assistance during all phases of the workshop.

Jean-Philippe Bouchead (Paris, France)
Domenico Delli Gatti (Milano, Italy)
Cees Diks (Amsterdam, Netherlands)
Doyle Farmer (Oxford, United Kingdom)
Cars Hommes (Amsterdam, Netherlands)
Domenico Massaro (Amsterdam, Netherlands)

Multiscale Modelling and Computing

08 – 12 April 2013 @Snellius

Many communities in the sciences as well as in the socio-economic domain are now confronted with the problem of understanding multiscale systems. Notwithstanding the tremendous progress being made in application domains such as e.g. chemistry, physics, or material science, we observed a lack of generic methodology and common language for multiscale modelling and computing. The aim of the workshop was to bring together a dedicated group of computational scientists and domain specialists to identify generic methodologies, algorithms and languages for multiscale modelling, as well as software environments that support multiscale computing, cutting through specific scientific domains.

The workshop will lead to a special issue on 'Multiscale systems in fluids and soft matter: approaches, numerics, and applications' in the Philosophical Transactions A. Publication of this special issue is expected in spring 2014. It will contain a number of papers covering themes of the workshop. Moreover, it will contain a discussion paper, that expresses the consensus expert opinions as reached during this workshop and explores open questions in the field of multiscale modelling and simulation, as identified during the workshop.

We concluded that notwithstanding notable successes, in our opinion, the field of multiscale modelling does have a number of unresolved questions that, although they are deemed important for the field, have so far hardly been explored. Given the importance of multiscale scale modelling for so many fields of science and engineering, we believe that targeted and substantially funded *multidisciplinary* research efforts are urgently needed. We should reach consensus on what exactly we mean by multiscale modelling and the terminology that is used; we should formulate a generic theory or calculus of multiscale modelling, including scale bridging methodologies; we should apply such theory to the urgent question of validation and verification of multiscale models; and we should develop formal mathematical approaches to the issue of error propagation in, and convergence of, multiscale models. Moreover, we believe that this would in principle lay the foundation for more efficient and well-defined multiscale computing environments. We observe that such fundamental cross-disciplinary research in multiscale modelling and computing is currently not well addressed by funding agencies, which contribute in part to the fragmentation we seek to redress. We believe that research to fill the gaps as identified during the workshop is timely, highly relevant, and with substantial potential impact on many scientific disciplines.

The workshop was very multi-disciplinary, with researchers coming from several science domains (physics, chemistry, material science, fusion, astrophysics, biology), from mathematics and from computer science. One could ask if such broad participation could actually result in scientific exchange. The answer in this case is *yes*. It was the goal of this workshop to discuss multiscale modeling and computing from the perspective of many different disciplines, in order to learn from each other and work towards a generic framework for multiscale modeling and computing. And, more important, to identify gaps in our knowledge and define multidisciplinary research topics that are timely and should be addressed now. We believe that we have succeeded in both. The Lorentz Center@Snellius venue very much helped to create an atmosphere in which an open exchange of information was possible, working together in intense brainstorming sessions, have small group meetings, etc.

The workshop was a mix of plenary lectures and discussion on specific themes. Given the fact that most participants did not know each other before the workshop and came from many different disciplines, we had to invest sufficient time to allow participants to lecture on the themes of the workshop from their own perspective. We mixed this with open discussions centered on specific themes. These discussions were done in two separate groups, and each group had a rapporteur who wrote proceedings of the discussions. These laid the foundation for the discussion paper mentioned above. This format worked out fairly good. In hindsight, for this workshop it would have been better

to focus more on the plenary lectures during the first half and more on the discussions during the second half.

Bastien Chopard (Carouge, Switzerland)

Peter Coveney (London, United Kingdom)

Alfons Hoekstra (Amsterdam, Netherlands)

Mathematics from Biology: a Roundtrip in the Light of Suns and Stars

15 – 19 April 2013 @Oort

This workshop was organized in honour of the 65th birthday of Odo Diekmann.

To formulate robust, well-posed and consistent mathematical models that capture the essence of relevant biological problems, and to derive biological insight from their analysis, is the true challenge in the field of mathematical biology. This workshop aimed to • bring together mathematicians working in the field of mathematical biology; • discuss the modeling of biological processes leading to interesting mathematics; • further insight in the underlying biological processes; • discuss the role of numerical simulation within this context.

The workshop attracted 56 participants and was filled to capacity. The participants came from 12 different countries, and four different continents, with several participants from the USA and Japan. The most tangible outcome of this conference is the special issue of the Journal of Mathematical Biology that is devoted to Diekmann's 65th birthday: Volume 66, Issue 4-5, March 2013. This issue was presented by the chief editor Matz Gyllenberg at the opening of the conference, at which occasion he also honored Odo Diekmann with the membership of the Societas Scientiarum Fennica.

Although we cannot mention specific new insights on the level of computing, it has been realized that the MatCont interface can be used to load SBML models to study biological models from a bifurcation point of view. User comments that were made on the usage of MatCont will be incorporated in the next version.

Several talks discussed the modeling of biological mechanisms beyond data driven modeling. It became clear that modeling of epidemiology and immunology are not yet done on the same footing. This has been marked as an area where much progress can be made in the future. During the conference it became clear that some problems in population migration theory are strongly related to certain neural field models. This relationship will be exploited in future work where techniques developed for population dynamics will be carried over to mathematical neuroscience. This is just one example where connections between different fields were observed.

The atmosphere during this week was stimulating and inspiring. The special occasion of the workshop only contributed to the scientific merits. Bringing together a number of very active and successful mathematician from the network of Odo Diekmann paved the way for many younger scientists to discuss their work with specialists. There was ample room for interaction and several people have mentioned the start of new collaborations based on the discussions during the workshop. This was precisely one of the aims of this conference. As always, the staff of the Lorentz Center was most helpful to give all participants an unforgettable week!

Stephan van Gils (Enschede, Netherlands)
Mats Gyllenberg (Helsinki, Finland)
Hans Heesterbeek (Utrecht, Netherlands)
Yuri Kuznetsov (Utrecht, Netherlands)
Hans Metz (Leiden, Netherlands)

What Regulates Galaxy Evolution?

22 – 26 April 2013 @Oort

Galaxy formation and evolution is a complex process involving the physics of gas heating/cooling, star formation, black-hole formation, and myriad feedback processes. Progress towards understanding these physical processes is further complicated by the fact that they take place within the context of large-scale structure formation in the universe. Recent years have seen significant progress in the field. However, we are still far from models of galaxy formation that employ the relevant physics in realistic ways and that correctly predict the properties and abundances of galaxies measured in observations.

This workshop brought together a diverse group of theoretical and observational astronomers working in the field of galaxy evolution. The goal of the workshop was to discuss recent progress in understanding the processes that regulate galaxy evolution. A significant portion of the workshop was devoted to identifying the most interesting open questions in galaxy evolution, and how progress can be made on these problems.

A total of 42 astronomers participated in the workshop. The workshop days were divided into four topics, "massive central galaxies", "low-mass central galaxies", "satellite galaxy observations", and "satellite galaxy theory". The format was designed so that each day started with a review talk on recent progress in the field. This talk was then counterpointed by an "open questions" talk led by a senior researcher in the field. The open question talks were designed to highlight where gaps currently exist in both theory and observations, and how these might be addressed in future work. Having these contrasting talks (i.e., current successes vs. current failures) back-to-back was stimulating and provided discussion material for longer discussion sessions later in the day. We would certainly recommend this format to future conference organizers as an excellent way to stimulate discussion.

The discussions and presentations in the conference served as the basis for a small review paper on the most important open questions in galaxy evolution. That paper is set to be published in the journal of *New Astronomy Reviews*, and the conference organizers are in the process of drafting it. The paper reviews the most interesting open questions in the field, as decided on by the participants and the most often returned-to discussion points.

Based on the discussions, we concluded that four important open questions in the field were: 1. Are we reaching a fundamental limit in accuracy to which we can measure the properties of galaxies? 2. What are the star formation histories of the lowest-mass galaxies? 3. Does the standard division of central/satellite galaxies really provide the best framework to study galaxy evolution? 4. When do galaxies that are satellites in a halo stop behaving like centrals in their own halo?

The diversity of these open questions highlight the current status of the field. Some are technical questions, whereas others are about unknown physics. In other words, it is clear that not only there is more knowledge necessary, but also new techniques need to be developed in order to address the current issues.

The Lorentz Center format was ideal for this conference and we would like to thank the organizing committee, particularly Ikram Cakir, Mieke Schutte, and Henriette Jensenius for making the conference run so smoothly, and overall being an excellent success.

Gabriella De Lucia (Trieste, Italy)
Adam Muzzin (Leiden, Netherlands)
Simone Weinmann (Leiden, Netherlands)

Galaxy Formation From $z=5$ to $z=0$

06 – 10 May 2013 @*Snellius*

The meeting was very much focussed on the 3D-HST survey, a wide field survey with the Hubble Space Telescope to take spectra of 10.000 galaxies on the sky to high redshift.

The aim of the survey is to measure galaxy formation through an accurate characterization of galaxy properties through cosmic time. The goal of the meeting was to bring together the "builders" of the survey, to make significant progress towards the processing of the data, and to discuss the science opportunities and papers coming out of the survey. Most participants were directly involved in the survey. One (external) junior MSc student participated to familiarize her with the general science topic and most participants were PhD students or junior postdocs.

The workshop was extremely valuable. All participants had made extensive preparations for the meeting and exchanged their results at the meeting. The survey published 5 papers since the meeting, and bringing the participants together at the meeting was crucial to make this possible. About half the time of the meeting was spent to test the analysis. This is a very important (but time consuming) aspect of the survey work.

The meeting was organized as a true workshop, with half of the time allocated to talks, and the other half to work (in small groups, or private). The work was an essential part, and allowed us to make much progress in a fairly small amount of time. The Lorentz Center@*Snellius* venue is uniquely suited for this format, and we can recommend this to anyone.

We would like to thank the Lorentz Center for the excellent support.

Pieter van Dokkum (New Haven, USA)

Marijn Franx (Leiden, Netherlands)

Locating Astrophysical Transients

13 – 17 May 2013 @Oort

New generation wide-field instruments, especially SKA pathfinders in the radio regime, will detect a huge number of transient sources that can be followed-up by the very long baseline interferometry (VLBI) technique at the highest possible angular resolution. The main goal of the workshop was to bring together researchers with various backgrounds to review the status of the transient science field, with a special focus on the radio band and VLBI. How to find and localize transients; how to make the best use of a multi-band approach; and how to improve the operations of the European VLBI Network (EVN).

The sessions were organized around topics like X-ray binaries, supernovae, gamma-ray bursts etc.; each followed by a discussion session to identify the key scientific questions in the field and the areas where radio (VLBI) observations could contribute the most. A special session was dedicated to the progress of automated triggering of the EVN and similar projects at other arrays. The NEXPreS eVSAG (e-VLBI Science Advisory Group) had a closed business lunch on 16 May, to discuss the inputs received from the participants on how to improve e-EVN operations. The last day was for presenting the latest results from other SKA pathfinders, and for a brief outlook to the future of VLBI in the SKA era.

The first success of the workshop was the great number of participants that registered; unfortunately we had to make a down-selection and reject some excellent researchers in the field. The second success was the lively atmosphere during the discussion sessions and the breaks which certainly played a great role in the forming of new collaborations during the week. These collaborations meant groups actually working on observing proposal ideas, but plans were also formulated on how to bring the various communities in closer contact (e.g. XMM-EVN, INTEGRAL-EVN). As a direct output, the eVSAG has prepared an 11-page workshop summary with recommendations to be submitted to the EVN Programme Committee and the EVN Consortium Board of Directors.

The most important scientific result presented was the discovery of four new Lorimer-type fast transients (by Dan Thornton). In general, finding and localizing fast transients featured in a number of talks, to the pleasant surprise of the organizers.

Another important result discussed in the corridors was the parallax distance determination of the dwarf nova system SS Cyg using triggered EVN and VLBA observations (published in *Science* just a few days after the workshop by the team lead by James Miller-Jones). At several other occasions there were mobile phone cameras taking snapshots of "secret" slides shown during the presentations.

The format of the workshop perfectly suited our goals; we would organize the sessions almost exactly the same way next time. We found that a discussion session for the morning and one for the afternoon is sufficient; those sessions that were left "free-floating" were usually much more productive than the well-organized ones that were sometimes a bit too much dominated by the discussion leader. The local organization was just excellent. It was a huge relief to be able to connect a review speaker (who had to cancel on a short notice) through Skype in the very first session and see that everything worked beautifully.

We expect to see a number of new results directly resulting from this workshop. The first of these have already been published. A newly-formed group teamed-up to observe a new type of AGN outburst (not even covered in the workshop topics) with the e-EVN. The first results were reported in an Astronomer's Telegram (Atel #5125, by Jun Yang *et al.*).

We thank the Lorentz Center for this fantastic experience, and to RadioNet3 and NEXPreS for additional support.

Joeri van Leeuwen (Dwingeloo, Netherlands)
Zsolt Paragi (Dwingeloo, Netherlands)

Mathematics of Information-Theoretic Cryptography

School: 13 – 17 May 2013 @Snellius

Workshop: 21 – 25 May 2013 @Oort

The central focus of this two-week event was on problems arising in information-theoretic cryptography. The aim was to foster and strengthen research on the intersection between cryptography, theory of computation and pure mathematics, and to present and advance the state of knowledge on several open questions of distinctly cross-disciplinary nature.

The first week consisted of a course aimed at junior researchers and was held in the Lorentz Center@Snellius venue. More than 20 junior researchers and 8 lecturers participated in this first week. The majority were PhD students, but there were also a few postdocs and master students selected.

The course featured lectures on some of the topics featured during the second week workshop. Each day typically consisted of three 1-hour lectures on a different topic: secure multiparty computation (Nielsen), towers of function fields (Beelen, Bassa) and their applications (Xing), secret sharing (Casado, Cramer, Padro) and applications of multiparty computation to several problems in two party computation (Ishai). Lecture notes of most of the sessions were quickly made available on the Lorentz Center webpage. The junior researchers participated actively during the lectures and the breaks, several of them convened for evening sessions at the hotel to further discuss the lectures.

The second week consisted of a workshop at the Lorentz Center@Oort venue with the participation of some 50 researchers, including the majority of the junior researchers who participated in the first week. There were nine 45-minute keynote presentations on recent results in topics ranging from cryptographic ones like secret sharing (Beimel), oblivious-transfer based multiparty-computation (Nielsen), key derivation (Dodis) to areas within mathematics and theoretical computer science which have important connections with cryptography, such as locally testable and correctable codes (Gopalan, Sudan), towers of function fields (Stichtenoth), lattices with symmetry (Lenstra), special sequences and codes from algebraic geometry (Niederreiter) and physics (Renner). In addition, 2013 Kloosterman Professor Chaoping Xing delivered a 45-minute special talk about recent results on list decoding. Moreover, there were 15 contributed talks of 25 minutes and a 'rump session', featuring several 10-minute talks announcing recent results and ongoing research.

There was also ample time for discussions during the breaks, wine and cheese party and boat trip. The atmosphere was very positive and exciting. As it was our intention, there was a great deal of interaction among researchers who do not frequently meet because they belong to different communities but who have overlapping interests. We therefore expect that interesting research will soon come as a result of collaborations started during this workshop. We are also confident that the junior researchers will have greatly benefited from this experience and are motivated to pursue research in some of the topics they learned about during the workshop.

Ignacio Cascudo (Amsterdam, Netherlands)

Ronald Cramer (Amsterdam & Leiden, Netherlands)

Venkatesan Guruswami (Pittsburgh, USA)

Yuval Ishai (Haifa, Israel)

Carles Padro (Singapore, Singapore)

Chaoping Xing (Singapore, Singapore)

Seismology of Stellar Coronal Flares

21 – 24 May 2013 @*Snellius*

It was already known that stars of a similar spectral type as the Sun emit a significant amount of X-rays. This energetic radiation is emitted by the stellar corona. Often coronae undergo a major restructuring of the magnetic field: a solar or stellar flare that is a giant explosion of magnetic energy. It is well established that these flares often show periodicities in their light curve. This phenomenon is called "quasi-periodic pulsations (QPP)". In solar physics, several groups are currently working on the seismology of the QPPs, i.e. they infer flare plasma properties (e.g. plasma-beta) by the study of the properties of the oscillations (e.g. period).

The aim of the workshop was to discuss possible science avenues in the seismology of oscillating light curves in stellar flares. This new branch of astrophysics could employ the expertise gained in the solar context and extend it to the stellar regime. A major restriction, however, is the loss of spatial resolution in the stellar coronal observations. Another aim of the workshop was to set up collaborations that enabled advances in the field.

To advance in the field of stellar coronal seismology, we invited experts in the field of solar coronal seismology and the field of stellar activity. Approximately half of the experts had a background in stellar observations of coronae and stellar activity. The other half had a history in the observation and physics of solar flares and/or solar coronal seismology. Our program planned scientific presentations in the morning, with discussions in the afternoon. However, in practice, we have taken extensive time after each presentation to discuss the content, how it related to other work, and what consequence it could have for stellar coronal seismology. One of the great successes of this workshop was indeed the lengthy discussions on each talk, because this working method resulted in a very close interaction between all participants and generated a great understanding between the two communities.

There are several scientific outcomes of the workshop. On the one hand, there is an article published in the *Astrophysical Journal* (The decaying long-period oscillation of a stellar megaflare by Anfinogentov S., Nakariakov V.M., Mathioudakis M., Van Doorselaere T, and Kowalski A.F., 2013) of which the work was discussed at the Lorentz workshop@*Snellius*. On the other hand, we are aware of several collaborations that originated at the workshop. For instance, there is a collaboration between Armagh Observatory (UK) and KU Leuven (Belgium) to study fast flare oscillations that have been observed with *Galex*. We are considering seeking funding from the Leverhulme Trust in the UK to form an International Network that will work on this topic over the next three years. Furthermore, it was noted at the workshop that several *Galex* targets were in the Kepler field of view. This could potentially provide multi-wavelength observations of stellar flares. Several groups were interested in continuing this line of thought.

Overall, the workshop has been a great success. All scientists were very active, eager to comment and to start scientific discussions. Many scientists were somehow engaged and are now involved in follow-up studies. We do not think this could have been achieved in a regular conference format and we believe that the success is due to the Lorentz Center's unique meeting format and meeting facilities.

Tom Van Doorselaere (Heverlee, Belgium)

Adam Kowalski (Greenbelt, USA)

Mihalis Mathioudakis (Belfast, United Kingdom)

Valery Nakariakov (Warwick, United Kingdom)

Econophysics and Networks Across Scales

27 – 31 May 2013 @Oort

This workshop celebrated the 'marriage' between Econophysics and Network Theory. With respect to 'mainstream' Economics, the unconventional approach of Econophysics is the investigation of complex economic and financial systems through statistical induction from empirical data, rather than mathematical deduction from (often unreasonable) postulates such as perfect rationality, complete knowledge, homogeneity, stability, and equilibrium. As Physics in general, Econophysics aims at reconciling theories with observations. On the other hand, since socioeconomic and financial interactions are invariably combined into networks with intricate topology, Network Theory is becoming a more and more popular approach in modern economic studies. This theory aims at developing tools to analyse real-world complex networks and understand their dynamics.

The workshop was organized around four main 'challenges': *micro-scale challenges* (interactions among individuals in financial markets and social systems), *meso-scale challenges* (interactions among firms, banks, institutions, etc.), *macro-scale challenges* (interactions among and across countries) and *cross-scale challenges* (interactions extending across all the above scales). Different days were devoted to different challenges, and this helped organize the knowledge accumulated so far and put it in a broader perspective.

The workshop was very successful in gathering together, from all over the world, top scientists, young researchers, practitioners, and experts in both Econophysics and Network Theory. Participants shared their expertise in a joint effort to discuss their different perspective while emphasizing the common challenges. Each day hosted invited talks and contributed talks, and left ample time for moderated and informal discussion among the participants. The "wine and cheese" party at the end of the first day was very appreciated, to the point that the participants asked to repeat it each of the following days! This gave the workshop an additional and enjoyable dimension of interaction.

While the majority of the participants were physicists, every day was opened by an invited talk by a renowned economist. Both physicists and economists appreciated the very positive and constructing level of interaction that was achieved among participants from different communities. This resulted in the desire of all participants to later on explore the possibility of publishing a special issue of an international interdisciplinary journal, with contributions from physicists, economists and possibly other experts, all focusing on the themes of the workshop. This exploration is underway, and we already received a positive response from a respected journal.

Another important output was the possibility to revive the figure of Jan Tinbergen within the context of Econophysics. Tinbergen, the first Nobel Memorial Prize winner in Economics, was trained as a physicist at Leiden University. His PhD thesis (defended in 1929 and entitled '*Minimumproblemen in de natuurkunde en de economie*') was supervised by the famous physicist Paul Ehrenfest. After that, Tinbergen started an academic career as an economist and in 1969 he was awarded the Nobel Prize for '*having developed and applied dynamic models for the analysis of economic processes*'. While Tinbergen was not previously credited by the Econophysics community for being one of its pioneers, he introduced a strongly quantitative approach to economic problems. This kind of approach is now at the core of Econophysics. Curiously, Tinbergen can also be regarded as a pioneer in 'the network approach' to macroeconomic systems: the 'gravity model' that he first used in 1962 to describe international trade can now be viewed as one particular case of a large class of network models that have been recently devised in order to study the international trade network and many other complex socioeconomic networks. Therefore, Tinbergen's work surprisingly integrates elements that are nowadays present both within Econophysics and Network Theory, an intersection to which the workshop was devoted.

For the Netherlands, and for Leiden University in particular, the workshop was a very important step towards the consolidation of Econophysics and Network theory as novel research themes. In 2011, the

Leiden Institute of Physics decided to expand its research program into these interdisciplinary fields, which were not previously present in the Netherlands. The organization of this workshop was an important step towards achieving an international visibility of the newly launched research program.

All the participants immediately recognized the expertise of the Lorentz Center staff in coordinating the workshop and facilitating its functioning. In general, the support of the Lorentz Center was amazing.

Diego Garlaschelli (Leiden, Netherlands)

H. Eugene Stanley (Boston, USA)

Heights and Moduli Spaces

10 – 14 June 2013 @Oort

The aim of the workshop was to discuss the state of the art in the study of the arithmetic of moduli spaces, and in particular heights on moduli spaces. Moduli spaces belong to the most basic and intensively studied objects in mathematics. They are geometric objects parametrizing other geometric objects of a specific kind, such as curves, abelian varieties or vector bundles.

Traditionally moduli spaces were studied using topological or analytical methods. This has led to fruitful connections with complex geometry and mathematical physics. Since the breakthrough results of G. Faltings around the so-called Mordell conjecture, in the 1980s, arithmetic methods have aroused a lot of interest and nowadays they are in the center of research.

The lectures (21 in total) were loosely centered around four themes: special cycles on Shimura varieties; degeneration of metrics on non-compact moduli varieties; explicit formulas and bounds for heights; and models over p -adic rings. Eight of the lectures were given by PhD students and junior postdocs. In the audience, the ratio between junior and senior researchers was about 50% - 50%. One of the successful aspects of the conference was this lively mix between key leaders in the field on the one hand, and promising young new researchers on the other.

Another remarkable aspect of the workshop was the joint venture we made for this occasion with the Intercity Number Theory Seminar and the Dutch-Belgian Algebraic Geometry Days. The last Friday of the conference was organized together with them, and brought an additional number of participants to the Lorentz Center.

A final successful aspect is that many new research contacts have arisen. Many discussions started in front of the whiteboard of the common room, where recent insights were shared, and new research collaborations were initiated. On the whole, there were many interactions, and the participants profited a lot from the open atmosphere created by the open doors and offices at the Lorentz Center. It is for sure that many will return, either as a participant of a next conference or as an organizer.

The Lorentz Center has been an ideal place for our event, with all participants praising the efficient organisation and helpful staff.

Gerard Freixas i Montplet (Paris, France)
Gerard van der Geer (Amsterdam, Netherlands)
Robin de Jong (Leiden, Netherlands)

The Antikythera Mechanism: Science and Innovation in the Ancient World

17 – 21 June 2013 @Oort

The Antikythera Mechanism is the most sophisticated scientific instrument of the ancient world. It is an astronomical computer of perplexing complexity, testimony of the awe-inspiring and surprisingly advanced astronomical and technological knowledge and skills of the Hellenistic and Roman world. The workshop accommodated a unique assembly of specialists from the exact sciences (mathematics and astronomy) and the humanities (historians, classicists, and archaeologists). It included nearly all of the most prominent experts on the subject of the Antikythera Mechanism, and also included museum curators of the Nat'l Archaeological Museum in Athens and Museum Boerhaave in Leiden. It focused on the latest state-of-the-art technical research done on the surviving fragments of the mechanism and discussed the implications for our understanding of astronomical knowledge and worldview in the ancient world. Particularly important was the focus of the workshop on the wider historic, social, and economic context of the instrument.

The workshop acquired a very high level of media attention. This included 5 radio interviews, including the Belgian national radio, and also involved long newspaper articles in the *Volkskrant* and *NRC*. The workshop itself was highly successful. It was the first time that such a diverse and large group of experts met around the same topic. Brill publishers has approached the organizers of the conference to assemble the various contributions, or related reviews, in an edited volume in the series "Technology and Change in History".

We can distinguish at least five major elements in the workshop. The first was an update and extensive discussion of developments with respect to the analysis of the technical construction and inscriptions of the Antikythera mechanism. The second focused on reconstructions of the mechanism, in particular on planetary extensions. A third element involved a range of historical, social and philosophical discussions on the context of the mechanism and the scientific knowledge it entailed. A truly outstanding new element was the extensive attention to the Antikythera shipwreck, strongly supported by the National Archaeological Museum in Athens, as well as Woods Hole Oceanographic Institution with respect to the new diving expeditions in the area of the island Antikythera. Finally, the workshop tried to include presentations and discussions on scientific and technical knowledge in other civilizations (Arab, Mesopotamian, Jewish).

Amongst the many contributions, we may single out three as examples that introduced original new insights. The first one was the excellent discussion on the contents and structure of the Antikythera shipwreck by Anastasia Gadoulou, shedding light even on the crew and passengers of the ship. The second was the systematic inventory by Tracey Rihl of technological know-how that was available in Graeco-Roman antiquity, as attested by an extensive range of artefacts. It offered unexpected new insights and emphasized that the mechanism should be entirely regarded as a product of its time. The third one were the hard-ware models by Michael Wright of the planetary extension of the Antikythera Mechanism and of Archimedes' Sphaera.

The context of the Lorentz Center proved ideal for the workshop. The excellent facilities, at the Center itself as well as at the hotel, lead to long and intense discussions, nearly all days until late at night. On the other hand, due to a range of circumstances it did not prove possible to devote more attention to the analysis of inscriptions. Hopefully this may be improved in an ensuing meeting.

Niels Bos (Groningen, Netherlands)

Mike Edmunds (Cardiff, United Kingdom)

Alexander Jones (New York, USA)

Onno van Nijf (Groningen, Netherlands)

Rien van de Weygaert (Groningen, Netherlands)

Bayesian Nonparametrics

16 – 21 June 2013 @*Snellius*

As a paradigm in statistics the 'Bayesian choice' goes back to Thomas Bayes in the 18th century, but is often contrasted with 'classical' statistics as developed in the 20th century. In the last decades its popularity has risen, partly due to increasing computational power and the invention of new algorithms, but also due to the needs of modelling high-dimensional data sets.

'Nonparametrics' refers to the use of functions as parameters, rather than Euclidean vectors. Bayesian nonparametrics was long thought to be problematic, because inference requires a prior probability distribution on the parameter set, which in nonparametric situations is a subset of an infinite-dimensional space. Not only was it difficult to come up with computationally tractable proposals for such priors, also by their nature prior probability measures support on small (sigma-compact) sets and hence were thought to add too much 'prior information' (prior to any observed data) to lead to useful statistical inference.

Mathematical and practical insights of the last decade have shown that these difficulties can be overcome. Developing new computational methods and theoretical (mathematical) investigation of properties of Bayesian methods go hand in hand with application of nonparametric Bayesian methodology in many areas of science.

The 25 participants investigated current challenges and solutions in a very interactive environment, about 60% of the time in plenary discussion and the remaining in smaller, specialised groups. For the plenary discussions, a topic was presented by a specialist in an informal manner, always also involving the 'blackboard'. This invariably led to many comments and questions from the audience, to the benefit of audience and presenter alike.

New insights were obtained regarding Bayesian uncertainty quantification, either through global measures or through functionals, or by the use of a different topology. There was special interest in species sampling priors, Bayesian sparse modelling, and applications in biostatistical modelling and causality. The work in smaller groups consisted of collaborations on ongoing research work as well as new projects, which eventually will lead to tangible output in the form of research papers.

Bas Kleijn (Amsterdam, Netherlands)

Aad van der Vaart (Leiden, Netherlands)

Harry van Zanten (Amsterdam, Netherlands)

Operando Research in Catalysis (ORCA)

24 – 28 June 2013 @Oort

In recent years, experiments and theory on the atomic and molecular mechanisms underlying catalytic reactions have been on the move from (ultra)-high vacuum and low temperatures to the high-pressure, high-temperature conditions of practical catalysis. The ORCA workshop aimed to bring together the different communities involved in this emerging field of operando research in catalysis, namely surface scientists – physics and chemistry, experiment and theory – developers of new instrumentation, and researchers from the chemical industry.

ORCA has been a much appreciated very useful, lively and timely workshop. What has been new and refreshing, with respect to the multitude of meetings in which catalysis is central, was:

1. The combination of the focus on operando conditions and the firm link to the fundamental physics and chemistry on the atomic and molecular scale.
2. The attention to new techniques, both experimental and theoretical, and including open discussion on both the opportunities and the drawbacks.
3. The mixture of attendants, from academia (chemistry and physics), from the instrumentation manufacturers and from the chemical industry.

The open format – a limited number of talks with ample room for discussion, dedicated discussion sessions fuelled through an introduction by a moderator, flash presentations by poster presenters and short contributions, in part put on the schedule during the week itself – was perceived as excellent and matching well to the purpose of the workshop. The open hours in the program have been used efficiently for in-depth discussions, in many cases in small circles of collaborating research teams.

Even though it is not appropriate to summarize the outcome of the workshop in a brief list of trivia, a few general statements can be made:

1. Experiment and theory are now both paying attention to the multi-scale aspect of catalysis, combining the atomic- and molecular aspects of the basic steps in the chemical transformations with the fluid dynamics of the flowing gas phase and the resulting inhomogeneities in the gas composition, the temperature, their interplay with the local surface structure and the local reaction mechanisms.
2. Much of the work discussed at the workshop was devoted to the 'fruit fly' of catalysis, namely the oxidation of CO. Even though we now know much more about this catalytic reaction, also about how it proceeds under operando conditions, there is still discussion/debate about fundamental issues, such as the chemical state of the surface (metallic or surface oxide). Nevertheless, it is generally perceived that "there is a world out there" of other chemical reactions that are demanding to be investigated (chemical industry!). First steps in this direction are now visible.
3. Impressive progress is being made in the investigation of ensembles of catalytic nanoparticles in addition to the more traditional 'surface-science' setting of flat, low-index, single-crystal surfaces.
4. The industry is really interested in this emerging research field. In bridging the pressure gap and our first steps to bridge the complexity gap, this community is also bridging the valorization gap between academia and application.

There are three relevant elements that should be mentioned regarding the organization:

1. The combination of organizers from different backgrounds, namely theory (Reuter), experiment (Frenken) and industry (Helveg), proved to be very useful in setting up a well-balanced program and in attracting an interesting mixture of speakers and discussion moderators.
2. ORCA was timed to coincide with the final stage of the SmartMix research consortium NIMIC (Nano-Imaging under Industrial Conditions), which had the development and application of new instruments for operando catalysis studies as one of its prime foci. This has generated a platform of expertise and experts. Two of these experts, Helveg and Frenken, were among the organizers, while the NIMIC community served as a natural, local nucleus of participants in the workshop. NIMIC has also provided a substantial financial contribution to ORCA.

3. Last but not least, the support by the Lorentz Center has been of crucial importance for the professional and smooth organization and operation of ORCA. The facilities are truly excellent and they optimally support the special workshop character. A special word of gratitude goes to Ikram Cakir, Henriette Jensenius and Mieke Schutte for guiding us in all aspects of the organization of the workshop's program and taking over all other organizational tasks. They have been instrumental in making ORCA a success!

Finally, the choice of theme and audience was experienced as so useful and fruitful that there was immediate talk of ORCA serving as the potential start of a series of workshops. Probably these will not be linked automatically to the Lorentz Center. But "ORCA-1" certainly has set the standard!

Joost Frenken (Leiden, Netherlands)

Stig Helveg (Lyngby, Denmark)

Karsten Reuter (Garching, Germany)

Steps Towards a New Generation of Stellar Models

01 – 05 July 2013 @Oort

This workshop had been initiated by the recognition that current theoretical models for stars are no longer accurate enough to explain a multitude of astronomical observations. Examples for these are asteroseismological inferences about the internal structure of stars, spectroscopic determinations of chemical abundances at the surfaces of stars, and the consequences for the chemical evolution of whole galaxies. The shortcomings of the - so far quite successful - theory of stellar structure and evolution can be traced back to the rather superficial and approximate treatment of hydrodynamical processes in stars, which are, by their nature, multi-dimensional, while stellar models are almost exclusively computed under the assumption of hydrostatic conditions and spherical symmetry.

The Lorentz Center provided the perfect environment for 40 scientists from 10 countries to gather and discuss the challenges for stellar evolution theory, the progress made with 1-D models, the capabilities of the current generation of multi-dimensional models, and possible paths to improve the former by using the latter. During the first two days the challenges and shortcomings of the 1-D models were discussed in a very candid and constructive way. Given that such models will also be the workhorse of stellar evolution in the foreseeable future, ways to model intrinsically multi-D processes within 1-D stellar evolution calculations were also presented. The following sessions saw the impressive efforts in the current hydrodynamical modelling of convection and rotation, as well as the limitations of such simulations. Evidently, only small parts of stars or time-limited phases can be followed in detail, and sub-resolution effects - in particular in the case of turbulence - are requiring either correct sub-scale models, or impose computational efforts still beyond supercomputer capabilities.

The workshop ended on the last day with an extensive discussion about strategies to improve stellar models. Indeed, thanks to the stimulating environment of the Lorentz Center and the various shorter discussion sessions that took place during the preceding days, a number of possibilities were suggested. They range from detailed verifications of simplified physics using asteroseismological objects, to joint efforts of various groups performing multi-D simulations (e.g. for code and numerical method verification), to the idea of designing a "Grand Challenge" simulation, in which several of the groups represented in the workshop apply jointly for substantial amounts of computing time at one of the forefront supercomputer centres. Also, a number of working and discussion groups were established, some of them considering to apply for future Lorentz Center workshops. The participants also favored a follow-up workshop within the next few years to keep up the momentum gathered during this very satisfying week.

The organizers feel that the purpose of the workshop has been reached and even exceeded: various research fields were brought together, the needs of the 1-D community and the possibilities of multi-D simulations were presented, the regions of productive overlap defined, and the wealth of high-quality, new observational results has been acknowledged to provide invaluable input for the further development of stellar models.

The organizers thank the Lorentz Center for providing the ideal environment for this workshop, and its staff for the efficient coordination and the pleasant and friendly cooperation. Financial support by the Max-Planck-Institute for Astrophysics (Garching), NOVA, and NWO is gratefully acknowledged.

Onno Pols (Nijmegen, Netherlands)

Maurizio Salaris (Liverpool, United Kingdom)

Henk Spruit (Garching, Germany, and Amsterdam, Netherlands)

Achim Weiss (Garching, Germany)

Radio Halos of Galaxies

01 – 05 July 2013 @*Snellius*

There were a variety of goals of this workshop, the main scientific ones included probing the origin and physical conditions in galaxy halos and related science such as understanding differences between galaxies, the relation of halos to star formation and to the environment. Thirty-five edge-on galaxies are being imaged in full polarization and at two frequencies. As this was the first face-to-face meeting held by the CHANG-ES consortium, a very important part of the meeting was to ensure good communication between all participants, to present scientific ideas via more formal talks, as well as discuss more informally how the enormous volume of data and data processing could proceed effectively. At the time of the meeting, all data had been acquired, and approximately 25% of the data had been processed. Therefore many details related to data quality were part of the meeting (e.g. how to include single-dish data, how data could be protected for PhD students, how to understand the errors, how to separate thermal from non-thermal emission given our data set, what supplementary data might be needed, etc.). A preliminary outline of scientific papers and who would be the lead author was also drawn up.

Several exciting results were emphasized, some of which were realized and some are in the process of exploration. An example is the discovery of a strong double-lobed radio source immediately behind an edge-on galaxy (UGC 10288), an idea that may open up new possibilities for probing foreground disks and halos (like a flashlight illuminating a foreground source). This result has led to a press release <https://public.nrao.edu/news/pressreleases/surprising-image-provides-new-tool> which was featured on many websites. The concept is now being followed up more thoroughly as a direct result of the Lorentz Center@Snellius workshop, since it was realized that many such sources around other galaxies may be used as probes of foreground gas and magnetic fields. Moreover, new techniques (such as rotation measure synthesis) permit the more detailed analysis of such systems. Another important result is the prevalence of nuclear cores, at least one of which is varying with time. This science has yet to be fully explored but will be soon. Our discussion of scientific papers has led, among other things, to the organization of our 4th paper and the first that will include all galaxies, namely the results of our low resolution/high sensitivity data, led by Dr. T. Wiegert. This paper is now well-advanced and will also culminate in the first public data release for CHANG-ES.

Our group was very impressed with the support (both organizational and financial) provided by the Lorentz Center and the freedom associated with the workshop format. The size and venue were excellent. Since it was our first meeting, the ratio of formal talks to informal discussions was perhaps higher than might be typical for a Lorentz Center@Snellius workshop, but this was a necessary first step. Having learned from our experience at Lorentz Center@Snellius, our follow-up meeting, to be held in Kingston, Canada, in July 2014, will reverse this emphasis and, in addition, will focus more on *new* CHANG-ES results. The workshop dinner/cruise was a delight and helped us to become a cohesive group. While some of us knew each other only professionally via scientific publications and occasional conferences, the open communications encouraged by such activity permits scientific ideas to flow as well.

Kudos to the Lorentz Center for being so forward-thinking that such a center exists and is well supported. I would recommend it to others.

George Heald (Dwingeloo, Netherlands)

Richard Henriksen (Kingston, Canada)

Judith Irwin (Kingston, Canada)

Marita Krause (Bonn, Germany)

D. Saikia (Pune, India)

Theresa Wiegert (Kingston, Canada)

Recent Insights in Mitochondrial Evolution Applied to Health and Ageing

08 – 12 July 2013 @Oort

Our workshop brought together researchers studying the molecular details of intra-cellular processes linked to conflict amongst mitochondria and between mitochondria and the nucleus at different levels. We particularly included medical researchers interested in mitochondria-related diseases, molecular biologists studying the details of mitochondrial organisation and function, and evolutionary biologists interested in genetic conflicts. Our expectations were that the interaction of these three fields would be reciprocally illuminating, as so far they have operated separately. Our aim was to advance the disparate fields by combining different kinds of expertise and to provide researchers with the necessary details to make more specific predictions about the consequences of mitochondrial evolution, both long term and during somatic growth, on diseases and aging.

Our workshop allowed evolutionary biologists to obtain a deeper understanding of the exact mechanisms underlying mitochondrial evolution. At the same time molecular and medical researchers were given evolutionary insights that will allow the formulation of specific predictions aimed at preventing or curing mitochondrial diseases.

A tangible outcome of our workshop is the collaboration between researchers at different stages in their career and with different research backgrounds in the writing of articles to be published in a special issue of the journal *Philosophical Transactions of the Royal Society of London Biological Sciences*. This special issue will contain 10 articles, all written by participants of this workshop, most of whom are working with new collaborators. The issue is due in April 2014.

After a talk by an evolutionary biologist, one of the medical researchers stood up and proclaimed that the talk he just heard fundamentally changed the way he thinks about the causes of mitochondrial diseases. Interestingly, this was not because the evolutionary biologist was presenting novel ideas, but because of the divide that exists between scientists in different fields, even when they are working on similar problems (in this case the role of mitochondria in aging and disease). We think this is an indication that we achieved our main goal of the workshop.

Our workshop mainly consisted of talks by most participants with plenty of time for discussions. We specifically allowed time for new collaborations to materialise based around writing articles for the special issue. Because these collaborations were truly new, it was often difficult for the organisers to keep the discussion going and to have the participants agree on writing articles. We are happy with the result, but it probably would have been easier to have prepared the participants better before the start of the workshop. On the other hand, our approach encouraged new collaborations- which was the intention.

We feel that we had a good mix of established researchers, postdocs and PhD students. The Lorentz Center workshops are ideal in size in that the number of participants is not so high to be intimidating. A large number of our participants were very vocal which made the discussions interesting, to say the least, but the atmosphere was always collegial.

We chose the boat tour for the dinner which was a good choice, apart from the cold weather. It was nice because it allowed the participants to mingle and talk. The support from the Lorentz Center staff was excellent and we highly recommend organising a Lorentz Center workshop.

Duur K. Aanen (Wageningen, Netherlands)

Madeleine Beekman (Sydney, Australia)

Marc Maas (Wageningen, Netherlands)

Hans Spelbrink (Nijmegen, Netherlands)

Elliptic Integrable Systems and Hypergeometric Functions

15 – 19 July 2013 @Oort

The recent birth of elliptic hypergeometric function theory and of representation theory of elliptic algebras has led to exciting new developments at the intersection of mathematics and theoretical physics. A fundamental role in this context is provided by the theory of integrable systems. The relevant integrable systems are elliptic integrable systems, which are amongst the least accessible and most challenging ones.

The workshop aimed to increase our understanding of these developments. This is of great importance for the whole area and for its manifold applications to related subfields in mathematics and theoretical physics. The workshop capitalised on the underlying unifying trends, by enabling researchers from the various pertinent areas to meet, learn about ongoing projects, discuss open problems and novel directions, and begin new collaborations from different complementary and mutually beneficial perspectives.

Each workshop day focussed on a particular theme and started with a talk by a keynote speaker. The keynote speaker spent the first part of the talk on introducing the theme, placing it in a general perspective and relating it to the other themes. The themes and keynote speakers were:

Monday: "Elliptic hypergeometric functions and elliptic Painlevé equations", M. Noumi (Kobe, Japan).

Tuesday: "Integrable lattice equations/models", Frank Nijhoff (Leeds, UK).

Wednesday: "Integrable many body systems", Martin Hällnas (Loughborough, UK).

Thursday: "Representation theory", Giovanni Felder (Zürich, Switzerland).

Friday: "Applications in quantum field theory", Hugh Osborn (Cambridge, UK).

The workshop led to a successful exchange of ideas between researchers from the different fields. The participants appreciated the format of the workshop and explicitly noted that the workshop has led to new perspectives and potential collaborations for them. The special session of five short talks by young researchers, sponsored by Elsevier, was a successful addition to the program.

We thank the participants for the high quality talks and for the pleasant and stimulating atmosphere with lively discussions. We thank the Lorentz Center staff for the excellent support.

Erik Koelink (Nijmegen, Netherlands)

Masatoshi Noumi (Kobe, Japan)

Eric Rains (Pasadena, USA)

Hjalmar Rosengren (Gothenburg, Sweden)

Simon Ruijsenaars (Leeds, United Kingdom)

Jasper Stokman (Amsterdam, Netherlands)

Language Interaction Design

15 – 19 July 2013 @Snellius

The goal of the Language Interaction Design (LIXD) workshop was to lay the foundations for a discipline of language interaction design that looks further than the traditional categories of syntax and semantics. The essential question discussed during the workshop concerns the relation between development *environment* and programming *language*, from the conceptual, technical and human perspectives. The attendees of the workshop came from diverse backgrounds, ranging from domain-specific languages, model-driven engineering, spreadsheets, interaction design, live programming and programming languages.

A running thread through the workshop was that, from the programmer's perspective, a programming language cannot be separated from its integrated development environment. This has consequences for reasoning about concepts such as productivity, maintainability in terms of program code alone. Indeed it affects the notion of programming language design itself: not only can a programming language be seen as a user interface for programmers - its use is also supported and guided by numerous tools (editors, outliners, navigators, inspectors, debuggers, visualizers, etc.) that lie outside of the category of language proper. Yet, the programmer's experience is affected by both. A deeper integration between the user interface and language hence opens up new ways of improving quality, productivity and reliability in programming. The talks in the workshop demonstrated some early examples of such synergy.

A concrete outcome of the workshop is the intent to plan a workshop on the application of the cognitive dimensions (CD) framework to programming languages. CD is a framework for evaluating the quality of interaction design. In this workshop we hope to attract presentations of case studies where such (qualitative) evaluations are performed on programming languages, domain-specific languages, modeling languages etc.

The workshop was organized with talks in the morning, and workshops and discussion in the afternoon. Each morning started with one of the invited keynotes. The afternoon sessions were moderated by one of the participants. During one afternoon we performed a scientific experiment, guided by Alan Blackwell. This consisted of performing a programming task in a visual programming language. The participants retreated in pairs: one participant sat at the keyboard, and the other one observed and made notes; finally a questionnaire had to be filled in. The results of the experiment were collected and then summarized by Alan Blackwell the day after. In more than one way, this was an eye opening experience for many of the participants.

William Cook (Austin, USA)

Tijs van der Storm (Amsterdam, Netherlands)

Eelco Visser (Delft, Netherlands)

The Triggering Mechanisms for Active Galactic Nuclei

22 – 26 July 2013 @Oort

It is increasingly recognized that the feedback effect associated with active galactic nuclei (AGN) plays a vital role in the evolution of galaxies. However, considerable uncertainties remain about how, when and where AGN are triggered. A challenge with making progress in this field is that different communities of astronomers working on the triggering problem (e.g. theorists, low-redshift observers, high-redshift observers) rarely meet to discuss their results and ideas collectively. Therefore the main aim of this Lorentz Center workshop was to provide a forum for discussion between the disparate communities interested in AGN triggering. The workshop was highly successful in this goal, and was marked by an unusually high level of free discussion of the key issues. Although this not the type of field in which there is likely to be a single "eureka moment" that leads to a stepwise change in perception, a general consensus was reached around the following issues.

- **Variability.** It is important to take into account AGN variability when interpreting the results of survey data relevant to the triggering problem, because the duty cycle of the AGN activity is short relative to the timescales of the major events that define the evolution of galaxies.
- **The triggering mechanism is likely to change with redshift.** Although there is now plenty of evidence that galaxy mergers are an important, perhaps dominant, mechanism for triggering the most luminous, quasar-like AGN in the local Universe, the substantially different conditions in the disks of forming galaxies at earlier epochs mean that other mechanisms, such as disk instabilities, are likely to become more important at high redshifts.
- **The timing of the AGN activity.** More theoretical work needs to be done on the timing of the AGN activity in galaxy mergers. Most theoretical models predict that the main phase of observed AGN activity will be triggered close to the peak, or shortly after, the merger-induced starburst that occurs around the time of coalescence of the black holes of the merging systems. However, this is in conflict with the detection of luminous AGN in systems that are observed at a much earlier merger stage, well before the nuclei have coalesced.
- **The last 100 pc.** Regardless of the mechanism that delivers the gas into the central, kpc-scale regions of the host galaxies, little is known about how the gas loses sufficient angular momentum to move from the 100pc scale to the sub-pc scale required to fuel/trigger the AGN. While facilities such as ALMA are likely to make considerable progress in the next few years in determining the distribution and kinematics of the cool gas on scales smaller than 100pc, theoretical progress in this area will require a better understanding of the detailed physical mechanisms, in particular the complex interplay between the gas flows, star formation and the feedback effects associated with both the AGN and regions of rapid star formation.

The excellent facilities of the Lorentz Center and the scheduling of a large fraction of the total time of the workshop to discussion, were key elements in the success of the workshop. In addition, the relatively young age profile of the participants helped to create a vibrant and open atmosphere. The involvement of early career researchers in running some of the discussion sessions and delivering the summary talks at the end of the workshop also proved highly successful.

Cristina Ramos Almeida (La Laguna, Spain)

Clive Tadhunter (Sheffield, United Kingdom)

Sage Days: Algorithms in Arithmetic Geometry

22 – 26 July 2013 @*Snellius*

The goal of this workshop was to bring together mathematicians at diverse career stages to work on the development of the open source computer algebra system Sage and to discuss related mathematical topics. The focus was on the field of arithmetic geometry. In particular, we have chosen to work on finite fields, function fields, Galois representations and semi-stable models of curves.

The participants ranged from PhD students to professors, and from newcomers to Sage to experienced developers. This diversity has proved to be very fruitful during previous Sage Days, and the current edition was no exception.

The talks, of which there were deliberately relatively few, ranged from introducing new users and developers to presenting the latest mathematical research results around the topics of the workshop. Most of the time was spent on actually programming and discussing new implementation projects. Some participants have learned how to use and extend Sage for their own research; others have continued existing Sage projects or started new ones.

Of a list of 48 concrete tasks (bug reports and enhancement requests), 38 have been completed during the workshop or the subsequent months (see <http://trac.sagemath.org/wiki/sd51>). Most of these improvements are already available in the newest release of Sage.

The format of the workshop at the Lorentz Center@*Snellius* venue of the has proved to be very suitable for our workshop. The mixture of lectures and mostly group projects was well-received.

The helpfulness, experience and flexibility of the Lorentz Center staff was extremely useful to us, especially since the organizers were not that experienced in organizing workshops. We highly appreciate the way in which the staff of the Lorentz Center have helped us to shape the workshop and their continuing openness to suggestions.

Peter Bruin (Zürich, Switzerland)

Maarten Derickx (Leiden, Netherlands)

Michiel Kusters (Leiden, Netherlands)

The Molecular Physics of Interstellar PAHs

29 July – 02 August 2013 @Oort

The Lorentz Center workshop brought together an international and interdisciplinary community for interstellar “polycyclic aromatic hydrocarbon” (PAH) research to make an inventory of and to address the key questions and strategies to advance our understanding of astronomical PAHs and maximize the scientific output of ground-based and space observations. The program consisted of invited reviews in this highly interdisciplinary field supplemented by contributed talks sketching the depth of on-going research. The program also included ample time for discussion. The workshop was attended by 57 scientists from 11 countries.

The workshop has very successful in defining the key questions for the field and advised strategies to address these (see below). Specifically, the close interaction between the participants has led to a number of new cross-disciplinary projects among the participants (one of which is already being written up), a newly-founded dedicated newsletter to connect researchers involved in studies on interstellar PAHs, and plans for a collaborative network involving the NWO Dutch Astrochemistry Network and the NASA Carbon in the Galaxy Consortium.

Key questions:

- How does the astronomical PAH spectrum vary?
- What do astronomical PAH spectra tell us about astronomical conditions and evolution?
- What is the inventory of astronomical PAHs and what is their role in the origin of life?

Advised strategies:

- Increase spectral bandwidth
- Enhance guidance and prediction from laboratory and theory
- Develop an “astronomer friendly” toolbox
- Increase diversity and spatial decomposition of astronomical objects
- Encourage interdisciplinary collaboration

Lou Allamandola (Mountain View, USA)

Annemieke Petrignani (Leiden, Netherlands)

Xander Tielens (Leiden, Netherlands)

New Challenges for Early Universe Cosmologists

05 – 09 August 2013 @Oort

The aim of the workshop was to bring together a group of scientist that work in the field of theoretical and observational cosmology, and discuss the status of cosmology after Planck. Theoretically, it is important to obtain a complete understanding of the various predictions that different models of the early Universe make, e.g. how unique is a set of predictions made by any single model. Hence, our goal was to gain a clear picture of model space and to what extend model space had been reduced by Planck. In addition, we hoped to discuss the future of precision cosmology. On the theoretical side, this includes the measure problem, the importance of the landscape and effective description of the early Universe as well as the large scale structure. From the observational side, we wanted to fully probe the potential of existing data, as well as discuss the probes of the future, including future Microwave Background (CMB) experiments as well as measures of large scale structure (LSS). We also aimed to devote time to discuss alternative measures and discuss the impact of large collaborative efforts in future experiments.

We organized the format of the workshop to maximize output, allowing to answer the questions outlined above. Here is a short summary of the main outcomes, which are mostly driven by the discussion sessions:

- Planck analysis probably needs to be improved, which could bring it closer to previous results and relax some tension with other experiments. A completely blind analysis is very challenging for most CMB and LSS, but some steps in that direction can be made.
- There are still several analyses that can be done with current data, including galaxy bispectrum, various CMB trispectra, cross correlations among e.g. CMB, CMB lensing, weak lensing, quasars and Lyman α .
- There is important theoretical work that is needed to interpret observations right now, including analytical tools for LSS with particular emphasis on the Effective Field Theory approach, a theoretically motivate parameterization of models of modified gravity, chart the landscape of predictions from multifield inflation and systematically derive second order effects in cosmological perturbation theory.
- There is a need to establish what we want to test and how. This has specific implications for inflation, the landscape, anthropic reasoning and practical issues, such as funding.

The format of the workshop proved excellent for discussion. We reserved plenty of time for discussion, which were the most productive and insightful of all events. We produced a short report of the workshop discussions, which we shared with all participants through the Lorentz Center website. We also like to stress that the format did encourage everyone to participate. The group size of the group was ideal for lively but effective discussions.

Overall, the organization was pretty good and we have always had the feeling we could immediately and effectively discuss problems and/or issues with one of the Lorentz Center staff members. Practical things that could be improved include:

- It would be way more efficient if organizers could edit things like the website, the schedule and the list of participants without passing through the workshop coordinator. Many changes for example to the schedule need to be done quickly, sometimes from one evening to the next morning and of course there is not enough time for the information to travel all the way through the workshop coordinator. Also this is quite inefficient since it takes much longer to explain what need to be changed, for example in the participant list, than to just change it. There are many effective and typically free options to choose from for sharing files (e.g. google docs, just to mention one).
- We did not feel completely satisfied with the process that lead to the poster. We had to go through intermediaries rather than discussing directly with the graphic designer. The final edits to the poster from the graphic designer were minimal and did not really improve the outcome.

Henk Hoekstra (Leiden, Netherlands)
Eiichiro Komatsu (Garching, USA)
Daniel Meerburg (Princeton, USA)
Enrico Pajer (Princeton, USA)
Koenraad Schalm (Leiden, Netherlands)
Eva Silverstein (Stanford, USA)
David Spergel (Princeton, USA)
Licia Verde (Barcelona, Spain)

Clinical Relevance of Circadian Rhythms

12 – 16 August 2013 @Oort

It is increasingly clear that a robust sleep/wake cycle is a critical component of good health. Work from our field has documented that disrupting the circadian system leads to a set of symptoms that impact cognition, cardiovascular function, metabolism and the immune system. In addition, patients with a wide range of nervous system disorders exhibit disrupted sleep/wake cycles with deficits in the timing of arousal states that could be the result of an underlying circadian dysfunction. These observations raise the possibility that circadian dysfunction may play an important role in disease pathology and that stabilizing the circadian system in the patients may actually improve this pathology. The goal of this meeting was to discuss these topics.

The workshop was designed to promote discussions, rather than to listen to overview talks. All participants were asked to present short lectures (25 min, including discussion) on a particular topic. We asked them to focus on three questions: (1) Does the disease result in deterioration of circadian rhythms? (2) Does the deterioration of circadian rhythms result in aggravation of the disease? (3) Is there evidence that improvement of rhythms can improve the patient's quality of life and perhaps even influence the pathology of the disease?

Many of the speakers presented empirical evidence indicating the causal role of rhythm deterioration in the ontogeny of disease. In the plenary discussions we discussed how to improve interaction between the clinicians and the basic scientists in this area. We also considered how basic information about circadian rhythms can be integrated into the medical school curriculum. Finally, we decided to prepare a document with a resume of our results and discussions. This manuscript should be written in the first place for clinicians, and should be general and accessible for the non-expert. The manuscript will be submitted early spring 2014.

The BBC was informed on our meeting and received input on the program. They have contacted Joke Meijer and several of the speakers (predominantly the British speakers) and are preparing a program on this topic.

The evaluation of the workshop by the participants was extraordinary. Several people commented that this was the most inspiring and pleasant meetings they had had in many years. The unique environment and informal atmosphere prompted the speakers to spontaneously present new and unpublished data, while they were not particularly asked to do so. Several of the speakers came up with new thoughts and presented these to evoke further discussion.

Christopher Colwell (Los Angeles, USA)

Russell Foster (Oxford, United Kingdom)

Johanna Meijer (Leiden, Netherlands)

Dick Swaab (Amsterdam, Netherlands)

NorMAS – Normative Multi-Agent Systems

19 – 23 August 2013 @Oort

Multi-Agent Systems (MAS) is viewed as being composed of a set of autonomous and heterogeneous components, called agents, interacting with each other in an environment. Open MAS are special kinds of multi-agent systems where individual agents may join and leave the system at run-time. Normative MAS (NorMAS) research combines models for open MAS with models for normative systems dealing, for example, with different types of norms such as constitutive norms, regulative norms, procedural norms and coordination norms. Indeed, this is one of the most promising answers to a major challenge raised by open distributed software systems: how to make MAS efficient through social models. In this regard, the employment of normative models in MAS has the purpose of controlling and coordinating the behaviours of individual autonomous agents and support, for instance, various forms of collaborations.

The aim of the workshop was to promote the discussion and exchange of ideas concerning normative MAS. In particular, our aim was to bring together researchers and practitioners from different areas related to MAS, including computer science, artificial intelligence, logic, and law, sociology, psychology, moral philosophy, and economy to discuss their theories, models, and tools that can be utilized in the development of normative multi-agent systems. Finally, we aimed at encouraging collaborations between research groups within and outside the Netherlands.

The workshop was a great success. We had about 50 registrations with an average of 40 participants each day. We had lively and active discussions and collaborations. For the morning sessions, we had 6 keynote presentations (1 hour) and 21 short presentations (15 minutes) on various aspects on normative multi-agent systems. For the afternoon sessions we formed five working groups with the themes 'Norms and Games', 'Norms and Cognition', 'Norms and Organisation', 'Norm Types, and 'Norms and Logic'. The working groups discussed these themes in separate rooms during the first afternoon sessions. The second afternoon sessions were plenary sessions in which the summary of discussions from various groups were presented and discussed. The outcome of the workshop is summarized and available from the Lorentz Center webpage of the workshop. We will have a special issue of the journal of AI & Law devoted to the themes of this workshop. The journal has already accepted our request to have a special issue and we will send out the call for papers very soon, probably before the end of 2013. We will encourage participants of the workshop to collaborate and submit their presented works to this special issue.

We would like to thank the Lorentz Center for giving us the opportunity to organize this workshop. The participants were very enthusiastic and positive about the Lorentz Center and how the workshop was organized. They found the workshop very interesting and productive.

Mehdi Dastani (Utrecht, Netherlands)

Antonino Rotolo (Bologna, Italy)

DFT-based Multilayer Methods for Nanoscale Systems

19 – 23 August 2013 @*Snellius*

The field of multiscale modeling is ever growing and broadening as researchers in both academia and industry are looking to gain deeper insight and better predictive power for real-life applications in life sciences, chemistry and material science.

This workshop brought together scientists from diverse fields (quantum chemistry, computational physics and molecular dynamics) to discuss how to further develop multiscale methods. They thereby focused on multilayer methods containing at least one layer treated with a DFT-based electronic structure method.

Particular issues that we were seeking to address:

- coupling strategies for QM/QM and QM/MM simulations in biochemical applications as well as materials science
- dealing accurately with the boundaries between the layers
- specialized polarizable force fields for multi-layer methods

The workshop brought together researchers from different application fields, in particular biochemistry and materials science. As they noted themselves, they develop and use similar methods and techniques, and thus face comparable problems, but they hardly interact with each other because they don't visit the same conferences or publish in the same journals. So one of the main conclusions was that there is a lot to be gained by knowledge transfer between these two seemingly disparate fields. Another issue that was raised a few times was the lack of good benchmark systems for testing developments before they are applied to other real-life systems.

A few specialists from sub-fields (adaptive QM/MM in biochemistry; subsystem DFT/QM-in-QM methods; development of polarizable force field) found each other at the first time and have made (further) plans for follow-up specialized conferences. SCM will host a small scale workshop in February 2014 where one of the topics that was coined will be tackled for implementation in a scientific code (QM-in-QM, or FDE, for periodic systems). For the longer term, plans have been made to assimilate different methodologies in adaptive QM/MM in a similar flexible environment that can be linked to different QM and MM codes.

An issue that came up over and over again is the need for so-called polarizable force fields in QM/MM applications with appropriate treatment of the boundaries (to eliminate ghost forces). This issue awareness was raised and fully subsumed by the participants, but unfortunately no concrete plans or follow-ups have been construed during the conference. The topic itself, how to generate transferable, general polarizable force fields warrants a focused workshop to make headway.

The format of the Lorentz Center@*Snellius* workshop worked well. The long presentations with explicit room for interruptions and discussions rather than monologues stimulated participation and allowed to gain real insights and to come to new ideas. Consequently, all discussions were more or less done at the end of the day where we scheduled brain storm sessions, which were less effective. Another format that we tried may have worked better there (e.g. specific assignments). We decided to give everyone homework for the last day to write down three take-home action points on the blackboard, which worked brilliantly to activate everyone and also to re-iterate common interests and cross-over points.

Fedor Goumans (Amsterdam, Netherlands)

Thomas Heine (Bremen, Germany)

Lucas Visscher (Amsterdam, Netherlands)

Gossip and the Management of Reputation: the Intersection between the Social, the Natural and the Computational Sciences

26 – 30 August 2013 @Oort

Aims and questions. Gossip and reputation management are essential features of society. Their investigation is part of the frontiers of research in at least three scientific domains: the social, the natural and the computational sciences. Understanding the dynamics, evolution and change of gossip and reputation requires a truly inter-disciplinary scientific effort. Some key questions in this domain are: What incites individuals to share third party information with others? Under which conditions will this information be honest? How do social networks and the Internet affect gossip and reputation dynamics and vice versa? How do reputation systems evolve, and how do they affect societal outcomes like coordination, integration, inequality and well-being? The aim of this NIAS-Lorentz workshop was to setup a collaborative framework through which scholars from diverse backgrounds could identify the most important unresolved research problems in the field, and work together towards the goal of bridging disciplines, methods and views.

Outcomes. The workshop achieved four major tangible outcomes. (1) Though a large variety of different disciplines have made key contributions to the study of gossip and reputation management, so far very little cross-fertilization has taken place. The workshop brought together scientists from disciplines as different as archaeology, anthropology, sociology, philosophy, psychology, biology, mathematics, informatics and cognitive sciences to share their ideas. (2) A general framework for an overarching research program was developed, and the first results produced by four interdisciplinary work groups consisted in the sketch of experimental paradigms and analytical frameworks for future work. (3) The work groups delivered the contours of a possible "work package", which will form the basis for a joint grant application. (4) A large part of the participants committed themselves to setting and maintaining a research community, and they agreed to contribute to the organization of a follow up workshop in 2015.

Major insights. A key insight was the identification of four major domains along which state-of-the-art research in the field of gossip and reputation management can be structured, regardless of the large disciplinary differences: (1) The functions of gossip. (2) The act of gossip. (3) The dynamics of group reputations. (4) The interrelation between gossip and reputation. Progress in each of these domains requires input from all disciplines, and insights about possible new developments were discussed.

Workshop format. The workshop was organized around three pillars: (1) The morning sessions consisted of 1-2 invited talks, covering perspectives from different disciplines followed by discussions. (2) A plenary collaborative mapping exercise, in which the "mainland" of the field was elaborated using the Metaplan-technique of eliciting shared concepts. (3) Afternoons were devoted to workgroup meetings and plenary feedback sessions, during which the groups sketched how their "work package" took shape.

Francesca Giardini (Rome, Italy)

Rafael Wittek (Groningen, Netherlands)

Modeling with Measures: from Structured Populations to Crowd Dynamics

26 – 30 August 2013 @*Snellius*

Four different communities met at the Lorentz Center: (1) Measure-valued balance laws; (2) Structured-population dynamics and selection-mutation models using measure formulation; (3) Abstract functional analysis and dynamical systems in spaces of measures on metric spaces; and (4) Modeling, analysis and simulation of collective dynamics applied to nonlocal transport of mass measures capturing the dynamics of human crowds in heterogeneous domains.

The aim was threefold: (1) Identify measure-valued balance scenarios (relevant for practical applications like population balances in heterogeneous environments) which are really open mathematically; (2) Establish the mathematical/modeling source of difficulties; (3) Start discussions and collaborations to solve some of the identified open problems.

As a direct consequence of the open problems presented by senior scientists, the 23 participants have formed five working groups:

- (i) Boundary conditions for measures-valued balance laws;
- (ii) Conservation laws with stochastic initial data, coefficients, productions;
- (iii) Hyperbolic-elliptic systems;
- (iv) Stability for measures-valued structured-population models;
- (v) Operator splitting techniques for equations in metric spaces.

N.B. Participants came from 7 countries. There were 5 female scientists. The junior-to-senior researchers ratio was 12/11.

We have succeeded to identify a couple of interesting open problems, which were able to generate a couple of basic questions triggering our attention. The titles of the working groups indicate the directions which were taken. Within the working groups contacts have evolved and are now followed-up by bilateral visits. The junior researchers have benefitted much from the tutorial lectures and the discussions afterwards.

There will be a special issue of the AIMS journal Mathematical Biosciences and Engineering (MBE) devoted to the topic of the workshop 'Modeling with Measures: from Structured Populations to Crowd Dynamics'. Any participant or group of participants is invited to submit a paper to this special issue.

From the feedback of the participants, we feel strongly that the workshop was a success. The participants have agreed that a follow-up workshop in the same research direction (and organization spirit) would be very much welcome. Potential candidate locations for this are CIRM/Marseille (France) and the Banach Center (Poland).

Azmy Ackleh (Lafayette, USA)

Rinaldo Colombo (Brescia, Italy)

Sander Hille (Leiden, Netherlands)

Adrian Muntean (Eindhoven, Netherlands)

SIMCO - Set-Oriented and Indicator-Based Multi-Criteria Optimization

02 – 06 September 2013 @Oort

Or... when even the largest whiteboards become too small...

The fascination of science is sometimes hard to understand for people who have not yet discovered it on their own. If people do not understand why coffee breaks at conferences are always too short, some discussion, writing, or coding must be completed although it is late at night, they surely cannot understand the distinctiveness and uniqueness of a Lorentz-Center workshop.

I guess the only situation during our time in Leiden where most of the colleagues really lost the connection to their scientific work was a beautiful sunset on the Kaag lakes during the workshop's dinner boat cruise. However, this was not the only thing perfectly organized by the Lorentz Center staff. Many thanks to them, also for making the scientific organizers establish moderators for each workshop day. This made the whole workshop much more stress-relieved and, thus, a scientific success for the scientific organizers as well.

Significant scientific progress was accomplished during our days at the Lorentz Center. We began to merge two distinctive scientific fields by learning from and about each other. We agreed upon a terminology to be used in upcoming publications and improved our understanding in set and indicator based approaches a lot.

But did we achieve *all* our scientific aims? We do not think so. For example, there was this working group discussing a special topic for hours in the afternoon sessions, even during coffee break of course. In the following plenary session (a daily event planned for 30 min., 60 would have also been too short ...) a colleague pointed them to a paper he knew where possibly some of their results have already been discussed. Of course, the group postponed dinner in downtown Leiden for more than 2 hours just recognizing that their afternoon discussion was more or less reinventing the wheel, and of course, they were disappointed at first. But, who can imagine what, in terms of work, money, etc., actually has been saved by the group having been made aware of this paper? Moreover, they of course continued their work but now with the bar set one or two steps higher.

Apart from the stated aims of the workshop, in which we also progressed, these lucky coincidences are also what made this workshop so useful, even invaluable. All in all, due to the contribution of all participants, we were privileged to have inspiring talks and discussion sessions. The organizers want to particularly thank all speakers and moderators, namely Ana Custódio, Mădălina Drugan, Viviane Grunert da Fonseca, Andreia Guerreiro, Jürgen Branke, Karl Bringmann, Tobias Glasmachers, Carlos Fonseca, Joshua Knowles, Luís Paquete, Jan Vahrenhold, and Marc van Kreveld.

Finally, another important result of the workshop was an up-to-date inventory of results and open mathematical questions that will be maintained as a public Wiki-list. Moreover, 10 high priority research themes to be addressed in future work were determined in a plenary discussion on the final day of the workshop. We stopped with just 10... before even the large whiteboard in the lecture room got too small again...

Dimo Brockhoff (Villeneuve d'Ascq, France)

André Deutz (Leiden, Netherlands)

Michael Emmerich (Leiden, Netherlands)

Boris Naujoks (Gummersbach, Germany)

Modelling Meets Infant Studies in Language Acquisition: A Dialogue on Current Challenges and Future Directions

09 – 13 September 2013 @Oort

The study of first language acquisition is crucial in furthering our understanding of the cognitive prerequisites and processes involved in language, a defining capacity of human cognition. Currently, early language acquisition is successfully studied from two main perspectives: one approach tests theoretical assumptions by studying infants' responses with behavioral and neurocognitive methods; the other implements theories by means of computational models. This workshop aimed to bring these two approaches closer together, a much needed advance in the field and one that promises to deepen our understanding of the issues that play a role during language acquisition.

The intended outcome of the workshop was to foster communication and collaborations between researchers from the different fields. With that goal in mind the workshop provided ample time for informal discussions in small groups. Partly these were directed towards the goal of forming future collaborations, partly they tackled current questions in the field of language acquisition and exchanged viewpoints. The groups formulated research and grant proposals that incorporate both a modeling and an experimental component. In fields where conferences and workshops are packed with plenary presentations, the workshop's focus on discussion in groups was a welcome change and proved very fruitful in incubating new ideas and collaborations.

Momentarily, several of these groups are working together and actively pursue the questions formed during the course of the workshop. A special issue in an international journal is planned to provide a platform for the outcomes of the currently conducted studies. In addition, we will invite contributions from other interested researchers who are currently collaborating in interdisciplinary teams. We, the organizers, believe that one of the main outcomes of the workshop was the realization that the lack of communication and understanding between the two fields on the one hand hampers the progress of science and on the other can be mitigated by continued collaboration and an open exchange of ideas and results.

The assistance in planning and execution of the workshop provided by the Lorentz Center was crucial to its success. Without the support of experienced organizers and without the wonderful venue we feel the workshop would not have been as successful and stimulating as it was. We can heartily recommend the Lorentz Center to other researchers - the experience they provided was truly unique.

Christina Bergmann (Nijmegen, Netherlands)

Rens Bod (Amsterdam, Netherlands)

Paula Fikkert (Nijmegen, Netherlands)

Maarten Versteegh (Nijmegen, Netherlands)

Biophysics, Biochemistry and Physiology of Fat Digestion

16 – 20 September 2013 @Oort

Description and aims

Many key issues in public health, such as obesity, adequate infant nutrition, food for the elderly, and at least some of the initiators of hypercholesterolemia and cardiovascular disease, are related to a disfunctioning or dysregulation of digestive and absorptive processes and inadequate food properties. Focusing on dietary lipids such as fat, cholesterol, lecithins and lipidic vitamins, the complexity of the digestion and absorption in the alimentary tract has resulted in a multitude of scientific disciplines (e.g. food emulsion technology, food physics, enzymology, medical, pharmacy, physiology, infant and elderly nutrition) that work more or less in isolation on separate aspects. It was the purpose of this workshop to bring together researchers from these different disciplines to stimulate debates and discussions and to cross fertilize new-ideas and facilitate establishing new cross disciplinary collaborations. The format of the workshop was generally considered to be a success. We would certainly advise it to others.

Tangible outcome

This workshop was considered to be a success if it would break down barriers and lead to collaboration between workers in the different science areas, and also attracts attention from those who can apply the information in the food industry. This was certainly achieved: the format and selection of disciplines of the workshop has led to lively discussions and strongly improved the feeling of shared interests between the different disciplines with many moments of recognition.

Typical "aha-moments" were:

- Medical workers realized that food physiology knowledge can give input in directing bariatric surgery.
- Cholesterol breast milk might be an important ingredient that is missing in infant formula; a possible role is that it protects against the harsh action of bile salt in the infants developing intestine.
- There is considerable overlap between the *in vitro* modeling tools used by food scientists and pharmacists, but they use different modeling conditions.

Intended tangible outcomes are:

- Setting up a collaboration between various participants of the workshop to work out a proposal for subsidized collaboration in the field of fat digestion.
- A journal paper reviewing the outcomes of the workshop in a journal such as Food & Function.
- Critical review on the functions and mechanisms of bile in fat digestion and lipid absorption.
- Critical review on the role of inter-individual variation in the interpretation of *in vivo* studies and consequences for *in vitro* trials.
- Critical review on fat lipolysis studies; which are the crucial parameters that should be taken care of?
- Critical review on capturing the complexity of the physiological system of the alimentary tract by suitable *in vitro* studies; balance between more complex *in vitro* simulation setups and dedicated smaller experiments and the role of computer modeling.
- To keep each other updated about the progress of these intended actions, a follow up meeting will be scheduled within 1 year, and a linked-in group (Biophysics, Biochemistry and Physiology of Fat Digestion) has been opened.

George van Aken (NIZO Food Research, Netherlands)

Simeon Stoyanov (Unilever R&D, Netherlands)

Peter Fischer (ETH Zürich, Switzerland)

Freddy Troost (Maastricht, Netherlands)

Observational Signatures of Type Ia Supernova Progenitors II

23 – 27 September 2013 @Oort

Scientific case and motivation

Type Ia supernovae are bright stellar explosions, observed in old as well as young stellar populations and are believed to be thermonuclear explosions of degenerate carbon-oxygen white dwarfs, most likely triggered by the compression of the objects as they grow in mass towards the Chandrasekhar limit. They are one of the main sites of nucleosynthesis in the Universe, being responsible for most of the iron ever produced. Their tight peak luminosity – light curve shape relation has enabled their use as distance indicators in cosmology, giving the first clues that the expansion of the Universe is accelerating. Yet, the configuration and trigger of the explosions are unknown. Three years ago we had a very successful Lorentz Center workshop on this topic and the current one was to see where we stand now. There have been many new developments, both on the observational as well as the theoretical side. In this Lorentz Center workshop we again brought together a significant fraction of the researchers working on the different observable signatures of the progenitors.

The workshop

A total of 55 participants from 9 countries participated in this second workshop in a series. Given the fast developments in the field, the mornings were filled with short talks in which almost all participants updated each other on the newest results. These include the non-detection of any signs of progenitors, companions, interaction with progenitor winds etc. The 2011fe supernova in M101 provides particularly strong constraints. The progenitor models have been developed much further, showing that there are many possibilities that still have to be explored further in order to interpret them in the light of the observational signatures. The afternoons were structured around either “round table” discussions, or moderated discussions. In these discussions the participants had the opportunity to exchange ideas and sharpen their own future research plans. At several points in the discussion participation of PhD students was stimulated (enforced) by allowing only them to talk.

Final remarks

The workshop was again a great success. Many participants were very excited about the topics, the mix of participants and the set-up of the workshop and expressed the hope that there would be a third one in the series in a few years’ time. The success was certainly also due to the excellent facilities and support of the Lorentz Center. We also gratefully acknowledge funding from the Lorentz Center, NOVA and NWO.

Andy Howell (Goleta, USA)

Dani Maoz (Tel Aviv, Israel)

Paolo Mazzali (Garching, Germany)

Gijs Nelemans (Nijmegen, Netherlands)

Jacco Vink (Amsterdam, Netherlands)

Life Sciences with Industry

07 – 11 October 2013 @Oort

Industries DSM, KeyGene, PamGene, Philips
Participants 32 PhD students and postdocs (30 NL, 1 BE, 1 DE)

Aim

Dutch research policy is increasingly stressing coupling of academic research to industrial R&D. To be effective, mutual understanding between the two worlds is essential. This workshop aimed to contribute to such understanding by exposing young investigators in the life sciences in academia to application-oriented research challenges of Dutch industry. The workshop builds on the long-term positive experience with similar workshops in the fields of physics and of mathematics.

Format

The students worked in four groups of eight participants, each tackling a specific challenge formulated by one of the four industrial partners. Each group was supported by a coach from academia and a senior scientist from the industry involved. During the workshop the groups mostly worked for themselves, doing research and discussing about tangible approaches and solutions of the problem they were confronted with. There were a few fixed points: (i) on Monday the representatives from industry introduced their problems and there was a brief introduction into the world of intellectual property, (ii) Wednesday morning each group presented a mid-term report that was discussed plenary, and (iii) on Friday the final reports were presented and discussed.

Outcome

The students tackled the challenges for the four companies with remarkable vigour and creativity. Also, the senior scientists from industry were enthusiastic, both about the process and the outcome. The students confirmed that for many of them the workshop was very challenging and an eye opener; using science to solve practical problems from industry was a new experience.

The success of this first Life Sciences with Industry workshop has convinced the organisers to repeat the workshop in 2014, using the same format, and possibly make this a yearly event at the Lorentz Center.

Jan Pieter Abrahams (Leiden, Netherlands)

Roel van Driel (Amsterdam, Netherlands)

Ellen Feddes (Utrecht, Netherlands)

Kirsten Martens (Leiden, Netherlands)

The Future of Art-Science Collaborations

07 – 11 October 2013 @*Snellius*

A growing number of both scientists and artists is becoming deeply unhappy with the still dominant view that art and science are largely unrelated – a view that is reinforced on all sorts of levels (institutional, educational, social status, and so on). They argue not only that science and arts can benefit enormously from what 'the other side' has to offer, but many also question the very presumption that we are dealing with fundamentally different areas of interest. The ambition to (re)unite art and science has given birth to a large number of so-called art-science collaborations. These projects are often met with great enthusiasm. But what to make of them? What is the rationale behind art-science collaborations and how valuable are they really?

The ease with which art-science collaborations are sometimes presented as 'urgent' or 'full of promise' justifies a critical examination of both the assumptions underlying these projects and their success rates. How well are art-science collaborations motivated? To what extent are they driven by a gut feeling, a desire even, that something good must come from mixing arts with sciences? And what about the projects that have already taken place? Are we (already) in a position where we can draw conclusions as to when and how art-science collaborations can be made a success, if at all?

In this workshop we took a friendly, open-minded but critical position as we explored the more fundamental aspects of art-science collaborations. The aim of the workshop was no so much to realise a scientific breakthrough as it was to explore and define the conditions under which art-science collaborations can be made a success, and thus, in a sense, laying the groundwork for scientific breakthroughs. We believe the workshop was a great success. Workshop participants were very keen to explore the 'project management dimensions' of art-science collaborations, a topic that is addressed rarely as scientists and artists tend to be focussed on the content of the project primarily. The results are also very valuable. By the end of the week, we had developed a firm understanding of how the most important aspects of collaboration (motives for collaboration, goals, collaboration models, collaboration performance indicators and institutional context) work together.

We tried the workshop to be as lively and interactive as possible. Very few key notes and lots of working in small groups. That worked really well for everyone. It ensured that everyone was actively involved. The Lorentz Center facilities are brilliant in this respect. It enables both plenary and break-out sessions, formal and informal talks, and so on. Support was also very good. The Lorentz Center staff really lets the workshop participants focus on the workshop itself.

The workshop organisers are now preparing a report in which we reflect on the workshop outcomes. The document is meant as a 'survival guide' for artists and scientists who intend to work on a joint project. This document should be published this year (2014).

Lucas Evers (Amsterdam, Netherlands)
Martijntje Hallmann (Amsterdam, Netherlands)
Edwin van der Heide (Leiden, Netherlands)
Joost Rekveld (The Hague, Netherlands)
Jacco van Uden (The Hague, Netherlands)
Louise Whiteley (Copenhagen, Denmark)
Rob Zwijnenberg (Leiden, Netherlands)

Noncommutative Geometry and Particle Physics

14 – 18 October 2013 @Snellius

Scope and goal

The main goal of this workshop was to bring together scientists working in noncommutative geometry and in particle physics, to see how experimental findings (e.g. in particle accelerators, but not exclusively) provide inspiration for noncommutative geometry, and *vice versa*, how noncommutative geometry can provide tools for phenomenological model-building.

Development

The workshop consisted of morning lectures (crash courses) on topics in noncommutative geometry for particle physicists (by Alain Connes, Walter van Suijlekom and Ali Chamseddine) and *vice versa* on particle physics for noncommutative geometers (by Elisabetta Pallante). Also, on Monday experimental updates were given on dark matter searches and on particle searches at the LHC, and a Higgs status report (Patrick Decowski, Paul de Jong and Stan Bentvelsen) which already on the first day led to lively discussions. Here it became clear that noncommutative geometry and experiments in particle physics both take a *spectral point of view* in analyzing the fine-structure of spacetime and matter: in the first through the spectrum of a linear operator, in the second through the energy spectrum.

Besides more advanced seminars there was much discussion time during the workshop, in particular through the "study groups". In the latter, two topics were selected (out of four) by the participants: *Higgs vacuum stability* and *Lorentzian NCG: is space-time non-commutative?* After the breakout in two groups, a plenary discussion brought thoughts and new insights together. Also, the discussions were sustained by a website www.noncommutativegeometry.nl, serving as a repository with background material as well.

Beyond the workshop

One of the successes of the workshop was that the mingling between noncommutative geometers and particle physicists actually took place, which is not an automatic result. In this respect, the active attitude of the latter in critically evaluating the noncommutative approach was very valuable. On Friday, it eventually led to new research questions during the final discussion which, though still open, could be formulated with clarity. This naturally suggests directions for future research in noncommutative model-building and in making predictions for physics beyond the Standard Model.

Acknowledgement

The organizational support of the Lorentz Center was excellent, leaving essentially only research problems for the organizers. Also the open nature of the Lorentz Center@Snellius venue was greatly appreciated by all participants.

Thijs Van den Broek (Nijmegen, Netherlands)

Alain Connes (Bures-sur-Yvette, France)

José Gracia-Bondía (Zaragoza, Spain)

Piet Mulders (Amsterdam, Netherlands)

Walter Van Suijlekom (Nijmegen, Netherlands)

Hot Nanostructures

21 – 25 October 2013 @Oort

Description and aims

The last few years have seen a flurry of research on the interplay of light and heat around metal nanostructures. This new scientific field holds much promise for the detection and tracking of nanoparticles in complex media, for monitoring and directing Brownian motion, and for the exploration of fundamental problems in non-equilibrium physics. The workshop explored several questions at the interfaces between these different subjects, including theory, numerical simulations, and experiments.

Main highlights

One of the main questions addressed by the workshop was the transport of heat at the nanoscale, from a theoretical point of view (Seifert, Kroy) as well as its description in numerical experiments (Donadio, Chalopin). In particular interfacial thermal resistance (Kebllinski) and its effect in carbon nanostructures and composite materials was pointed out.

Temperature gradients and energy flows give rise to a number of fascinating effects (Sano), leading to transport –Soret effect– or to rotation of particles –the much lesser known Lehmann effect. These effects can be combined with optical forces and applied in biophysics (Dholakia, Oddershede) and lead to ordering in colloidal assemblies (van Blaaderen) or to thermophoresis in life cells (Seidel). These effects allow new types of thermal swimmers to be controlled and tracked (Yang) and their interactions with the fluid environment can be accurately modeled (Sader).

The workshop also aimed at bringing together the heat transport community with the plasmonics and nano-optics community. Therefore, a number of discussions and talks were concerned with thermal effects in plasmonic structures and around nanoparticles (Käll, Giessen, Link, Sheldon). In particular the reliable measurement of the local temperature is a central question, to which different experimental approaches were proposed (Quidant, Oddershede, Lohmüller). The major role of the near field in thermal radiation at short distances was stressed and came as a surprise to many of us (Greffet).

Tangible outcome

The discussions were mostly concentrated and channeled during the three round tables, which were designed to explore the interfaces between theory and simulations, the thermal driving and control of swimmers and applications of heat transport in biological systems. The sometimes passionate discussions must be considered as one of the successful outcomes of the workshop.

The notion of effective temperature and its justification in non-equilibrium systems was hotly debated. The treatment of temperature gradients and the use of equilibrium versus nonequilibrium methods is still controversial, as is the manner of including anharmonicity in phonon based treatments.

Plasmonics is a very active field, with applications to sensing, Raman spectroscopy and chemical analysis, stable markers, photovoltaics and new conducting materials such as graphene. Plasmonic particles are particularly interesting as swimmers based on a different principle than chemical or magnetic swimmers, and which potentially can be controlled and optically switched in live cells or tissues.

Finally, the description of heat transport is surprisingly well described by Coulomb forces only, including radiation in the near field. The Kapitza interfacial resistance appears important for small particles only (less than 10 nm), as it can be regarded as adding a small, constant effective layer of material. However, the size dependence of many parameters is still an open issue and will greatly benefit from detailed comparison between laboratory and numerical experiments. These effects are of great importance for the technology of nanocomposites. Similarly, the question of phase transitions at the nanoscale is largely open and will provide a large field of basic and applied questions for the coming years.

Generally, the workshop brought together a number of scientific domains (non-equilibrium thermodynamics, diffusion, plasmonics, biophysics) that barely meet each other in usual discussion fora. In the future, more subjects of interest will be approached and invited to join this new community, in particular spin-heat coupling, and the non-equilibrium thermodynamics of molecular motors. Davide Donadio has agreed to organize a follow-up meeting in two years in Germany (Mainz).

Workshop format and acknowledgment

The workshop gathered 37 registered participants from 13 countries and a number of informal participants from Leiden University and Delft universities. The organizers received very positive feedback from nearly all participants, who appreciated not only the choice of subjects and their variety, but also the excellent ambience and facilities provided by the staff and organization of the Lorentz Center.

Jean-Louis Barrat (Grenoble, France)

Frank Cichos (Leipzig, Germany)

Michel Orrit (Leiden, Netherlands)

Training Workshop Interdisciplinary Life Sciences

21 – 25 October 2013 @*Snellius*

The aim of the workshop is to bring together 25 junior Life Science researchers and train them in modelling of biological systems based on 'learning by doing'. This will be achieved by tackling carefully selected problems in modern Life Sciences. Students will work together during one week in small multidisciplinary groups supervised by an experienced senior scientist. Groups will identify the relevant system parameters and catch the problem in quantitative and predictive models. Important is that each participant is not only involved in the problem of his/her own group. They also learn from modelling strategies and results of other groups. This setup of actively involving young researchers in problem solving is supported by lectures in which techniques and concepts necessary to address modelling problems are presented.

The teams worked on the following topics:

- Modelling of networks regulating flowering time in plants
- Modelling of blood vessel growth
- Reconstruction of the gene network regulating branching Tomato

Splendid plenary lectures were given by Bas Teusink (Free University Amsterdam) on Modelling of Glycolysis and Bela Mulder (FOM Institute Amolf, Wageningen University) on Biophysical Modelling of Plant Cell Walls.

The teams worked hard and enthusiastic. At the end of each day the teams presented the progress of that day in a plenary session. This worked very effectively: sometimes the members of another team came up with a suggestion that was immediately picked up and worked out the next day.

The enthusiasm to work on the problems was that high that we cancelled the planned third plenary lecture. Our experience is that the number of plenary events must be kept low. If needed, the supervisors can provide an introduction on a modelling topic (e.g., parameter estimation) for the members of each team separately.

During the week there was hardly time to write a report. However, the teams continued the cooperation and produced three thorough and nicely written reports. These reports are loaded up to the *PeerJ Archive* for scientific reports. The team working on reconstruction was so inspired that they intend to continue this research in order to publish it.

In general, the participants responded that they had learned a lot of both modelling in systems biology and cooperating in an interdisciplinary team.

Roel van Driel (Amsterdam, Netherlands)
Roeland Merks (Amsterdam, Netherlands)
Jaap Molenaar (Wageningen, Netherlands)

Responsive Matrices for Solar Fuels

28 October – 01 November 2013 @Oort

The need for renewable fuel sources on a large scale is one of the most pressing problems facing today's society. Many scientists believe that it will be possible to use the working principles of photosynthesis for the production of solar fuels. One of the most intriguing aspects of nature's success is the use of 'responsive matrices': the various components (antennas, charge separators, multi-electron catalysts for water splitting and fuel production) in photosynthesis are pre-programmed by their protein environment for optimal operation in their given function. Furthermore, this matrix enables the system to self-assemble and self-repair. This workshop brought together researchers from diverse areas in (artificial) photosynthesis research to gain an understanding of how nature uses these responsive matrices, and how we can imitate nature's success.

There were 54 participants, 22 talks and about 15 posters. The program was designed with ample time for discussion: plenary discussions at the end of each session, coffee breaks with posters hanging nearby, lengthy lunch breaks giving opportunity for informal interactions and parallel small group discussions after lunch on three of the five days.

Key steps for the construction of a solar-to-fuel device with responsive matrix components are synthesis and design, structure-function analysis, and systems integration. The presentation sessions were therefore divided up into these themes. The talks were all met with great enthusiasm by the participants and led to lively discussions at the end of each session. The parallel discussion sessions were on the subjects of antenna systems and charge separators, multi-electron catalysis, systems integration, self-assembly and self-repair in photoelectrochemical systems, and analysis methods and theory. In these groups, researchers working in these various areas brainstormed on how to move their area of research forward. During these sessions participants defined common goals and identified the problems that needed to be solved to achieve those goals. Collaborations were even seen between these different groups: on the penultimate day of the meeting, the multi-electron catalysis group and the systems integration group discovered that they had so much in common that they combined forces to discuss new directions of research together. One of the key conclusions of the discussion sessions was that there is a need for more sharing of information between different disciplines. Strategies for achieving this were proposed.

The workshop was connected to the Leiden University Honours program with the class "Responsive matrices for solar fuels". We had four Honours students present at the workshop. Each of these students was assigned to a discussion group where they participated in the discussion, took notes and helped with the reporting of the group. It was a delight to see these students participate more and more through the workshop as they became more familiar with the subject and more relaxed with the workshop environment.

All in all, it was a highly successful meeting where new collaborations were forged and researchers obtained a better view on the next steps for their field to achieve the goal of making an artificial photosynthetic device. As a result of this workshop, ideas for new proposals have been seeded and at least one has been submitted.

We are extremely grateful to the Lorentz Center, for their expert handling of all practical matters. This made the workshop a pleasure to organise and a relatively stress free experience. This workshop would not have been possible without financial support from the Lorentz Center and the BioSolar Cells program.

Richard Cogdell (Glasgow, Scotland)
Huub de Groot (Leiden, Netherlands)
Alfred Holzwarth (Mülheim an der Ruhr, Germany)
Sebastian Mackowski (Torun, Poland)
Robin Purchase (Leiden, Netherlands)

Hidden Order, Superconductivity, and Magnetism in URu_2Si_2

04 – 08 November 2013 @ *Oort*

The aim of the Workshop *Hidden Order, Superconductivity and Magnetism in URu_2Si_2* was to understand strongly correlated electron materials by focusing on the metallic heavy fermion (HF) systems. Among the many intermetallic HF compounds one particular material stands out, viz., URu_2Si_2 whose above-titled behavior has puzzled researchers for 30 years. By bringing together ca. 45 experts, i.e., active researchers in the HO problem, for 5 intense days of discussions and debates (plus some of the 2 weekends), progress and understanding were accomplished by:

- i) Creating relationships and correlations among the different experimental techniques, e.g., ARPES and quantum oscillations, and STM/STS and optical spectroscopy.
- ii) Use of density functional theory as a guiding principle for experimental comparisons.
- iii) Searching out the valid theoretical description of certain experiments.
- iv) Identifying areas of ambiguous or controversial experimental results.
- v) Eliminating theories or models through their invalid experimental predictions.
- vi) Deriving consensus towards a valid description of HO and its coexisting superconductivity and nearby magnetism.
- vii) Listing future steps for a complete and final understanding of the HO problem which unfortunately was not reached during the workshop.

A unique form of the lecture sessions was to have 2 experimentalists present their latest results on a particular technique with full audience discussions, then after a coffee/tea break a theorist, whose work is directly related to the specific experiment, offers a criticism and a comparison. Naturally there is ongoing scrutiny from the participants which often needs to be controlled by a strict session moderator. The dialogue usually continues into the 2 hour lunch break or evening venue. We found that this "trimer" experiment/theory session functioned quite well and led to an enhanced stimulation of questions and interactions. And we recommend its future use in other workshops where there exists a need for comparison between experiment (data) and theory (models). So with the impulse of the trimer sessions we generated a continuing and penetrating debate throughout the workshop. Posters were viewable the entire week and generated additional areas of discussion.

The workshop began with 2 general overview talks on HF and HO. Wednesday afternoon was devoted to the very latest experiments, polar Kerr effect and Raman scattering, followed by 2 explanations of the state of the theory. There were 7 of the above-described trimer sessions. And at the concluding session 2 senior theorists and 2 of the organizers give their views and thoughts on the workshop. These and the reactions from the participants were very positive and indicated a most successful and stimulating event. After the workshop a series of "thank you" notes were received in Leiden to confirm the above. In addition a number of manuscripts of new results that were generated by the workshop have been submitted to leading scientific journals.

Financial support for the workshop was garnered from the Royal Netherlands Academy of Arts and Sciences (KNAW), National Science Foundation (NSF) and Institute for Complex Adapted Matter (ICAM), Institute Lorentz (IL) and Lorentz Center (LC). This funding included lodging, lunch and travel support for the needy, mostly USA, participants. We are most grateful for this generous support which not only enhanced the workshop venue but further stimulated its scientific component. And most important was the competent advice, assistance and coordination of the Lorentz Center with its highly competent staff and organizational ability. This daily support allowed the workshop to become a focused scientific event and not a bureaucratic episode. We extend our heartfelt appreciations and thanks to the staff of the Lorentz Center for making the workshop a singular scientific happening.

Yuji Matsuda (Kyoto, Japan)

John Mydosh (Leiden, Netherlands)

Peter Oppeneer (Uppsala, Sweden)

Jan Zaanen (Leiden, Netherlands)

Synthetic Biology and Symbolic Order

04 – 08 November 2013 @Snellius

1. Description

Leading natural scientists and scholars from the humanities and social sciences, from different countries, were brought into a dialogue on the relation between Synthetic Biology (Synbio) and the present symbolic order.¹

Questions: What do the metaphors used in the presentations of Synthetic Biology tell about the way in which reality is constructed, understood and handled? How do these metaphors relate to central elements of our predominant symbolic order? What could be the long term social and cultural implications?

Aims:

- State of the art of Synbio; promises and the likely direction of its development.
- What metaphors are prevailing in the stated aims of Synbio and descriptions of the field? To what extent do we see tensions between these metaphors and distinctions pertaining to our prevailing symbolic order?
- In light of that: How could Synbio affect the predominant Symbolic Order and what could be the cultural and social implications?
- What could and should that mean for the public debate and public policy regarding Synbio?

2. Tangible outcome

Better insight into how public discourse on Synbio and public policy should be given shape in order to avoid unfounded polarisation as well as problematic socio-cultural implications (even apart from immediate risks for human life or the environment).

3. Scientific breakthrough?

An important insight that grew during the workshop, in our view, is:

- (Many) Synthetic biologists aiming at scientific insight into the physical chemical substrate of life realize that living organisms are never completely predictable and makeable; there is a dimension to them that transcends the purely mechanical. This characteristic can be used in letting certain 'redesigned organisms' continue to evolve to optimize some characteristics. Reductive metaphors like 'living machine' have a heuristic value in a certain context but should not be reified as true descriptions of reality.
- Synthetic biologists aiming primarily at redesigning organisms to produce desired substances more strongly aim at total control and they use corresponding metaphors, like 'chassis', biobricks as 'lego parts'. Such reductive metaphors easily provoke resistance to this work because it challenges the symbolic order (see also below).

4. "Aha" moments?

We are not aware of clear-cut Aha-experiences, but the reactions make clear that many participants, both Synbio researchers and philosophers/social scientists, have deepened their insight into the background of the 'uneasiness' that presentations of synbio provoke as well as into ways how to avoid that, viz., by also using open, non-reductive metaphors, e.g. 'nudge life' instead of 'remake life'.

5. The format of the workshop

We used a combination of expert lectures, open discussions and group discussions with brief presentations of results. The strong diversity of disciplines (both natural and social scientists and philosophers) required time for explanations but proved fruitful. The strategy of openness to all types

¹ Symbolic order: those notions and distinctions that constitute the symbolic environment in which people in a certain culture live, e.g. the distinctions life - death, biological life – organic material, living - non-living, natural - artificial, (biological) organism – machine.

of (communicable) arguments and postponing judgement worked well. The content and sequence of the expert lectures was carefully designed in order to develop together insight into the subject.

New was that for the last day of the workshop we invited interested and informed new participants to discuss the preliminary results of our work. This forced us to formulate clearly what we had come up with and, as foreseen, broadened the discussion to the topic of public debate and policy.

For our purposes the format of the workshop was ideal. The facilities, the time span and the size of the group were perfect for the exciting but uncertain endeavour of this workshop.

We have published and are publishing (some) results in a newspaper article, professional articles and (a) scientific paper(s).

Henk Jochemsen (Utrecht, Netherlands)

Bert Poolman (Groningen, Netherlands)

Dirk Stemerding (The Hague, Netherlands)

Hillie van de Streek (Utrecht, Netherlands)

Hub Zwart (Nijmegen, Netherlands)

ICT with Industry 2013: from Specific Problems to Innovative Solutions

11 – 15 November 2013 @Snellius

Following the success of Mathematics with Industry and Physics with Industry, the Netherlands Organization for Scientific Research (NWO) and Technology Foundation STW organized for the first time the workshop ICT with Industry at Lorentz Center@Snellius. The aim of this workshop was to provide a platform for networking between computer scientists and industrial partners. About forty computer scientists from a wide range of universities in the Netherlands worked together extensively on challenging problems proposed by the industry during a week. The workshop was expected to lead to a number of new papers and/or research initiatives and to establish new research collaborations between computer science and industry.

The industrial partners presented their urgent industrial problems and objectives on the first day. The following days the computer scientists started brainstorming, programming and solving the problems in different groups closely guided by the industrial representative and supported by senior researchers. On the last day, all groups presented their findings and solutions with concrete next steps.

New understanding of power smartphones: a safe way for cyclists to pass on information about road conditions

Computer scientists from different disciplines worked on three study cases submitted by the Netherlands Institute for Sound and Vision (NISV), Seecr and Rijkswaterstaat. The study case of NISV resulted in a system design for scalable content querying of the NISV archive. Another group of computer scientists worked on the study case submitted by Seecr, which delivered a completely generic semantic clustering approach that can be further developed for real time queries. And finally, the study case of Rijkswaterstaat resulted into an initial approach using off-the-shelf technology in combination with the datasets delivered by cyclists.

The representative of Rijkswaterstaat, Marcel de Rink, who is account manager within ESRI Netherlands said:

"It is promising that there is such a great result after one week. In the test rides we can already see that the sensors measure the differences in acceleration. This result is very promising and I expect this will make a change. There is certainly a market for this type of tools. Operators and companies with an appropriate business model can pick this up and capitalize the knowledge. ESRI should be able to link the measurements to the road network. So a great and promising result for this group."

In general, the participants were enthusiastic about the format of the workshop, which gave them the opportunity to expand their knowledge and network by collaborating intensively on a real practical study case. The participating industrial and public partners attended the workshop by presenting the study cases. During the workshop the researchers were more than happy to assist the industrial partners in formulating their research questions. The organizers received positive feedback about the hospitality and facilities offered by the Lorentz Center.

To ensure the success and the embedding of the Workshop ICT with Industry study group in the Dutch research community, it is essential to organize a second edition as part of the continuity process. The second edition of the ICT with Industry study group will be organized 13 – 17 October 2014.

For more information and papers please visit <http://www.nwo.nl/en/about-nwo/organisation/nwo-divisions/ew/events/2013+ICT+with+Industry+workshop>

Margriet Jansz (Utrecht, Netherlands)

Rosemarie van der Veen-Oei (The Hague, Netherlands)

Physics with Industry: 1 Week, 50 Scientists, 5 Problems

18 – 22 November 2013 @Oort

1. Workshop description and aim

The main aim of this annual workshop is to obtain creative solutions for challenging industrial problems and to bring physicists in contact with industrial R&D. During the workshop a group of about fifty junior and senior scientists (mainly physicists and some participants from other (applied) sciences) come together to tackle industrial problems. After a thorough presentation of the five problems by the companies, the scientists devote the entire week at dissecting, modelling, analysing and discussing their problem of choice within their group and with the industrial representatives. Several groups perform experiments in the laboratories of Leiden University. By Friday the groups present their solution to the companies. This year's cases were provided by: Océ Technologies, PamGene International, RGS Development, Oranjewoud and Tata Steel.

2. Outcome

At present negotiations are taking place with respectively Tata Steel and Antea Group (formerly Oranjewoud) and the Technology Transfer Offices of several Universities to enable patenting of workshop results from both cases.

The SME company RGS Development describes the impact of the workshop as follows: "Analyzing the results after a couple of months "back at work", we realize that this week had a great impact on our development strategy and that the outcome of the Physics with Industry workshop became the basis for our line of thinking today."

3. Scientific breakthrough

RGS Development now provides funding for a student doing research in Amarante Bottgers group to test the composites advised by the PwI-group.

4. "Aha moments"

Tata Steel and RGS Development realized that they can help each other. Tata Steel will be a launching customer for RGS Development, helping the latter to further develop their product.

5. Format of the workshop

The general format of the workshop is now well settled and proved. This year we added three things. The company visits in advance of the workshop (for 2 cases) were very successful and we will certainly promote to do this again next year. These visits make the problem more tangible for the participants and promote group interaction from the start. On Monday we tried a game with photographs to introduce people to each other. This was fun and also a good manner to get the wine and cheese party going from the start. We will do something similar again and would recommend it to others. The dinner and tour at the Boerhaave museum were also something to keep.

6. Other comments

Ikram thank you for your help & enthusiasm!

Marcel Bartels (Utrecht, Netherlands)

Martijn de Jager (Utrecht, Netherlands)

Floor Paauw (Utrecht, Netherlands)

The Complex Structure of Attracting Sets

18 – 22 November 2013 @*Snellius*

This workshop focused on a well-known open problem in holomorphic dynamical systems, the Bedford Conjecture, which considers the complex structure of stable manifolds. A classical result states that for an invertible holomorphic map, the attracting basin of an attractive fixed point is always equivalent to complex Euclidean space. Whether the same holds for more general stable manifolds is not known. The goal of this workshop was to bring together many researchers working on the Bedford conjecture, for the purpose of exchanging thoughts and starting new collaborations. Solving the main conjecture during this workshop was not to be expected, instead we aimed at finding new approaches and related open problems that might be more accessible. Both in terms of establishing new collaborations and in finding new ways to attack the main conjecture, the workshop was a tremendous success, and will certainly lead to several new publications.

The organization of the workshop was unusual. First of all, there were no talks on recent research. Instead, we opened each day with a presentation by one of the participants on an area of research related to the main problem of the workshop. In each of these talks new open problems were highlighted, which opened new directions for discussion.

The opening lecture on Monday was followed up by a long interactive problem session. Participants were asked to explain their suggestion to a moderator, who would ask further questions until the suggestion was completely clear, and then the moderator would write the suggestion on the blackboard. Besides listing some of the well-known open problems in the field, new questions were thought up on the spot, often in reaction to problems suggested by others. Some of these questions could be answered immediately, others led to very interesting discussions later in the week. After the problem session we split into smaller groups that were going to attack the different problems.

Every following day we held a session in which the different groups reported on their progress. Some problems were solved, some other problems turned out to be too difficult to approach. Often groups thought they had no progress to report, but when urged they were able to report on interesting new thoughts. Then groups would switch to a different problem, or mix with other groups. The atmosphere at the workshop was very open, and often researchers from one group would be sharing thoughts with other groups before going back to their own group.

In our experience problem sessions at conferences usually do not work very well, so it is worthwhile to analyze why this workshop was such a success. First of all, it was made very clear to all the participants that this workshop was aimed at sharing, and that there would be no research talks. Many of the participants had already visited each other prior to the workshop, and had discussed possible new approaches to the problem. These discussions had led to the writing of a survey article, which was posted on the online archive shortly before the workshop and contained many open problems. As a result, many participants came prepared to the workshop and knew what to expect. Finally, it seems to us that the Lorentz Center@*Snellius* venue was absolutely perfect and greatly contributed to the open atmosphere at the workshop.

Filippo Bracci (Rome, Italy)

Han Peters (Amsterdam, Netherlands)

Generalizations of Symmetric Spaces

25 – 29 November 2013 @Oort

The topic

Groups and their homogeneous spaces are basic objects in science and to unravel their structure and that of certain classes of functions on them is of fundamental importance. The key objects of study in the workshop were the classical symmetric spaces of real Lie groups, their p-adic and Kac-Moody generalizations and spherical varieties.

A unifying feature of these generalizations of symmetric spaces of non-compact type is that the acting groups admit a BN-pair, which leads to a deep interaction between the theory of (generalizations of) symmetric spaces on one hand and the theory of spherical, affine, and hyperbolic Tits buildings on the other hand. At the workshop special emphasis was put on this interaction. It played a role in about one third of the lectures and there one could observe a real cross-fertilization: in certain cases, known results on the classical side formed the inspiration to look for analogues on the building side and reversely, properties of buildings could be used to prove results for symmetric spaces.

Program

The program consisted of 22 addresses of 45 minutes each followed by lively discussions. The program possessed a number of leading threads, namely:
Geometric aspects of classical symmetric spaces;
Representation theoretic questions for classical symmetric spaces;
Representation theory related to p-adic symmetric spaces;
Infinite dimensional symmetric spaces: Kac-Moody and beyond;
Properties of various types of buildings.

Participants

The program was attended by 48 participants from Belgium, Denmark, France, Germany, Israel, Italy, Japan, the Netherlands, Russia and the US, showing the broad international interest in and the character of the workshop. Among them there were five female researchers and a substantial group of junior researchers.

Outcome

Reactions at the end of the conference and afterwards at later encounters, were very positive: many participants told us that this workshop formed a source of inspiration for them, leading to new ideas and yielding various new collaborations that will result in joint papers and activities. E.g. during the conference concrete plans were developed for future follow-ups in the USA and Israel.

Acknowledgements

The conference was financially made possible by the support of the following institutions or organizations:

- 1) The Lorentz Center
- 2) The Royal Dutch Academy of Sciences (KNAW)
- 3) Foundation Compositio

Finally we like to express our gratitude to the staff of the Lorentz Center, in particular Henriette Jensenius, Mieke Schutte and Sietske Kroon for their guidance, help and support at the whole process of organizing this workshop. All participants were impressed by the pleasant ambiance at the Lorentz Center and the excellent support from its staff.

Aloysius Helminck (Raleigh, USA)

Gerard Helminck (Amsterdam, Netherlands)

Ralf Köhl (Giessen, Germany)

ESA/GTTP Teacher Training Workshop 2013

25 – 29 November 2013 @*Snellius*

This workshop was the fourth in a series organised by the European Space Agency (ESA) with the Galileo Teacher Training Programme (GTTP). Aimed at European science teachers of students between 11 and 19 years of age, the workshop was designed to provide participants with the opportunity to gain practical skills to enable them to enhance teaching of the physical sciences in a formal education environment.

Participants at the workshop were presented with innovative and inspiring tools, and methods using astronomy and space science as a context to engage their students in the sciences, in particular physics. In addition to networking with their peers from across Europe, teachers were invited to present how they apply the context of 'space' to their lessons.

The workshop was devised to train the teachers with the intention of providing them with the necessary skills to then train colleagues in their home country. The aim was also to allow sufficient time to familiarise participants with the material presented to enable them to adapt it to the requirements of their students and national curricula after completion of the workshop.

The workshop programme was structured to provide a balance between theoretical and practical training, and sufficient discussion time. The theoretical training included lectures from ESA scientists presenting cutting-edge astronomy and space science, and the latest trends in science education. The practical training provided a variety of experiments and demonstrations that could easily be recreated in a classroom laboratory, as well as a number of computer-based activities, including the application of real spacecraft data in the classroom.

Feedback about the workshop was immediately captured from participating teachers in the form of an online evaluation survey. The constructive feedback that we received plays an important role in the planning of future workshops and development of new recourses. Overall, the feedback received was excellent, with 100% of the participants stating that they would recommend this workshop to colleagues. All participants said that following the workshop: they had greater awareness of space education resources; felt more confident in using space education resources to teach science, technology, engineering and mathematics (STEM) subjects and had developed new ideas for using space as a context for teaching STEM subjects.

On average, more than 85% said that they found the practical sessions across the 5 days of the workshop useful or very useful in terms of the new ideas and skills they learned and their application in the classroom. A new aspect to the workshop programme in 2013 was the addition of two practical sessions about the method of teaching using Inquiry Based Science Education. It was clear in the feedback received that these sessions were by some participants deemed to be the least useful part of the programme and require refinement ahead of future workshops. When asked if the sessions were long enough and informative enough to be able to train their colleagues to use the material presented, 20% of the participants felt that they would have liked more time during the workshop to familiarise themselves with the material. This is an important consideration to take on board for the future to ensure that the aim of participants training colleagues in their home countries is fulfilled as much as possible. Many of the teachers did agree that sufficient time was allowed and have already made plans to disseminate what they have learned to their colleagues.

Overall, the workshop was a success, the Lorentz Center@*Snellius* is a great venue and we are very grateful for the excellent organisation provided by the Lorentz Center.

Rebecca Barnes (Noordwijk, Netherlands)

Rosa Doran (São Domingos de Rana, Portugal)

Modeling Kinetic Aspects of Global MHD Modes

02 – 06 December 2013 @*Snellius*

This workshop brought together researchers from several different research communities within fusion plasma physics to discuss common problems faced in the simulation of global magnetohydrodynamic (MHD) modes and instabilities in high temperature tokamak plasmas. These problems arise from the collisionless nature of the plasmas involved and from the presence of significant populations of energetic ions or electrons. These energetic particle populations arise from the various plasma heating methods, or from the fusion produced energetic alpha particles.

A total of 19 researchers from 7 countries participated in the workshop including specialists in plasma fluid closures, RF heating and current drive, plasma fluid modeling, and gyrokinetic modeling. In addition the participants represented the theoretical and computational physics as well as numerical mathematics communities. The main problems discussed during the workshop were introduced in a series of six tutorial lectures which evoked lively discussions. In addition six spontaneous presentations were given by workshop participants on their recent research and on specific issues that came up during the workshop.

A number of questions were identified that were subsequently discussed in smaller groups. Final conclusions are still difficult to draw, as more time is needed to work out possible answers identified in these discussions. A major result of the workshop was the initiation of two benchmark activities. The first benchmark concerns a comparison of tearing mode simulations between 3D reduced MHD codes and global gyrokinetic codes. In the second benchmark the $m=1$ internal kink mode in a large aspect ratio tokamak will be modeled in a number of different gyrokinetic codes including PIC as well as Vlasov codes.

A final lecture on 'Space Weather Prediction' completed the workshop and showed the similarity of problems faced in the simulation of laboratory fusion plasmas as well as space and astrophysical plasmas.

Jonathan Citrin (Nieuwegein, Netherlands)

Guido Huijsmans (St. Paul-lez-Durance, France)

Barry Koren (Eindhoven, Netherlands)

Arthur Peeters (Bayreuth, Germany)

Emanuele Poli (Garching, Germany)

Egbert Westerhof (Nieuwegein, Netherlands)

Ast(e)rospheres* : From the Sun to Red Super Giants

09 – 13 December 2013 @Oort

*one important conclusion of the workshop is that the commonly preferred terminology is asterosphere instead of astrosphere.

Science

The main goal of the workshop "Astrospheres: From the Sun to Red Super Giants" was to bring together scientists with different backgrounds (observational vs. theoretical and numerical, hot stars vs. cool stars, solar physics vs. astronomy etc.) whose research focused on the interaction between stellar winds and the local ambient medium. By bringing scientists from such diverse backgrounds together we wanted to encourage an increase in cooperation and allow people to benefit from experience gained in different fields. In the course of the workshop, we achieved our main goal in opening a general dialogue between researchers from different fields. This allowed all participants to gain a better understanding of each other's efforts. In the observational field we identified how observations at different wavelengths allow us to gain understanding of specific processes. Such data can be combined into a comprehensive picture of an asterosphere. In the theoretical/computational field we identified the physical processes that have to be included in accurate models of circum- and interstellar "bubbles" and the numerical techniques that can be used to implement those processes. We intend to write a review paper based on the contents of the workshop and are in the process of identifying the best venue for such a publication.

Organisation/Format

We originally envisioned that the workshop consisted of two major components:

- A small number of oral presentations, intended to inform the audience of the issues in the speakers area of expertise and identify key scientific problems.
- Separate discussion sessions where the participants would discuss specific topics within the general framework of the workshop and report back to the general audience.

The program had been designed around this format with time set aside both for the discussions and the final reports. In practice, this did not occur. The total number of participants (~ 30) was small enough for effective plenary discussions where the whole group participated. This proved a positive development that allowed the participants to benefit from each other's experience and henceforth allowed for a deeper understanding of the various astrophysical problems. Particularly, participants became much more aware of limitations, problems, and open questions in fields beyond their own expertise. During the week several smaller groups of participants got together to discuss ongoing and future research projects. As hoped and anticipated we particularly noted frequent interactions between observers and modellers.

Participants were unanimous in noting that regular meetings on the topic of astrospheres would be highly desirable, and advocated more coordinated research efforts, for example through the EU research collaboration framework, Horizon 2020. In summary, this Lorentz Center workshop managed to bring together experts from different fields working on astrospheres and related issues, and has given further impetus to the newly developing field of astrospheres.

Nick Cox (Leuven, Belgium)

Vasilii Gvaramadze (Moscow, Russia)

Lex Kaper (Amsterdam, Netherlands)

Rosine Lallement (Paris, France)

Allard Jan van Marle (Leuven, Belgium)

Towards an Evolutionary Theory of Nongenetic Effects

09 – 13 December 2013 @Snellius

Evolutionary theory provides a mathematical description of the gradual change of organisms over time, due to natural selection and the retention and inheritance of phenotypic variation. Evolutionary insights are widely used throughout the life sciences, and applications range from genetic algorithms, through breeding programs to the study of antibiotic resistance. However, at the heart of evolutionary theory lies the crucial assumption that inheritance is exclusively governed by the transmission of DNA-basepair variations, which contrasts with growing evidence that there are other ways in which phenotypic variation can be inherited: for example, through the inheritance of epigenetic or structural modifications of the DNA, the transmission of maternal hormones and antibodies, or social learning. While some progress has been made to map the consequences of these nongenetic effects, we are yet unable to make detailed predictions about their evolution, strength and nature in a range of ecological and social contexts. The workshop set out to address this question by developing novel theoretical models of the evolution of nongenetic effects.

To enrich evolutionary theory with insights on nongenetic effects, a team of evolutionary biologists, ecologists and mathematicians got together to work on the following questions:

- What ecological conditions (e.g. what type of environmental fluctuations) favor the evolution of nongenetic effects?
- How does intergenerational conflict (such as genetic conflicts of interest between parents and offspring) affect the evolution of nongenetic effects?
- How do nongenetic effects affect long-term adaptation?

Overall, hard work in all of the subgroups paid off and a number of studies were initiated that we hope will lead to publishable outputs: foremost, we are currently working on a collaborative perspectives paper that summarizes conceptual progress on the three questions listed above, which we aim to submit to *Trends in Ecology & Evolution* (impact factor 18.9) or *BioEssays* (impact factor 5.8). In addition, each subgroup explored one or more specific projects dealing with one of the three questions. For example, one project focused on the evolutionary dynamics of epigenetic modifiers in fluctuating environments - this led to a model being finalized during the workshop, forming the basis of a manuscript that is now being written.

Perhaps the biggest 'aha moment' came from a subgroup that included a mix of developmental and theoretical biologists, who modeled epigenetic effects in developmental networks. Using this network approach yielded a rich range of features, and may explain the common pattern of developmental re-emergence, in which an ancestral traits may be lost, but re-appear in phylogenetically younger taxa after a disturbance. This project has sparked a new collaborative venture for which grant proposals are being written to share PhD students between the University of Arizona and the University of Pierre et Marie Curie in Paris.

Other tangible outcomes resulting from the workshop are models dealing with long-term effects of birth order and the evolution of sex determination dependent on maternal effects, which we hope will lead to submission of manuscripts for publication in the coming year.

All participants very much appreciated the format of the workshop, in which participants worked together in a number of small subgroups to address specific problems over the course of the five days - this was felt to be more productive than conventional meetings which are dominated by talks and lectures. Needless to say, the configuration of the Snellius site at the Lorentz Center greatly facilitated such an arrangement. We would recommend the Lorentz Center@Snellius venue as a venue for other biologists who aim to bring together empiricists and theoreticians; and we are eager to come back ourselves.

Possible improvements that we might suggest mainly concern the workshop format: we scheduled all plenary talks during the first three days, to leave more time for actual hands-on work later. In hindsight, however, it would have been good to spread talks more evenly over the full five days.

Rufus Johnstone (Cambridge, United Kingdom)

Bram Kuijper (Penryn, United Kingdom)

Ido Pen (Groningen, Netherlands)

Cold War Science

16 – 20 December 2013 @Oort

Our main goal was to establish, for a wide variety of disciplines, how the Cold War affected the circulation of knowledge between the United States and Europe. How did the Cold War condition local practices and decisions? In particular, how was western European science reshaped after the American mold by US relief efforts aimed at reconstructing Europe? Reversely, we would also like to address how American science was affected by exchanges of knowledge across the Atlantic, under the Cold War conditions of sharing and secrecy.

Several interesting case studies of local practices have been presented (Greenland, Finland, the Netherlands and West Germany), in which the 'Cold War conditions' determined the scientific endeavors in different ways. Our main perspective – the existence of something as a 'Cold War Science' proved to be fruitful for some of the cases presented. Some speakers have challenged this notion, suggesting that internal developments and continuity with prewar scientific practices had a more significant and autonomous impact on the development within that science. In some other cases different historical perspectives (modernization, European integration, decolonization) were put forward as alternative frame.

A tangible outcome of the workshop is that the Dutch publishing house Brill has agreed to publish a volume with selected conference papers, which will appear by the end of 2014. At a very practical level, a number of Dutch scholars (in the field of history of mathematics, history of economics, history of physics and history of astronomy) have decided to start a discussion-group on Cold War science in the Netherlands. The meetings are thematically structured and held on regular basis. Already in the first week of 2014 some of the Lorentz Center workshop participants came together for an initial meeting. We also had a number of participants from outside the academic world: policy makers and analysts working in the Dutch defense complex. Through our workshop they connected to academic scholars, to each other's mutual benefit. So, we hope that our workshop may also pay broader, social dividends in terms of informing policy and national security analysis.

Within the relative young field of the history of Cold War science, scientific breakthroughs are not the most obvious aims. However, we have had comprehensive discussions on the nature of this growing discipline: what kind of questions should we be asking ourselves and what kind of sources do we need for answering them? Which perspectives would contribute to a better understanding of the sources and the available interpretations? One could thus say that this workshop actively shapes the discipline.

Eureka moments were experienced by different scholars from different parts of the world who have been doing research on the same topics - broad themes like classification of knowledge, or specific international organizations like NATO. These moments were not only triggered by the kinship of their research topics, but also by the deeper insights that were gained in shared research-problems, discussed during the conference. It should also be pointed out that at least two key participants (John Krige of the Georgia Institute of Technology and Simone Turchetti of the University of Manchester) became aware of the particular role and dilemmas of Dutch scholars (and other small European nations) operating in the Cold War context. In turn, most local scholars were confirmed through the feedback received at this workshop that their work is very much on the right track for making a valuable contribution to the recently opened up field of Cold War science historiography.

Both the formal structure (five days, several lectures a day) and the numerous more informal meetings during the coffee and lunch breaks generated a very productive interaction between the participants. The fact that a substantial part of the participants came from abroad reinforced the natural coherence, which was based on the shared focus on Cold War Science.

First of all we would like to thank both the advisory boards and the Lorentz Center staff for helping us to improve our proposal and for creating such a fertile setting for intellectual debate. In all these respects you did an excellent job. Many of our foreign participants commented on the unique and

stimulating format of the workshop, both with respect to its interdisciplinary character and the large amount of time reserved for discussion. All we can say is: keep up the good work!

Dirk van Delft (Leiden, Netherlands)

Jeroen van Dongen (Amsterdam & Utrecht, Netherlands)

David Kaiser (Cambridge, USA)


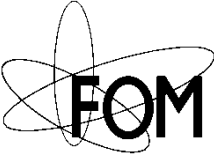




Frans van Lunteren (Amsterdam, Netherlands)

Ad Maas (Leiden, Netherlands)

Funding Sources of the Lorentz Center

Basic Funding of the Lorentz Center




Funding granted to the Lorentz Center, supporting its operational activities and providing a refund budget to meetings held at the Lorentz Center

<p>Leiden University Faculty of Science</p>		<p>Facilities and staff</p>
<p>FOM Foundation for Fundamental Research on Matter</p>		<p>Physics workshops</p>
<p>NWO Netherlands Organisation for Scientific Research</p>		<p>Workshops in Astronomy, Computational Science, Informatics, Life Sciences, Mathematics, and NIAS-Lorentz workshops</p>
<p>OCW Ministry of Education, Culture and Science</p>		<p>Lorentz Center@Snellius venue: renovation and interior Workshops Outreach</p>
<p>NIAS Netherlands Institute for Advanced Study in the Humanities and Social Sciences</p>		<p>NIAS-Lorentz workshops</p>
<p>Lorentz Fonds</p>		<p>Physics workshops</p>










Additional Funding for Specific Lorentz Center Meetings

Funding granted to the scientific organizers of the meetings

Sponsor		Workshop
Agilent Technologies		> The Dynamic Nature of Baryons in Halos
Abo Akademi		> Obstacles and Catalysts of Peaceful Behavior
ASTRON		> Locating Astrophysical Transients
Beeld & Geluid		> ICT with Industry 2013: from Specific Problems to Innovative Solutions
BioSolarCells		> Responsive Matrices for Solar Fuels
BNVK!		> Formal Methods for the Informal World
CECAM		> Multiscale Modelling and Computing
COST		> Plasma to Plasma!

CRISIS		> Complexity Models for Systemic Instabilities and Crises
Cytron II		> Life Science with Industry 2013
De Nederlandsche Bank		> Econophysics and Networks Across Scales
Descartes Centre		> Cold War Science
DIAMANT Cluster		> Heights and Moduli Spaces > Sage Days: Algorithms in Arithmetic Geometry
DIFFER		> Modeling Kinetic Aspects of Global MHD Modes
DSM		> Life Science with Industry 2013
ECMI		> Study Group Mathematics with Industry 2013
Elsevier		> Elliptic Integrable Systems and Hypergeometric Functions








EPSRC		> Towards an Evolutionary Theory of Nongenetic Effects
ERC Hevo		> The Complex Structure of Attracting Sets
ERC European Research Council		> High-Mass Star Formation, From Large to Small Scales in the Era of Herschel & ALMA > The Molecular Physics of Interstellar PAHs > Noncommutative Geometry and Particle Physics
ESF European Science Foundation		> Noncommutative Geometry and Particle Physics
European Physics Letters (EPL)		> Universal Themes of Bose-Einstein Condensation
Foundation Compositio Mathematica		> Trends in Arithmetic Geometry > Heights and Moduli Spaces > Elliptic Integrable Systems and Hypergeometric Functions > Sage Days: Algorithms in Arithmetic Geometry > Generalizations of Symmetric Spaces
Friesland Campina		> Biophysics, Biochemistry and Physiology of Fat Digestion
Fresenius Kabi		> Biophysics, Biochemistry and Physiology of Fat Digestion
Fytagoras		> Study Group Mathematics with Industry 2013
EPSRC		> Towards an Evolutionary Theory of Nongenetic Effects

GQT		<ul style="list-style-type: none"> > Heights and Moduli Spaces > Elliptic Integrable Systems and Hypergeometric Functions > Noncommutative Geometry and Particle Physics > Generalizations of Symmetric Spaces
Heineken		<ul style="list-style-type: none"> > Study Group Mathematics with Industry 2013
Humboldt University Berlin		<ul style="list-style-type: none"> > Heights and Moduli Spaces
ICAM-I2CAM		<ul style="list-style-type: none"> > Hidden Order, Superconductivity, and Magnetism in URU2Si2
ICS		<ul style="list-style-type: none"> > Gossip and the Management of Reputation: the Intersection between the Social, the Natural and the Computational Sciences
ICOG		<ul style="list-style-type: none"> > The Antikythera Mechanism: Science and Innovation in the Ancient World
ILLC		<ul style="list-style-type: none"> > Modelling Meets Infant Studies in Language Acquisition: A Dialogue on Current Challenges and Future Directions
ISM-SPP		<ul style="list-style-type: none"> > C+ as an Astronomical Tool
ISTC		<ul style="list-style-type: none"> > Gossip and the Management of Reputation: the Intersection between the Social, the Natural and the Computational Sciences







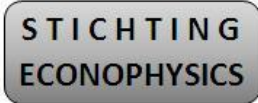


JIVE		> Locating Astrophysical Transients
JM Burgerscentrum		> Plasma to Plasma!
Kadaster		> ICT with Industry 2013: from Specific Problems to Innovative Solutions
Keygene		> Life Science with Industry 2013
KNAW		<ul style="list-style-type: none"> > Trends in Arithmetic Geometry > Models of Consciousness and Clinical Implications > Mathematics and Biology: a Roundtrip in the Light of Suns and Stars > Recent Insights in Mitochondrial Evolution Applied to Health and Ageing > Normative Multi-Agent Systems: NorMAS 2013 > Noncommutative Geometry and Particle Physics > Hidden Order, Superconductivity, and Magnetism in URU2Si2 > Synthetic Biology and Symbolic Order > Generalizations of Symmetric Spaces > Cold War Science > Towards an Evolutionary Theory of Nongenetic Effects
KWG		> Study Group Mathematics with Industry 2013
Lorentz Fonds		<ul style="list-style-type: none"> > Universal Themes of Bose-Einstein Condensation > Econophysics and Networks Across Scales > New Challenges for Early Universe Cosmologists > Noncommutative Geometry and Particle Physics > Hidden Order, Superconductivity, and Magnetism in URU2Si2
JIVE		> Locating Astrophysical Transients

JM Burgerscentrum		> Plasma to Plasma!
Kadaster		> ICT with Industry 2013: from Specific Problems to Innovative Solutions
MAPPER		> Multiscale Modelling and Computing
Marie Curie Actions		> DFT-based Multilayer Methods for Nanoscale Systems
Max Planck Gessellschaft	 MAX-PLANCK-GESELLSCHAFT	> Steps Towards a New Generation of Stellar Models
Medical Museion University of Copenhagen		> The Future of Art-Science Collaborations
Ministerie van Economische Zaken		> Recent Insights in Mitochondrial Evolution Applied to Health and Ageing
MIRA		> Plasma to Plasma!
Mondriaan Stichting		> The Future of Art-Science Collaborations

Museum Boerhaave		> Cold War Science
NCMD		> Recent Insights in Mitochondrial Evolution Applied to Health and Ageing
NCSB		> Life Science with Industry 2013 > Training Workshop Multidisciplinary Life Sciences
NDNS+		> Mathematics and Biology: a Roundtrip in the Light of Suns and Stars
NedCoffee BV		> Study Group Mathematics with Industry 2013
Netherlands Genomics Initiative		> Recent Insights in Mitochondrial Evolution Applied to Health and Ageing > Life Science with Industry 2013
Nexpres		> Locating Astrophysical Transients
NIOO		> Eco-evolutionary Dynamics in a Changing World
NIZO		> Biophysics, Biochemistry and Physiology of Fat Digestion
NOVA		> Imaging the Low Frequency Radio Sky with LOFAR > The PN.S: Future Projects and Ideas > The Antikythera Mechanism: Science and Innovation in the Ancient World > Steps Towards a New Generation of Stellar Models > The Molecular Physics of Interstellar PAHs > Observational Signatures of Type Ia Supernova Progenitors II > Astrospheres: From the Sun to Red Super Giants > What regulates Galazy Evolution?

NRAO		> Radio Halos of Galaxies
NSF		> Hidden Order, Superconductivity, and Magnetism in URU2Si2
NVTI		> Towards an Evolutionary Theory of Nongenetic Effects
OCE		> Physics with Industry: 5 Problems, 50 Scientists, 1 Week
Oort Fonds		> The Molecular Physics of Interstellar PAHs
Oranjewoud		> Physics with Industry: 5 Problems, 50 Scientists, 1 Week
PamGene		> Life Science with Industry 2013 > Physics with Industry: 5 Problems, 50 Scientists, 1 Week
Philips		> Life Science with Industry 2013 > Study Group Mathematics with Industry 2013
PN.S		> The PN.S: Future Projects and Ideas
Queen's University		> Radio Halos of Galaxies

Radboud University Nijmegen		<ul style="list-style-type: none"> > Modelling Meets Infant Studies in Language Acquisition: A Dialogue on Current Challenges and Future Directions
Radionet		<ul style="list-style-type: none"> > Imaging the Low Frequency Radio Sky with LOFAR > High-Mass Star Formation, From Large to Small Scales in the Era of Herschel & ALMA > Locating Astrophysical Transients > Radio Halos of Galaxies
Rathenau Instituut		<ul style="list-style-type: none"> > Synthetic Biology and Symbolic Order
RGS Development		<ul style="list-style-type: none"> > Physics with Industry: 5 Problems, 50 Scientists, 1 Week
Rijksakademie van Beeldende Kunsten		<ul style="list-style-type: none"> > The Future of Art-Science Collaborations
Rijkswaterstaat		<ul style="list-style-type: none"> > Study Group Mathematics with Industry 2013 > ICT with Industry 2013: from Specific Problems to Innovative Solutions
Kabk		<ul style="list-style-type: none"> > The Future of Art-Science Collaborations
SCM		<ul style="list-style-type: none"> > DFT-based Multilayer Methods for Nanoscale Systems
SEECR		<ul style="list-style-type: none"> > ICT with Industry 2013: from Specific Problems to Innovative Solutions
Seventh Framework Programme (FP7)		<ul style="list-style-type: none"> > DFT-based Multilayer Methods for Nanoscale Systems

SERG		> Language Interaction Design
SFB		> C+ as an Astronomical Tool
SIGO		> Obstacles and Catalysts of Peaceful Behavior
Sintelnet		> Normative Multi-Agent Systems: NorMAS 2013 > Formal Methods for the Informal World > Gossip and the Management of Reputation: the Intersection between the Social, the Natural and the Computational Sciences
Star Stochastics		> Bayesian Nonparametrics
Stichting DOEN		> The Future of Art-Science Collaborations
Stichting Econophysics		> Econophysics and Networks Across Scales
Stichting Physica	Stichting Physica (Opgericht 24 december 1948)	> Universal Themes of Bose-Einstein Condensation > Cold War Science
Stichting voor Christelijke Filosofie		> Synthetic Biology and Symbolic Order
STT	STT Netherlands Study Centre for Technology Trends 	> The Future of Art-Science Collaborations

Studiegroep Mathematics		> Study Group Mathematics with Industry 2013
Synenergene		> Synthetic Biology and Symbolic Order
Tata Steel		> Physics with Industry: 5 Problems, 50 Scientists, 1 Week
TNO		> Study Group Mathematics with Industry 2013
The Arts and Genomics Centre		> The Future of Art-Science Collaborations
Unilever		> Biophysics, Biochemistry and Physiology of Fat Digestion
University of Amsterdam	 UNIVERSITEIT VAN AMSTERDAM	> Multiscale Modelling and Computing
University of Groningen	 university of groningen	> The Antikythera Mechanism: Science and Innovation in the Ancient World
Utrecht University	 Universiteit Utrecht	> Mathematics and Biology: a Roundtrip in the Light of Suns and Stars
Waag Society	 waag society institute for art, science & technology	> The Future of Art-Science Collaborations
Wrenner-Gren Foundation		> Obstacles and Catalysts of Peaceful Behavior

