Scientific Report 2010

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Cover: The image was used for the announcement poster of the workshop ‘Integrating Cultures: Models, Simulations & Applications’ that was held in Lorentz Center in April 2010. The high-heeled shoes were designed by the Dutch Designers House of Viktor & Rolf, shown at the exhibition ‘Gejaargd door de Wind’ at the Zuiderzee Museum, Enkhuizen in 2009. Image by Erik and Petra Hesmerg.

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

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Preface by the Director

With its roots firmly planted in astronomy, informatics, mathematics and physics, the Lorentz Center has been extending its scientific spectrum since 2006. The life sciences had subsequently been added and the collaboration with NIAS (Netherlands Institute for Advanced Study in the Humanities and Social Sciences) brought the humanities and social sciences to the program. The spectrum of scientific disciplines is exemplified by workshops like *Capillary Shaping of Solutes,* a beautiful workshop (co-)organized by the Lorentz Chair of the Instituut-Lorentz for theoretical physics, professor Tom Witten; *Provable Security against Physical Attacks,* a very stimulating workshop on cryptography: an active research field within mathematics and informatics with connections to physics; *Philosophy of the Information and Computing Sciences*, a pioneering workshop organized by the Distinguished Lorentz Fellow 2009, Professor Jan van Leeuwen; and *The Artificial Leaf*, a highly relevant workshop on the development of photochemical devices for the conversion of solar energy into fuels. These workshops exemplify that the Lorentz Center not only has extended the spectrum of scientific disciplines in its program but, along the way, also organized more and more interdisciplinary workshops. The Lorentz Center is unique in hosting workshops with such a rich blend of themes, in the Netherlands as also worldwide. For 2010, it is fair to say that Lorentz Center has further established itself as a core element of the Dutch scientific community.

The year 2010 also was the year in which the Lorentz Center organized its first computational science workshops. It was as if the scientific community had been waiting for this opportunity: with highly successful workshops like *Advanced School and Workshop on Computational Gravitational Dynamics*; *Poly and Polymer Electrolytes for Energy Conversion: Ab Initio, Molecular, and Continuum Models*; and *Modeling with Images in the Life Sciences*; the 'eScience' extension of the Lorentz Center got a jump start. One of my personal favorites among the computational science workshops is *Modelling Angiogenesis: Joining Cells, Maths and Computers*. The topic of this workshop was the intricate pattern forming process of (re)growing blood vessels. As the subtitle promised, the workshop indeed provided a true synergy of life sciences, mathematics and computational science. Clearly, the inherent interdisciplinary nature of computational science blends naturally in the scientific program of the Lorentz Center.

Strengthening the bonds between the scientific community and industry has been, and still is, a long term objective of the Lorentz Center. That is why the Lorentz Center applauded in 2010 the first workshop that was organized on initiative of scientists from Océ Technologies BV and ASML Netherlands BV. Their workshop *Contact Line Instabilities* brought together people from academia and industry, on the subject of stability of contact lines and its impact on industrial applications. Another breakthrough in 2010 was the *Physics with Industry* workshop. *Physics with Industry* was an initiative of FOM and STW (Foundation for Fundamental Research on Matter, and Technology Foundation STW, respectively). The scientific aim of the workshop was explicitly stated as '... to work collaboratively with physicists of different backgrounds on urgent industrial problems to come up with creative solutions, and to acquaint (young) physicists with industrial R&D.' Although these two workshops are still mostly a beginning, I'm confident that they form the germ of a growing active involvement of industrial researchers in the scientific program of the Lorentz Center.

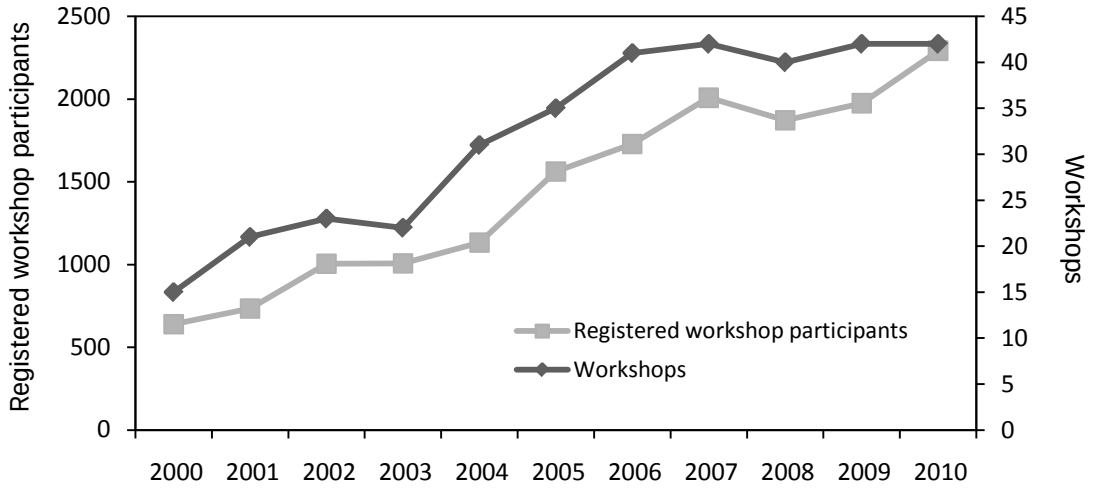


Figure1: The number of workshops and number of participants per year

The ongoing activities of the Lorentz Center would not have been possible without the substantial financial support of the national science agencies FOM, NWO (Netherlands Organization for Scientific Research), and the ministry of OCW (Education, Culture and Science). In 2010, both FOM and NWO have acknowledged the success and viability of the Lorentz Center by generously granting funding for another period of five years (2011-2015).

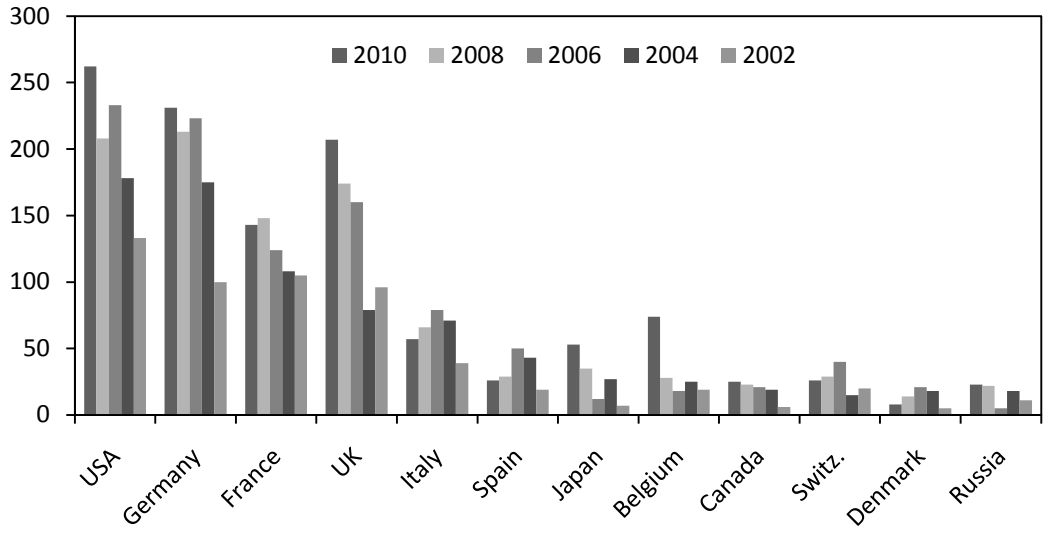


Figure 2: Relative rates of the background of the workshop participants in the year 2010

The interdisciplinary evolution of the Lorentz Center is reflected by the fact that for this new granting period the Lorentz Center no longer will be funded only by the NWO division EW (natural sciences), but by an additional five divisions (ALW, earth and life sciences; C, chemistry; GW, humanities; MaGW, social and behavioral sciences; and NGI, Netherlands Genomics Initiative). It is uncommon that this many divisions of NWO invest jointly in a single scientific initiative. This joint venture then motivated the governing board of NWO (AB) to grant an additional bonus, allowing the Lorentz Center to further extend its scientific activities in at a second facility. I'm extremely grateful for the confidence of FOM and NWO

in the Lorentz Center. Their funding provides a firm foundation for our current work and a further inspiration for our plans for the future of the Lorentz Center.

Ideas for a second facility of the Lorentz Center have been on our minds since 2007, yet a sound foundation for the extension was laid only in 2010. The generous funding of the governing board of NWO was pivotal in our plans to set-up a second facility. Apart from the funding by NWO, substantial support was received by the ministry of OCW and the Faculty of Science of Leiden University. Several years ago, the Snellius building across the street of the current Oort facility came up as a possible and appealing location of a second Lorentz Center facility. During 2010, various options within the Snellius building have been explored, together with the other inhabitants of the building: the Mathematical Institute (MI), the Leiden Institute for Advanced Computer Science (LIACS) and the central ICT (I) group of Leiden University.

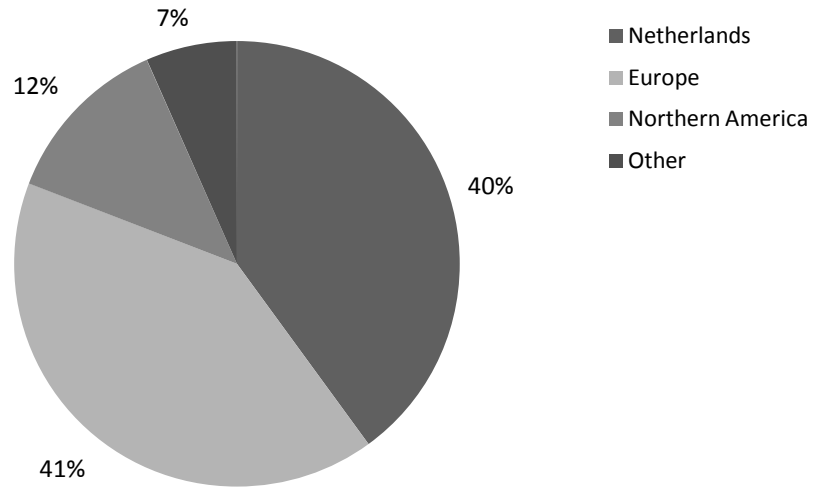
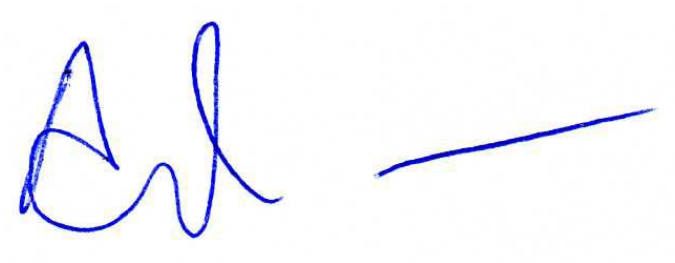


Figure 3: The number of workshop participants by nationality

I am looking forward to the spring of 2012 when we hope to open the new Snellius branch of the Lorentz Center. This prospect is especially exciting because the Lorentz Center will host meetings of quite a different format at the Snellius facility. The maximum number of participants in the Lorentz Center Snellius will be around 20, allowing intense communication, and interaction and collaboration in an open atmosphere. The smaller group size strongly encourages active research on a well-defined theme, with only a minor part of the program being devoted to lectures. In fact, the program necessarily will be flexible and driven by the developments within the group. I have been involved in this type of intense meetings – at the Mathematisches Forschungsinstitut in Oberwolfach and at the American Institute of Mathematics in Palo Alto – and I consider these meetings among the most fruitful activities in my scientific life. I'm convinced that this new Lorentz Center concept will be able to provide a similar boost to many researchers and thus will bring a new dimension to our activities.

Since we both started in 2009, 2010 was the first full year that Mieke Schutte and I have experienced as management team of the Lorentz Center. Now we have seen all aspects of the organization, we can truly appreciate the remarkable input of our workshop coordination and science planning and evaluation teams. The professional attitude combined with the warmth, personal involvement and drive of Gerda Filippo, Corrie Kuster and Pauline

Vincenten form the crucial ingredient of the overwhelmingly positive responses from the workshop participants. Henriette Jensenius has a significant and very stimulating impact on many aspects of the scientific format of the workshops. We are very glad that Auke Planjer has been able to team up with Henriette in 2010, together forming a solid foundation for the scientific program of the Lorentz Center. The Lorentz Center staff forms a coherent team that runs like a well-oiled machine. With such a team, I look forward with a lot of confidence to an undoubtedly turbulent year to come.



Arjen Doelman
Director Lorentz Center

May 2010

Mission Statement

The Lorentz Center is an international center that coordinates and hosts workshops in the sciences, based on the philosophy that science thrives on interaction between creative researchers. Lorentz Center workshops focus on new collaborations and interactions between scientists from different countries and fields, and with varying seniority.

The Lorentz Center concept

In order to allow both junior and senior researchers to catch up with the rapid international developments and to establish new contacts and collaboration, Lorentz Center workshops bring together groups of 30 to 40 junior and senior researchers in a stimulating environment and with working space for all participants: offices with a desk, white boards and meeting rooms. Through a combination of informal talks, working sessions and discussions, participants are able to assess the status of a field and its future, and to collaborate, establish new international contacts, and spot upcoming talent.
Workshops can be proposed and organised by any researcher from any country. Workshops organised by researchers from different scientific backgrounds and nationalities are encouraged. Submission procedures are aimed at rapid evaluation. Proposals for workshops are reviewed by external scientific advisory boards. Currently there are boards for astronomy, computational sciences, life sciences, mathematics, physics and NIAS-Lorentz workshops. The Lorentz Center program is also open to proposals within other fields of the natural sciences.

Surrounded by excellence

The Lorentz Center is located in Leiden University's J.H. Oort Building which also hosts the Instituut Lorentz for theoretical physics, the Kamerlingh Onnes Laboratory and the Leiden Observatory. The Mathematics and Chemistry Departments and the Leiden Institute of Advanced Computer Science are located in adjacent buildings. All Dutch universities and research institutes can easily be reached by public transport; the universities in Amsterdam, Utrecht, Delft and Rotterdam can be reached by train within an hour. Schiphol International Airport is only 15 minutes by train.

Collaboration with NIAS

In collaboration with the social sciences and humanities institute NIAS (located in Wassenaar), the Lorentz Center welcomes proposals for workshops that bring together one or more disciplines of the natural sciences with those of the social sciences and humanities. Proposals for these workshops are reviewed by the NIAS-Lorentz Center Scientific Advisory Board. Lorentz Fellowships are awarded by NIAS to scientists who are engaged in research across the boundaries of the humanities and the social sciences on one hand and the natural sciences on the other hand. As part of the fellowship, the Lorentz Fellow is offered the opportunity to organize a workshop at the Lorentz Center.

Funding

The Lorentz Center is supported by Leiden University, Ministerie van OCW (the Dutch Ministry of Education, Culture and Science), FOM (the Dutch Foundation for Fundamental Research on Matter), and NWO-Research Councils for Physical Sciences and Chemical Sciences. The Lorentz Fonds regularly supports workshops in Physics.

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Contact Line Instabilities

January 4 – 8, 2010

Motivation

The newest industrial technologies in producing most accurate imaging at micro and nano scales, such as nano-lithography and micro inkjet printing, have opened up a plethora of unsolved issues in further development of the machines to realize these technologies. Many of these issues find their origin directly in the contact line instabilities at the interface of liquid, gas and solid at micro and smaller scales. The physical mechanisms behind these instabilities are very diverse in nature and raise a number of fundamental challenges. The aim of the workshop was to provide a bridge between the industrial and academic worlds, connecting technological challenges to the latest experimental and theoretical findings on contact line instabilities. The workshop also links the FOM-Industrial Partnership Program on wetting dynamics to the international scientific community.

The workshop

The workshop was attended by 71 people from 10 countries, and enjoyed a mixed audience of leading scientists, young researchers and representatives from industry (ASML, OCE, Philips, SKF). Among the keynote speakers were: Andreotti (Paris), Bocquet (Lyon), Eggers (Bristol), De Coninck (Mons-Hainault), Limat (Paris), Pomeau (Paris), Quere (Paris). The main industrial and fundamental challenges were outlined by lectures during the first days of the program. This was followed by thematic workshops on the following specific topics:

- Air entraiment
- Inkjet printing
- Surface tension gradients
- Film breakup

These sessions were very instrumental in generating open discussion and turned out a key part of the meeting. In addition, the program contained many talks by PhD students and postdocs.

Outcome of the workshop

Several latest scientific and industrially related subjects were presented and intensively discussed. Some of the noteworthy findings are summed below:

Liquid layer break-up for layer thickness of the order of micron (or 0.1 micron) was discussed next to recent findings on this phenomenon at nano size thicknesses. It turns out that the nucleation for relatively thick layers is still a moot question that should be researched more. Specially the micron size is of considerable importance for immersion lithography. Some new contacts have been made between ASML and a few academic centers, Thiele (Loughborough University), Rauscher (Max-Planck-Institut für Metallforschung in Stuttgart) together with a PhD project at University of Eindhoven (Darhuber) to understand and model this phenomenon.
Possible similarity was observed in the transition mode at critical speed during pulling of a plate from a liquid bath and the critical speed observed in immersion lithography. The phenomenon was shown with recent findings by Eggers. A follow-up will be started in co-operation between ASML (Riepen) and University of Twente (Snoeijer).

Valuable findings were shown when comparing pearls formation at sliding drops (Limat) and the water loss under a needle for immersion lithography (Winkels, Snoeijer, Riepen). Large similarity was shown quantitatively. It was also shown that at high speed the 3D structure becomes very dominant and deviation from 2D solutions is very large. The behaviour of top curvature of the sliding drop is very important in this analysis.

For inkjet printing several not well-understood phenomena were discussed and contacts for further research were successfully made. Some of mentioned phenomena were: collision between free surfaces; inclusion of air pockets and parameters determining contactline pinning and the nozzle outlet.

Some latest results on Leidenfrost effects or similar phenomena were shown by Quere on surfaces that have special structures and where the size of the profile structures on the surface are of importance. These can also be used in immersion lithography where removing undesired drops on certain surfaces is needed. Some new activities have recently been started on this subject at ASML.

Splashing phenomena were shown to be highly dependent not only on surface geometry and chemistry but also on surrounding pressure level of the drop.

New contacts were made for contribution to another Lorentz workshop in May 2010 on capillary shaping of solutes, deposition of particles etc.

Many of the above-mentioned discussions showed that still critical issues exist in film pulling, pinning, marangoni effects, teapot effects, splashing and coalescence that are apt for a new workshop later with more industrial applications. The goal of providing a bridge between industrial and academic world on the subject of contact line instabilities was well achieved during this workshop.

We thank the Lorentz Center for their excellent support both for organizational as well as financial aspects.

Detlef Lohse (Enschede, the Netherlands)
Jacco Snoeijer (Enschede, the Netherlands)
Ramin Badie (Veldhoven, the Netherlands)
Michel Riepen (Veldhoven, the Netherlands)
Hans Reinten (Venlo, the Netherlands)
Herman Wijshoff (Venlo, the Netherlands)

Electrochemistry in Historical and Archaeological Conservation

January 11 – 15, 2010

The workshop was sub-divided in six sessions over 5 days. Each session dealt with a different topic and started with an introductory talk presenting the most recent knowledge in the field, which was then followed by other presentations, laboratory experiments/technique demonstration and a general discussion. For the experiments, we could rely on the generosity of Professor Ludo Juurlink and Professor Marc Koper (Leiden University, department of Chemistry), who offered us laboratory space.

The first session of the workshop was dedicated to the presentation of "Analytical techniques" used for identification and characterization of corrosion products. Especially voltammetry of micro-particles (VMP) appears to be a very practical tool. The use of a paraffin impregnated graphite electrode (PIGE) makes sampling easy, as micro-particles stick to the electrode surface simply by rubbing the metal graphite electrode over the object under study. It was highlighted that the correct choice of the electrolyte is essential to obtain a good separation between the oxidation and reduction peaks of different materials. VMP can further be improved by using different working electrodes, such as the cavity microelectrode which allows micro-sampling (about ten nanograms) or treating samples by square wave voltammetry, which allows a better characterization of corrosion products in complex systems such as patinas.

The second session dealt with "Cleaning and stabilization treatments" using electrochemical techniques. The presentations made clear that informing conservators of electrochemical techniques for conservation treatments is the first step in correct dissemination of these techniques; the second dissemination step being their evaluation by conservators and the latter's engagement with electrochemists for furthering applications specific to their artefacts' circumstances. Regarding electrolytic reduction of lead and silver plate, several speakers and participants acknowledged the need for complementary techniques such as surface finishing via physical means – an under considered issue that requires further experimental evaluation and discussion relating to ethical considerations of such procedures. Masking of multi-component artefacts also needs to be evaluated in terms of its efficacy. In addition remote monitoring of electrolysis of marine artefacts has permitted regional engagement and support of cultural heritage preservation by regional community councils and public populations.

The "Protection" session on the third day of the workshop could be divided into two subjects: the use and evaluation of electrochemical techniques as a tool for testing the anti-corrosion efficiency of protective coatings, and metal protection using self-assembled monolayers (SAMs) as a surface modification.
Electrochemical tests were presented as new techniques and very valuable tools for research on the protectiveness of coatings and films applied to metal objects and artefacts. Electrochemical impedance spectroscopy (EIS) and polarization resistance measurements (Rp), for instance, are simple and inexpensive techniques, which have a lot of advantages to other more commonly used (in the automotive industry) techniques such as natural exposure and climatic chamber tests. Electrochemistry is used to obtain a high sensitivity, follow the corrosion rate of an object and measure this in real conditions on real artefacts. For the

protection of metals, organic products can be used which have the possibility to react with the metal or metal oxide surface (e.g. dodecanethiols on gold surfaces). These ultrathin organic films are called self-assembled monolayers (SAMs). The protectiveness of the film depends on the functional group, the chemical reactivity of the head group, the surface pre-treatment and the solvent.

The fourth day of the workshop began with a session titled “Testing and Monitoring”. This session focussed on the development and use of *in situ* techniques for the monitoring of chemical processes affecting cultural heritage materials, primarily via the use of simulant samples. The first three presentations concerned a portable electrochemical and environmental cell apparatus designed for *in situ* use with various analytical techniques. The final presentation in the session concerned the application of a variety of techniques to materials which may be of interest to conservators. The techniques included grazing incidence X-ray diffraction (GIXD), Fourier transform infrared spectroscopy (FTIR), and laser techniques.

The first part of the final morning began with a series of talks that were intended to give an overview of the current “Educational programmes and standards” involving the application of electrochemical techniques to cultural heritage conservation. Topics such as can conservator-restorers be trained at a bachelor level in application of electrochemical techniques? and the different approaches curators, conservators and scientists have towards the conservation and treatment of cultural heritage artefacts were discussed. The final talk of the session concerned the CEN/TC 346 technical committee on conservation of cultural property. The need for standards in the field of cultural heritage conservation was emphasized, a point which most participant were in agreement with.

The final session of the workshop “Applications” began with a talk concerning the use of electrochemical techniques at the Rijksmuseum in Amsterdam. This was followed by an overview of the work carried out during the ETIC (Use of electrolytic techniques in metal conservation) project from 2003 to 2006. Finally, there was a talk concerning work being carried out in Qumran in Israel, the location of the Dead Sea Scrolls. A significant outcome of the final session was that a suggestion was also made to apply for a new COST action in the application of electrochemical techniques to heritage metals.

Annemie Adriaens (Ghent, Belgium)
Luisa Maria Abrantes (Lisbon, Portugal)
Vasilike Argyropoulos (Athens, Greece)
Virginia Costa (Meudon, France)
Christian Degrigny (La Chaux-de-Fonds, Switzerland)
Mark Dowsett (Coventry, United Kingdom)
Paola Letardi (Genova, Italy)
David Thickett (London, United Kingdom)

Micro- and Nanofluidics for Cell Biology

January 18 – 22, 2010

Objectives

The aim of the workshop was to bring together two different scientific worlds, cell biology, on one hand, and the science of flow at the nano- and micro-scale, on the other hand, which can gain a lot of being combined. Many examples of novel, relevant and promising research work allying these two worlds is found in the literature, while frontier research in cell biology but using microfluidic devices is still very scarce. A reason for this rarity is the difference of languages/jargons spoken by both classes of researchers, making collaborative work difficult and giving rise to a number of misunderstandings.
In that context, the specific goals of this workshop were (i) to bridge the gap between the fields of cell biology and microfluidics, (ii) to initiate a dialogue between researchers from both fields and (iii) hopefully to identify new areas of potential frontier research.

The workshop

The workshop gathered around 70 scientists in the Lorentz center for a whole week, and covered different aspects of both scientific fields. The program of the week was organized along five biological topics that showed a gradual increase in the complexity of the biological systems, from a small scale (signaling) to a larger scale (systems biology, stem cell, tissues) and ending with small organisms and embryos. Those biological topics were combined with different areas of microfluidic development and two additional lectures were placed on Tuesday and Wednesday evenings.
All together, 22 speakers presented their work, with two different types of contributions: plenary lectures for advanced/well-established scientists combining a tutorial section and a research overview, and shorter lectures by younger researchers focusing on more recent developments. In addition to these lectures, a poster session was organized to give the opportunity to all attendants to show their work. The posters were available during the whole workshop and were also briefly introduced as a 2-min oral presentation at the beginning of the week, before the wine and cheese party. The last essential ingredient of the workshop was without any doubt, the discussion sessions aiming at debating on identified topics such as the role that microfluidics can play in stem cell research, about microfluidics roadmapping that was summarized in the wrap-up lecture Friday afternoon.
The program contained other leisure-like activities, giving a more relaxing and favorable context for scientific exchange; this notably included two conference diners, one on a boat and the other in the center of Leiden preceded by a walk through the city.

Outcomes

The course of the workshop was evaluated on a daily basis with short morning presentations given by the chairs of the previous day, aiming at highlighting the golden moments of the workshop. Some of them are mentioned here. The number of hits obtained for “cellular signaling” can increase of 0.7 million within less than one day. A 10-micrometer-sized cell contains 23,000 genes. The mechanical behavior of cells can be described by the tensegrity model, which also applies for well-known statues such as the needle tower in the Kröller-Muller museum. Cell signaling does not compare to electrical signals as known by engineers; in a cell signaling pathways are redundant and mainly rely on chemical signals. This essential difference is also commented in a scientific article “Can a biologist fix a radio?”. Solid-state nanofabricated structures can be employed to engineer new phenotypes of bacteria. Microfluidic systems are promising platforms for the culture of embryos.

The discussions naturally brought new material and emphasized the importance of outreach; not only during this workshop but also during follow-up. One immediate action is the use of the participants list to notify the participants to new upcoming events in this field.

Conclusion

At the end of the workshop, the gap between microfluidicists and biologists was narrowed. Microfluidicists certainly returned back home with more biological knowledge e.g., on stem cell biology, and potential contact names for future collaborations. Biologists became aware, if not already, of the existence of micro- and nano-tools that bring novel experimental possibilities and schemes to cellular biology. For instance, the cell signaling field will benefit from microfluidic platforms where the well-defined spatial and temporal patterns of chemical signals found *in vivo* can be reproduced.

However, more opportunities are still needed in a multidisciplinary context to promote frontier research between microfluidics and cell biology. One identified issue for this is the lack of appropriate funding opportunity to support such frontier research. One possible solution to stimulate collaborations between the two fields is to create a common work environment that helps biologists accessing micro-/nano-tools.

This last point led notably to the wish to organize a second edition of the workshop, with a more massive action to outreach biologists. This second workshop could, for that purpose, be organized in the frame of either a biological society such as FEBS, or the Gordon conference network, for instance. The uTAS conference in Groningen can be used to discuss the possibilities in an international context.

Acknowledgement

The workshop organizers are very grateful to the Lorentz Center team that supported this workshop, especially Auke Planjer, Pauline Vincenten, and Dr. Henriette Jensenius. On other aspects, the workshop would not have been so successful without all the participants, through their oral presentations, posters or active presence during the discussion session. Lastly, the organizers would like to thank all the financial sponsors of the Lorentz Center, the KNAW, the MESA+ Institute for Nanotechnology, as well as companies that agreed to support the workshop such as FEI, Lionix, Micronit and the Royal Society of Chemistry.

Séverine Le Gac (Enschede, the Netherlands)
Jan Eijkel (Enschede, the Netherlands)
Albert van den Berg (Enschede, the Netherlands)
Maxim Kuil (Leiden, the Netherlands)
Hans Tanke (Leiden, the Netherlands)

Analysing First Imaging Data from LOFAR

January 25 – 29, 2010

LOFAR, the Low Frequency Array, is a next-generation radio telescope that is being built in the Netherlands and neighboring countries. It will carry out a broad range of fundamental astrophysical studies. An important goal of LOFAR is to explore the low-frequency radio sky by means of a series of unique surveys. The main aim of these surveys is to advance our understanding of the formation of galaxies, clusters and active galactic nuclei. These surveys will be carried out and scientifically exploited by a large international science team, consisting of 75 staff astronomers, 17 postdocs and 15 PhD students. Currently LOFAR is in its role-out phase. At the end of November 2009, 12 stations were operational, and with the current projected rate of building, the complete LOFAR facility with 36 Dutch stations should be ready at the end of 2010. Also the main software pipeline that is capable of delivering maps of the radio sky from the basic data is advancing rapidly. The main challenge for the survey project 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. The serious issues that need to be tackled before deep and scientifically useful maps can be made include:
(i) an efficient usage of the computational resources,
(ii) an effective removal of radio frequency interference (RFI),
(iii) dealing with the corrupting influence of the ionosphere, and
(iv) properly correcting for the station beams.
To deal with all these issues, the survey team has been and is organizing a series of `busy weeks'. The idea is that a team of astronomers from the survey team attempts to tackle a number of issues related to the challenges just mentioned. Three busy weeks have already been held in 2009 (Aug 17-21, Sept 28-Oct 2, Oct 19-23). During these busy weeks very basic functionalities of the system were tested. The fourth busy week has been held at the Lorentz center in 2010 (Jan 25-29).

With 28 participants, recent LOFAR data was carefully scrutinized. Various existing (aips, casa, myriad) and new (BBS) radio reduction packages were used to reduce the new LOFAR data. As there was a constant interaction between software developers and astronomers significant progress could be made. A high light was the production of a deep image of 3C61.1.

The Lorentz center was ideal for this meeting. The many offices with computers allowed the participants to work very hard on the data. Once or twice a day plenary sessions were held during which progress was reported and ideas where exchanged on next steps to take. During the conclusion, a list of issues was drafted to be used by the (software) developers to steer their work.

Huub Röttgering (Leiden, the Netherlands)

The Artificial Leaf

February 1 – 5, 2010

Description and Aims
Our understanding of the function of Nature's blueprint of photosynthesis can guide the development of photochemical devices for the conversion of solar energy into fuels. In this workshop the participants have addressed how the physical boundary conditions imposed by the photochemical thermodynamics of the conversion can be put to use in guiding the design of 3D nanostructured "artificial leaf" topologies that derive from biochemical and biophysical insights on natural water oxidation and on hydrogenases to address the complex chemistry of conversion and storage by systems integration of light-harvesting, photo-induced charge separation and multi-electron photocatalysis functions. Such "artificial leaves" mimic the photosynthesis of plant leaves and could serve in the future to produce renewable fuels from solar energy using water as raw material in an efficient, cheap and robust process.

Tangible outcome
The brainstorm sessions have served as the preparatory stage for the ESF "Eurosolarfuels" Eurocores and the FOM/ALW call "Towards BioSolar Cells" that is part of the Dutch BioSolar Cells FES program. The "Solarfueltandem" consortium was initiated at the workshop and was recently selected for funding by the ESF. In the FOM-ALW open call 7 out of the 10 awarded programs are in the direction of the artificial leaf, and many of the consortia were seeded or took input from the workshop prior to submitting their proposal (http://www.fom.nl/live/nieuws/artikel.pag?objectnumber=140992).
The workshop was connected with the Leiden University Honours Programme and the class "The Artificial Leaf". Bachelor students have attended the workshop as young participants after preparation with an introductory course. Several of the participating students have pursued their studies in the direction of the topics discussed at that workshop. Selected participants have been asked to write a chapter for a book on the topic.

Scientific breakthroughs
The photosynthesis and materials science scientific communities have realized that they have significant parallels that can be explored, and based on the outcome of the Eurosolarfuels and FOM-ALW programs in the direction of the artificial leaf breakthroughs are now anticipated. To facilitate this further, the accumulated knowledge of the workshop has also provided input to a new teaching volume "Fundamentals of Materials for Energy and Environmental Sustainability", which is currently in the final stages of preparation with the Materials Research Society and Cambridge University Press.

The workshop was organized very well by the staff of the Lorentz center, and the support of Gerda Filippo, Henriette Jensenius and Mieke Schutte in preparing and organizing the workshop is gratefully acknowledged.

Thijs Aartsma (Leiden, the Netherlands)
James Barber (London, United Kingdom)
Gyözö Garab (Szeged, Hungary)
Huub de Groot (Leiden, the Netherlands)
Alfred Holzwarth (Mulheim, Germany)
Stenbjorn Styring (Uppsala, Sweden)

Philosophy of the Information and Computing Sciences

February 8 – 12, 2010

Motivation

Computer science (informatics) is branching out to any field of scientific, industrial, and societal relevance. Yet, after many years of great technological development, the nature of computer science as a science seems far from understood. What is its scientific core? What are the fundamental questions the field is addressing? What are its unique methodologies?

The purpose of the workshop was to discuss the developments in the philosophy of computer science (informatics) and to contribute to the ongoing research in the field, from foundational issues about the concept of information to ethical issues in the design of computer games. The workshop specifically sought to expose the interdisciplinary nature of this field, with inputs from philosophy, logic, the philosophy of technology and computer science itself

Workshop

The workshop was attended by 44 people from 10 different countries, with varying backgrounds. The group consisted of leading senior and junior researchers as well as PhD students and participants of different background eager to learn of this upcoming field. The unique focus on surveying the field and pursuing research gave a sense of uniqueness and cohesiveness, which resulted in a very lively and enthousiastic meeting.

Program

The main program consisted of 20 keynote lectures of 45 minutes each, spread over the days of the Workshop. The lectures were followed by lively discussions, often extending well into the coffee breaks. There also was a nice poster session, in which twelve posters were presented

On the first day, four discussions groups were formed, on the following themes:
Theme 1: Philosophical aspects of agents and virtual intelligence
Theme 2: Philosophical aspects of computing and computation
Theme 3: Philosophical aspects of information and ethics
Theme 4: Philosophical aspects of the foundations of models of information
The discussion groups were enthousiastically welcomed and led to extensive debates all through the week. The groups met daily (except on Wednesday) and reported their conclusions in a plenary session on the last day of the workshop.

Distinguished Lecture

A special highlight of the workshop was the public *Distinguished Lecture* delivered by Luciano Floridi, in the auditorium of the beautiful Academy Building of Leiden University. In a thought-provoking lecture, Luciano Floridi sketched the impact of the information revolution ('the fourth revolution') as it is unfolding in our society.

Impressions

The workshop showed the state of the art in several important directions in the philosophy of informatics.
On the first day several main different directions were highlighted: Luciano Floridi on the constructionist philosophy of the field, John Jules Meyer on the impressive developments in

the understanding of agent technology, Klaus Mainzer on the integral view of complexity in dynamical systems, and James Moor on a developing ethics framework for Artificial Intelligence.
The second day was more specialized and devoted to two themes: the philosophy of information (Rovan, van Benthem, Seligman), and novel computational frameworks like amorphous computing (Wiedermann) and stochastic diffusion processes (Bishop).
The third day was devoted to several appraisals of the notion of trust (Grodzinsky, Taddeo), the stimulating vision of human computing (Russ) and an excellent analysis of the societal effects of the developing social communication media (Ess). The later part of the day was devoted to the Distinguished Lecture and the Workshop Dinner in the Faculty Club of Leiden University.
The fourth day emphasized investigations into causality and computation (Cooper), a well-illustrated analysis of the notion of values in the design of computer games (Sicart) and in technology in general (Brey), and the contours of a general theory and understanding of design (Turilli).
The final day was devoted to the role of specification in designing and constructing computational artefacts (Turner), computations from deductions in theories with algorithms as axioms (Dowek), and a general machine characterisation of hyper-computation related to the levels in the arithmetic hierarchy (Van Leeuwen).

Conclusion
The aim of the workshop was to bring the most recent viewpoints and insights together, and to work on advancing the field. The workshop fulfilled its goal excellently. The talks and the conclusions of the lively discussion groups were inspiring and presented much food for thought, and were excellent stimuli for research during the week. The presentations are all available of the website of the workshop

Acknowledgment
We thank the Lorentz center, in particular the workshop coordinator Pauline Vincenten, for the excellent local organization and facilities. We thank the Lorentz Center (LC) and the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS) for supporting the Workshop, as part of the Distinguished Lorentz Fellowship 2009-2010.

Jan van Leeuwen (NIAS / Utrecht, the Netherlands)

Provable Security against Physical Attacks

February 15 – 19, 2010

Physical attacks are cryptanalytic attacks against physical implementations of cryptosystems that exploit some kind of information leakage from the cryptodevice during its execution (called side-channel attacks) or intentionally introduced errors to the computation (called tampering attacks). Traditional cryptographic security notions (which are mostly from the early eighties) do not provide any security guarantee against such attacks. And in fact many, if not most, cryptanalytical attacks on lightweight cryptographic devices like smart-cards or RFID-tags we've seen in the last few years were physical attacks. Not surprisingly, much research has concentrated on finding countermeasures against physical attacks. But only more recently, formal models where proposed which adapt the design principles of modern cryptography to the setting of physical attacks. That is, one requires that a cryptosystem is proven secure against all adversaries in a broad and well-defined attack scenario (as opposed to specific attacks). This research on "provable security against physical attacks" has become a very active area in the last two years. In this workshop, we for the first time brought together cryptographers working on provable security and applied research working on physical attacks.
One goal of this workshop was to make practitioners aware of the work that is currently going on in the crypto community. We've had several survey talks outlining most of the recent work. In the other direction, we've had many talks by practitioners teaching theoreticians about practical aspects of physical attacks. Besides the regular talks, we've had a rump session featuring many short talks about latest research in the amazing faculty club in Leiden.

A particularly successful event was our panel discussion on "models for physical attacks", where theoreticians and practitioners discussed the right assumptions and models of physical attacks. We learned a lot from this interaction. Many misconceptions and misunderstandings that were around were clarified.
This workshop was a success on many levels and a first follow-up meeting (with roughly one dozen people) already took place in Leuven, April 22-24th, 2010.

The Lorentz Center was an excellent setting for our workshop. The feedback from both the workshop participants and speakers was very positive! The organizers are very grateful to the Lorentz Center for helping us to organize this very interesting and productive workshop.

Ronald Cramer (Amsterdam / Leiden, the Netherlands)
Shafi Goldwasser (Cambridge, USA / Rehovot, Israel)
Eike Kiltz (Amsterdam, the Netherlands)
David Naccache (Paris, France)
Krzysztof Pietrzak (Amsterdam, the Netherlands)
Francois-Xavier Standaert (Louvain, Belgium)

Formal Theories of Communication

February 22 – 26, 2010

Objective: To explore the interaction between intensional and extensional theories of communication from the viewpoints of cognitive science, computer science, game theory, linguistics and philosophy

The workshop ran as scheduled, from the morning of February 22 until mid-afternoon on February 26. Since the workshop was centered on interdisciplinary themes, the event was structured accordingly: 7 invited talks (60 to 75 minutes each) on each of the themes, and 18 presentations from participants (of 30 minutes each). There was one Group Discussion (Feb 23), a Panel Discussion (Feb 24), a Problem Session (Feb 25) and a session for presentations on Projects (Feb 25). An excursion by boat on Wednesday evening (followed by a dinner) provided a social interlude in a dense academic program. With extensive interaction and discussions, the workshop was lively (with some heated debates) and highly educative. The central objective of the workshop was to look for questions and techniques common to research on formal models of communication from several perspectives, and to learn from each other; this was achieved satisfactorily.

The workshop was intended as a meeting between several disciplines: logic, computer science, artificial intelligence, game theory, philosophy and psychology. While the bridge to psychology was less effectively made, the meeting provided conversation between the other perspectives. Apart from formal presentations, informal group discussions, a panel discussion led by keynote speakers and an open session with the objective of identifying questions for research, helped in easing interdiscipinary communication. A session on on-going group projects in the Netherlands helped to discuss broad research programs (rather than focussed technical research).

Certain concerns emerged as being central to all the approaches. For instance, many speakers discussed taking into account *intersubjectivity* and how that enriches communication and complicates its analysis. The gap between what experiments reveal and what theory assumes was pointed out by many speakers, who urged that theory be anchored in practice. The effect of *communication structure*, in terms of medium, whether it is dyadic or in groups etc. was seen as important in several contexts. The fact that the meaning of communication is *dynamic* and *negotiated* was emphasized, since formal models often tend to work with static and pre-determined meaning. The emergence of *conventions* and *norms* as well as how they structure and delimit communication was seen to be important from several points of view.

From the discussions, the following ***agenda for research*** emerged. This is a somewhat loose collection of problems, but hopefully future work will provide structured ways of unifying these concerns:

1. Formal models that involve interaction in dynamic networks, which implies unboundedly many agents, who enter and leave the system at arbitrary moments.
2. A measure of communication complexity of problems and games whereby we can classify the achievability of goals in terms of how much (and how complex) communication is required.
3. Models for communication architectures and relaxing assumptions on them systematically to obtain subclasses.

4. Taking into account scale of interaction: determine thresholds where intersubjectivity matters less and aggregation takes over.
5. Combining the discrete with analogue communication primitives, as in depictions, pointing, etc., using the convexity properties of such means systematically.
6. Models for wisdom of the crowds, whereby authentication of knowledge is arrived at by group dynamics.
7. Models for interaction where rationality is parameterized, especially when all agents are not of the same rationality type.
8. Generealizing backwards induction procedures to infinite games, and in the presence of imperfect information.
9. Modelling malicious agents who violate norms deliberately for gain.
10. Formation of a curriculum that builds skills for understanding these different approaches, as well as form healthy attitudes towards them.

While formal logic provided the lingua franca for the workshop, the discussions were not exclusively on logic. There were presentations that emphasized perspectives from linguistics, perception and cognition which raised doubts on what can be formalized, at all.

The Lorentz center setting, with its unique atmosphere backed by excellent organization and amenities, provided just the right tone for the workshop, allowing participants to focus on research interaction. While a mix of experienced and young researchers took active part, the gender ratio was less than we might have hoped for. In summary, we confidently expect that the workshop will lead to new collaborations and to the development of new ideas in communication theory.

The list of participants and detailed program, as well as slides of presentations can be found on the workhop website ably managed by the Lorentz center.

Johan van Benthem (Amsterdam, the Netherlands)
Ram Ramanujam (NIAS, the Netherlands / Chennai, India)
Rineke Verbrugge (Groningen, the Netherlands)

Surveying the Low Frequency Sky with LOFAR

March 8 – 12, 2010

LOFAR, the Low Frequency Array, is a next-generation radio telescope that is being built in the Netherlands and neighboring countries and will be fully operational at the end of this decade.
It will operate at frequencies from 15 to 240 MHz (corresponding to wavelengths of 20 to 1.2 m). Its superb sensitivity, high angular resolution, large field of view and flexible spectroscopic capabilities will represent a dramatic improvement over previous facilities at these wavelengths.
As such, LOFAR will carry out a broad range of fundamental astrophysical studies and will be an important vehicle for astronomical research. An important goal that has driven the development of LOFAR since its inception is to explore the low-frequency radio sky by means of a series of unique surveys. We are planning to exploit the unprecedented sensitivity and wide instantaneous field of view of LOFAR to conduct large-sky surveys at 15, 30, 60, 120 and 200 MHz.

Four topics are driving the definition of the proposed surveys. These are:
- Formation of massive galaxies, clusters and black holes using z>6 radio galaxies as probes,
- Intercluster magnetic fields using diffuse radio emission in galaxy clusters as probes,
- Star formation processes in the early Universe using starburst galaxies as probes, and
- Exploration of new parameter space for serendipitous discovery.

Furthermore, the LOFAR surveys will provide a wealth of unique data for a huge number of additional important topics. These include:
- Physics of nearby AGN
- AGN evolution and black hole accretion history
- Nearby normal galaxies
- Lensing studies
- Large-scale cosmological effects and baryonic oscillations
- Galactic radio sources

At the end of 2009 the LOFAR telescope consisted of 20 stations. With this system first observations were carried out.

The workshop at the Lorentz Center focussed on:
- Updating the entire Dutch astronomical community on the LOFAR projects and its key programs,
- discussing the first data from the 20 station LOFAR,
- updating the survey plans for the full LOFAR in light of the experience from both the 36 station LOFAR and the first outer station,
- exploring synergies with surveys in other wavebands.

With 65 astronomers from 10 countries, the discussions were lively and fruitful. The staff of the Lorentz center were very helpful, which much contributed to the success of the workshop.

Huub Röttgering (Leiden, Netherlands)

Quantum Measurement and Chemical Spin Dynamics

March 15 – 19, 2010

The workshop brought chemists and physicists working in the field of spin chemistry together with experts in quantum information to explore the overlap between these hitherto largely separate fields. The aim was to discuss the theoretical interpretation of quantum spin-chemical effects (e.g. the radical pair model of avian magnetoreception), to determine the parallels between spin chemistry and the properties of quantum dots, and to define experiments that would reveal quantum spin-chemical phenomena such as the quantum Zeno effect.

About 50 scientists attended. There were 19 invited talks, 4 contributed talks and 12 poster presentations.

Part of the motivation for holding the workshop was a recent claim that the spin dynamics of an experimental model system mimicking the conjectured avian radical pair compass can not be explained in terms of the traditional stochastic Liouville equation (SLE) customary in theoretical spin chemistry. A modified form of the phenomenological SLE was claimed to be more successful than the conventional method, supporting the notion that the quantum Zeno effect is crucial to the theoretical interpretation of spin-chemical effects in general and the magnetic compass hypothesis in particular. The consensus of the workshop was that this claim was incorrect and that the choice was between the original method due to Haberkorn and a closely related equation proposed very recently by Jones. Although, in most practical cases, the two approaches make very similar predictions, it is clearly unsatisfactory not to be certain which if either is correct. As a result of our discussions, experimental tests of the two approaches will take place in the coming months and new theoretical descriptions will shed further light on which equation of motion, if either, should be used for reactions in solids and liquids.

Entanglement, a central concept in quantum information processing, was also a focus of much interest in the context of the coherent superposition of radical pair spin states. It appears that, at least for certain reactions, the radical pairs need to be formed in an entangled state to account for the observed magnetic field sensitivity, but apart from this such entanglement is not necessarily a particularly useful resource for either magnetoreception or photosynthesis, the two biological processes in which radical pair chemistry seems to be involved. It is difficult to see that entanglement would lead to large increases in the efficiency of charge separation and stabilisation in photosynthesis or in the sensitivity to weak magnetic fields in magnetoreception. One possible exception is quantum communication protocols such as quantum teleportation. Unfortunately both speakers invited to lecture on this subject had to pull out at the last minute. Although radical pairs do not seem to be ideal experimental or theoretical candidates for the study of entanglement because of the relative lack of experimental control over their behaviour compared, for example, to single spins in quantum dots, they are, or appear to be, important in biology and so worthy of continued study.

Interestingly, the quantum Zeno effect did not figure as strongly in the workshop as we had anticipated. Depending on one's point of view as to precisely what constitutes a genuine Zeno effect, it is either extraordinarily difficult to observe experimentally or so common as to be of little genuine interest. However, the idea that one could choose experimental

conditions so as to suppress singlet-triplet interconversion in radical pairs is interesting and could inspire new chemistry by controlling the lifetimes of radicals to a much greater extent than is possible with more conventional magnetic field effects.

For many of us in the spin chemistry field, one of the most inspiring aspects of the workshop was the opportunity to learn about the astonishingly clever experiments possible by manipulating single electron spins in quantum dots. The parallels with spin chemistry are manifold. These technologies offer the possibility of elucidating radical pair processes, for example in connection with magnetoreception, under circumstances that would be extraordinarily challenging to realise using chemical reactions. Clearly it can only be a matter of time before the first single-molecule spin-chemical experiments are reported.

In conclusion, the workshop achieved most of its stated scientific aims.

We are very grateful to the staff of the Lorentz Center for their expert handing of all administrative matters. The workshop was a joy to organise with such cheerfully reliable support. The meeting would not have been possible without the Center's generous financial support for which we are also most grateful.

Ulrich Steiner (Konstanz, Germany)
Jörg Matysik (Leiden, the Netherlands)
Jonathan Jones (Oxford, UK)
Peter Hore (Oxford, UK)

Part and Whole in Physics

March 22 – 26, 2010

Western philosophy began by asking the question "What is everything made of?" Today many look to physics for an answer, but the question has two presuppositions. It presupposes that physical systems are organized into levels and that this hierarchy is founded on entities of no more than a few basic kinds. The purpose of the workshop was to bring together prominent physicists and philosophers in an intense but informal atmosphere to investigate how well the two suppositions hold up in the light of contemporary physics and philosophy.
The program was designed to bring about mutual appreciation among philosophers and physicists of the relevance and significance of each other's work on matters of mutual concern. The workshop was attended by 43 participants from 11 different countries, with diverse backgrounds in philosophy and history of science, analytic philosophy, as well as physics and related scientific disciplines. There was a nice mix of senior and junior participants, ranging from prominent senior scientists and philosophers to Ph.D. students. Among the speakers were four scholars with recent PhDs and three young women.

The program was organized along five main topics:
1) Objects, existence and composition
2) Basic building blocks in physics and metaphysics
3) Composition in physics and metaphysics
4) Ontological emergence in physics and metaphysics
5) Individuals, structure and complex systems

In addition, Richard Healey presented a distinguished public lecture, entitled "A Lego universe?" in the Kamerlingh Onnes Laboratory on Wednesday evening.

There were four workshop talks on Monday, Tuesday and Thursday, and three on Wednesday and Friday. Each talk was 45 minutes to ensure ample time for discussion. Further, a special plenary discussion session was held each day to address the themes of that day in greater depth. These discussion sessions were led by two moderators who had been instructed beforehand to collect the questions and discussion points submitted to them by the participants during the day. We found that this procedure worked very well to stimulate a lively yet focused discussion, and a cross-disciplinary exchange of ideas. We believe the workshop thus realized its goal of finding not only formulation of common ground amongst scholars from various backgrounds, but clarification of reasons for continued disagreement to be pursued more profitably as a result of the understanding achieved during the workshop. Papers from the workshops are presently being collected to be included in a forthcoming special issue of the journal Studies in History and Philosophy of Modern Physics.

Many participants expressed their praise for the competent and helpful staff at the Lorentz Center, and admiration for the smooth organization and the excellent facilities provided. The organizers wish to thank The Lorentz Center and the Royal Dutch Academy of Science for their financial support and Pauline Vincenten and Mieke Schutte for their invaluable assistance in preparation and organization.

Richard Healey (Tucson, Arizona, USA)
Jos Uffink (Utrecht, the Netherlands)
Philip Stamp (British Columbia, Canada)

Single Dopant Control

March 29 – April 1, 2010

In the past few years it has become possible to control the incorporation of doping atoms in a semiconductor material at the atomic level and to assess and even manipulate individual doping atoms. In this exciting workshop for the first time we brought people together working on single doping atoms with various techniques and approaches and in different semiconductor materials. The meeting was fully booked with over 75 participants from all over the globe with 19 extended presentations by the leading international experts. The workshop focused on 4 common problems and included these explicitly in the program by devoting a day to each of them. These problems are:

“The interaction of a dopant with its environment”. The properties of a dopant are strongly influenced by its environment. This affects properties like the spectrum, orbital and spin relaxation times, quantum coherence times, coupling to photons and phonons. The complexity of this problem is further enhanced when the dopant is not in a bulk environment, which is required to electrically influence a dopant in a device. This problem holds for all 3 systems and the combination of the different fields and techniques will lead to cross-fertilization.

“Deterministic doping”. Although most of the researchers currently work with randomly placed dopants in the semiconductor, scalable applications require controlled placement of the dopants. In recent years there has been great progress in single ion implantation and bottom-up dopant placement. In this case the three material systems are at very different development stages. Clear links between the Si and NV community were identified and links to the Mn system in II/VI and III/V materials were made.

“Modeling”. The predictive power of dopant modeling (in nano-devices) greatly advanced over the last few years. The techniques used range from effective mass models, via tight binding to DFT calculations. This session highlighted successful approaches in link with experiments and discussed their different strengths. The goal was to transfer the knowledge of working approaches from one material system to another and to identify obstacles that can be resolved in collaboration.

“Devices and applications”. Ultimately we utilize the unique properties of dopants in device applications. This session will ranged from quantum applications to the impact of dopants on conventional device performance combined with theory work. The goal was to identify new functionality of dopants as well as the ability to understand device performance at room temperature based on quantum measurements.

This workshop was very instrumental for a first review on single dopants in semiconductors that appeared in January 2011 in Nature Materials.

Joaquin Fernandez Rossier (Alicante, Spain)
Paul Koenraad (Eindhoven, the Netherlands)
Sven Rogge (Delft, the Netherlands)

Integrating Cultures: Models, Simulations and Applications

April 6 – 9, 2010

This workshop brought together researchers and practitioners from computer science, social science, artificial intelligence, cognitive science, economics and psychology to discuss the role of culture in computer-based systems and virtual environments. The aim of this workshop was to discuss and develop culture-sensitive models that will enable policy makers and developers to represent and reason about different, possibly conflicting, social norms and practices. This is of importance to the building of support tools for policy makers that want to assess the possible effect of a new policy, like the smoking ban in public places or speed limit of 80 kilometers in highways. (It is known that these policies have different effects in different countries in Europe.) Such models furthermore enable to integrate concepts that play a role in culture from the perspective of the different research areas that study culture. In particular, the models must include constructs to represent expressions of culture (rituals, norms, symbols), to represent different social contexts and to simulate individual behavior to express the effects of culture in different contexts (groups, organizations, tribes). During the workshop, participants discussed the application of such models to the study of complex social systems, e.g. through the use of computational simulations of virtual societies.

Keynote speakers at the workshop were Don Beck from Spiral Dynamics Integral, US; Cristiano Castelfranchi, CNR Italy; Jeroen van den Hoven, TU Delft; Raimo Tuomela, Helsinki and Yoshi Kashima, Melbourne Australia. Together they presented a wide area of topics from philosophical logic, to pragmatic approaches applied in culture-related conflicts such as the Palestine-Israel situation. Several of the more than 57 participants also were able to present current research ideas.

The workshop format was organized around discussion groups that took most of the afternoon sessions. From these discussions many new topics for research have emerged and some of the participants have subsequently developed project proposals derived from these ideas (e.g. for the FP7 program on “Governance and Policy making”). The discussion sessions were structured such that participants became aware of their own cultural biases and how this plays a role when modeling systems and developing theories.

The wide diversity of participants made clear how culture determines many aspects of our lives and how the same concepts have different aspects in different perspectives. In this sense the workshop really functioned very well as the start of a research area, opening up new avenues of research cooperation. By talking with people from completely different backgrounds many participants suddenly noticed the relevance of theories from a different research field for their own work.

The workshop organizers are editing a volume including extended versions of work presented at the workshop to be published by Springer for which 36 papers were submitted. This volume is currently in the second round of reviews and is expected to be published by end 2011.

Virginia Dignum (Delft, the Netherlands)
Frank Dignum (Utrecht, the Netherlands)
Jacques Ferber (Montpellier, France)
Tiberiu Stratulat (Montpellier, France)

The Interface of Integrability and Quantization

April 12 – 16, 2010

Aims

Both integrability and quantization are central themes in modern mathematical physics and thus form a common meeting ground for the research of mathematicians and physicists. The goal of the conference was to bring together reknowned mathematicians and physicists working on a selected number of topics in these fields, to stimulate cooperation and to offer young scientists from both sides a good interdisciplinary view on recent progress in these fields. These topics were:

1) Quantum groups, their geometry and representation theory
2) Integrable models in string and field theories and their quantizations
3) Infinite dimensional groups and algebras in integrability and quantization
4) The role of complex analytic geometry in both themes

Conference

There were 36 participants from 12 different countries that attended the week program with a substantial group of young researchers. An additional group of people joined the program on Friday, as the workshop was combined that day with the colloquium of the cluster Geometry and Quantum Theory.

Program

The program consisted first of all of 15 keynote addresses of 45 minutes each followed by lively discussions. Each day they were centered around a joint aspect.
Besides this part of the program, there was also the possibility for young researchers to give a short presentation of their work and ample use of this opportunity was made: all reserved time slots were fully booked.
The time reserved for the discussion sessions was mainly spent on discussions in small groups and working on joint papers, but spontaneous talks also occurred. Participants showed no interest in presenting their work in poster sessions.

Outcome

Besides that the participants told us the conference was a source of inspiration for new ideas and yielded various new cooperations, also concrete plans were developed during the conference for the set-up of an European Mundus program with Russia.
In the mean time A.G. Helminck and V. Roubtsov have obtained the permission from the Journal of Geometry and Physics to be the editors of a special issue devoted to this conference.

Acknowledgements

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

1) The Lorentz Center (NWO)
2) The Journal Compositio
3) The cluster “Geometry and Quantum Theory” (GQT)
4) The Mathematical Research Institute (MRI)

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

Loek Helminck (Raleigh, USA)
Gerard Helminck (Amsterdam, the Netherlands)

How to Weigh Clusters of Galaxies

April 19 – 23, 2010

The focus of the workshop was to bring together experts on various methods to measure masses of clusters of galaxies and to discuss the pros and cons of the techniques. Unfortunately an ash cloud produced by a volcanic eruption on Iceland shut down air travel, which led to the cancelation of approximately one third of the participants (trans-Atlantic and Italy) and prevented organizer Andisheh Mahdavi from attending. Fortunately the remaining participants were able to arrive by train and two talks were done through video conferencing. Importantly, the composition of the group of attendees was such that expertise in essentially all aspects of cluster mass determination remained. We were extremely pleased that, despite the travel troubles, we were able to cover all the topics of the workshop.

Nevertheless, the program was adjusted, with the Friday reserved for collaborative discussions and general interactions. Interestingly, due to the smaller size of the group, the discussions were extremely interactive. Also, the talks were very interesting, with the speakers providing honest assessments of the limitations of the various methods. Such frank discussions are not possible at a typical conference, and the more intimate setting of the Lorentz Center has to be credited for this. Therefore all present felt that the workshop was a sounding success.

The discussions demonstrated the impressive progress that has been made in both observations and numerical simulations and the need to connect both in order to interpret the impressive multi-wavelength data that have been, and are being, collected ideas for a collaborative effort were discussed, but current data sets can still be managed by the various research teams that were present. Therefore there was little enthusiasm to expand current collaborations. Nonetheless the need for a follow-up meeting, with a focus on simulations and cluster physics, was recognized.

For many participants this was their first visit to the Lorentz Center and they were impressed with the facilities and the very efficient organization. Although the program was diverse, we felt that still more time for discussion would be needed (even with the reduction in talks we already experienced). Fortunately the Friday without talks allowed us to discuss various projects informally.

To summarize, despite being adversely affected by the flight-ban, the workshop turned out great. The small size of the group led to frank and interactive discussions. The only negative moment was the treatment of the participants in the cafeteria due to an obvious misprint on the lunch tickets. Rather than being welcomed as guests of the university we were considered “criminals” trying to get a free lunch...

Henk Hoekstra (Leiden, the Netherlands)
Arif Babul (Victoria, Canada)
Andisheh Mahdavi (San Francisco, USA)

Inter-phase:
Novel Electronic States at Interfaces in Oxides

April 26 – 29, 2010

Interfaces provide tantalizing opportunities for the occurrence and/or stabilization of electronic states that do not occur in bulk materials. In semiconductors for example, the 2-dimensional electron(hole) gasses are famous examples, with the (fractional) quantum Hall effect as prominent features. And in combinations of cuprate perovskites, high-T_c superconducting interfaces have been created while the abutting crystals are not superconducting. Not only interfaces connecting two dissimilar materials are of interest in this respect, but also surfaces and internal interfaces such as grain boundaries.

The occurrence of new electronic interface states became especially topical with studies done on complex oxides, in particular with the seminal publication in Nature by Akira Ohtomo and Harold Hwang (2004). They established that the interface between the band insulators $LaAlO_3$ and $SrTiO_3$ can become conducting, depending on its atomic arrangement. It is conceivable that the polar nature of the $LaAlO_3$ is the main driver of a charge transfer process from the $LaAlO_3$ surface to the $SrTiO_3$-$LaAlO_3$ interface, giving rise to delocalized states there. Subsequently various groups showed that under the right preparation conditions such interfaces can even be made superconducting or show magnetic effects. An important aspect in this research is the formation of defect states, such as oxygen or cation vacancies, interdiffusion as well as the influence of epitaxial strain. All these various factors lead to a rather complex picture of what actually drives the interface conductance and controls important characteristics of it, such as the charge carrier density and mobility.

This workshop was aimed to share the latest knowledge on such ‘Inter-phases’ and to educate the Dutch community, especially the new FOM PhD students, on this topic. Electronic transport properties were intensively discussed, as well as microstructural and spectroscopic analyses and new theoretical insights on the interface states. Most of the main players in the research on perovskite oxide interfaces were present, both from the experimental side such as Tokyo (Hwang, Fujimori), Augsburg (Mannhart), Geneva (Triscone), Tel Aviv (Dagan), Würzburg (Claesen) to name only a few, as well as from theory Colombia (Millis), Munich (Pentcheva), Oak Ridge (Okamoto), Cambridge (Littlewood). This of course in addition to the Dutch groups united in the FOM ‘Interphase’ programme (Twente, UvA, Nijmegen, Leiden, Delft) through which this Lorentz Center workshop was initiated.

A special key-note speaker at the workshop was Nobel Laureate Prof. Klaus von Klitzing (MPI Stuttgart), who in a lovely talk made a bridge between interfaces in oxide systems and the famous semiconductor 2-dimensional electron(hole) gases. Especially tantalizing is the situation in which two 2-DEGs are closely coupled and novel exciton-like (condensate) states can appear. In the oxides it is possible to bring such interfaces about a factor of 10 closer than in the standard semiconductor systems, as was demonstrated in a publication by the FOM programme groups that came out just before the workshop.

The workshop included 19 oral presentations (1 hour each including Q&A), 10 lively discussed posters and organized- and free-time for discussion. One of these discussion sessions was named the ‘Wim van Saarloos session’. This all took place in a very pleasant

atmosphere to which the beautiful April weather certainly contributed. About 70 people attended the workshop, in a healthy mix between really young and young-at-heart. The conference diner was on board of a ship making a marvelous tour on the canals and lakes around Leiden, which was extremely well received by all the participants. The scientific and social interactions at the workshop have meanwhile resulted in various new collaborations.

We thank the local staff of the Lorentz Center, in particular Mieke Schutte, Gerda Filippo and Henriette Jensenius for their wonderful help in all the practical arrangements and the suggestions how to stimulate the scientific interactions. Financial support from FOM through the program ‘Interphase’ is also gratefully acknowledged.

Hans Hilgenkamp (Enschede, Netherlands)
Alexander Brinkman (Enschede, Netherlands)
Mark Golden (Amsterdam, Netherlands)
Uli Zeitler (Nijmegen, Netherlands)
Guus Rijnders (Enschede, Netherlands)
Paul Kelly (Enschede, Netherlands)
Jeroen van den Brink (Dresden, Germany)

Advanced School and Workshop on Computational Gravitational Dynamics

May 3 – 13, 2010

The advanced school and workshop on computational gravitational dynamics was attended by some 24 young apprentice researchers and some 32 experienced researchers world wide.

Computational astrophysics is a fast growing discipline which envelopes computational science, astronomy and physics. There is a range of expert fields within computational astrophysics, some of which seem obviously related but are socially and professionally well separated. We will organize an advanced school and workshop to bridge gaps between a range of specialized fields in computational astrophysics, in particular on those disciplines that simulate gravitational dynamics using N-body techniques

The advanced school grouped the students to work in collaboration with an experienced researcher (in parenthesis) on one of the following topics:

- Orbital Dynamics of Multi-Planet Systems w/GPUs (Prof. E. Ford)
- Planetary System Stability (Prof. A. Quillen)
- Toomre & Toomre Redux (Prof. J. Dubinski)
- Galactic Disk and Bar Formation (Prof. Ch. Boily)
- The Final Parsec Problem (Dr. S. Harfst)
- Exploring Galaxy Dollision Products (Dr. I. Pelupessi)
- Forming Ultra-Compact Dwarf Galaxies (Dr. H. Baungardt)
- Do Spiral Galaxies Contain a Dark Matter Disc? (Dr. P. Teuben)
- Collisional Dynamics with a Tree Code (Dr. J. Stadel)

After this first week, we continued with a more classical approach of a workshop, for which we had invited some 24 experienced researchers. During the workshop the student-teams were encouraged to present their results to the more experienced audience.

We achieved our prime objective in cross fertilizing the computational science aspects of the four core-disciplines in computational gravitational dynamics: planetary dynamics, star cluster dynamics, galaxy dynamics and cosmology. New research project have been initiated during the school. Among these are a collaborative effort to model a real star cluster using a Barnes-Hut tree-code, a tool often adopted by cosmologists and galaxy modelers.

We have achieved in bringing a broad range of students and researchers from domains which are classically well separated. We hope to see the researchers in the 'other' domains more frequently at our local domain-specific conferences, as we have layed the seeds for such further cross fertilization during the school and workshop.

We made important progress in initiating cross disciplinary software tools. It turns out that some of the domain-specific application algorithms are rather specialized and hard to port across the disciplines. But several of our methods appear to transfer quite easily across domains, such as planetary system evolution in context of cluster dynamics, or improving orbit approximations inside other than Keplerian potential to improve accuracy of tree or direct codes other potentials. However, we did not settle on a specific fixed approach that was a clear winner. The workshop was pretty intense and covered a lot of ground so it may

take some time for the pieces and new collaborations to become clearer. But surely the seeds for new ideas/approaches were planted, and in due time we expect a flurry of progress in the interdisciplinary research field of computational gravitational dynamics.

We think that it was a good idea to limit ourselves to computational gravitational dynamics. During the school and in particular during the workshop we already had some difficulty understanding the other experts from a different specific research area. Broadening-up the domain could easily result in a Babylonian situation; where most of the time would be spend in trying to understand each other without direct progress.

We are very enthusiastic about the combination of an advanced school with a workshop, as it gains the interest of a new generation of young students and establishes cross fertilization among the different physical scales which utilize similar numerical techniques. A next proposal to the Lorentz Center will certainly have these same two ingredients.

Alice Quillen (Rochester, USA)
Steve McMillan (Philadelphia, USA)
Simon Portegies Zwart (Leiden, the Netherlands)
Joachim Stadel (Zurich, Switzerland)

Capillary Shaping of Solutes

May 17 – 21, 2010

Goal

This meeting sought to improve the understanding of a novel class of kinetic material-shaping phenomena. The material is a colloidal or macromolecular solute in a liquid solvent. The phenomena arise from capillary flow, dictated by the liquid's surface tension. Such flow can be induced for example by evaporation or by gravity. The workshop considered principally surface flows. The novelty arises because of the reciprocal interaction between the capillary forces on the one hand and the adhesive and cohesive forces of the solute on the other. Thus solute particles may be swept along the substrate by the capillary flow. But once anchored on the substrate, e.g. at a contact line, the solute particles constrain the shape of the interface and thence the flow field.
A simple example is the drying of a drop of dirty water on a surface. The colloidal dirt becomes strongly concentrated at the contact line, forming a characteristic and generic concentration profile. Altering parameters of the solute or substrate leads to a rich variety of different patterns: radial pitchfork deposits, azimuthal concentric rings, and multiscale patterns resembling a Sierpinski gasket. The workshop dealt with several deposition geometries and several substrate effects as mentioned below.

The meeting sought to identify common structural elements and common pattern-forming mechanisms and limiting principles. In particular, it sought to identify features caused by quasi-static forces and those caused by kinetic forces where the rate of flow and deposition are crucial.

Meeting size and format

The one-week meeting attained its target size of 50 participants. By active selection and recruitment, we were able to attract the people needed to study the diverse phenomena of the workshop. Discussion centered on only three overview talks per day. Each speaker was followed by a pre-arranged discussant: speaker, discussant's remarks and audience discussion were scheduled for 90 minutes of time. All participants were invited to contribute a poster. The meeting began with a brief self-introduction by every participant. Virtually all the participants were active as speakers, discussants, poster presenters or session chairs. The meeting was leavened with an opening wine-and-cheese party and a dinner excursion. A final session aimed to state what learnings had emerged from the meeting.
The workshop staff actively developed an online presence for each participant. The workshop web site had a place for each participant's picture with links to their introductory slides, their presentation slides and their own web sites.
This format seemed to be successful. The tone and atmosphere of the meeting was very interactive with many lively discussions. Many participants emphasized afterwards how much the meeting had been valuable for them. Though no one specifically praised the web site arrangements, we think the accessibility of participants' work via this site helped to build the momentum of the discussion.

Major developments and findings

Mechanism for stick-slip behavior

Many of the patterns featured periodic oscillation between a stationary (stuck) contact line and a moving (slipping) one. Early in the conference, stick-slip was attributed to a simple static force balance. But at the end a kinetic mechanism dominated by viscous forces

seemed to emerge as the more generic mechanism. The importance of viscous forces for influencing the solidity of the deposits and thus their resistance to later capillary forces was noted.

Buckling and chevrons
Two groups reported a puzzling chevron pattern in the drying of a concentrated suspension. The chevrons are regular parallel stripes oriented at 45 degrees to the flow direction and to the deposition front. Since the two groups used different formulations and geometries, both were very interested in the leverage to be gained by comparing the experiments. Both groups agreed to pursue their work in order to decide whether the chevrons were a form of buckling, a density wave or a shock-front phenomenon.

Cracks and labyrinths
At least two groups studied deposition of dense suspension between parallel plates. They found crack patterns resulting from capillary failure of the fluid air interface. One puzzle is to explain the separation of the cracks that form. A possible mechanism was proposed based on the difference between the density of the uniform deposit versus the close-packed density.

Appraisal, impact and recommendations
Any meeting of this sort helps to advance its field by keeping participants abreast of one-another's work and challenging the speakers' assertions. Some meetings go beyond this level to develop a sense of coherence and direction in the field. The organizers had the impression that this workshop achieved some of this coherence. We believe that the impact of this coherence will emerge in the next year or two in publications addressing the puzzles noted above. The workshop aimed to identify the diverse deposition effects as a common body of phenomena amenable to common ways of understanding. We believe the workshop promoted this view, though some participants argued forcefully that each phenomenon needed to be treated on its own terms.
We found the online aspect of the workshop useful and worth repeating in future workshops. It gives ready access of each participants work and viewpoint for the other participants to see and engage with each other.
We found the speaker/discussant format borrowed from previous Lorentz-center meetings useful and worth emulating.
We liked the use of a self-introduction session on the first day of the workshop. The participants used their introduction time to good advantage, and it gave everyone a sense of the others. These introductions were particularly valuable for this meeting, where most participants didn't initially know one another.
Some conclusions seemed to emerge with clarity during the meeting. We summarized these above. However, it would have been beneficial to articulate these findings in convincing detail, citing specific phenomena and quantitative mechanisms. We regret that we didn't take the opportunity to write a review article detailing these findings. However, we still have our notes and memories, and there is still a prospect that such an article can be written.

Thomas Witten (Chicago, USA)
Laurent Limat (Paris, France)
Vincenzo Vitelli (Leiden, the Netherlands)

Multi-frequency EPR in the Biosciences

May 25 – 28, 2010

The challenge of proteomics is to understand the function and reaction mechanism of highly specialized proteins on the level of their molecular and electronic structure. Owing to recent technological and methodological advances, Electron Paramagnetic Resonance (EPR) is in an outstanding position to contribute to this demanding field. The workshop focused on instrumental and methodological developments toward sensitive and widely applicable high-frequency EPR, spin-label and transition-metal multi-frequency EPR, and the study of the dynamics of spin systems at different time scales, all in view of applications in the biosciences.

In the professional and stimulating environment of the Lorentz Center about 45 scientists came together. A limited number of talks and posters were presented to allow ample time for discussion. Recent developments were reported, for example with respect to instrumentation, the use of (novel) spin labels for structure determination and probing of local environment, the elucidation of the electronic structure of transition-metal sites in proteins, the (electronic) structure of transient species in relation to photosynthesis, the modeling of large-scale structural changes of proteins based on EPR-derived restraints, and the multi-frequency approach to the study of molecular dynamics at largely different time scales. These presentations initiated extensive and lively discussions in the lecture room, in the common room and in the corridor. Besides contributions from the EPR perspective, some contributions were given from the perspective of the biosciences leading to discussions concerning the expectations of the biochemist as regards EPR and the convictions of the spectroscopist as regards the potential of modern EPR for the biosciences. In more general terms, the question was addressed what goals the EPR biocommunity should set for the near future.

The workshop was completed by a (too) short visit of the Boerhaave Museum, the renowned Dutch national museum for the history of science and medicine, and a dinner in the center of Leiden. All participants enthusiastically put in a lot of energy to make the workshop into a success. They reported to return home with new inspiration and some new cooperations have been started.

Klaus Möbius (Mülheim a.d. Ruhr, Germany)
Heinz-Jürgen Steinhoff (Osnabrück, Germany)
Martin Engelhard (Dortmund, Germany)
Maurice van Gastel (Bonn, Germany)
Edgar Groenen (Leiden, the Netherlands)

Understanding and the Aims of Science

May 31 – June 4, 2010

Scientific background and motivation

The workshop focused on the topic of understanding as an aim of science. Both scientists and laypeople typically regard understanding as one of the most important and highly valued aims of scientific research. But what precisely is scientific understanding, and how is it achieved? These are philosophical questions, and there is hardly any consensus about the answers. The aim of the workshop was to advance the discussion about understanding as an aim of science by bringing together philosophers of science and practicing scientists from various scientific disciplines. The interdisciplinary nature of the workshop was meant to provide philosophers of science with first-hand information about scientific practice and about scientists' criteria for understanding, and to press scientists to reflect on the aims of their research activities and to make their criteria for achieving understanding explicit.

The workshop: program and overview

The workshop featured 20 invited speakers and 8 young scholars, and attracted a further 19 registered attendees. Of all participants, 28 were based in the Netherlands, while the remainder came from Belgium, Germany, Denmark, the UK, France, Greece, Finland, the USA, and Canada. The interdisciplinary nature of the workshop was reflected in the background of the participants, among whom were philosophers of science and scientists from a wide variety of disciplines, ranging from physics to the social sciences.

Each workshop day focused on a specific topic, and opened with a short introduction to this topic by one of the organizers. The topics were:

- Aims of Science and the Place of Understanding
- Theories of Understanding I: Mechanism-Based Approaches
- Theories of Understanding II: Unification- and Reduction-Based Approaches
- Simulations and the Provision of Understanding
- Understanding, Imagination, and Visualization

Each day featured three or four invited lectures, followed by ample discussion time. In addition, there were plenary sessions to evaluate the progress made during the workshop, a concluding wrap-up session, and short presentations by 'young scholars' (PhD students or recent PhDs).

On Tuesday, invited speaker Herman Verlinde (Princeton University) gave a public lecture, "On the Emergence of Space and Gravity", in the lunchtime lecture series "This Week's Discoveries" of the Faculty of Science. This lecture attracted a large audience of faculty members and students and stimulated a lively discussion.

Evaluation and conclusions

The chief aim of the workshop, interdisciplinary discussion and research on the nature of scientific understanding, was successfully realized. There was much fruitful discussion and interaction between scientists and philosophers with backgrounds in various scientific disciplines. Since ideas and presuppositions regarding the nature of understanding and the ways it can be achieved vary widely across disciplines, and since philosophers of science do not usually interact with scientists on a day-to-day basis, the workshop offered a unique opportunity for participants to widen their horizons and gain new insights.

At a more practical level, the excellent facilities of the Lorentz Center and the pleasant and efficient support of its staff contributed enormously to the success of the workshop. The

Lorentz Center 'home', with office space for every participant and a common room, creates an informal atmosphere that fosters interaction and discussion between participants.
The abstracts and slides of all lecture presentations are available on the website. A selection of the invited papers will be published in a special issue of a philosophy of science journal, devoted to the topic 'Understanding without Explanation'.

Acknowledgements
We thank the Lorentz Center, in particular Pauline Vincenten and Mieke Schutte, for the excellent local organization and facilities, and the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS) for supporting the workshop as part of the Lorentz Fellowship 2009–2010. Finally, we thank the Lorentz Center, NIAS, and the Institute of Philosophy, Leiden University, for financial support.

Henk W. de Regt (NIAS / Amsterdam, the Netherlands)
James W. McAllister (Leiden, the Netherlands)

Numeration

June 7 – 18, 2010

First week

Preceding the Numeration Workshop, the organizers organized an instructional conference with introductory lectures on Numeration, aimed at young researchers such as Ph.D.-students, post-docs and researchers in their tenure tack. Four leading mathematicians were invited to give lectures on various aspects of Numeration. The Instructional Conference was a success. We had far more participants than expected.

On Monday, June 7, Mark Pollicott gave two one-hour talks on dynamical zeta-functions, on Tuesday Vilmos Komornik lectured two times one-hour on expansions in non-integer bases, on Wednesday and Thursday both Mike Keane as well as Boris Adamczewski delivered a one-hour talk. On Wednesday Keane gave a review lecture on ergodicity, while Adamczewski lectured on the use of automata in Number Theory. On Friday there was a special meeting of the so-called *Intercity Number Theory Seminar*, in which not only Pollicott, Komornik, Keane and Adamczewski gave lectures for a more general audience, but also a lecture was given by Shigeki Akiyama. Three of the four lectures by our four main speakers will appear in a special issue of *Integers*. Only Adamczewski declined, since his lecture will be part of a research monograph he is currently writing.

Apart from these talks, there were every day talks by young lecturers, and in the program a lot of space was kept open for discussions and scientific cooperation. Every afternoon there was an exercise session (for deeper understanding of the lectured material). All these things together yielded a very lively atmosphere in which there was a lot of cooperation between various participants, both junior and senior, of the workshop. This was further cemented by the wine-and cheese party on Monday, and the diner on the beach on Wednesday, which was organized by Corrie Kusters of the Lorentz Center.

There was a large international interest for the instructional conference. In total there were 46 participants, and also a number of 'locals'. Thanks to the financial support of the Lorentz Center, the TU Delft, the Universities of Leiden and Utrecht, and of the research-schools *Stieltjes Institute for Mathematics* and the *MRI,* we were able to invite and financially support able young researchers to participate in the Instructional Conference. Their reactions were very positive, and we intend to organize a similar workshop again in the Netherlands in the future.

Second week

Numeration is the study of the representation and properties of numbers and sequences. Numeration is a subject not just important for Number Theory, Ergodic Theory, Symbolic Dynamics and Combinatoric onWords, but has various applications in the theory of Automata, Computer Science, Crystallography, Formal Languages and Physics. Following the Instructional Conference on Numeration, a workshop on Numeration was held at the Lorentz Center from June 14 to June 18, 2010. As the Instructional Conference was focussed on young scientist working in/interested in Numeration, the workshop brought together a wide variation of mathematicians, computer scientists, and researchers with a physics background.

The workshop was organized by topic, and each day had a special subject as focal point. For example, on Monday the subject was Ergodic Theory, on Tuesday Number Theory, on Wednesday Symbolic Dynamics, on Thursday Physics and Theoretical Computer Science. The last day was reserved to bring all these themes together. All lecturers for this workshop were

pre-selected, and all gave a one-hour talk. The set-up was such, that high-level talks were given in the morning and at the end of each afternoon (except for Friday). In the early hours of the afternoon there was a lot of time reserved for get-togethers, informal talks, etc.
The quality of the invited speakers made it necessary to cap the number of participants. The maximum capacity of the Lorentz Center is 67 participants, and early spring 2010 it was necessary to close the registration for this workshop: there was simply no more space available.
Thanks to generous financial support, in particular by the Lorentz Center itself, the KNAW, and the DIAMANT-cluster, the travel cost and hotel costs of the speakers could be covered. The financial support of the three organizing universities (UL, UU and TU Delft) was used for activities to further cement the interaction between the participants. Examples of this are the wine-and cheese party on Monday, and the workshop diner on Thursday, all organized by Corrie Kusters of the Lorentz Center. It should be mentioned that all the staff-members of the Lorentz Center really made the instructional conference ant the workshop into the success it became; due to their great support the organizers only needed to take care of the scientific aspects of the two weeks.
The proceedings of this workshop will appear in *Integers*, a journal in which the proceedings of two similar conferences appeared before. For this special *Numeration*-issue of *Integers*, the four organizers of the workshop will act as guest-editors. In this way the tals of this workshop will be made public to a wide audience; Integers is a freely-accessible internet journal.

Karma Dajani (Utrecht, the Netherlands)
Robbert Fokkink (Delft, the Netherlands)
Cor Kraaikamp (Delft, the Netherlands)
Rob Tijdeman (Leiden, the Netherlands

IPTA 2010: Detecting Gravitational Waves with Pulsars

June 21 – July 2, 2010

Pulsar Timing Arrays (PTA) are programs developed in order to detect and measure extragalactic gravitational waves using super-precise timing of an array of millisecond pulsars. These programs are long-term campaigns which have been rapidly growing on 3 different continents: the Parkes PTA in Australia uses the data from the Parkes telescope, NANOGrav in North America uses the data from Arecibo and the NRAO/GBT telescopes, and the European PTA utilizes 5 telescopes: Westerbork (Netherlands), Jodrell Bank (UK), Effelsberg (Germany), Nancay (France), and Sardinia (Italy). There is a strong need to both educate the young researchers (students and postdocs) in this field, and to coordinate research and exchange ideas across the three PTAs. This timely workshop addressed both of these needs.

The workshop's first week-long half served as a school for students and postdocs. Four days were devoted to morning lectures (2 lecturers per day), while the afternoon was devoted to practical exercises. The fifth and last day was devoted fully to practical exercises. Judging from the students feedback and the impression of the lecturers themselves, this was a great success. A good fraction of attending students are now working full-time in the PTA research.

The second week-long half consisted of seminars and discussion sessions on the forefront of the PTA research, where all of its aspects observational techniques, instrumentation, data analysis, interference from the interstellar medium, gravitational wave sources, and analysis techniques used for extraction of the gravitational wave signal were debated in friendly but robust manner. Many new unpublished results were presented, and useful feedback was obtained from all of the PTA representatives. For example, one of the talks presented the result from data analysis of the European PTA, placing the most stringent limit on the gravitational waves from binary black holes at the centers of distant galaxies. The feedback from the community on the workshop organization was most positive: it was decided that an annual workshop like this is essential for molding the three separate PTA programs into a coherent International PTA, and the next meeting, modeled on the Lorentz Center workshop, is already being organized in the United States for June 2011.

The 2010 Lorentz Center workshop has already had a large, positive effect on this rapidly developing field!

Paul Demorest (Charlottesville, USA)
Sam Finn (University Park, USA)
Yuri Levin (Leiden, the Netherlands)
Ben Stappers (Manchester, United Kingdom)
Dan Stinebring (Oberlin, USA)

Sage Days 23:
Number Theory and Computer Algebra

July 5 – 9, 2010

Motivation
The purpose of this workshop was to explore the state of the art in computational number theory and computer algebra, to investigate concrete open source implementations of relevant algorithms in Sage (http://sagemath.org), to explain to young people how they can contribute to Sage, and to identify directions for future work.

Workshop
The workshop was attended by 48 people from Australia, Belgium, Canada, France, Germany, Italy, the Netherlands, Sweden, United Kingdom, and the United States. Many were from European Research Training Network GTEM that organized the meeting. There was a particularly strong showing of junior researchers and graduate students.

Program
The main program of talks consisted of 7 keynote lectures that were each 50 minutes long, with 1-2 talks each day.

There were also working sessions and coding sprints on the following topics:

- Descent on Cyclic Covers of the Projective Line
- ABC triples
- Models for elliptic curves
- Function field arithmetic
- Hyperbolic geometry
- Rational polynomials in FLINT
- Factoring in ZZ[x] using FLINT, and computing Swinnerton-Dyer Polynomials
- MPIR integer arithmetic development
- Linbox development
- Design of the Sage Notebook (for classroom use)
- Improve integer factorization in Sage
- Solving conics
- Counting representations of numbers of sums of squares
- Porting functionality from ECHIDNA: computation of dimensions Atkin-Lehner spaces

Each morning of the workshop we had status reports about the progress of each group, and many of the groups worked very hard on their projects, long into the night, both at the hotel lobby and at the Lorentz Center.

Impressions
The main impact of the workshop was that several young mathematicians that are also exceptional computer programmers, including Maarten Derickx and Jeroen Demeyer, learned what Sage is, and have subsequently become very involved in the development of Sage. In particular, they learned a wide range of skills and procedures that are needed to do Sage development, which are quite difficult to learn without a workshop. Robert Miller's tutorial on “how to do Sage development” was especially helpful in this regard.

Another outcome of the workshop is that many participants became aware of whole classes of algorithms, problems, and coding techniques, which they hadn't been aware of before. The long list of coding sprint topics above gives a sense of this range of topics. There were also many informal talks, by Dan Bernstein and others, that went into much more detail about some of these topics. Also, the workshop resulted in new work on implementing the Lenstra-Stevenhagen finite field representation algorithm.

Conclusion
The goal of the workshop was to teach mathematicians about Sage and current computational issues in number theory and computer algebra, and get new people to contribute to Sage. The talks did a great job at conveying some of the state of the art in the above topics, and the working sessions and coding sprints succeeded and getting many talented software engineers involved in Sage development.

Acknowledgement
We thank the Lorentz Center for the excellent facilities and for the excellent local organization by workshop coordinator Pauline Vincenten.
The meeting was supported by the European Commission under contract MRTN-CT-2006-035495 (GTEM) and by the Lorentz Center.

Wieb Bosma (Nijmegen, the Netherlands)
Bart de Smit (Leiden, the Netherlands)
William Stein (Seattle, USA)

Coherent Structures in Evolutionary Equations

July 12 – 16, 2010

The goal of this workshop was to bring together researchers who work in the areas of pattern formation and evolutionary PDEs. A particular goal was to facilitate communication between those working on deterministic equations with those working on stochastic ones. Many young participants, young faculty, tenure trackers, postdocs and PhD's got to know each other, framed their field and communicated latest results.

With more than 40 participants the turnout was higher than expected and provided a lively atmosphere, and sufficient mass for discussions in subgroups. The program had 26 presentations, but only about 14 main talks of 45 min, a number of shorter talks and two sessions for PhD students to present in 5 min each. This left much time for individual and group discussions that was highly appreciated. Wednesday's social event was the boat trip - a great success in wonderful weather.

The topics of the presentations ranged from analytical questions of existence and uniqueness, justification of amplitude equations and reductions, to asymptotic analysis and numerical experiments. The concept of coherent spatiotemporal patterns and coherence within evolutionary equations in broader generality have been the unifying themes. It became clear how non-trivial coherence emerges at onset of instabilities in bifurcations and through strong separation of spatiotemporal scales. In a similar vein, coherent patterns such as the propagation of fronts or motion of defects can also be observed in a robust fashion on spatiotemporally random backgrounds.

In 'focus groups' some topics were discussed in more depth, or served as tutorial sessions for stochastic effects, in particular on scaling laws at instabilities. The effect of noise on pattern formation and on the stability of coherent structures has been discussed from a new point of view. Some of the participants used the opportunity to work on joint papers, but were open to other people wandering in and joining the discussion.

Yet, the interaction between noise and coherent structures and its effect on pattern forming systems is still poorly understood and many important questions remain open.

Greg Pavliotis (London, United Kingdom)
Jens Rademacher (Amsterdam, the Netherlands)

Flow Instabilities and Turbulence in Viscoelastic Fluids

July 19 – 23, 2010

It has recently been discovered that flows of polymer solutions can become unstable even at very small Reynolds numbers. Unlike the usual hydrodynamic instabilities in Newtonian fluids like water, these *purely elastic* instabilities are not related to inertia. Instead, they are driven by the stretching and orientation of long flexible polymer molecules in the flow. At high velocities, the flow becomes chaotic leading to a new, completely unexplored, type of turbulence.

The purely elastic instabilities and turbulence is a new emerging field. They have been actively studied only in the past 20 years resulting in the discovery of purely elastic turbulence in 2000. Research in this field is conducted in physics, applied mathematics and engineering communities with little interactions among them. This workshop was the first event focusing on the emerging field of purely elastic instabilities and turbulence and its main goal was to bring together people from different disciplines and discover common research directions. The main outcomes of the workshop was to find parallels between instabilities seen in polymer solutions and shear-banding of worm-like micelles, a potential link between polymer-induced drag-reduction and elastic turbulence and emergence of stagnation point asymmetries as a new class of flow instabilities. The scientific report of the workshop will be published in the Journal of Non-Newtonian Fluid Mechanics.

The perceived importance of the workshop was highlighted by a very high percentage of prominent scientists attending. Only two invited speakers could not come due to prior commitments and nobody cancelled. The workshop had about 45 participants. There were 22 long (40 min.) and 6 short (20 min.) talks. Additionally, the afternoon program contained four 1.5-hour-long discussion sessions that were chaired by an expert in a particular field. The discussion topics were selected by the organisers based on the suggestions of the participants. Though initially the idea of having organised discussion sessions was met with scepticism, very quickly everybody started enjoying them and the attendance was very high. The workshop BBQ was held on the very pleasant Wednesday evening on the beach in Katwijk.
The workshop closed with two review talks given by M. Graham (theory) and V. Steinberg (experiments) who summed up new developments and interesting ideas that were presented during the workshop.

We would like to acknowledge the Lorentz Center and the J.M. Burgerscentrum for generous support, and Gerda Filippo and Mieke Schutte for making the workshop a pleasant experience.

Bruno Eckhardt (Marburg, Germany)
Ronald Larson (Michigan, USA)
Alexander Morozov (Edinburgh, United Kingdom)
Christian Wagner (Saarbrücken, Germany)

X-ray Bursts and Burst Oscillations

July 26 – 30, 2010

Though generally understood, there are many aspects of thermonuclear shell flashes on neutron stars which are not well understood. This varies from understanding the ignition conditions of carbon flashes, through the relationship between nuclear burning stability and accretion rate, to the origin of the millisecond oscillations seen in many flashes.

Thermonuclear flashes from neutron stars are detected as bright bursts of X-rays that usually last one minute. They were discovered in 1975 with the Dutch-built Astronomische Nederlandse Satelliet (ANS). Recent missions such as NASA's Rossi X-ray Timing Explorer, the Dutch-Italian Satellite per Astronomia X ('BeppoSAX'), and ESA's INTEGRAL provided a large growth of data on this phenomenon and enabled the detection of rare but important types of X-ray bursts and burst oscillations.

35 years after the discovery, it was time for a first workshop dedicated to X-ray bursts and it was very fitting to have it in Holland, at the Lorentz Center. 47 researchers participated from 12 countries, most from the USA (15) and the Netherlands (11). Except for a handful, all participated in the whole workshop. The program consisted of 22 plenary invited talks during the mornings, 11 contributed posters, a plenary flash poster session with 5-min oral presentations of the posters, 6 organized/chaired discussion meetings and 3 end-of-the day 'wrap-up' sessions where the chairs of the discussion meetings reported back to the whole group. There was 8 hours of schedule-free 'office time' spread over 3 days. The social program consisted of a wine-and-cheese party on the first day and a boat trip with dinner on the third day.

The workshop was received very well by the participants. They enjoyed the stimulating atmosphere induced by the abundant time for discussion, the flexibility of the program, the well-balanced variety in expertise contained in the group and program, and the pleasant environment provided by the Lorentz Center staff and locality. The workshop appeared to initiate various new collaborations in the field. The most important result of the workshop is a status overview of the field. Where do we stand on observations and models, what are the unanswered questions and how do they need to be addressed. This brought about a list of 'homework assignments'.

Most of the discussions centered on three issues. First, X-ray bursts hold the promise of a profound new insight into the fundamental behavior of matter. Inside neutron stars, matter is compressed to super-nuclear densities. Therefore, their mass and size depends on ill-understood details of the strong nuclear force. Measuring mass and size therefore yields constraints on this fundamental force. While neutron star masses are well measured in a few tens of cases, radius measurements have been insufficiently accurate so far. X-ray bursts, being bright surface phenomena, might bring resolution. Currently, measurements are seriously hampered by calibration issues. A lively workshop discussion succeeded in clarifying what those issues are and how they can be tackled to make further progress. A homework assignment is that agreement needs to be achieved on the dependence of the color correction on the gravitational acceleration.

Another focus of discussions was burst modeling, involving questions such as how high the fuel heating from the crust is, what breakout reactions are important in mixed hydrogen-

helium burning, and what can be learned from models of classical novae. A positive conclusion from recent work is that consensus arises on the nature of the upper crust. Homework assignments involve modeling of convection and photospheric expansion, including rotation in burst models, move on to 2-D modeling, and self-consistently model the crust/envelope interaction. Furthermore, the different codes for burst models need to be mutually verified and validated.

The third focal point of discussion was the origin of burst oscillations. It is generally accepted that their (asymptotic) frequency is equal to the spin frequency of the neutron star, but the mechanism by which they are caused is unclear. During burst rise they are thought to be caused by local ignition spreading out with a time of order 1 s. This time scale is supported by models involving flame spreading at high rotation rates. However, the discussion made clear that the evidence for this explanation is based on just a few bursts and the data on all burst rises need to be investigated more thoroughly. During burst decay this explanation is, *a priori*, not applicable. The discussion yielded that it is likely related to the non-dipolar component of the NS magnetic field, but there are many questions on the generation, destruction and morphology of such fields in bursting neutron stars. A suggestion is that the magnetic field is locally so strong ($\sim 10^{10}$ G) that it may contain the fuel. The homework assignment is the further development of the theory of such magnetic fields - how are they generated/changing (through processes like convection, winding up by differential rotation, the Tayler-Spruit dynamo and thermomagnetic drift) and is it possible to get pulsations out of disordered fields? The further exploitation of existing data was considered important as well, for instance to investigate the relationship between 'type II' bursts (powered by accretion, possibly gated by the magnetic field) and thermonuclear 'type I' bursts.

There is room for improvements through future measurements. Many burst oscillations are measured with moderate accuracy and there is need for more sensitive observations, particularly to increase the time resolution of frequency drifts in burst oscillations and search the oscillation profile for higher harmonics, detect more bursts with oscillations to enable population studies to test flame spreading models, and measure the spectrum below 2 keV (which is below the bandpass of most current detectors) and with higher spectral resolution. Several missions are being designed that meet these challenges, particularly IXO (ESA/NASA) and AXTAR (NASA). In the mean time, several niches still exist for current missions (RXTE, XMM-Newton, Chandra) and soon-to-be-launched missions (Astrosat, Astro-H, Nustar, GEMS). The homework assignment is to bring these future observations to a success by advocating them and writing observation and instrumental proposals.

The organizers thank the Lorentz Center, NOVA, NWO, ESA, Stichting Physica and SRON for their generous financial and infrastructural support, and the staff of the Lorentz Center for their work which enabled a very smooth organization. Lastly, we are indebted to all participants. Their involvement and enthusiasm were essential to the success of the workshop.

Anna Watts (Amsterdam, the Netherlands)
Jean in 't Zand (Utrecht, the Netherlands)
Erik Kuulkers (Madrid, Spain)
Andrew Cumming (Montreal, Canada)

Symplectic Techniques in Conservative Dynamics

August 2 – 6, 2010

Topic

The roots of symplectic geometry lie in the study of conservative dynamical systems: the space of positions and velocities of the solutions of a system of Hamiltonian equations admits a natural symplectic structure and this underlying geometric structure, together with the topology of the energy levels, determines the dynamics. In the last thirty years symplectic geometry (together with its 'sister', contact geometry) has developed into a prominent field of research in its own right, and the efforts of an increasing and very active community have brought about many new and exciting results.

Questions in conservative dynamics have again been among the major driving forces behind these developments. In particular, variational principles have been used to define new symplectic invariants, which have shed light on the nature of the relationship between dynamical questions and questions in symplectic geometry. The potential of the new symplectic techniques for the solution of dynamical problems, though, has been far from fully exploited. On the one hand these techniques are undeniably very sophisticated and not easily accessible, on the other the main focus in the construction of invariants like contact homology, symplectic homology and symplectic field theory has been on the applications to classification problems in symplectic and contact topology. As a consequence, there are still plenty of very interesting problems to be explored in dynamics with the help of these new tools.

With our workshop we brought together researchers working in symplectic geometry and in different areas of conservative dynamics, in an effort to foster discussions that could broaden the participants' horizons and, ultimately, achieve a more comprehensive view of the interactions between symplectic geometry and dynamics and of the challenges and possibilities found at this interface.

The main topics that were addressed during the workshop are:

1. Symplectic and Contact Topology;
2. Hamiltonian Dynamical Systems;
3. Applications of Floer Theory and Contact Homology;
4. Geometry of Hamiltonian and Symplectic Diffeomorphisms.

Workshop program

This workshop lasted five days, with four 45 minutes lectures per day, usually three in the morning and one in the late afternoon. Apart from the lectures there were two 'Short presentations' sessions on Monday and Tuesday afternoon, during which ten younger participants presented their work. The program contained a lot of free time, and we are under the impression that most participants used this time well for discussions and collaboration.

The following participants gave a lecture: Alberto Abbondandolo (Pisa), Miguel Abreu (Lisbon), Silvia Anjos(Lisbon), Albert Fathi (Lyon), Urs Frauenfelder (Seoul), Hansjörg Geiges (Köln), Basak Gurel (Nashville), Richard Hind (Notre Dame), Janko Latschev (Zürich), Klaus Niederkrüger (Toulouse), Alexandru Oancea (Strasbourg), Yaron Ostrover (Princeton), Sheila Sandon (Nantes), Felix Schlenk (Neuchâtel), Michael Usher (Athens), Jan Bouwe van den Berg (Amsterdam), Otto van Koert (Seoul), Joa Weber (Berlin), Chris Wendl (Berlin).

The following junior participants delivered a short presentation: Yeongjin Bae (Seoul), Marta Batoreo (Santa Cruz), David Bauer (Leipzig), Jacqui Espina (Santa Cruz), Yusuf Gören

(Istanbul), Doris Hein (Santa Cruz), Muriel Heistercamp (Neuchâtel), Jungsoo Kang (Seoul), Blaz Mramor (Amsterdam), Simone Munao (Amsterdam).

The following people also participated: Barney Bramham(Leipzig), Konstantinos Efstathiou (Groningen), Dorothee Müller (Neuchâtel), Murat Saglam (Leipzig), Alvise Trevisan (Amsterdam).

Participants' impressions and remarks

The workshop program left ample time for discussion, and it is our impression that participants eagerly made use of this possibility. The participants commented very positively on the facilities of the Lorentz Center and the accommodation provided (the new conference hotel was very much approved of). The quality of the talks was extremely good and the topics managed to generate a lot of interest, as demonstrated by the fact that every talk was followed by very animated discussions. These in turn created, we believe, significant new opportunities for exchanges and collaboration. The atmosphere during the workshop was also another plus point: there was immediately a lot of interaction, on a mathematical as well as on a social level - the organizers must admit that they did not have to do much at all to stimulate it. Altogether the participants were so happy with the course and outcome of this workshop, that there was an immediate request for another workshop to be organized at the Lorentz Center in two years from now, focusing on the interactions between symplectic and contact topology and conservative dynamics.

We would like to mention in this report that a particularly successful component of the workshop program were the short presentations delivered by graduate students: the students found it a challenging and ultimately very useful experience to be presenting their work for the first time in front of an audience of specialists and the senior participants were impressed with how well the presentations were prepared and delivered. The short presentations were scheduled at the beginning of the workshop and this was also very positive: having introduced themselves and their work in this way, younger researchers felt more at ease in approaching and talking to the senior ones. We will include these sessions in any future workshop and can only but recommend it to other workshop organizers.

Funding

Apart from the facilities and financial contribution of the Lorentz Center, we obtained funding from the cluster Nonlinear Dynamics of Natural Systems (2500 Euro) and from NWO (incidental financial support for scientific meetings, 2250 Euro).

Viktor Ginzburg (Santa Cruz, USA)
Federica Pasquotto (Amsterdam, the Netherlands)
Bob Rink (Amsterdam, the Netherlands)
Rob Vandervorst (Amsterdam, the Netherlands)

Assembling a Multi-Cellular Circadian Pacemaker

August 16 – 20, 2010

Nearly all organisms possess an endogenous circadian clock that regulates biological processes in the temporal domain. While it is now known that the basic circadian oscillatory mechanism is intracellular, much less is known about how these molecular clockworks are entrained by light and how they ultimately gain expression beyond the cell. In fact, behavioral rhythms in insects and mammals appear to be the product of complex brain pacemakers that are composed of multiple individual cellular circadian oscillators coupled together in neuronal networks. In large part, the elucidation of molecular clocks was catalyzed by the fantastic cross-talk between researchers working on insects and mammals. This workshop was organized to actively foster a similar collaboration at the neural circuit level of analysis, seeking principles of circuit organization across invertebrate and vertebrate brains. Our aim was to promote a new dialogue by bringing together senior and junior scientists – including insect and mammalian anatomists, physiologists, photobiologists, molecular / cellular biologists, and mathematicians – to work together on this problem in an informal but intensive way.

In addition to the 4 organizers, 39 invited participants from Europe, the United States, Japan, and Argentina were joined by 9 graduate and post-doctoral students from the Netherlands. Each invitee had a short, formal speaking role, either in one of the seven plenary sessions (presented by balanced teams of insect and mammalian researchers), or in one of the corresponding discussion groups, or in a mathematical theory / modeling tutorial. In addition, time was allotted for four 1-hr "hot data" sessions and for free, uninhibited general discussion.

The opening question of the workshop – how is it that circadian timekeeping is accomplished using 150 neurons in fruit flies but requires 10,000 in rodents – surfaced repeatedly throughout the 5 days. The problem was not solved, but in the course of the discussions several analogies between the two systems were revealed. As examples, the photic entrainment system in insects now appears to be more like that in mammals than previously thought, and the mechanisms for intercellular coupling include peptides with notable similarities (pigment dispersing factor in fruit flies and vasoactive intestinal polypeptide in mice). New data, perspectives, and ideas were also presented with respect to the role(s) of the cell membrane in clock function, novel properties of "clock" gene products, the regulation of arousal, network plasticity and history dependence, and the significance of glia, among others.

By all measures, the workshop was a resounding success. There was full attendance at every session and discussion group with contributions from every participant (and a notable lack of concurrent e-mailing and internet surfing from laptop computers), and nearly 80% attendance at the concluding morning session. Participants were asked to provide a rating (on a scale of 1 - 10, 10 being highest), grading (a) the overall workshop experience and (b) their enthusiasm for holding a similar type of meeting in the future; the scores were 9.56 and 9.88, respectively, with no individual score less than 9. The written comments included several superlatives; notation of the successful and unique discussion format, which was lively, inclusive, candid, and shared by insect and mammalian researchers; and a pointed characterization of the workshop as "...the feeling of a lab meeting between some of the best researchers in the world."

In retrospect, there were several factors that we believe contributed to the success of the workshop. The subject was timely, catalyzed by recent experimental findings and new technical approaches. The organizers selected participants based on their lucid teaching and speaking abilities, collegiality, and willingness to attend for the full 5 days of the workshop; and in turn the participants were prepared to contribute to a unique workshop that would clearly differ from the usual meetings in our field. The Lorentz facilities were superb, with the layout and offices putting participants "in residence," essentially on sabbatical for 5 days. Of note, discussion was enhanced by arranging our meeting room in a classroom, rather than in an amphitheatre, configuration.

Many thanks to the Lorentz Center staff, especially to Ms. Pauline Vincenten and Drs. Mieke Schutte and Henriette Jensenius, and to generous funding by the Lorentz Center, National Institute of Neurological Disorders and Stroke, United States Air Force Office of Scientific Research, Servier Laboratories, Philips Lighting, and Greiner Bio-One.

Charlotte Helfrich-Förster (Würzburg, Germany)
Johanna Meijer (Leiden, the Netherlands)
Larry Morin (Stony Brook, USA)
William Schwartz (Worcester, USA)

Poly and Polymer Electrolytes for Energy Conversion: Ab initio, Molecular, and Continuum Models

August 23 – 27, 2010

The interaction of charged polymers with solvent leads to rich classes of materials with important properties, most specifically selective charge transport. The workshop was comprised of 23 talks, 3 tutorials, and 2 discussion sections. The participants hailed broadly from computational polymer science and applied mathematics, two groups which historically had not interacted in a formal arena. The goal of the workshop was to stimulate exchange between the Ab initio and molecular model builders and the more recent continuum models and, as measured by the energy level of the discussion, the workshop has to be considered a great success.

The effort was put on an excellent first footing by Marcus Mueller's talk, which described a novel method for up-scaling of coarse-grained MD simulations to continuum models. The ensuing speakers set off a very lively discussion that ranged broadly over the fields of energy conversion, polymer simulation, and up-scaling. The tutorials on self-consistent mean field theory, given by David Wang and Carlos Garcia-Cerva, and on Renormalization group techniques by Dmitry Vvedensky where very well received. It was widely acknowledged that the interaction between the computational polymer and applied mathematics groups was both stimulating and long over-due.

The rental of the bikes from the Lorentz center was a huge hit, and one could see the bikes around downtown Leiden in the evenings. The boat cruise along the Kaaglakes was a huge success, serving to further cement the relationships built between these groups.

Arjen Doelman (Leiden, the Netherlands)
Stephen Paddison (Knoxville, USA)
Keith Promislow (East Lansing, USA)

Summer School on Models for Embedded Signal Processing Systems

August 30 – September 3, 2010

Scientific background and motivation
In the past two decades, a new programming style has emerged for the concurrent specification and parallel implementation of streaming applications. This so-called visual programming language provides consistent specifications in terms of dataflow models of computation. The objective of the summer school was to offer graduate students, early stage researchers, and practitioners in signal processing and embedded signal processing systems related domains state-of-the-art model based approaches to specifying concurrent signal processing applications and parallel implementing of these applications.

The program
The summer school was partly devoted to the theory of dataflow models of computation, among which are the dataflow graphs, the dataflow process networks, the Kahn process networks, the reactive process networks, and mixtures of dataflow networks and fine-state machines. This theory was presented in a series of in-depth lectures given by 7 experts in the field. All lectures were based on related chapters, written by the same experts, in a Springer Signal Processing Systems Handbook that appeared precisely in the week that the summer school was held.
Apart from attending the lectures, attendees were actively involved in a series of hands-on sessions. In these, several specification and design frameworks that have been developed in the research groups of the lecturers were used by the attendees under the supervision of framework developers.
Finally, the program also offered a few regular talks about the usefulness of the theory under practical conditions and constraints, and a really impressive key note by an expert in wireless communication applications.

Evaluation
All lectures have been given in a common style that helped stimulate lively in-class brain storm sessions in which participants spontaneously addressed research issues hidden in or suggested by the presented basics. The gap between the theory lectures and the hands-on sessions was smoothened by a few real life application talks - given by expert practitioners - to illustrate ways in which theory could be successfully turned into useful and powerful specification and design methods. The hands-on sessions were attended by nearly all participants. All of them agreed that the hands-on sessions had been of great value to them.

Acknowledgement
The organizers of the summer school want to thank the Lorentz Center for offering the opportunity to host the school only two months before the event had to take place. The help and guidance of in particular Mieke Schutte (Executive Manager) and Corrie Kuster (Workshop Coordinator) has been excellent and highly appreciated.
Financial support was also mainly provided by the Lorentz Center. Other financial support was received from the ArtistDesign European Network of Excellence, from the HiPEAC European Network of Excellence, and from the IEEE Signal Processing Society.

Final statement
Organizers, lecturers, speakers, instructors, and participants alike (35 in total) confirm that the summer school format, style and content has been a success. Because there is always room for improvement, the suggestion is to do precisely this next year.

Shuvra Bhattacharyya (College Park, USA)
Ed Deprettere (Leiden, the Netherlands)

4th Euro-Japanese Workshop on Blow-up

September 6 – 10, 2010

This was the 4th edition of a series of Euro-Japanese workshops on blow-up phenomena. These workshops were initiated by a collaboration between European and Japanese scientists working in the field of semilinear parabolic equations, an area motivated in part by the early attempts to understand singularity formation in the solutions of the Navier-Stokes equations and the onset of turbulence in fluid flows. The workshops also reach out to application areas in which the occurrence or non-occurence of blow-up is a fundamental issue. Once blow-up is established, the main questions are when, where and how does it occur, as well as what happens after blow-up. More precisely, in order to understand the singularity formation, it is natural to investigate the blow-up time, blow-up set, blow-up profile in time and space, and whether or not the solution can be continued beyond the blow-up time

The aim of this workshop was to bring together leading researchers in the field of semilinear parabolic equations, and various other fields related to blow-up (such as fluid mechanics, mathematical biology, geometric flows), as well as junior scientists. There were a total of 41 registered participants from 8 European countries and Japan, 14 of them are PhD-student or post-doc. During the workshop, 19 invited speakers gave longer talks (45 min.) and 9 young researchers presented short talks (15 min.). The talks fuelled vivid discussions during and after the presentations and also in smaller circles during the breaks and during the time reserved for discussions. Several papers were initiated or worked on.

The workshop in Leiden will be followed by a new one in France, in two years from now.

We acknowledge the excellent working environment and organizational support of the Lorentz Center staff, in particular Pauline Vincenten. We are grateful for the financial support provided by the Lorentz Center, KNAW, Stieltjes Institute and NDNS+.

Marek Fila (Bratislava, Slovakia)
Joost Hulshof (Amsterdam, the Netherlands)
Juan Luis Vazquez (Madrid, Spain)
Eiji Yanagida (Tokyo, Japan)

History of Software, European Styles

September 13 – 17, 2010

As the Inventing Europe program draws to a close, members of the Software for Europe project met at the Lorentz Center in Leiden in mid-September for the final discussion of the edited volume that will encompass the most notable achievements of the project. The book, edited by Gerard Alberts, with the tentative title “Computing in many languages: European practices and identities in the early Cold War era”, covers aspects as diverse as postwar policies of European governments to appropriate the new computing technology, early attempts of international cooperation in computing, the role of US corporations in promoting the circulation of knowledge in Europe, or the relevance of local practices of computer programming to understand the emergence of software as a separate entity.

The workshop brought together the contributors to the volume and their ‘critics’. Senior historians of computing and technology Martin Campbell-Kelly, Eda Kranakis, Nathan Ensmenger, Helmut Trischler and Hannu Salmi supplied valuable comments on the book content and design. Not only that, they presented their own recent research in keynote speeches on Victorian data processing (Campbell-Kelly), on the short-lived pan-European computing company Unidata (Kranakis), on the historical role of experts in promoting innovation cultures in Europe (Trischler), and on how human computer operators were replaced by operating systems (Ensmenger).

Besides, contributed papers were devoted to early research results by Jos Peeters on the first software houses in the Netherlands, Hennie Kok on software production at Philips, and Gauthier Vandenhove on Dutch computer scientist Edsger W. Dijkstra’s contributions to computing science.

The youthful promise of future research conquered the room in a special session of contributed papers on counterculture and the reception of the PC in Europe. Histories of hardware cultures and home computing in Poland, Czech Republic, Greece and Yugoslavia, in the 1980s and beyond were presented in fascinating talks by Patryk Wasiak, Johan Söderberg, Theodoros Lekkas and, most engaging of all, Bruno Jakic.

On Wednesday, the workshop was open to the public. On a special day at the Museum Boerhaave, the National Museum of the History of Science and Medicine, the participants convened to celebrate the 50th anniversary of the first full implementation of the programming language ALGOL by the team led by Edsger W. Dijkstra and Jaap Zonneveld of the Mathematisch Centrum in Amsterdam (August 1960). The celebration featured talks by computing historian Mark Priestley and computer scientist Jan van Leeuwen on ALGOL contribution to the emergence of computer science as a scientific discipline. In the evening, the celebration opened to a broader audience, with the presence of Dutch Nobel prize winner in physics Martinus J.G. Veltman and a public interview with Dutch software pioneers Jaap Zonneveld, Frans Kruseman Aretz and Dirk Dekker by journalist Herbert Blankesteijn and Gerard Alberts.

Finally, the organizers of the workshop wish to publicly acknowledge the support of the following institutions: Lorentz Center, Museum Boerhaave, University of Leiden, University of Amsterdam, Netherlands Organization for Scientific Research (NWO), Foundation for Fundamental Research on Matter (FOM), European Science Foundation, Foundation for the

History of Technology (Stichting Historie der Techniek), Royal Netherlands Academy of Arts and Sciences (KNAW), and the Dutch Ministry of Education, Culture and Science.

David Nofre Mateo (Amsterdam, the Netherlands)
Gerard Alberts (Amsterdam, the Netherlands)
Helena Durnová (Brno, Czech Republic)

Observational Signatures of Type Ia Supernova Progenitors

September 20 – 24, 2010

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. It is very frustrating and unfortunate that we don't know the configuration and trigger of the explosion, i.e. their direct progenitors. In this Lorentz workshop we brought together a significant fraction of the researchers working on the different observable signatures of the progenitors. The aim of the workshop was to discuss the best way forward for obtaining tight observational constraints on the progenitors of type Ia supernovae in the next decade.

The workshop
A total of 50 participants from 10 countries have participated in the workshop. The workshop had "assigned" talks in the mornings, giving overviews of the state-of-the-art in the different topics, some "hot" talks, showing new results and extended disussion sessions in the afternoons. The overview talks were an excellent setting of the scene and the discussions were lively and led to many interesting observations. It is clear that the Ia supernovae show great diversity and that improved theoretical modelling now predicts several observable progenitor signatures that can be searched for in existing and particularly in future observations. Several new results were presented, such as global delay time distributions, double white dwarf merger simulations and likely progenitor features in the SN spectra. X-ray and in particular Radio observations will soon put very tight constraints on the presence of circumstellar material.

Final remarks
The workshop was 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 a similar workshop would be repeated in a few years. 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, KNAW and NWO.

Andy Howell (Santa Barbara, USA)
Dani Maoz (Tel-Aviv, Israel)
Paolo Mazzali (Garching, Germany)
Gijs Nelemans (Nijmegen, the Netherlands)
Jacco Vink (Utrecht, the Netherlands)

New Directions in Modern Cosmology

September 27 – October 1, 2010

Aim

The majority of current cosmological observations, such as the scale size of fluctuations of the Cosmic Microwave Background radiation (CMB), the measurements of clustering mass on large scales, and the magnitude-redshift relation of type Ia supernovae (SNe Ia), are interpreted to give consistent estimates of the amount of dark matter. This situation has given rise to a spectacular popularity of the so-called ΛCDM (Cosmological constant + Cold Dark Matter) model of structure formation. In this framework, baryons, which can be detected in the form of, for example, luminous objects such as stars, galaxies and hot clouds, would only constitute some 5% of the total mass in the universe. The rest is made of entities about which little is understood: dark matter and dark energy. Dark matter, in the form of non-baryonic elementary particles, would dominate the $\sim$30% of the total mass of the universe. Despite great efforts, the direct detection of the cosmological dark matter particles in laboratory experiments or sky searches is still lacking and becoming worrisome.

In order to interpret observations within the standard cosmological framework, which includes the non-baryonic dark-matter, it has been necessary to introduce another substance, which has been termed dark energy, which behaves as if it has a gravitational negative pressure. This mysterious form of energy would cause the accelerating re-expansion of the universe and should account for about 70% of the mass-energy in the universe. In the ΛCDM model, the amount and properties of these different kinds of dark matter can only be defined *a posteriori*: however they are supposed to provide more than 90% of the total fraction of the mass-energy in the universe, playing a crucial dynamical role both in the early and in the present-day universe.

Many successes of the ΛCDM model to fit different observations can actually be traced back to very strong *a priori* assumptions, a large number of free parameters and ad-hoc hypotheses. Recently a growing number of astrophysical papers are being published on specific cosmological observations which differ significantly from the predictions of ΛCDM and which challenge the standard ΛCDM model in fundamental ways. These observations include: the large scale flows, the sizes and amplitude of galaxy large scale structures, the systematic effects biasing the analysis of the CMB data provided by the WMAP satellite and the lack of large-angle correlations, the anisotropy of the Hubble flow, the evolution of galaxy size, and the failure to find the sub-halo building blocks left over from the primordial fluctuation spectrum. Also the observation of older and older galaxies and black holes with apparent enriched chemistry seems to “confound” the dark age of the model.

While each of these observations can be seen as an anomaly that the model would possibly explain, the bulk of them calls for a more careful analysis of the model foundations, particularly the amount and role of dark substances. From the theoretical side it is by now known that the role of hydrodynamics at the end of the plasma epoch can be more important that often assumed, and that CDM could not have such a central role in the theory of structure formation as is currently thought. Moreover recently there has been a considerable theoretical effort to develop a coherent picture in General Relativity which appropriately takes into account matter inhomogeneities. In this perspective the problem of dark energy would be intimately related to the correct understanding of observational anomalies, in particular, the observed abundance, size scales, and emptyness of voids.

A workshop that puts together these many different approaches and results would be very timely and can provide a substantial advance in the comprehension of the large scale universe. Progress can be hoped for by combining the insights from the various groups and researchers studying the different observational and theoretical problems. The workshop offers a unique opportunity to discuss conceptual and methodological problems of the modern cosmological paradigm.

A measurement of the success of this workshop could be a consensus on or a way out of the dilemma that ΛCDM is both too good to be ignored but fails too often to be correct.

Outcome

During the workshops there have been 28 talks which can be divided into 4 main different groups: (i) large scale structures in the universe, (ii) cosmic microwave background anisotropies, (iii) general relativistic models with inhomogeneities and (iv) structure formation.
Each of these topics has been then discussed in a round table. For the topic (i) the chairman was Michael Joyce, for (ii) Ruth Durrer, while topic (iii) and (iv) where discussed in the longer round table at the end of the meeting chaired by Theo M. Nieuwenhuizen and Rudolph E. Schild. The aim of the round table was to confront different views and to identify the open problems and the directions to consider for further investigations.

From the discussion of the question of the size and amplitude of structures it has been concluded that it is necessary to test all the different assumptions which are used in the data analysis. Indeed, the final information about the size and amplitude of structures depend on a number of assumptions which enter, implicitly or explicitly, in the statistical methods and in the treatment of observational selection effects. It was agreed in particular that the different groups working on the problem would consider the same data sets and consider in detail the properties of the statistical estimators used in the data analysis.

The point in the discussion of the CMB fluctuations is that it is necessary that different groups of researchers analyze the rough data from the basis. The data from the WMAP satellite were subject of intense discussions as during the workshop four different approaches with respect to the standard data analysis were presented. Each of the speakers has found important differences with the published data analysis. This situation clearly points out that it is extremely important that different teams may have access to the rough data and consider the whole data analysis from scratch.

In the discussion about structure formation several points were discussed. The first concerns the understanding of the numerical resolution, the second the formation of structures at small scales and the third the effect of hydrodynamics in the gravitational clustering. The first two are closely related, as the issue of numerical resolution is behind the predictions of the models at small enough scales. The role of hydrodynamics in gravitational structure formation was largely discussed as it is generally not included in the models while it can have an important impact, especially at small scales.

Finally the problem of how to model inhomogeneities in general relativity was discussed along two different lines of approach. The first involves the consideration of an average solution to the Einstein field equations together with the effect of inhomogeneities on the synchronization of clocks. The second uses solutions to a spherically symmetric distributions without fluctuations. Different tests of model were discussed together with their predictions for future observations.

It was generally felt that being together with many diverse opinions and having much time for discussions, will enhance the understanding of the physics that lies behind the data.

Theo M. Nieuwenhuizen (Amsterdam, the Netherlands)
Rudolph E. Schild (Cambridge, USA)
Francesco Sylos Labini (Rome, Italy)
Ruth Durrer (Geneva, Switzerland)

Modelling Angiogenesis: Joining Cells, Maths and Computers

October 4 – 8, 2010

Scientific Background

The outgrowth of new blood vessels from pre-existing vessels, called angiogenesis, is a crucial step in myriad physiological and pathological mechanisms. Unfortunately, the complicated causes and effects of angiogenesis make it very difficult to control blood vessels. Computational models and simulations help unravel both the basic mechanisms of angiogenesis and can help identify the steps in the mechanisms most amenable to intervention. A wide range of mathematical and computational models is currently available. Single cell-based models predict how vascular-like patterns follow from the behaviors and interactions of individual endothelial cells. Many discrete models describe the branching conditions of blood vessels, and predict the morphology of vascular trees near tumors. Continuum models often focus at the tissue level, and describe densities of blood vessels rather than individual vascular structures.

Despite the biological insights these mathematical models have produced, computational modeling as yet rarely finds application in experimental angiogenesis research. Why is that? One reason is a different focus: experimental and pharmaceutical research necessarily focus on the molecular level, whereas most angiogenesis models take single interacting endothelial cells or vessel branches as the smallest units of their models. Another reason is the lack of predictive, quantitative models and the required quantitative experimental data to feed such models. We will need models that bridge organizational scales, by showing how molecular intervention modifies the behavior of endothelial cells and, consequently, changes the dynamics of angiogenesis.

Workshop

Our workshop hosted both experimental researchers and computational models working in vascular biology, endothelial cell biology, angiogenesis, and pharmaceutics. On Monday, we discussed the state-of-the-art of angiogenesis research in a series of lectures and moderated discussions on computational modeling (Aleksander Popel), experimental biology of angiogenesis (Thomas Sato), and cross-disciplinary approaches (András Czirók). We also discussed a range of available computational and experimental models, and the types of questions that can be answered using them. In the early afternoon we also had our poster flash presentations. On Tuesday, we went into more cellular and molecular detail. Andrea Gamba discussed his stochastic model of endothelial cell polarization, and Cynthia Reinhart-King discussed her work on the mechanobiology of endothelial cell-extraceullar matrix interactions. After that we left for the Kaag Lakes for a boat trip and conference diner, where we continued our discussions. Having both the poster flash and the conference dinner early in the week worked very well, because it primed many informal discussions during the rest of the week.

On Wednesday our discussions shifted to the collective behavior of endothelial cells. How can we use our insights into single cell behavior of endothelial cells to explain how they self-organize into blood vessels? James Glazier introduced his cell-based models of angiogenesis and Peter Friedl gave an impressive talk on imaging of collective cell behavior during cancer invasion. Federico Bussolino gave a recent overview of the role of VEGF-A during angiogenesis. In the afternoon András Czirók gave a tutorial on cell tracking. We were delighted that Peter Carmeliet from the Vesalius Research Center of the KU Leuven, Belgium

could make it to our workshop. He argued that instead of pharmaceutically inhibiting angiogenesis during tumor growth, it makes more sense to try and renormalize tumor vasculature in order to improve drug delivery and reduce clonal selection pressures. Also he discussed the role of endothelial metabolism in this process.
On Thursday and Friday we shifted focus from vascular biology to medical applications using tissue to whole-body scale models. On Thursday we focused on drug development: Zvia Agur discussed the use of tumor growth modeling for personalized medicine, and Iñaki Troconiz and Paolo Magni discussed recent pharmacokinetic/pharmacodynamic modeling approaches. In the afternoon Maciej Swat gave a clear introduction on cell-based modeling using the Open-Source tool CompuCell3D, which helped experimental biologists to make the first steps into computational modeling. On Friday we looked at tissue engineering. Victor van Hinsbergh showed how *in vitro* models of angiogenesis have given us more insight into endothelial cells' counter-intuitive dependence on oxygen. Hans van Oosterwyck introduced his mathematical models of bone regeneration and bone engineering, and discussed the role of angiogenesis therein. Marco Harmsen discussed the plasticity of angiogenic stem cells during tissue engineering and formulated a series of useful questions for modelers.

Evaluation
The workshop has been very successful. Bridging the gap between theoretical modelers and experimental biologists was initially perceived as a necessary, but very ambitious goal because both groups speak different scientific languages and ask different types of questions: experimental biologists typically look for more detail, whereas theoreticians try to simplify the system. By the end of the workshop, however, essentially all participants were very enthusiastic. The main reason of success was the informal atmosphere and the workshop format that allowed for plenty of discussion and exchange of ideas: nobody felt inhibited to ask questions. Several useful collaborations have come out of the workshop and many participants are still commenting on the pleasant atmosphere at the Lorentz Center. Organizing the workshop was a very pleasant experience, which is entirely due to the excellent support and facilities of the Lorentz Center. We only had to worry about the science, which was great. We would like to thank in particular Gerda Filippo and Mieke Schutte. They have taken care of the practical organization of the workshop and have also been a tremendous help in putting our workshop into the *Lorentz workshop* format, which was key to its success. We also thank the Lorentz Center, the Dutch Program for Tissue Engineering, Centrum Wiskunde & Informatica, and the Netherlands Institute for Systems Biology for financial support.

Roeland Merks (Amsterdam, the Netherlands)
Pieter Koolwijk (Amsterdam, the Netherlands)
Benjamin Ribba (Lyon, France)
Enrico Giraudo (Turin, Italy)

Physics with Industry

October 11 – 15, 2010

The main aim of the 'Physics with Industry workshop' was to obtain creative solutions for industrial problems and to bring (young) physicists in contact with industrial R&D. The workshop was inspired by the 'Mathematics with Industry' workshops, which have regularly been organised by the 'International Study Group Mathematics with Industry' since 1968.

Sixty-seven physicists participated in the workshop, ranging from PhD students to professors. These scientists spent a week working in groups on five industrial problems, which were selected by a program committee from proposals put forward by industry. Following an introduction to the various problems by the companies on Monday, the participants worked on these in groups for the rest of the week. On the last day, the groups presented their findings to the companies.

Besides the scientific outcomes, the workshop also resulted in new collaborations and researchers were approached by recruiters of the participating companies. Participants were mostly driven by the shear pleasure of applying their physics knowledge to new problems, the desire to enrich their scientific network and the interest in gaining hands on experience with industrial R&D processes. Companies benefited from the scientific input they received and participating in the workshop enlarged their academic network. The organisation captured the scientific results in the Proceedings that can be down loaded from www.fom.nl. Besides these proceedings a booklet (in Dutch) was made that gives a look and feel of the workshop week.

Based on the results reported in this document and the highly positive feedback received from both industrial and academic participants about the week, the organising committee aims at organizing another 'Physics with Industry' workshop in October 2011.

ASML case: Droplet removal with impinging planar micro jets

A strategy is proposed to model the interaction between normally impinging laminar jet flow and water droplets. First, the hodograph method is adopted to compute the inviscid flow at the impingement plate. The wall pressure is computed with Bernoulli's principle. The wall shear stress follows from a boundary layer development by Thwaites method. The shear layer at the free stream line is assumed to grow like the shear layer between a parallel uniform and stagnant flow. These results are combined to define a first-order velocity profile at distance from the stagnation point and beyond, with the width of the nozzle exit. First attempts to match this first-order solution to Glauert's self-similarity solution for the laminar wall jet turned out unsuccessful. The gas flow models are used to compute the wall stresses. These serve as input for estimating the drag force exerted on a droplet in impinging gas flow. Because of mathematical difficulties, this part of the original problem is simplified. We adopt a purely 2D geometry and fix impingement plate (i.e. no relative motion between droplet and plate). We extend existing lubrication models to deal with interface shear stress. The next step is to extend such models to 3D and add relative motion between plate and droplet.

NXP case: Protecting high frequency Integrated Circuits from ElectroStatic Discharge

NXP aims to develop electronic circuits that can improve our everyday energy efficiency, connectivity, and security. One of the challenges the company is facing is ElectroStatic Discharge (ESD) as it damages Integrated Circuits (IC's). Devices for ESD protection should drain charge in a very short time (~10 ns), to prevent high voltages to build up over the sensitive IC's. Additionally, these devices should have low capacitances to prevent high frequency signals to leak to ground. These requirements make it challenging to produce protective devices for high frequency IC's.
We found three types of devices which could possibly be used to protect high frequency IC's, namely field emission devices, spark gaps devices, and electrostatic switches. With the help of strongly simplified models we have approximated the performance of these devices.

NIZO case: Water-water interfaces

One of the key objectives in food research is the understanding under which conditions water-water emulsions are stable. It is often desirable from an environmental point of view to replace organic solvents by water. Also, the increased demand for low-fat food products leads to the question to what extent water-water emulsions can replace water-oil emulsions. The NIZO research question posed to the physics community is therefore to find surfactant-like molecules that sit at the water-water interface. The surfactant-like molecules may then be tailored (1) to make sure that there is a repulsion between emulsion droplets (by adding charge, etc) necessary for stability, (2) to change the rigidness of the emulsion droplet's surface. The formulation of a theoretical framework to understand the properties of the water-water interface is therefore our main goal.

Teijin case: The homogeneity of yarn in the heat treatment section of the production process of Twaron®

The heat treatment section of Twaron® production consists of a series of heated rolls with different temperatures and rolling speeds. This part of the production line provides heat transfer required for drying the yarn, and a controlled increase and decrease of yarn tension required for enhancing the stiffness of the yarn. The analysis of this process was split into two tasks.
In task 1 the heat transfer and the evaporation of the free water and the moisture are described. The results from this theoretical description comply reasonably with results from experiments and on-site results. Especially the description of the drying of the filaments still has some weaknesses. Suggestions were given on changing roll temperatures for controlling boiling and drying of the filaments, and for improving the modelling of the filament drying process.
In task 2 the dynamics of the yarn running over the rolls is considered. First, a possible mechanism is proposed for the formation of 'loops' in the final yarn product, which is based on the inhomogeneous heat treating, hence stiffening on the rolls. Combined with a positive feedback, which forces the stiffer fibres to be closer to the hot roll surface in all subsequent roll passes, this leads to inhomogeneities in both filament stiffness and filament length. An experiment to check this is proposed. Secondly, the classical 'belt friction equation' was reconsidered. Especially stick-slip phenomena were described by cutting down the contact area with the roll surface into a large but finite set of mass-spring systems. The dynamic behaviour was simulated in a computer model. Average tension profiles and their statistics were predicted, and according experiments to check these were suggested.
The problem in its original form has not been solved, however a few possible directions for further study have been given, based on desktop (theoretical) work as well as based on experiments that can be carried out in the Arnhem test-site.

FrieslandCampina case: Schrödinger's Capsule: a (micro)capsulate that is open and closed at the same time

We exploit different routes for encapsulation of food additives, such as minerals or vitamins, in a polymeric capsule. The added active ingredients should remain inside the capsule for at least a year in an aqueous environment (e.g. a dairy product), since sensory properties or functionality of the ingredients may otherwise be affected. However, after intake the active compound should readily (within 1 h) be released due to the acidic environment in the stomach. First, we propose a phenomenological model in order to study how a polymeric matrix may limit the diffusion of incorporated active molecules. The relation between the release rate of the active compound and its molecular weight is elucidated. Second, the desired capsules may be obtained by specific binding between subunits within the capsule and the active ingredient. We show two examples that rely on this mechanism: amylose-lipid complexes and mixed metal hydroxides. Amylose is able to form inclusion complexes with various types of ligands, including iodine, monoglycerides, fatty acids and alcohols, where the hydrophobic parts of the ligands are entrapped in the hydrophobic helical cavity of amylose. Mixed metal hydroxides are a versatile class of inorganic solids that consist of sheets of metal cations that are octahedrally surrounded by hydroxide molecules. In between these layers anionic species compensate for charge neutrality. In this way, various metal cations (minerals) may be incorporated with a high loading, and negatively charged actives may be placed between the layers. Upon digestion the particles dissolve and the ingredients are digested. Finally, we show that nature has already developed many intriguing capsules.

Marcel Bartels (Utrecht, the Netherlands)
Pieter de Witte (Utrecht, the Netherlands)

Aggression and Peacemaking in an Evolutionary Context

October 18 – 22, 2010

The goal of the workshop was to include interdisciplinary perspectives from archaeology, primatology, nomadic forager studies, and human behavioral ecology. Findings from each of these disciplines pertain to the study of conflict management within an evolutionary framework. The goal was to bring together primatologists who have researched aggression, reconciliation, or some aspect of conflict management in non-human primates; archaeologists who could speak to how conflict (or the lack thereof) are evidenced in the prehistoric record; nomadic hunter-gatherer specialists who have knowledge about how topics like reciprocal sharing, cooperation and competition, and resource utilization relate to conflict resolution and violence in nomadic band societies; and human behavior ecologists who consider such topics as evolutionary models of conflict, restraint, ritualization, cost-benefit models of aggression, territorial defense, resource competition, and so forth. Hence the workshop explored how an exchange of knowledge among scholars from different disciplines could begin to provide a more complete understanding not only of conflict and aggression but also of conflict management and conflict resolution within an evolutionary perspective. A premise of the workshop was that a more complete picture of these phenomena can emerge from an intellectually interactive process that brings together scientists and scholars from several relevant disciplines.

The workshop took place over the course of a week and included many formats for formal and informal interaction among participants. The workshop consisted of panel discussions, small-group focused discussions, plenary presentations, open whole-group discussions and Q/A sessions. Participants also interacted during lunches, coffee breaks, an opening reception, and a group dinner. The majority of the participants were established specialists, representing the anthropological subfields of hunter-gatherer studies, primatology, archaeology, social-cultural studies of peace and war, and behavioral ecology. Additionally, other participants came from fields such as evolutionary biology, game theory, peace studies, philosophy, and psychology. Some students also participated

The participants were very engaged in discussing the focal topics of the workshop. Each day had a theme for panel discussions and plenary presentations, although open discussions spanned topics throughout the workshop. The daily themes were as follows: Monday's was "The Antiquity of War and Peace," Tuesday's was "Evolutionary and Ecological Models and Theories," Wednesday's was "Forager Aggression and Conflict Management," Thursday's was "Conflict Resolution in Human and Nonhuman Primates," and Friday's, intended as a day to build interdisciplinary bridges, was "Integration and Synthesis of Knowledge about Aggression and Peacemaking."

Participants found the topics, length, and interdisciplinary nature of the workshop very beneficial. One reason that the type of interdisciplinary exchange engaged in during this workshop is important is to address controversies about the human nature that continue, in part, due to a lack of interdisciplinary integration of knowledge. As a tangible outcome of the workshop, a proposal for an edited book has been presented to a publisher and is currently under review. The idea is to build upon the interaction and knowledge exchange begun

during the workshop and to create a tangible product that can be further shared with a broader scientific audience.

Douglas P. Fry (Vasa, Finland)
Johan van der Dennen (Groningen, the Netherlands)

Arithmetic of Surfaces

October 25 – 29, 2010

The aim of the workshop was to bring together specialists from all over the world working on the arithmetic of surfaces. This allowed them to continue old collaborations started recently thanks to the similar meeting held in Banff in 2008, to join forces in new ones, and to divulge the topic among masters and PhD students. Here are some highlights.

Anthony Várilly-Alvarado and Jaap Top were responsible for introducing the topic to PhD students with two mini-courses on del Pezzo surfaces and elliptic surfaces respectively. These courses were also followed by specialists since they provided a well-presented overview of the advances of the theory for two important classes of surfaces.
Tetsuji Shioda spoke on Mordell-Weil lattices, a theory developed by him, broadly used nowadays to understand and classify fibrations on elliptic surfaces and abelian varieties. He brought up previous and recent results presenting an up-to-date status of the subject.
Elliptic surfaces were also the topic of Patrick Ingram's and Bianca Viray's talks. The former presented his results on specialization and divisibility on the Mordell-Weil group, while the latter spoke on descent on elliptic surfaces and transcendental Brauer elements. A more general picture of transcendental Brauer groups was given by Alexei Skorobogatov in his talk, where he discussed the progress and open problems.
Damiano Testa gave a talk on del Pezzo surfaces of degree two, telling us the advances of his joint work with Cecilia Salgado and Anthony Várilly-Alvarado on the problem of unirationality for such surfaces. The question was previously considered by Yuri Manin and János Kóllar.
On a day dedicated to K3 surfaces Sir Peter Swinnerton-Dyer spoke on the problems related to (the presence, absence and density of) rational points providing examples and raising questions. Martin Bright devoted his talk to a special class of K3 surfaces, the diagonal quartics. He showed that a sufficiently general diagonal quartic surface, despite having non-trivial Brauer group, has no Brauer-Manin obstruction to the existence of rational points.
David MacKinnon gave an outstanding presentation, where he showed that Vojta's Main Conjecture implies the well-known conjecture that for any K3 surface X defined over a number field, and for any positive real number _, there is a nonempty open subset U of X such that the number of rational points in U of height at most B is O(B_).
The atmosphere during the workshop was pleasant and work-stimulating. The high quality of the seminars and mini-courses as well as the facilities and helpful staff of the Lorentz Center were an incentive for people to participate and spend the time in between lectures at the Lorentz Center. We had a very positive feedback from several participants who expressed their appreciation during and after the meeting. This friendly and encouraging environment allowed exchanges among senior researchers as well as PhD students assuring the success of this workshop.

Hendrik Lenstra (Leiden, the Netherlands)
Cecília Salgado (Leiden, the Netherlands)
Lenny Taelman (Leiden, the Netherlands)
Ronald van Luijk (Leiden, the Netherlands)

Seeing Enzymes in Action

November 1 – 5, 2010

One of the exciting developments in single-molecule spectroscopy is the study of enzyme activity and turn-over at the single-molecule level. Observing a single molecule removes the usual ensemble average, allowing the exploration of hidden heterogeneity in complex condensed phases as well as direct observation of dynamic changes, without synchronization. This workshop addressed the challenge of taking the study of single enzyme catalysis beyond the proof-of-principle stage, bringing together leading players in this field.

What do we know? Xie and others have found that a single enzyme molecule exhibits fluctuations of catalytic rates over a wide range of time scales, i.e., a single enzyme molecule does not have a rate constant! Rigler, Hammes and Xie discussed the general mechanism that is beginning to emerge. It is a multiple-pathway, multiple intermediate scheme involving conformational ensembles. This mechanism has to be described in terms of transition state theory and free energy surfaces.

Many experiments corroborate these observations. Yet in the discussion it also was pointed out that developments in this field are hampered by a number of constraints. For example, the necessity of non-native, fluorogenic substrates is a severely limiting factor and may not be representative for the natural catalytic process. Immobilization of the enzyme is required, but may affect the range and dynamics of conformational fluctuations. Finally, brighter probes are needed with improved photostability. Potential breakthroughs presented at the meeting are highlighted below.

FRET-based optical and electrochemical studies of redox enzymes down to the single-molecule level: a new method was presented by Canters, Aartsma and co-workers for monitoring redox enzyme activity at the single-molecule level. It is applicable to a large variety of enzyme systems and does not interfere with the enzymes' natural activity. Feasibility was demonstrated of trapping enzymes in the Anti-Brownian Electrokinetic trap (ABEL trap), developed by Moerner and co-workers and discussed by Goldsmith, eliminating the Brownian motion. It is a promising alternative for immobilization schemes. Dual focus fluorescence correlation spectroscopy (FCS) was described by Enderlein, which allows for more precise and quantitative measurements of molecular dynamics and diffusion parameters of biomolecules. An important future direction is the utilization of single-molecule techniques to unravel the orchestration of large macromolecular assemblies. Van Oijen discussed single-molecule studies of the replisome, the multi-protein machinery that is responsible for replication of DNA. J. Cao presented and discussed a generalized form of the Michaelis-Menten (MM) equation, providing a unified approach to analyze non-MM behavior and to describe cooperativity, inhibition, and multi-stability. The potential of nanoparticles as optical probes and for monitoring catalysis was discussed by Orrit and Chen. The most important feature is the great photostability of nanoparticles. The cellular and biological contexts of single-enzyme experiments were discussed by Schmidt, Schütz, and Spaink.

The future of single-molecule imaging and spectroscopy calls for higher throughput and better temporal resolution. Important technological advances were presented by Weiss. He described superresolution optical fluctuation imaging (SOFI), a new 3D super-resolution method based on the analysis of temporal fluorescence fluctuations of emitters that works with any wide-field microscope. The enhanced resolution results in striking images of cellular

structures. Weiss also reported on the development of two new devices consisting of arrays of single-photon detectors. In combination with the possibility to generate multiple focal spots from a single laser beam, a system for parallel data acquisition can be constructed with greatly improved throughput. These detectors are still largely experimental, but they mark the direction in which the field is developing.

The workshop has resulted in an agreement between Moerner, Canters and Aartsma to collaborate on combining the ABEL trap with single-enzyme studies. Preliminary data had been obtained, but they will seek financial funding to establish a solid footing for this research. A number of participants, headed by L.J.C. Jeuken, have submitted a joint proposal for an FP7/ITN network as a follow-up to this workshop.

Franco Gilardi (Torino, Italy)
Thijs Aartsma (Leiden, the Netherlands)
Gerard Canters (Leiden, the Netherlands)
Antoine van Oijen (Groningen, the Netherlands)

Worker 2010: Workshop on Kernelization

November 8 – 12, 2010

An important step when solving combinatorially hard problems (from many applications) is to first preprocess the data, i.e., transform the input to a smaller sized but otherwise equivalent input, and use a slow exact solving method on the result. In this workshop, we look at a mathematical analysis of such preprocessing algorithms, termed kernelization algorithms.

The workshop program consisted of eleven keynote lectures, nine participant lectures, and two lectures in a special session on the multi-cut problem. In addition, several discussion sessions were held, discussing in depth in what direction standardization of the main used definition of kernelization should go, important open problems in the field, and the publicity of kernelization. Also, participants worked with each other on open problems. The social program consisted of a cheese and wine party at the first day of the conference, and a very nice conference dinner during a boat trip in the neighborhood of Leiden.

The lectures presented the most important recent developments in kernelizations, including new techniques to obtain lower bounds for kernels, the very new technique of cross composition, meta-results, i.e., techniques that allow to obtain kernelization algorithms for not one but entire classes of problems (the notion of protrusion plays an important role here), kernelization for problems from logic and data clustering, the use of nonstandard parameters, and notions related to kernelization. The lectures were very informative, often explaining deep new results in a clear way, and gave a good view of the current state of research in the field.

In two special sessions, the participants discussed the definition of kernelization. These discussions were very lively. A report on the conclusions of the discussion is in preparation. Over fifty participants from many different countries and continents gathered for the workshop. Most of the world experts from the field came to the workshop. We expect that a number of new results and papers will be the results of the work that was carried out or started during the workshop. The excellent facilities and the helpful staff were very beneficial to make the workshop a big success.

Hans Bodlaender (Utrecht, the Netherlands)
Fedor Fomin (Bergen, Norway)
Saket Saurabh (Chennai, India)

Mining Patterns and Subgroups

November 16 – 19, 2010

MPS2010 intended to bring together leading researchers from two branches of the Data Mining field: pattern mining and subgroup discovery. The aim of the workshop was to leverage the commonalities between these two branches, and further advance the field by streamlining future developments.
The organisers kicked off the workshop by presenting the – provocative - hypothesis that pattern mining and subgroup discovery are equivalent. The talks and discussions that followed contributed to a better understanding of both the commonalities and the differences between the two branches. At the end of the week, consensus was reached that although the fields face similar challenges and collaboration is definitely useful, the tasks addressed by the respective fields are not equivalent.
Important challenges for the next 5 years were identified and discussed, resulting in new problems and collaborations. As far as we are aware, several new collaborations that started during the workshop are still ongoing and are likely to result in publications, e.g. on the topic of using direct pattern sampling techniques for fast pattern set selection. As an even more tangible result, the open source subgroup discovery system Cortana was launched during the workshop (see http://datamining.liacs.nl/cortana.html).

We will now summarise some of the key results of the scientific discussion. Although the recently emerged topic of pattern selection is widely accepted as an important direction, it was commonly agreed that objective quality measures for pattern sets are lacking. Numerous pattern selection methods have been proposed and to be able to compare these, real-world applications and intuitive visualisations are required. First steps in this direction have been taken during the workshop. More in general, it is believed that fast heuristic methods have the future: given large amounts of data, it is better to quickly compute a representative set of results than to take a very long time to obtain the complete (and usually redundant) list of all results.
Different levels of complexity can be defined based on the data and task at hand, and a hierarchy has been devised to this end. Pattern mining, for example, traditionally considers binary data in an unsupervised setting, while subgroup discovery usually considers numeric data and has a ‘target’ attribute. With more complex data and more complex tasks being introduced all the time, the algorithmic challenges become harder. Prime examples are multi-target data (Exceptional Model Mining), mining social networks, process mining, and so on.
Finally, we believe this workshop has resulted in both a better understanding and more appreciation between the researchers active in the branches of pattern mining and subgroup discovery.

Both the workshop in general and the workshop program in particular were very well received by the 50 participants. The workshop length of 4 days was experienced to be long enough and the interesting keynote talks at the start and at the end of workshop contributed to ensure a lively workshop from start to end. The social events facilitated informal discussions and the three Awards (for Best Innovation, Best Vision and Best Discovery), announced at the special Award Reception organised in the Rijksmuseum van Oudheden, definitely caught the participants' attention.
The mixture of talks and discussions, mainly in groups of 8-10 people, made this workshop a real workshop (and not a small conference). This was much appreciated, and we would reserve even more time for discussions if we were to organise a new workshop.

All participants were encouraged to submit a paper in advance of the workshop, and this resulted in 13 interesting submissions. We experimented with a ‘double open’ peer reviewing system, in which authors, papers, reviewers, and reviews were all made available to all workshop participants on our website. Additionally, reviewers were encouraged to initiate discussion after a paper had been orally presented. This format worked out very well, but the general impression was that this is more suited for informal workshops than for large, international conferences, where many papers are rejected.
For more information about MPS2010, such as overviews of the talks, papers, posters, discussions and photos, we refer to the workshop's website at www.mps2010.nl.

Matthijs van Leewen (Utrecht, the Netherlands)
Marvin Meeng (Leiden, the Netherlands)
Arno Knobbe (Leiden, the Netherlands)
Stefan Wrobel (Bonn, Germany)

Analysis, Geometry and Group Representations for Homogeneous Spaces

November 22 – 26, 2010

Aims

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. A classical example in that respect form Fourier series and integrals. Harmonic analysis on locally compact groups is the search for a non-commutative generalization of this theory. During the workshop we focused on a selected number of topics of actual interest: symmetric spaces, representation theory related to number theory, special functions and quantum groups. The goals were to discuss the various interrelations between them and to stimulate future research in these directions. Therefore we gathered renowned specialists in these fields and young researchers to get a vivid exchange of views.

Workshop

There were 52 participants from 10 different countries that attended the week program with a substantial group of young researchers.
The program consisted first of all of 15 keynote addresses of 45 minutes each followed by lively discussions. The speakers and their titles were:

1) Masato Wakayama: Hermitian symmetric spaces of tube type and multivariate Meixner-Pollaczek polynomials
2) Joachim Hilgert: Wigner and Patterson-Sullivan distributions for locally symmetric spaces
3) Hideyuki Ishi: The Berezin transforms associated to homogeneous Kaehler metrics on a homogeneous bounded domain
4) Atsumu Sasaki: Visible actions on multiplicity-free spaces
5) Volker Heierman: On Shahidi's tempered L-function conjecture
6) Patrick Delorme: Constant term of Eisenstein integrals of reductive p-adic symmetric spaces
7) Hidenori Fujiwara: On the polynomial conjectures
8) Bernhard Krötz: Invariant measures on homogeneous spaces, with applications to function spaces and lattice counting
9) Erik van den Ban: On the symplectic structure of hyperbolic co-adjoint orbits
10) Taro Yoshino: Topological blow-up
11) Hiroyuki Ochiai: Positivity of an alpha determinant
12) Michael Pevzner: Spectral approach to composition formulas
13) Katsuhisa Mimachi: Connection formulas of the solutions of Fuchsian differential equations and intersection numbers of twisted cycles
14) Masatoshi Noumi: Remarks on elliptic Schur functions
15) Erik Koelink: Modular properties for quantum groups

Besides this part of the program, participants also had the possibility to give a short presentation of their work and ample use of this opportunity was made: all reserved time slots were fully booked. Their respective titles were:

1) Troels Johansen: Almost everywhere convergence of Bochner-Riesz means in Jacobi Analysis
2) Stéphanie Cupit-Foutou: Real structures on wonderful varieties
3) Ralf Gramlich: Topological split Kac-Moody groups and their buildings

4) Eitan Sayag: Distinction, Gelfand property and base change
5) Oksana Yakimova: Nilpotent Gelfand pairs and spherical transform of Schwartz functions
6) Job Kuit: Radon transformation on reductive symmetric spaces: support theorems
7) Andreas Kollross: Nonnegatively curved homogeneous metrics
8) Antonio Jose Di Scala: A geometric proof of the Karpelevich-Mostow theorem
9) Stefan Berceanu: Holomorphic discrete series representations on Siegel-Jacobi domains
10) Stefan Kolb: Braid group actions on quantum symmetric pair coideal subalgebras

There were further two discussion sessions led by the organizers containing the following contributions:
1) Detlev Poguntke: Synthesis properties of orbits in the unitary dual of nilpotent Lie groups
2) Bas Janssens: Universal central extensions of Gauge groups

Finally, Loek Helminck organized a special session on Generalized Cartan spaces, of which he described in an overview the present state of affairs and led the discussion.

Outcome

Besides that the participants told us the workshop was a source of inspiration for new ideas and yielded various new cooperations, also concrete plans were developed during the conference for future follow-ups.

Acknowledgements

The workshop was financially made possible by the support of the following institutions or organizations:
1) The Lorentz Center (NWO)
2) The Japanese Science Foundation
3) The cluster “Geometry and Quantum Theory” (GQT)
4) The Mathematical Research Institute (MRI)

Finally we like to express our gratitude to the staff of the Lorentz Center, in particular Henriette Jensenius, Mieke Schutte and Corrie Kuster for their guidance, help and support in 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.

Gerard Helminck (Amsterdam, the Netherlands)
Takaaki Nomura (Fukuoka, Japan)

Modeling with Images in the Life Sciences

November 29 – December 3, 2010

Description and aim

Modern imaging and image processing is revolutionizing the scientific investigation in the life sciences. However, much current practice is tailored toward specific workflows and uses cases that are neither sharable nor generalized appropriately to manifold and diverse scientific questions. One reason for this shortcoming is lack of a standardized image modeling workflow and vocabulary. The purpose of this workshop was to develop a framework for bio-imaging theory by elaborating on the methods and terminology currently applied. Starting from the image as produced by imaging devices at micro-scale resolution, the workshop focused on the exploration of the range of methodologies developed for modeling based on series of images and on establishing common ground for formulation of theory.

A principal aim of this workshop was bringing together different communities that deal with images in the life sciences, and increasing understanding in modeling workflows in BioImaging, with a focus on BioImaging at the micro-scale. Effective BioImaging requires collaboration between several distinct research communities, each having their own perspective and vocabulary. A common framework for workflow and vocabulary is a necessity for the communication between scientists, exchange of data (images) and interpretations of these data. Such a framework will help to distill theory from established practices. The workshop covered a spectrum of topics, ranging from image acquisition and processing to interpretation, visualization and analysis.

The workshop

Each day of the workshop was dedicated to a particular component of imaging workflows, ranging from image acquisition to visualization and analysis. The morning sessions were comprised of a plenary lecture and a plenary discussion session, whereas the afternoon sessions contained another lecture followed by discussions in smaller groups. These sessions in smaller groups resulted in vivid discussions about the workflows in various subfields of BioImaging, covering Brain Imaging, Cell Imaging, Molecule Imaging and Developmental Biology. The division of the subject provided a good format for discussion and most of the participants took part in several of these group discussions.

The workshop attracted a highly interdisciplinary group of 56 participants from 22 different institutes from 9 countries. The number of junior researchers among the participants was 20. As a consequence of their mixed backgrounds, including Computer Science, Biology, Chemistry and Mathematics, many participants were unacquainted with each others' work and methods, and many new contacts were made. This effectively fulfilled a principle aim of the workshop: bringing together researchers from various communities involved in BioImaging and setting up dialogues. Two poster sessions and a software demonstration, specifically aimed at the young researchers, allowed for the participants to present their own work.

Outcome

To preserve the outcome of the many discussions, a Wiki site was set up and for each discussion session, a moderator made a written report available. These results can now serve as a starting point for defining workflows and a common vocabulary and discussion framework in BioImaging. The general discussions, in plenary sessions, during lunch and coffee breaks taught us that possibilities to annotate all parts in the imaging workflow in an

unambiguous manner are very much required. In addition, many new initiatives for collaborations between the participants were taken. Examples include: Leiden-Antwerpen, Antwerpen-PSI (Switzerland), Leiden-Amsterdam, Leiden-Groningen, Turku-Leiden, Praag-Leiden.

Organization and Funding

The organization of the workshop by the Lorentz Center staff, in particular Mrs. Pauline Vincenten, Dr. Henriette Jensius and Dr. Mieke Schutte, was very smooth and gave the participants full freedom to enjoy the workshop in a relaxed and inspiring environment. The organizers would like to express their gratitude towards the Lorentz Center, and gratefully acknowledge financial support of the KNAW and the Cyttron II project.

Joost Batenburg (Antwerp, Belgium)
Fons Verbeek (Leiden, the Netherlands)

Mathematical Life in the Dutch Republic

December 6 – 10, 2010

Instigated by the commemoration of the 400th anniversary of the decease of Ludolph van Ceulen, the aim of this workshop was to develop new perspectives on the history of the mathematical sciences of the late sixteenth century. The workshop particularly aimed at advancing our understanding of the interplay between mathematical content and historical context in the Dutch Republic in the late sixteenth and early seventeenth centuries, a period that was constitutive for both the Republic and early modern mathematics. The workshop brought together historians of mathematics, historians of social and cultural history, and mathematicians. Lectures and discussions were organized around three themes: Mathematical Methods, Mathematical Practices, and Mathematical Cultures.

This workshop also tied in with the NWO-funded project “Circulation of Knowledge”, involving the Huygens Institute and the Descartes Center, for the collection and digitalization of early modern Dutch scholarly correspondence. In that project, tools are being developed to analyze a large body of content of correspondence and trace the spatial and temporal development of the correspondent's networks. Participants experimented with a development version of the software and data and provided valuable feedback for the developers.

The organizers and participants are very positive about the format and the setting of the workshop. The staff of the Lorentz Center have been very helpful and inspiring, and have turned the workshop into a true workshop in which the participants were enabled and stimulated to discuss the themes and exchange ideas and expertise. The support by the Lorentz center was perfect, enabling the organizers to fully concentrate on the content.

The cooperation between the various disciplines present in the workshop proved to be a fruitful one. For example, many historical artifacts (globes, maps) that are often praised for their artistic values, could now be studied for their meaning in the developing scientific context of their days. Because of the international participation in the workshop it became feasible to compare the character of Dutch mathematical practices and culture to the situation abroad, and thereby to identify the Dutchness in Dutch Mathematics.

In the course of the workshop two important themes developed. First, it became clear that the concepts of 'mathematical practitioner' is valuable for historical analysis, and is being enriched since its introduction some 25 years ago. Second, in order to acquire a rich historical picture of early modern mathematics that is not hampered by anachronistic concepts, research can be focused on various kinds of projects: academic, technical, and so on. These themes turned out to be enlightening and inspiring for the whole range of participants.

Part of the participants are positive about publishing a collection of articles based on the contributions to the workshop. This collection will focus on the themes that have emerged. The organizers are considering the best format for such a collection (book; special issue).

Fokko Jan Dijksterhuis (Deventer, the Netherlands)
Charles van den Heuvel (Amsterdam, the Netherlands)
Steven Wepster (Utrecht, the Netherlands)

HART – Human-Agent-Robot Teamwork

December 13 – 17, 2010

Human-machine interaction is increasingly important in domains where artificial systems are expected to take up tasks, take initiatives, make decisions, and coexist and collaborate with people. This implies a need to understand the consequences of the interaction (cooperation, competition, coordination) between people and robots or agents. The aim of HART (Workshop on Human-Agent-Robot Teamwork) was to create a roadmap of the relevant research questions and topics for the coming two, five and ten years. The workshop brought together an excellent mix of senior researchers and young PhD students. The lectures provided by the senior researchers were an immense bonus for the young PhD students to help them understand more about the underlying problems and the state of the art in Human-Agent-Robot Teamwork. The talks by the PhD students gave them the opportunity to discuss their research plans and ideas with the more experienced researchers. The feedback they received will have a clear impact on the focus of their research and the approach they will follow in their projects.

During the workshop a number of topics attracted most attention: understanding between team members, the notion of teamwork in relation to task dependencies and interdependencies of team members, and the purpose of HART. Based on these discussions, a number of questions and issues were raised that will help focus future research on topics related to HART. The plan is to refine our understanding of these questions and issues in the coming months and to try and publish that overview, and perhaps also additional articles summarizing aspects of the state-of-the-art, in a high profile journal that is relevant for HART.

The remainder of this report contains a short summary of some of the notions put forward. From Answer.com we used the running definition: “teamwork is the actions of individuals, brought together for a common purpose or goals, which subordinates the needs of the individual to the needs of the group. … The interactions among the members and the work they complete together is the teamwork.”
The debate over the week repeatedly came to the questions: what makes HART different from pure human teamwork? What is teamwork, and what is essential for teamwork? How can we model that? How do we program agents and robots capable of flexible teamwork? What do humans expect from HART? Is there a unified theory of teamwork? Is all teamwork the same?

These broad questions where further refined through small and large group discussion. For example, what is the role of the agent in HART? Should it be an intermediary between human and robot? The different teamwork phases should be modeled and implemented in order to harmonize goals and team members: initiation (recognition of the need for others to get the work done), team formation and role adoption, doing the work and team maintenance, and abandoning team activity (recognition of end-resolution). What is the effect of the timing of teamwork (synchronous, asynchronous, ad-hoc)? How do we model and implement pre-organized vs. self-organized teamwork? What is the difference between coordination, cooperation, collaboration and teamwork? To what extent does the team need common ground / shared understanding / shared mental models? What are the roles of context and environment? How should we model and how should team members deal with

the difference between individual goals (for the individual or for the team) and team goals (for individual team members or for the team as a whole)?

Catholijn Jonker (Delft, the Netherlands)
Jeff Bradshaw (Pensacola, USA)
Virginia Dignum (Delft, the Netherlands)

FUNDING SOURCES OF LORENTZ CENTER

Basic Funding of Lorentz Center

Funding granted to Lorentz Center, supporting its operational activities and providing a budget to each meeting held at Lorentz Center

Leiden University Faculty of Science at Leiden University		Facilities and staff
FOM Foundation for Fundamental Research on Matter		Workshops in Physics
NWO Netherlands Organisation for Scientific Research		Workshops in Astronomy, Computational Sciences, Informatics, Life Sciences, Mathematics, and workshops within the NIAS-Lorentz Center collaboration
OCW Ministry of Education, Culture and Science		Workshops in Astronomy, Computational Sciences, Informatics, Life Sciences, Mathematics, and workshops within the NIAS-Lorentz Center collaboration
NIAS Netherlands Institute for Advanced Study in the Humanities and Social Sciences, an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW)		Workshops within the NIAS-Lorentz Center collaboration
Lorentz fonds		Workshops in Physics

Additional Funding for specific Lorentz Center Meetings

Funding granted to scientific organizers of meetings held at Lorentz Center

Sponsor	Workshop
Åbo Akademi	• Aggression and Peacemaking in an Evolutionary Context
Artists Design	• Summer School on Models for Embedded Signal Processing Systems
ASML	• Physics with Industry
ASTRON	• IPTA 2010: Detecting Gravitational Waves with Pulsars
Buchem bv	• Quantum Measurements and Chemical Spin Dynamics
COBRA	• Single Dopant Control
Compositio Mathematica	• The Interface of Integrability and Quantization • Arithmetic of Surfaces
COST	• Electrochemistry
CWI	• Modelling Angiogenesis
Cyttron	• Analysis, Geometry and Group Representations for Homogeneous Spaces
DIAMANT Cluster	• Numeration
Dutch Program of Tissue Engineering	• Modelling Angiogenesis
Ecrypt	• Provable Security against Physical Attacks

EdRox 	• Seeing Enzymes in Action
EPTA 	• IPTA 2010: Detecting Gravitational Waves with Pulsars
ESA 	• X-ray Bursts and Burst Oscillations
ESF 	• Computational and Gravitational Dynamics
Eurisotop 	• Quantum Measurement and Chemical Spin Dynamics
Fei Optics 	• Micro and Nanofluidics for Cell Biology
FOM (additional) 	• Inter-phase
FrieslandCampina 	• Physics with Industry
GQT Cluster 	• The Interface of Integrability and Quantization • Analysis, Geometry and Group Representations for Homogeneous Spaces
Greiner Bio-one 	• Assembling a Multi-Cellular Circadian Pacemaker
HiPEAC 	• Summer School on Models for Embedded Signal Processing Systems
IEEE 	• Summer School on Models for Embedded Signal Processing Systems
Ingenico 	• Provable Security against Physical Attacks
Isotech Inc 	• Quantum Measurement and Chemical Spin Dynamics
J.M. Burgerscentrum 	• Flow Instabilities and Turbulence in Viscoelastic Fluids

Kavli Foundation	• Single Dopant Control
KNAW	• Micro and Nanofluidics for Cell Biology • Part and Whole in Physics • Numeration • Symplectic Techniques in Conservative Dynamics • 4th Euro-Japanese Workshop on Blow-up • History of Software, European Styles • Observational Signatures of Type Ia Supernova Progenitors • Arithmetic of Surfaces • Analysis, Geometry and Group Representations for Homogeneous Spaces
Leiden University	• The Artificial Leaf • Numeration
Leids Universiteits Fonds	• Mining Patterns and Subgroups
Leoni FiberTech	• Quantum Measurements and Chemical Spin Dynamics
Limo Mikrooptik	• Quantum Measurement and Chemical Spin Dynamics
LioniX	• Micro and Nanofluidics for Cell Biology
LUMC	• Assembling a Multi-Cellular Circadian Pacemaker
Marie Curie	• Sage Days 23: Number Theory and Computer Algebra
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Micronit	• Micro and Nanofluidics for Cell Biology
NANOGrav	• IPTA 2010: Detecting Gravitational Waves with Pulsars

NDNS+ Cluster	• Coherent Structures in Evolutionary Equations • Symplectic Techniques in Conservative Dynamics • Poly and Polymer Electrolytes for Energy Conversion • 4th Euro-Japanese Workshop on Blow-up
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NSF	• Poly and Polymer Electrolytes for Energy Conversion
NWO (additional)	• The Artificial Leaf • Computational and Gravitational Dynamics • Multi-frequency Electron Paramagnetic Resonance • X-ray Bursts and Burst Oscillations • Symplectic Techniques in Conservative Dynamics • Observational Signatures of Type Ia Supernova Progenitors
NXP	• Physics with Industry
Philips	• Assembling a Multi-Cellular Circadian Pacemaker
PPTA	• IPTA 2010: Detecting Gravitational Waves with Pulsars
RadioNet	• Analyzing First Imaging Data from LOFAR • Surveying the Low Frequency Sky with LOFAR
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Rototec-Spintec GmbH	• Quantum Measurement and Chemical Spin Dynamics
Servier	• Assembling a Multi-Cellular Circadian Pacemaker

SIKS	• Integrating Cultures: Models, Simulations and Applications
SRON	• X-ray Bursts and Burst Oscillations
Technische Universiteit Delft	• Numeration
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Thomas Stieltjes Institute for Mathematics 	• Numeration • 4th Euro-Japanese Workshop on Blow-up
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