Scientific Report 2009

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Contents

Preface by the Director

The year 2009 was the year in which two crucial changes took place at the Lorentz Center. After 9 years of being the driving force behind all organizational aspects of the center as its executive manager, Martje Kruk retired at the end of September 2009. Wim van Saarloos, director of the Lorentz Center for 12 years, resigned in November 2009. For 9 years, Wim and Martje formed the beating heart of the Lorentz Center, together guiding and shaping the evolution of the Lorentz Center from a promising local initiative to the flourishing fully international workshop center of today.

The success of the Lorentz Center has its core in the vision of Wim van Saarloos: science thrives on interaction between creative researchers. A scientific workshop should be organized from the point of view of the scientist, the technical aspects of its organization should be kept to a minimum, both for the participants and the organizers. Wim had the vision, Martje's dedication was the crucial ingredient that indeed made the Lorentz Center into a smoothly running workshop center where it is fun rather than a hassle to organize a workshop. The appreciation for Martjes commitment to the Lorentz Center was reflected by the presence of overwhelmingly many (former) participants, workshop organizers and members of advisory boards and their enthusiasm at the special party that was organized in honor of Martje on October 1.

Wim van Saarloos has been the architect of the Lorentz Center. Moreover, without Wim's relentless energy the Lorentz Center would most probably not have been able to celebrate its 10^{th} anniversary – as it did in 2007. Unlike the large majority of workshop centers within the international community, the Lorentz Center has never focused its scientific spectrum on a single fundamental discipline, such as physics or mathematics. This was simply not possible within the, from an international perspective, relatively small Dutch scientific community. *A priori* one could see this as a disadvantage, but Wim van Saarloos turned it into an advantage. The solid embedding of the Lorentz Center in a wide variety of fundamental disciplines – physics, astronomy, mathematics, computer science, and, since 2006, the life sciences – gives the center a unique position within the international scientific community. It also provides the Lorentz Center with a fertile foundation for further growth. Moreover, under Wim's guidance, the Lorentz Center has become essential to the vitality of the Dutch sciences. By the open and completely international character of its workshops, the Lorentz Center has had a direct impact on the careers of many young, mostly Dutch, scientists. Given the powerful combination of vision of, and dedication to, the sciences and especially physics, as he exhibited both as (outstanding!) researcher and as director of the Lorentz Center, it is not surprising – certainly not in afterthought – that Wim was appointed as director of the Dutch physics funding agency FOM by November 1, 2009.

The way Wim and Martje took care of the Lorentz Center is also expressed by the way they prepared the center for its future after they stepped down. As his successor, I can say from direct experience that Wim set up a smooth, natural and inspiring transition process for me. A process, he already initiated in 2008 and that gave the perfect preparation for my present position. My involvement in our search of a successor to Martje has been part of this process. All three of us are excited about the fact that Mieke Schutte has been willing to join the Lorentz Center by September 2009 as its new executive manager. Mieke has a PhD in biology and has been leading a research group studying breast cancer. Her passion for science and her organizational talents ensure the stability of the Lorentz Center for the coming years.

In one way, these changes indeed have been quite crucial. However, it has on the other hand been possible to reduce the effects of these changes on the day to day affairs of the Lorentz Center to a negligible level. From the point of view of the organizers and the participants of the Lorentz Center workshops – the most important point of view for the center – the year 2009 did not significantly distinguish itself from previous years. This remarkable continuity has for a large part been ascertained by our workshop coordination team. This team takes care of most of the direct contacts between Lorentz Center and its visitors. Being relatively new to this part of the organization, I was impressed by its professionalism and by the way the team offers a warm welcome to all visitors. A similar thing can be said of the second main aspect of the Lorentz Center's day to day affairs, the science planning and evaluation. Although the pressure on the evaluation procedure is increasing – the number of submitted proposals in 2009 was (again) higher than in any of the preceding years – it has been able to maintain its high standards (Figure 1).

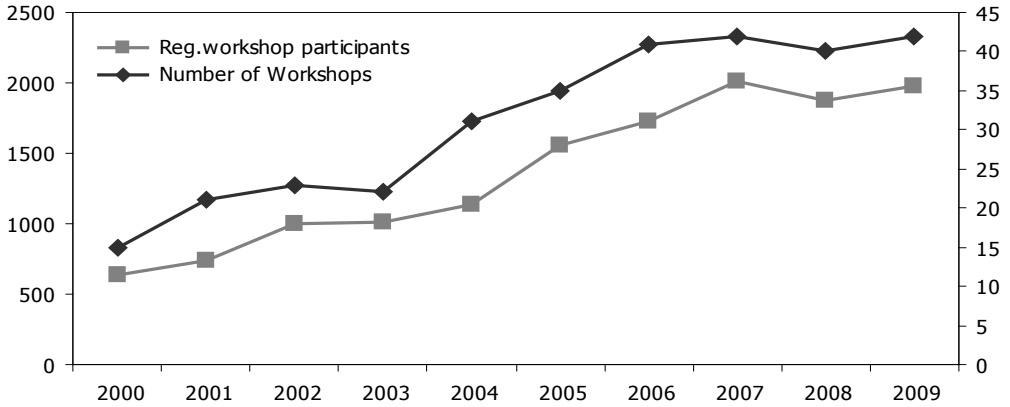


Figure 1 The number of workshops and registered workshop participants since the year 2000.

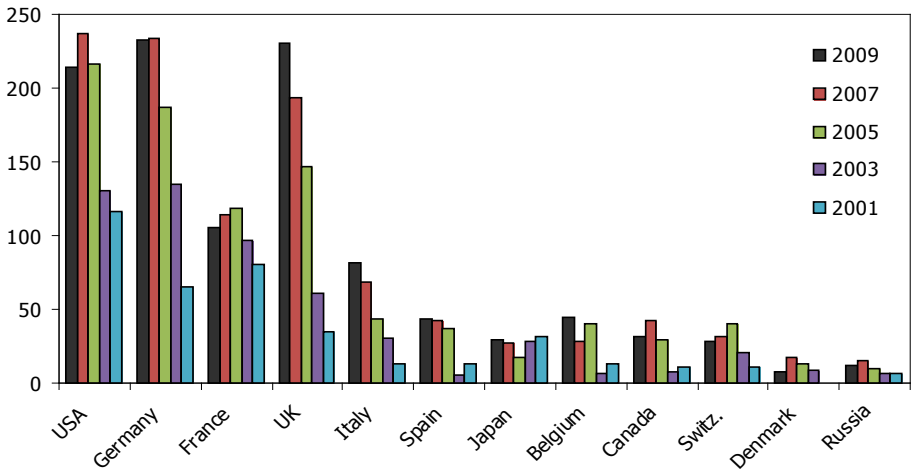
The year 2009 is also the year in which the first *Distinguished Lorentz Fellowship* has been awarded. This fellowship is an initiative of the NIAS *(Netherlands Institute for Advanced Study* in the Humanities and Social Sciences) and the Lorentz Center and is an award for a prominent scientist who brings the social sciences and humanities together with the natural sciences through his or her research. Jan van Leeuwen of Utrecht University is the first *Distinguished Lorentz Fellow*, the theme of his research project being *Philosophy of the Information and Computing Science*. He performs his research on this subject at the NIAS and has organized a Lorentz Center workshop in February 2010. The application round for the second *Distinguished Lorentz Fellow* saw a very strong field of highly interdisciplinary applicants. We – the Lorentz Center and the NIAS – are very pleased to see that the initiative clearly caught on. Another example of the continuing and growing success of the NIAS-Lorentz Center collaboration is the noteworthy workshop *Context, Causes and Consequences of Conflict* in which conflict and violence has been addressed through converging concepts originating from different disciplines, such as the social and developmental sciences, neuroscience, behavioral endocrinology, psychiatry, criminology and genetics.

I'm glad to see that in the life sciences, the number of workshops per year gradually increased since 2006. In the spirit of the Lorentz Center, these workshops had a multidisciplinary theme in which a subfield of biology meets an exact science as physics, mathematics, or computer science. In 2009, the workshop *Brain Waves* was a particularly appealing example: physicists and mathematicians interacted with experimental and

theoretical clinical neurophysiologists to share their insights, especially in the context of the (de)synchronization of neuronal activities in Parkinson's disease and epilepsy. Of course, the Lorentz Center saw other noteworthy workshops in 2009. Being a mathematician myself, I'd like to especially mention *Mathematical Challenges in Climate Science*. This workshop focused on highly relevant questions as 'How to incorporate data from observations into model simulations in an optimal way?' and 'How to represent in a numerical model the dynamical and physical processes with spatial scales below the model grid scale?'.

The year 2009 also was a year in which several plans for the future obtained a solid foundation. Already in 2007, the Lorentz Center has initiated plans for the further development of the field of *Computational Science* (CS) within the Dutch scientific community. The character of this field is in spirit very close to that of many workshops organized at the center: on the one hand, CS is a transdisciplinary research field that can be seen as standing perpendicular to the classical disciplines, on the other hand, research projects within the CS almost without exception have a strong embedding in (at least) one classical discipline. With support from NWO, the Lorentz Center will in 2010 extend its activities and its scientific range into the field of *Computational Science*. At the European level, this will be done in close collaboration with the *Centre Européen de Calcul Atomique et Moléculaire* (CECAM) in Lausanne, Switzerland. Together with the *Amsterdam Center for Multiscale Modeling* (ACMM), the Lorenz Center will form a node within an European network centered around CECAM in which the new activities in the field of CS will be embedded.

2A



2B

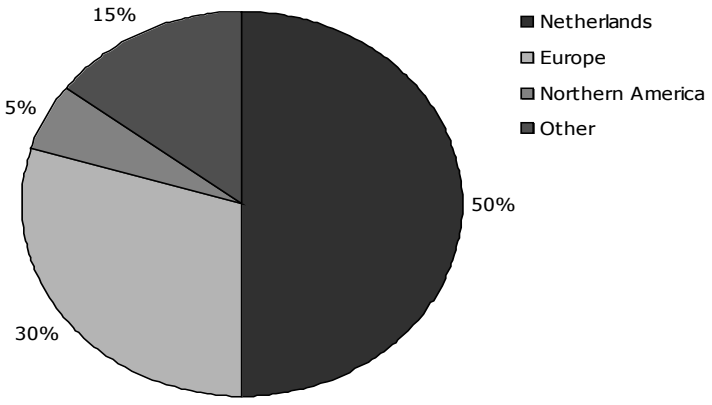


Figure 2A The backgrounds of the foreign participants of Lorentz Center workshops in the years 2001 through 2009. **B** Pie chart for the nationalities of all registered participants in 2009.

Although it is central to the completely international character of the Lorentz Center that it is open to workshop proposals from outside the Netherlands, and that the center deliberately does not impose quota for the number of participants from the Netherlands, the year 2009 has seen a somewhat larger number of participants from the Netherlands (it has been roughly at 35-40% in the preceding years) (Figure 2). The percentage of junior workshop participants – graduate students and postdocs – has remained stable at the high level of approximately 40%.

Finally, I'd like to mention – as was done last year – that the number of workshops and participants is saturating: the Lorentz Center is operating year round since 2007 and is thus close to its maximum capacity (Figure 1). At the same time, the number of submitted proposals is still increasing, while the Lorentz Center is initiating novel activities (for instance in the field of CS). We have been making plans for extending the center since 2007. There is a fertile scientific ground for going beyond the set-up of one workshop per week. Moreover, there is a very appealing location for this extension that is very close to the present Lorentz Center. With a growing support for our plans, the final decision about the extension of the Lorentz Center will be made in 2010.

Arjen Doelman
Director Lorentz Center

April 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 40 to 60 junior and senior researchers in a stimulating environment and with working space for all participants: offices with a desk, personal computer, 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. Proposals for workshops are reviewed by the Program Advisory Boards. Currently there are Advisory Boards for astronomy, computer sciences, lifesciences, mathematics, physics and interdisciplinary workshops. The Lorentz Center program is also open to proposals within other fields of the natural sciences. Submission procedures are aimed at rapid evaluation.

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 interdisciplinary 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 Interdisciplinary 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 an interdisciplinary workshop at the Lorentz Center. Applications for Lorentz Fellowships should be sent to NIAS.

Funding
The Lorentz Center is supported by Leiden University, Ministerie van OCW (the Dutch Ministry of Education, Culture and Science), FOM (the Dutch Physics Funding Foundation "Fundamenteel Onderzoek der Materie”), and NWO-Research Council EW. The Lorentz Fonds regularly supports workshops in Physics.

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Interdisciplinary Program Board

The interdisciplinary program board oversees the collaboration of NIAS (Netherlands Institute for Advanced Study in the Humanities and Social Sciences) and Lorentz Center, including the selection of interdisciplinary workshops, and the selection of the Lorentz Fellows at NIAS.

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Scientific Report

Rich Cognitive Models for Policy Design and Simulation

January 12 – 16, 2009

The aim of the workshop was to derive a perspective on how much cognition is required in social simulation models to make them useful in practical policy issues, such as the conflicts in Afghanistan and Georgia, the contrasting views on energy issues and the diffusion of the iPhone, to name just three very different examples

The invited speakers presented contrasting views on this matter. B. Silverman presented a simulation framework which was very rich and incorporated many cognitive concepts such as culture. N. Gilbert took the opposite view, and took the stand that cognition is usually not necessary to model higher order phenomena. Here two different approached were contrasted, one which reflected a more engineering view, aimed at building complex models, and one focusing primarily on a Occam's razor approach, trying to explain social phenomena from simple models. This fuelled discussions during the rest of the week on the trade off between the complicatedness of models versus the transparency of outcomes, a critical issue for understanding and modeling complex systems. Another approach was illustrated by J.M. Bradshaw, who focused on man-machine interactions. This presentation raised the issue on the level of agent cognition needed for the interaction with people.

During the workshop a total of 19 attendants gave short presentations on their own work, which further fuelled vivid discussions, as the common interest in cognitive rich agents in social settings were addressed in many different ways. Hence these presentations were both informative for the audience, being confronted with different approaches, as well as for the presenters, getting feedback from different perspectives.

An important part of the workshop was devoted to work in subgroups. During the first day, attendants joined different topical groups on the basis of their research interest, such as environmental policy, migration in Europe, transportation and transitions in energy. Here discussions emerged on what tools and methodologies could and should be used in developing simulation models that would provide a perspective on policy making in complex environments. During the second day groups were formed along theoretical methodological interests. Here the groups focused on questions relating to norms, second order cognition (the representation I have of what another thinks of me) and social networks.

Over the week discussions were aimed at developing ideas for joint research projects. Several ideas for proposals (often aimed at the EU FP7 program) emerged, and discussions are continuing after the workshop, indicating that a number of working groups will actually submit proposals. Also it was decided to organize a special session during the upcoming ESSA conference on rich cognitive models.

Finally we observed that the discussions during the day and the evening were very vivid, indicating that the workshop contributed to strengthening the links between researchers from different disciplines. The many positive comments we received after this workshop confirmed our belief that this workshop reached it's aims.

Virginia Dignum (Utrecht, Netherlands)
Wander Jager (Groningen, Netherlands)
Catholijn Jonker (Delft, Netherlands)

Deep IR Studies of the Distant Universe

February 2 – 6, 2009

We organized the workshop entitled "Deep IR Studies of the Distant Universe" on Feb 2 - 6, 2009. The meeting focused on the evolution of galaxies from z=5 to z=0. The emphasis was on galaxies selected in the Near-Infrared, corresponding to the rest-frame optical. Such galaxy samples give a coherent view of the stellar mass in the universe at higher red shift, and are essential for a proper understanding of galaxy formation.

We had a total of 25 participants, from the Netherlands, Europe, and the USA. Various collaborative efforts brought the group together, and the meeting was crucial to obtain an overall view of the status of the field, but also of the specific projects that the participants worked on. The meeting was structured to have most presentations in the morning, with ample time for discussion in the afternoon. These discussions were often in small groups; but we also had plenary discussions concerning general topics, and the overall status of the field.

The participants included both theorists and observers. The confrontation of the observations with theoretical models is one of the most important aspects for the future, as the models improve with time.

The Lorentz Center is the perfect location for such workshops, as it provides ample office space and discussion rooms for the participants. Furthermore, thanks to the open program in the afternoons, we could also do true work during the workshop, which led to significant results. Many papers were initiated during the workshop, or worked on. The environment of the Lorentz Center, with the office space, discussion rooms, and presentation rooms is therefore crucial to the success of this meeting. The support of the staff was excellent, and we are very grateful for the support of the Lorentz Center.

Marijn Franx (Leiden, Netherlands)
Pieter van Dokkum (New Haven, USA)

Spin Caloritronics

February 9 – 13, 2009

"Spintronics" is the science and technology of harnessing the electron spin degree of freedom in circuits and devices in order to realize new or improved technological functionalities. The focus of attention in "Caloritronics" is the control of temperature gradients and the corresponding thermoelectric phenomena in small structures. "Spin Caloritronics" is defined by the intersection of both fields.

The international community interested in this emerging field is still rather small and we were happy to have been able to attract practically all main players from Europe, the US, China and Japan, with more than 50 participants each day.

The workshop was organized in terms of topical session with invited expert speakers, followed by discussion sessions introduced and moderated by selected leading scientists. The workshop started by focusing on novel effects, such as spin-related thermoeletric effects. The interpretation of the recently discovered Spin Seebeck effect excited lively discussions. Special focus was directed as well to the zoology of Hall effects due to thermal current flow, such as the anomalous and spin Nernst, Ettingshausen and Righi-Le Duc effects. Other topical/discussion sessions were devoted to materials and devices. The workshop was wrapped up on the last day by extended discussion sessions devoted to experimental and theoretical developments of the field.

The workshop created significant synergy between the fields of spintronics, electron device physics, materials science, and energy research, between experiment, theory, and computational physics. It stimulated new ideas and collaborations. There was a consensus that the progress in the field should be monitored by subsequent follow-up conferences. At present, the possibilities are being investigated to fund Spin Caloritronics II in Japan in early spring of 2010.

The stark beauty of the lake district around Leiden during a crisp winter afternoon pleasantly surprised the participants (even those from the Netherlands).
All participants have been in awe of the high quality of the Lorentz Center's premises and expressed their gratitude for the excellent support by the highly motivated staff. We gratefully acknowledge the financial support by the Lorentz Center, the IMR and the Kavli Institute of NanoScience Delft.

Gerrit E.W. Bauer (Delft, Netherlands)
Sadamichi Maekawa (Sendai, Japan)

DECOI Design of Collective Intelligence
Third International School

February 23 – 27, 2009

The third International workshop on the design of collective intelligence (DECOI) aimed at providing a research and discussion platform within the relatively new and fragmented field of large scale, autonomous and adaptive systems. DECOI covers a spectrum of topics within this field to provide participants with state-of-the-art knowledge about methods and techniques (evolutionary computing, artificial life models, self organising systems) as well as related research domains (sociology, economics, biology). The workshop is setup as a combination of lectures and projects on which participants work during the week. Especially this latter provides a fruitful environment for the development new ideas and future collaborations and overcomes the problem of participants absorbing information only passively.

DECOI 2009 attracted 39 participants from 10 (European) countries. This amount could have been larger, but the organization committee specifically decided to keep the group of participants manageable and therefore closed registration early. Since the emphasis of DECOI is on 'learning by doing', the main audience for the workshop where Master/Graduate and PhD students. During the registration procedure, applicants were asked to provide a short biography and motivation on which selection of participants was based.

This year DECOI presented a broad variety of speakers covering topics like crowd simulation, pervasive computing, self-organising and multi-agent systems, insect based computing and complex structural engineering. The lectures were given by renowned experts from all over Europe and gave a good overview of the state-of-the art within their respective research topics. Anders Johanson (ETH Zurich, Switzerland) showed how crowd simulation is used to analyse catastrophes occurring during the yearly Hadj in Mekka. Martin Middendorf (University of Leipzig, Germany) focussed on swarm inspired algorithms solving resource and network related problems. Franco Zambonelli (University of Modena and Reggio Emilla, Italy) covered ambient/pervasive computing and a framework to embed communicating intelligent sensors/agents throughout its environment. Giovanna Di Marzo Serugendo (University of London, UK) provided a general framework to understand self organizing systems and finally Jeroen Coenders (Arup, Amsterdam) showed the state-of-the-art in applied research and focussed on how complex adaptive systems/methodologies are currently used in structural engineering (e.g. the 'Birds nest' Olympic stadium in Beijing).
As already mentioned, the field of large scale, autonomous and adaptive systems is fairly fragmented into a multitude of research topics and disciplines. To address this challenge, the organizers opened the conference with a lecture that grounded many of these topics into a wider framework. Since self organising systems typically show characteristics like robustness and adaptation, they are in the storefront of demand driven research since in face of the current crises society demands systems to become more resilient towards perturbations (financial crisis, climate crisis, etc.).

Before the workshop, each of the invited speakers was asked to define a specific task/project that the participants could work on during the week. To overcome the problem of speakers just attending DECOI for a few hours for their presentation, the organization committee specifically selected speakers that guaranteed to be present during most of the week in

order to supervise the projects and be present during the final presentation. Although eventually not all invited speakers were able to fulfil this prerequisite, 2 of the 5 speakers managed to stay until the final project presentation, while 2 others were attending DECOI multiple days to supervise the project progression.

Apart from the lectures and projects, a number of other initiatives were developed to ensure maximum knowledge exchange between participants. These included a poster-session, various social events (drinks, dinners). All in all this resulted in a positive reaction from participants as well as invited speakers. At the end of DECOI each participant filled in an evaluation form, and the overall response was overwhelmingly positive. The provided working environment, facilities, informal atmosphere and level of the presentations were regarded positively.

A final indicator of success of such an event is the formation of new collaborations extending into the future. At the time this report is written we cannot yet assess the impact DECOI had in this respect. DECOI developed a website (www.decoi2009.collectivae.net) as a platform on which the participants are stimulated to publish DECOI-related collaborations. During the week many initiatives were discussed to organize lectures, classes, projects and write papers.

Finally, we would like to add that the organization of DECOI became a breeze because of the extensive support from the Lorentz Center. This includes the handling of applicants prior to DECOI, publicity, daily affairs, accommodation and facilities. Without this support we are confident that DECOI wouldn't have been the success that it seems to be.

Martijn Schut (Amsterdam, Netherlands)
William Veerbeek (Delft, Netherlands)
Konrad Diwold (Leipzig, Germany)
Virginia Dignum (Utrecht, Netherlands)

Animal Migration
Linking Models and Data

March 2 – 6, 2009

Scientific background and motivation
The starting point for organizing this workshop was the notion that despite some pioneering efforts, the interaction between theoreticians and empiricists has not been intense in the study of animal migration, which has probably hampered progress in this field. Therefore, we brought together experts in both areas in order to stimulate the integration of empirical phenological data on animal migration into theoretical models in order to 1) advance our fundamental understanding of migration and migratory phenomena such that we 2) increase our capability of management and conservation of migratory systems. At the same time, scrutinizing theoretical models will also 3) identify gaps in our current knowledge, and 4) generate insight into the benefits and drawbacks of the various theoretical approaches.

The workshop
The workshop's emphasis was on interactions rather than presentations, with only eight major talks during this one-week meeting. These keynote lectures covered both the general characteristics of migration in the major migratory taxa, (i.e. zooplankton, insects, fishes, turtles and birds) and the important theoretical approaches to migration (e.g. simple analytical models, dynamic optimization models, individual-based models and models based on evolutionary methods).
During the meeting, considerable time was dedicated to discussing possible generalizations across taxa and ways to integrate empirical and modelling efforts. Six topics received particular attention:
1. The evolution of migration.
2. Variation in migration strategies.
3. Currencies of migration.
4. Tracking of migrants.
5. Predictability during migration.
6. Development of graphical user-interface modelling frameworks.

(for more details see our meeting report: S. Bauer, Z. Barta, B. Ens, G.C. Hays, J.M. McNamara, and M. Klaassen (2009) Animal Migration - Linking models and data beyond taxonomic limits. *Biology Letters* 5(4):433-435).
Both the workshop, its topics and discussions and the supportive environment at the Lorentz Center have greatly enthused the participants and immensely benefitted the workshop aims. Many of the topics discussed are presently followed-up, and two meetings with subgroups of the participants of the Leiden meeting have already taken place. In one of them, further studies for the investigation of the evolution of migration and the role of predictability in migration have been started. In another meeting, an explicit comparison has been made in the way migratory animals of several taxa deal with drift, e.g. by wind or currents. We plan to organize another workshop, during which we discuss the progress of these and other ongoing projects, in the near future.

Silke Bauer (Maarssen, Netherlands)
Marcel Klaassen (Maarssen, Netherlands)
Bruno Ens (Den Burg, Netherlands)
Zoltan Barta (Debrecen, Hungary)
John McNamara (Bristol, United Kingdom)

Mathematical Challenges in Climate Science

March 9 – 13, 2009

Climate science is a field that harbours great challenges for applied mathematics. The aim of this workshop was to bring applied mathematicians and climate scientists together in order for the latter to learn about new mathematical developments with relevance to practical climate research and for the former to learn about the challenges faced by climate scientists at present. As it was impossible to cover all mathematical aspects of climate science in a single workshop, we focused on two of the most urgent topics: data assimilation (incorporating data from observations into model simulations in an optimal way) and subgrid-scale parameterization (how to represent in a numerical model the dynamical and physical processes with spatial scales below the model grid scale).

As the amount of observations of the climate system rapidly increases, data assimilation becomes more important than ever. Already a classical research theme in weather forecasting, the importance of data assimilation for climate research topics such as paleoclimatology and biogeochemical modelling has now also been recognized. However, these emerging research fields may need different assimilation tools than operational weather forecasting, because the requirements and limitations of models and data can be quite different: typically, models have coarser resolutions, simulations span much longer timescales and observational data have much poorer spatial and temporal resolution.

For subgrid-scale modelling, new strategies are being mapped out, often with a stochastic flavour, as researchers start to acknowledge some of the intrinsic shortcomings of existing approaches. The practical relevance of these new ideas cannot be taken for granted however, as their transfer from simple, idealized toy model environments to the complex models used in climate science often proves to be a difficult task. At the same time, new developments in applied mathematics, regarding for example numerical modelling of multiscale systems, are hardly known among climate scientists in spite of the potential relevance of these new ideas.

The workshop

The workshop drew nearly 40 registered participants from various countries (Netherlands, Belgium, France, Germany, UK, Canada, USA), with backgrounds both in applied mathematics and in atmosphere-ocean-climate science. Many participants had university affiliations but some came from research/operational centers such as KNMI (Royal Netherlands Meteorological Institute), NCAR (National Center for Atmospheric Research, USA), the British Antarctic Survey and the German Aerospace Center (DLR). There was significant interest from researchers in the Netherlands, with for example strong participation by KNMI researchers.

The first two days of the workshop were devoted to data assimilation, with presentations covering topics such as data assimilation in paleoclimate studies and biogeochemical modelling, numerical aspects and validation of algorithms, assimilation of Lagrangian data and Bayesian approaches to ill-posed inverse problems. The rest of the week was dedicated to subgrid scale modelling, with presentations focussing on parameterization of clouds and convection, stochastic methods for parameterization, regularized Navier-Stokes equations, cascades and spectral energy transfer, multiscale methods and parameterizations in ocean models.

The workshop program consisted of 16 presentations (lasting either 60 or 45 minutes), moderated group discussions (one each day) and a poster session. There was a wine and cheese party on the first day of the workshop and a dinner in the historic "Regentenkamer" in Leiden on the third day. For both the data assimilation theme and the subgrid scale modelling theme, there was a good mix of speakers, bringing in theoretical/mathematical as well as more practical/operational perspectives. The group discussions were very lively and interactive, with many participants contributing. Summaries of these discussions can be found on the workshop webpage.

Some of the topics that came up regularly during the discussions were (i) the need for systematic approaches to calibrate climate models using observational datasets, (ii) how to initialize climate models, (iii) what measures to use for assessing model performance, (iv) the current lack of a mathematical framework to guide the development of subgrid parameterizations and (v) the potential use of multiscale methods based on scale separation for parameterization. We recommend the discussion on these issues to be continued in future workshops. During the wrap-up session that concluded the week, some further topics for future meetings were suggested, going beyond the themes of the current workshop: characterization of structure in data, design of observation systems, uncertainty analysis and identification of model error, predictability.

Overall, the workshop was successful in reaching both applied mathematicians and climate scientists and in stimulating interactions between these groups. Several participants reported back to us on the good organization, the excellent presentations, and the interesting discussions. New ideas generated during the workshop will find their ways into the scientific community and are already being considered for new research proposals.

It is a pleasure to thank the Lorentz Center staff, in particular Corrie Kuster and Martje Kruk, for the excellent organizational support. We also gratefully acknowledge the financial support provided by the Lorentz Center as well as the NDNS+ mathematics research cluster and NWO-EW.

Daan Crommelin (Amsterdam, Netherlands)
Rachel Kuske (Vancouver, Canada)
Peter Jan van Leeuwen (Reading, UK)

From Disks to Planets: Learning from Starlight
2009 EARA Workshop

March 16 – 20, 2009

The European Association for Research in Astronomy (EARA) is comprised of 6 European universities in 6 different countries. The aim is to encourage and promote collaborative research in observational and theoretical astronomy. On a roughly annual basis, a workshop is organized and hosted by one of the participating institutes on a current astronomy topic. The 2009 event was selected from proposals submitted during an open call for young researchers to propose, lead, and organize the meeting.

From 16 - 20 March 2009, 47 registered participants plus many more local attendees from Leiden came together during the PhD student organized workshop "From Disks to Planets: Learning from Starlight". The participant list included representation from all 6 EARA institutes, 4 of the 5 major Dutch university astronomy departments, and 10 different countries located throughout Asia, Europe, North and South America. Students represented just over one third of the registered participants, counting 17 in total.

The goal of the workshop was to bring together star, disk, and planet experts to merge the most recent results from proto-planetary disk evolutionary studies, planet formation theory, and extra-solar planet statistics to pose questions about early stellar evolution. In most cases, the star and disk components are treated separately, limiting stellar studies to diskless systems where the starlight is less distorted or veiled by an active circumstellar environment, and requiring disk structure and evolution studies to make approximations about the input energy from the central engine at the system center. But to fully understand the system as a whole, and to explain the diversity of planetary systems formed and in-formation, it is necessary to probe the star-disk connection. In this workshop we completed the participant list with experts who study planetary systems around older stars, as the examples of successful outcomes, to help identify the environment and initial conditions at earlier stages that encourage, or facilitate, the formation of planets.

We began the week with a review talk in each research area (stars, disks, and planetary systems) to bring each participant up to speed on the background and challenges facing each research field. At the end of the first day, three groups were formed, one for each research area, to define the goals for the week and identify the most important open (cross-over) questions.

For the rest of the week, the morning sessions were filled with 7 more invited talks and 18 contributed talks, addressing: growth mechanisms from interstellar dust to planets and disk diversity (Tuesday), the stellar radiation field, the chemistry of molecular gas and the role of magnetospheric accretion models (Wednesday), abundances and age-dating of stars including the relationship between disk lifetimes and planet formation (Thursday), and finally, clues on the frequency of planets and their properties, rotation evolution of stars and planets, magnetic activities and how new instrumentation will help advance the field (Friday). All sessions were chaired by students to engage the participation of everyone and the afternoons were filled with break-out sessions in different topics. In the closing session on Friday, the open questions were revisited to highlight the afternoon group discussions

that took place throughout the week, generally lead by one or two discussion leaders, and the conclusions on future research directions to pursue.

Throughout the week the discussion was not limited to the main presentation room, but many participants could be seen collaborating in private offices outside the hours of the formal program. These participants were overheard discussing future collaborative work, proposing working visits, suggesting observing proposals, working on current collaborations, sharing data sets and expertise, and participating in the general enjoyment of the friendly atmosphere at the Lorentz Center. Fellow students were extremely enthusiastic at the opportunity to see how their research projects fit into the bigger picture of star and planet formation, as well as the opportunity to interact with well-known researchers in the field. We have heard from participants of how much they learned from the merging of these three different fields, and the importance of it to better understanding how stars and planets from and evolve. This, more than anything, tells us that the workshop was a success.

Many participants commented on the wonderful organization and facilities provided by the Lorentz Center and its staff, and for which the scientific organizing committee is extremely grateful. We would also like to thank the Lorentz Center, NOVA, and the Leiden Observatory for their financial support, including a fantastic mid-week workshop dinner and tour through the Kaag. We are also indebted to the EARA association for this opportunity and their support for young researchers in Europe.

Demerese Salter (Leiden, Netherlands)
Isa Oliveira (Leiden, Netherlands)
Michiel Hogerheijde (Leiden, Netherlands)
Ewine van Dishoeck (Leiden, Netherlands)

Active Beam Spectroscopy for Control of the Fusion Plasma

March 24 – 27, 2009

Over the past three decades the use of active neutral beams injected into a fusion relevant plasma has developed into a powerful diagnostic technique to obtain local values of the main ion features: ion temperature, rotation and ion density. Now a new era is entered with the development of the first net energy producing fusion reactor: ITER. In this device the diagnostic information forms the basis of several control loops for the plasma operation. Expertise, in the past provided by spectroscopists, should now be broadened towards engineers (for the control algorithms), atomic physicists (for the quantitative interpretation of the spectral measurement), plasma physicists (for the physics mechanisms involved) etc. Apart from that, still new applications of active beam spectroscopy in fusion devices are being assessed. The monitoring of the fast alpha particles produced in a fusion process is the newest challenge that has come into reach of the new diagnostic capabilities.

Since the opportunities for the gathering of those various disciplines are limited, it was the aim of this workshop to bring together these experts sharing an interest in the newest developments as well as in the application of the active beam spectroscopy for fusion devices. The workshop was a big success, not only in this aspect. Almost all invited persons accepted the invitation to participate. Moreover, with a total of about 55 scientist from all over the world, the participation was about twice as big as originally anticipated. This resulted not only in lively discussions during the presentations, but more importantly, provided an excellent opportunity to have in-depth discussions in smaller circles. The Lorentz center is perfectly equipped for this. Several collaborations were concretized during this week, leaving some measurable results behind.

Apart from the scientific aims, the workshop was partly intended as a tribute to Manfred von Hellermann, who retired immediately after the workshop. Numerous colleagues in the field who over the years collaborated with him took this opportunity to express their sincere respect to Manfred and his scientific achievements. As a results of this, the atmosphere during the workshop was very relaxed and pleasant, being a meeting between friends, where the old generation transferred part of their expertise to the new generation. In this respect it is important to note that about one third of the attendees where on a PhD or Postdoc level. This mix and combination of participants was regarded as essential for the success of the workshop. However, the most important reason for the success was undoubtedly the Lorentz center concept itself with its excellent facilities and extremely friendly and capable staff.

Roger Jaspers (Nieuwegein, Netherlands)
Wolfgang Biel (Jülich, Germany)

Solar Biofuels from Microorganisms

March 30 – April 3, 2009

The aim of the workshop was to assess the potential of the light-driven oxidation of water and the evolution of hydrogen and carbon based fuels by existing photosynthetic microorganisms for the development of a sustainable infrastructure for the efficient production of biofuels. Exploration and optimization of direct routes for the conversion of solar energy by photosynthesis can lead to the production of solar fuels with much higher efficiency than current practice. These third generation biofuels require a systematic elimination of losses coupled to optimization of downstream conversion into fuel in minimally redundant systems that are redesigned and optimized by a variety of systems biology and synthetic biology methods. In the workshop novel concepts for durable solar energy conversion of microorganisms to collect solar radiation, split water and convert atmospheric CO2 into environmentally clean fuels were discussed. A systems-based approach is required, ultimately achieving end-to-end integration of individual process steps.

In the workshop the challenges, the potential, and the roadmap towards sustainable biofuel production based on photosynthesis were discussed. Photosynthesizers like plants and bacteria are abundant in the biosphere and use solar energy to make oxygen from water and convert atmospheric CO2 into carbohydrates. The focus was on microorganisms, bacteria and algae, some of which can also produce hydrogen. Over the past decade remarkable progress has been achieved in understanding the basic mechanisms of photosynthesis from a structural and a mechanistic point of view. We are now at a stage that we can strive to understand and exploit the photosynthetic process at a higher level of complexity, that of membranes and the whole cell, in a direct relationship with biofuel production. To achieve this, a link between the photosynthetic community and new methods from genomics will be fruitful.

A next step will be to carry this to a higher level of scientific effort, where Europe is far behind the US and other parts of the world. The focus of this European science efforts needs to be in microorganisms, not biomass, and new species will be needed, metabolic control will be necessary, and the community will have to team up with electrochemists. The integration of the new technologies into the existing technological infrastructure will be essential. The organizers of the workshop will feed the outcome of the discussions into the Eurocores effort that is being developed for the ESF, to work towards a European research grid that contributes to the larger international effort, similar to the human genome project of the recent past. There is a need to bring in more people on the fuel side and to form a consortium while sharpening the aims and goals. The ESF could fulfil a strong role in the communication with member organizations in different countries, as Europe is lacking an organization like the DOE in the US. It will be important to have research projects that are application-oriented, not only science-oriented.

The workshop was connected to the Leiden University honours program and this connection worked very well. The concept allows to combine multidisciplinarity with scientific depth, and leads to community building. The students were smoothly taken up and were instructed not to try to understand everything, but do cherry picking for themselves. Students were able to passively understand most, if not all, of the lectures, while there was sufficient diversity for everyone to select an element for active participation in depth, in the form of writing a short research proposal, instead of doing an exam. This is an important observation, as the

honours program has been struggling to find a balance between multidisciplinarity and depth. Attempts to make all the lectures fully comprehensible for all students in a multidisciplinary setting have consistently resulted in superficiality, and this was strictly avoided in this workshop, which was held fully in line with the strong international discipline of the scientific community. The only difference was that the speakers were informed in advance that the honours students would be present and were asked to bring an educational dimension in their lecture. All speakers were also given ample time for their lecture, 1 hour, to make this possible.

The workshop was organized very well by the staff of the Lorentz Center, and the support of Corrie Kuster and Martje Kruk in organizing the workshop is gratefully acknowledged. Special thanks also goes to the scientific coordinator, Henriette Jensenius, for moderating the board in the proposition stage for this topic, which was not entirely without controversy.

T.J. Aartsma (Leiden, Netherlands)
H. van Amerongen (Wageningen, Netherlands)
K.J. Hellingwerf (Amsterdam, Netherlands)
R. Croce (Groningen, Netherlands)
R. van Grondelle (Amsterdam, Netherlands)
H.J.M. de Groot (Leiden, Netherlands)

Interactions in the Dark:
Physics of Dark Energy-Dark Matter Interactions

April 6 – 9, 2009

This workshop organized by the capable people at the Lorentz Center (and Gerda Filippo in particular) has been a resounding success. It was attended by about 45 participants, with a good mix of experts from Dutch institutes (Leiden, Utrecht, Groningen, UvA) and international speakers. With the help of Erik Deul, the talks were connected to video conference facilities in Beijing and Edinburgh for 3 hours each morning, allowing us to include a few remote audiences to offset a few last minute cancelations. Several Dutch experts helped to either chair the sessions (Leon Koopmans, Bob Sanders, Jan Smit, Ana Achucarro, Henk Hoekstra) or lead the discussions (Tomislav Prokopec, Jan Smit, Brendan Foster, HongSheng Zhao). We are particularly pleased by the fact that we managed to bring together a unique combination of three communities: theoretical physicists, observational astronomers and young simulation experts. As a result the interactions have been very dynamical, with well-attended daily discussions.
The structure of the meeting included about 6 talks in the morning, and discussions plus 2 talks in the afternoon. Among the outcome of the discussions, there was some consensus that 2010 should see further interactions in three areas:

1. Better (lensing) data which are less affected by baryon physics.
2. Further development of tools for testing interactive theories of Gravity and Matter (with an emphasis on numerical simulations).
3. Better integration of Dark Matter and Modified Gravity and Dark Energy.

The participants felt that a follow-up workshop would be desirable, because of the rather unique angle of the meeting. We feel that the interactions may lead to new research directions to optimally make use of the developments on the data and simulations sides. We discussed what the focus of such a meeting should be, and several ideas were circulated. The most popular idea was to focus on tests of gravity beyond the solar system (i.e., the Galaxy and beyond), thus moving a bit more to the observational/tools side of the meeting. This makes sense, as it became clear from some of the interactive sessions that there is no shortage of theoretical ideas, but it is much more difficult to put these to the test, due to the lack of appropriate tools. Many people from the outside were impressed with the facility and efficient organization of the Lorentz Center. The social events and the lunches ran very smoothly. Some other things that worked well are:

1. It is good to arrange the afternoon to start with a talk (to gather people from lunch), followed immediately by discussion, and the break for coffee and workgroups, and finish the day with a short talk.
2. It is a good idea to set aside a 1-hour session to accommodate about 10 short talks for people who brought posters.
3. The compactness of a four-day program is actually welcomed by some attendants.

These are among things to note for organizing future workshops. Also it might help if the chair could summarize the talk before opening the questions, and give more encouragements to the younger audiences to voice their questions.

H.S. Zhao (St Andrews, UK)
H. Hoekstra (Leiden, Netherlands)
B. Famaey (Bruxelles, Belgium)
B. Foster (Utrecht, Netherlands)

Counting Points on Varieties
Stieltjes Onderwijsweek

April 14 – 24, 2009

The workshop "Counting Points on Varieties" consisted of two parts.
The first week, April 14 - 17, was a so called Stieltjesweek, aimed at high-level masters students, graduate students, and beginning postdocs. There were three mini-courses: one on the Birch and Swinnerton-Dyer conjecture, another on Zeta functions, Laplacians, and étale cohomology, and a third on the Batyrev-Manin conjecture. Each morning there was a one-hour lecture on each of the three topics, while the participants worked on exercises during the afternoon, which they presented to each other, every day at 16.00.

Tim Dokchitser taught the course on the Birch and Swinnerton-Dyer conjecture, one of the famous one-million dollar millennium problems. It relates the rank of the Mordell-Weil group of an elliptic curve to the order of vanishing of its associated L-series. He focused mostly on the parity conjecture, which follows from the Birch and Swinnerton-Dyer conjecture. There is no reason to believe the parity conjecture is easier to prove, but it is more easily accessible, especially in a short course.

Ted Chinburg taught the course on Zeta functions, Laplacians, and étale cohomology. He presented a wide variety of related problems, including the question whether you can hear the shape of a drum.

Ronald van Luijk taught the course on the Batyrev--Manin conjecture, which predicts the asymptotic growth of the number of rational points of bounded height on certain varieties in terms of the bound.

The courses were well received by the students, who almost all (around 40) participated very actively in the exercises and the presentation of the solutions. Thursday night there was a well-attended dinner where all students from various countries (Netherlands, Germany, England, France, Switzerland, Tunesia, Turkey) were able to integrate
in a nonmathematical manner.

Based on the responses from the students, we consider the week a big success.

The second part, April 20 – 24, was a week-long research workshop. About 20 talks were given by experts in one of several fields, all related to the "counting points on varieties" theme. In total about 60 people attended the workshop, amongst them were many participants of the first, instructional week and other young mathematicians.

The speakers were very well aware of the broad nature of this workshop and consistently went through a lot of effort to communicate to the whole audience, and not just to those most familiar with their topic. Also this made it easier for the attending students to connect some of these talks with what they had learnt in the first week of the workshop.

With only four one-hour talks per day, the program was designed to allow ample space for informal discussion during the breaks. This opportunity was used intensively and it was not

uncommon to find mathematicians of the highest reputations (Stephen Lichtenbaum, Jean-Pierre Serre) discuss mathematics with young mathematicians during the breaks.

Almost everybody was present for the conference dinner which was held on Wednesday evening, on a boat making a tour of the Groene Hart.

The conference ended with two talks on Friday morning, given by the renowned mathematicians Carl Pomerance and Manjul Bhargava. These talks formed also the beginning of the day-long festivities organized for Hendrik Lenstra's sixtieth birthday. On top of the workshop participants, about 50 mathematicians mostly from the Netherlands came to Leiden to attend those talks.

T. Chinburg (Philadelphia, USA)
L. Taelman (Leiden, Netherlands)
R. van Luijk (Leiden, Netherlands)

Cambridge – Leiden:
easyMeeting on Quantum Matter

May 6 – 7, 2009

Quantum matter is the area within condensed matter physics in which quantum effects play a prominent role. Active research focuses on those phenomena that cannot be explained by the framework that was developed in the 20th century, in such sub-fields as high temperature superconductivity, quantum criticality, spin-orbital coupling effects, topological quantum phases, and ultra-cold atom systems.

The Cambridge-Leiden easyMeeting on Quantum Matter aimed to bring together the Dutch and British quantum matter scientists. This meeting was a follow-up to a similar meeting in November 2008 in Cambridge, and we intend to have such a meeting annually. There were 71 participants (nearly using the full capacity, 72, of the lecture room), an increase with respect to last year's meeting, which was attended by some 50 participants. The program consisted of 15 talks, followed by ample discussion time, which was appreciated very much by the participants and created an informal atmosphere in which further discussions during lunch and coffee breaks thrived. Even the (paper) tablecloths in the restaurant were covered with equations by Wednesday night. The program was very much balanced in terms of junior-senior speakers, theory-experiment, UK-NL and spread over the various institutions. Both established experts and talented young physicists presented an overview of their recent work.

During the meeting, a planning session was held to coordinate the next joint NL-UK Quantum Matter workshop. It was decided that the meeting is to be held in Oxford, in the spring of 2010.

We would like to acknowledge the Lorentz Center for its generous support, and in particular Martje Kruk and Auke Planjer for their efforts to make the workshop a success.

Bas Overbosch (Leiden, Netherlands)
Luuk Ament (Leiden, Netherlands)
Stephen Rowley (Cambridge, UK)
Jasper van Wezel (Cambridge, UK)

The Giant Branches

May 11 – 15, 2009

After central hydrogen burning almost every star inflates to giant dimensions and cools, becoming a Red Giant. In particular, stars of initial mass less than about 8 solar masses constitute two Giant Branches, the Red Giant Branch (RGB) and the Asymptotic Giant Branch (AGB), evolving with increasing brightness by many magnitudes at almost constant temperature. As these bright stars are both longer-lived and more numerous than the more massive stars, they are an important part of the stellar content of galaxies.
Besides this aspect, stars on the Giant Branches have complex interior structures resulting from the combination of many physical processes – from nucleosynthesis to internal mixing and mass loss. They therefore provide also stringent test cases for the theory of stellar evolution.
This workshop aimed at bringing together experts in the fields of stellar evolution and stellar populations, to exchange data, stimulate progress in the field and develop new ideas. We focussed the sessions on the following main topics:

1 Features of the colour-magnitude-diagrams and luminosity function, such as the RGB and AGB bumps and clumps, and the tip of the RGB, which can serve as distance or age indicators, when identified in a stellar population;
2 Nucleosynthesis, which along the AGB leads to the production of heavy elements through the neutron capture s-process and of intermediate mass elements such as carbon and oxygen through hydrostatic burning;
3 Mixing processes by convection, partially induced by thermal instabilities, both at the tip of the RGB and during the AGB, which lead to modification of the surface properties including effective temperatures;
4 Mass loss, which together with nucleosynthesis and mixing determines the contribution of stars on the Giant Branches to the chemical evolution of galaxies and the universe, and also determine the morphology of the Horizontal Branch phase in old stellar populations;
5 Surface properties (colours and temperatures), which are particularly important for age determinations of old galaxies; this includes the theory of extended stellar atmospheres.

About 45 participants from 14 countries have taken part in the workshop, that was structured with talks during the morning sessions, free time after lunch for work and interactions among the fellow participants, plus afternoon open discussions on specific themes. The Lorentz Center provides an ideal environment for this format, with meeting rooms and office space for participants. Its pleasant atmosphere stimulated intensive exchange between the participants working on the different aspects listed above.

Among the range of open problems and recent results reviewed during the week, we wish to mention the substantial progress in radiation/hydrodynamics models of stellar atmospheres, to address the long-standing issues of predicting stellar mass loss rates and temperature gradients in super adiabatic envelopes. These theoretical results are accompanied by impressive observational advances in techniques to unveil the structure of circumstellar envelopes around mass-losing giants.

One highlight of the workshop has been ”The Giant Challenge”. The rationale of the challenge is that - for well-defined specifications of the constitutional physics - stellar models are expected to agree at the per cent level or better with respect to global quantities, such

as luminosity and radius, and the interior structure. In the first part of the challenge several groups have submitted models of low-mass stars, from the pre-Main Sequence to the tip of the Red Giant Branch, computed with a specified set of input physics and initial chemical compositions. Comparisons of the results have shown some differences in the evolutionary lifetimes that have been reduced by further calculations carried on during the workshop. The second part of the challenge comprised a comparison of Red Giant Branch effective temperatures obtained from spectroscopy of large sample of stars in several globular clusters, with stellar libraries produced by various groups, each employing the preferred choice of input physics. Within the empirical error bars of the order of 100 K the various sets of models are all generally consistent with the data, apart from the more metal-poor clusters, where the theoretical effective temperatures appear too high. It is clear that more accurate temperature determinations (possibly with direct interferometric techniques) are needed to put stronger empirical constraints of the effective temperatures of Red Giant Branch stellar models.

Thanks to the excellent organization and facilities of the centre the workshop ran smoothly without any problem, and many participants expressed their appreciation for both the workshop and the facilities of the Lorentz Center, some of them showing interest in organizing their own workshop at the same venue.

We are very grateful for the financial and organizational support provided by the Lorentz Center. Special thanks are for Martje Kruk, Gerda Filippo and Corrie Kuster who on a daily basis have helped us and the participants in all necessities that emerged.

A. Weiss (Garching, Germany)
M. Salaris (Liverpool, UK)
M. Groenewegen (Brussels, Belgium)

Varying Fundamental Constants

May 18 – 20, 2009

Motivation & Aims

The deepest enigma of modern physics is whether or not there are any fundamental scalar fields in nature. Although there are widely accepted theories in particle physics and cosmology which rely on them, neither side has so far produced any direct and definitive evidence. On the other hand, Einstein gravity does not contain any scalar fields. This is a very remarkable fact, because almost any consistent gravitational theory that one can think of will have them.

Recent developments suggest that scalar fields are just as important in cosmology. Among other roles, they are the preferred explanation for the recently claimed variations of what have been considered fundamental constants of nature. Varying fundamental constants directly map the dynamics of the underlying cosmological scalar fields, and the large redshift lever arm afforded by a range of observational techniques in astrophysics and cosmology combined with local laboratory measurements can be used to optimally probe gravity on large and small scales, as well as providing crucial indirect clues on the presence of extra dimensions and ultimately string theory itself.

Varying fundamental constants are part of ESA and ESO science drivers for next generation of facilities, so closer interactions between theorists, observational astronomers, cosmologists and atomic physicists will be crucial for progress in the field. There are controversial claims of a 5-sigma detection of a smaller value of the fine-structure constant, and of a 3-sigma detection of a larger value of the electron-to-proton mass ratio, which are contradicted by analyses of other groups. Meanwhile laboratory measurements find null results, as do other astrophysical probes. Given the potential implications, it is important to shed light on this controversy. Confirmation of these variations would immediately imply a violation of the Einstein Equivalence Principle, signalling the breakdown of the concept of gravity as geometry and pointing to undiscovered gravitational physics.

We planned the workshop with the aim of bringing together representatives from the key groups working on this topic, to devise a strategy for a thorough inter-disciplinary study of varying constants, combining theoretical expectations and predictions, astrophysical observations (from the ground and space) and local experiments (mostly with atomic clocks, either in ground laboratories or in microgravity). A specific goal was the discussion of a proposal for a European research network on this topic.

The Workshop & Outcomes

There were a total of 46 registered participants, of which 20 were students or young post-docs. Given the goals of the meeting, we had a series of review talks in the mornings (10 in total – one of the scheduled reviewers cancelled at the last minute and it proved impossible to replace him), while the afternoons were split into tutorials for the junior participants and discussion sessions for the senior participants.

Broadly speaking, the first morning was devoted to particle physics and cosmology aspects, the second to astrophysical observations (the subject of the ongoing controversy) and the third to local laboratory measurements. The tutorials (each lasting a total of 3 hours) also addressed each of these three areas.

The review talks and tutorials have almost all been recorded, and the audio files are available on the workshop web-page together with pdf versions of the presentation slides. The quality of the recordings was very high and we would like to suggest to the Lorentz

Center staff to encourage others to do the same, since it provides a unique service to the rest of the academic community in The Netherlands and elsewhere.
The interaction between researchers and students coming from different areas was extremely fruitful, and was greatly aided by the friendly atmosphere of the Lorentz Center. The workshop allowed the participants to gain a deeper understanding of the key issues at the forefront of research in this emerging field, as well as of the strengths and weaknesses of the European community as a whole. This was crucial for the discussions of future European-wide activities.
The main outcome of the workshop was the decision to submit a proposal in reply to the ESF call for EUROCORES Research Themes. The organizational details were decided during the three days of the workshop, and a significant part of the proposal was also written there. This proposal has now been submitted, and we await its outcome in the fall.

Final Remarks

We are most grateful for the generous financial support of the Lorentz Center, and particularly for agreeing to host the workshop at fairly short notice. The fact that such an ideal venue is available and can organize things very quickly as an opportunity suddenly arises is one of the great strengths of the Lorentz Center. The workshop would not have been possible without the help, constructive suggestions and support of Henriette Jensenius, Martje Kruk and Corrie Kuster through the various stages of the organization. We look forward to new developments in this emerging field, and to discussing them again in the future at the Lorentz Center.

Carlos Martins (Porto, Portugal)
Jarle Brinchmann (Leiden, Netherlands)

The Chemical Enrichment of the Intergalactic Medium

May 25 – 29, 2009

From May 25 through May 29, 2009, 65 people from 11 countries participated in what turned out to be a very successful meeting at the Lorentz Center.
The chemical enrichment of the intergalactic medium (IGM), which contains most of the baryons in the universe, provides us with a fossil record of past star formation and a unique laboratory to study physical processes that are crucial for our understanding of galaxy formation and evolution. The pollution of the IGM with metals also has profound consequences for the formation of stars and galaxies through its effect on the radiative cooling rates.
Although substantial progress has been made in recent years, the enrichment of the IGM remains poorly understood. The distribution and relative abundances of intergalactic metals are still uncertain and it is unclear what the dominant enrichment mechanism is and how it varies with redshift and environment. Much observational and theoretical work remains to be done to fully exploit the potential of intergalactic metals as a tool to constrain models of galaxy formation and evolution.
The workshop "The chemical enrichment of the intergalactic medium" brought together researchers working on models and observations, on the intracluster/group medium and the diffuse IGM, on the low- and high-redshift IGM, and on galactic winds. There was a healthy balance between senior researchers, postdocs and PhD students.
The program consisted of 9 invited reviews, 9 invited targeted talks, 23 contributed talks, 9 plenary discussions, 18 posters, and ample time for people to work in small groups in their offices or in the one of the meeting rooms. There were two workshop dinners, one as part of a boat tour and one on the beach in Katwijk, as well as a wine & cheese party.
The workshop was successful in all respects. People were brought up to date, existing collaborations were expanded and new ones were formed. The mix of different backgrounds turned out to be very productive as it enabled the participants to get to know different communities working on related aspects of the same problems. The large amount of time scheduled for "self-organized work" was very much appreciated. It allowed people to sit down together for in depth discussions and brain storms. It also made it possible for collaborators who work at different institutes to work together and for new people to get involved.
The diverse and excellent facilities of the Lorentz Center, as well as the efficient and friendly help from Auke Planjer and Martje Kruk, greatly contributed to the success of this workshop.
The workshop also marked the end of a 4-year EU Marie Curie Excellence Grant that hosted a team of researchers working on the topic of the meeting at Leiden Observatory. A large part of the costs was funded through this grant, while the remainder was generously covered by the Lorentz Center.

Joop Schaye (Leiden, Netherlands)
Stefano Borgani (Trieste, Italy)
Xavier Prochaska (Santa Cruz, USA)
Micheal Shull (Boulder, CO, USA)
Charles Steidel (Pasadena, USA)

Experimental Design in Systems Biology
Data Analysis and Parameter Identification

June 2 – 5, 2009

One of the great challenges in systems biology is the coupling of mathematical models and experimental data. To construct a quantitative model one needs many steps in the iterative cycle "experiment → data → model → experiment". For each new model, parameters that cannot be measured should be estimated using available experimental data. In the first few stages the model will be crude and parameter estimation is in general not critical. These models have limited predictive value, but can still be used to guide new experiments. However, systems biology now enters the stage that data becomes abundant and models complicated and are expected to give realistic quantitative predictions.

To fit a mathematical model to experimental data and design new experiments e.g. to discriminate between rivalry models is in itself a series of mathematical and computational challenges: (i) a priori parameter identification – prove that the parameters of the model can be identified if there were continuous and error-free data available for the experimental observables, (ii) the actual optimization procedure to minimize a chosen measure or fitness function with global, local or hybrid search methods, (iii) a posteriori parameter identification - the statistical analysis of the obtained parameters corresponding to the minimum, (iv) optimal experimental design. The current methods in systems biology for steps (ii)-(iv) are based on the Maximum Likelihood Estimation, i.e. the observations have a joint probability density function, and on the assumptions that the observations are independent and that the data contain normally distributed errors. In this case the maximum likelihood solution is the least squares solution (i.e. the measure in (ii) is the least squares sum).

However, in practice the assumption of independent, normally distributed observations is often not valid. The data used to fit the models may be gene-expression data (cDNA, SAGE, Affy), proteomics data (MS based), metabolomics data (NMR or MS based) or spectroscopic data (UV, NIR, Raman). The instruments used to generate these data have their characteristics resulting in heteroscedastic and colored instrumental error. The sampling process also contributes in a nonhomogenous way to the error distribution.

The focus of this workshop was to develop a more general strategy for steps (ii)-(iv) that take into account the influence of the experimental heteroscedastic error structure, where possibly the PDF is not even available in a closed form, and certain requirements for the models like robustness. Topics discussed during the workshop were: (i) (design of) biological experiments, (ii) multivariate data analysis, (iii) parameter identification, (iv) model discrimination and experimental design.

The aim of this workshop was to bring together scientists working on the above subjects but with a different disciplinary background in statistics, biology, mathematics. The workshop thus provided a forum to interact and make progress in the integrative approach.

Workshop report
The workshop lasted 4 days, with a tutorial program on the first day and 3-4 talks on the other days leaving ample time for work sessions with informal discussions and collaborations.

On the first day there was a poster presentation and a wine-and-cheese reception and on the third day a very nice workshop dinner.

The work sessions were specifically used to integrate the several disciplines, e.g., experimentalists and modeling people. The tutorial program of the first day made sure that all researchers understand each others language.

There were 35 participants from 7 different countries. Also the disciplines were quite diverse: biology, chemistry, mathematics, bioinformatics, statistics, computer science. The atmosphere was stimulating and relaxed. Especially, there was enthusiasm for the combination of scientists from different communities. New collaborations have started due to bringing together these people.

Acknowledgements
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Joke Blom (Amsterdam, Netherlands)
Age Smilde (Amsterdam, Netherlands)

Géométrie Algébrique en Liberté XVII

June 8 – 12, 2009

The GAeL conferences are a series of annual meetings of young researchers in algebraic geometry. Their objective is not only to introduce participants to subjects that are likely to be of relevance in the forthcoming years, but also to allow them to participate actively in scientific communication at an early stage of their career. This is fostered by the selection of participants who are PhD students or early-career postdoctoral fellows, and the inclusion of numerous junior talks. These short talks are of a non-technical nature and usually focus on explaining the approach to the problems that the participants are currently investigating. At the end of the meeting, participants choose from among themselves a board of organisers for the next year which reflects the name:

GAeL - Géométrie Algébrique en Liberté

We believe that this concept for a school is very well adapted to research, specifically in algebraic geometry where the threshold for developing independent research projects is particularly high and complete results are only achieved at the end of a thesis project.

The annual character of the meetings contributes to the network spirit of GAeL. The establishment of these networks at an early stage contributes to output in the highly specialized field of algebraic geometry. In addition the provision of international contacts is invaluable to students who aim to join algebraic geometry's workforce at the end of their PhD studies.

This year's edition, the 17th, gathered 42 junior participants (including organisers), from a wide range of European and American countries. In addition, three senior participants took part in the conference, namely Gavril Farkas, Stefan Müller-Stach and Frank Sottile. They gave three independent introductory lectures on the topics "Intersection theory on moduli spaces," "Higgs bundles and families of special varieties," and "Real solutions to equations from geometry". However the emphasis was on talks of young participants, 19 in total. These covered a wide variety of topics in algebraic geometry. Most of the junior speakers followed the organisers' request to give introductory talks without too many technical details. This fact, along with the ample time for free interaction, contributed to many enthusiastic discussions during and after the talks.

This year's GAeL was sponsored by the Lorentz Center, Foundation Compositio Mathematica, the Thomas Stieltjes Institute, the Mathematical Research Institute, and the Cluster Geometry and Quantum Theory (GQT) institute.

S. Erdogan (Ankara, Turkey)
A. López (Zurich, Switzerland)
M. Melo (Rome, Italy)
K. Taipale (Saint Paul, USA)
I. Utku Turkmen (Ankara, Turkey)
F. Viviani (Berlin, Germany)
T. Wouters (Leuven, Belgium)

Monodromy and Geometric Phases in Classical and Quantum Mechanics

June 15 – 19, 2009

Monodromy and geometric phases of classical and quantum mechanical systems are two phenomena which attract the interest of a broad and diverse range of researchers in mathematics, physics and chemistry. During the last few years this has resulted into some significant developments which concern both theoretical and experimental aspects of the two phenomena. The understanding and study of both subjects require similar mathematical notions and methods. This workshop has been the first attempt to bring together people from the monodromy and geometric phase research communities and to foster their interaction.

The aims of the workshop were:
- Communicate recent advances in the fields of monodromy and geometric phases.
- Bridge the gap between the monodromy and geometric phase communities to exchange ideas and techniques.
- Establish collaborations between researchers in the fields of monodromy and geometric phases and encourage researchers from one field to work on problems of the other.
- Bring together mathematicians and application oriented researchers to inspire further research in both directions.
- Stimulate research towards a better mathematical understanding of generalized monodromy and propose experiments in which monodromy can be directly observed in classical mechanics.

We attempted to achieve the aims of the workshop through a combination of keynote and research talks, plenty of free time for informal discussions, and also a more formal discussion session.

The purpose of keynote talks was to assist in bridging the gap between the two communities. Keynote talks on monodromy were given by Richard Cushman, Hans Duistermaat, and Boris Zhilinskii, while keynote talks on geometric phases were given by Joseph Avron and John Hannay. Furthermore, 18 research talks covered many aspects at the forefront of research in both monodromy and geometric phases. Most talks were perceived very well and raised interesting discussions. The slides for several talks are available as PDF files from the Lorentz Center website for the workshop. The structure of the programme left plenty of time for informal discussions between the participants and the participants made ample use of this possibility.

In terms of concrete results, several participants agreed to contribute to a book about the subjects covered in the workshop. The head editor for this book is Henk Broer. The workshop was attended by 31 participants, among whom 4 PhD students.
Several of the participants expressed personally to the organizers their satisfaction with the organization of such a workshop, and the quality of the services offered by the Lorentz Center.

We thank the Lorentz Center, the KNAW, the NWO, and the Dutch national mathematics clusters NDNS+ and GQT, for their financial support. Finally, we thank the organization of

the Lorentz Center and in particular the Executive Manager of the Lorentz Center Ms Martje Kruk and the Program Assistant Ms Gerda Filippo for their kind and efficient help throughout the workshop and its preparation.

K. Efstathiou (Groningen, Netherlands)
J. Robbins (Bristol, UK)
D. Sadovskii (Dunkerque, France)
H. Waalkens (Groningen, Netherlands)

Brain Waves

June 22 – 26, 2009

The brain consists of approximately one hundred thousand million neurons, each of them connecting to approximately ten thousand other neurons. They receive and transmit electro-physical pulses (action potentials) that either excite or inhibit other cells, depending on the neurotransmitter that is used for transmission. The connectivity in the network that they form changes over time, depending on the past activity, which is thought to be crucial for learning and memory.

Physics of the brain starts at the single cell level. At this level the dynamics is nonlinear as ion channels responsible for the rate of change of the voltage across the membrane depend nonlinearly on the voltage across the cell membrane. Large ensembles of cells may be active rhythmically, as measured by fMRI, MEG or EEG. The brain rhythms emerge from the functional connectivity between cells in the network and external inputs to these cells. Brain rhythms, including their synchronization and desynchronization, form an important and possibly fundamental part of the orchestration of perception, movement and conscious experience. Synchronization and desynchronization of multicellular domains represent transitions, which are potentially fundamental for proper functioning of the brain. In various neurological disorders, these processes are disturbed, resulting in e.g. epilepsy, Parkinson's disease or movement disorders.

This, in a nutshell, has been the playground for mathematicians, physicists and neurophysiologists at the Lorentz Center during the Brain Wave workshop. On a daily basis there were more than 45 participants. Over the whole week there were 65 participants. About 50 of them were from the Netherlands, 50so different fields. Special days have been devoted to the mathematics and physics of neuronal networks that are thought to be responsible for epilepsy and Parkinson's disease. These sessions attracted more than average attention. Round tables took place to discuss recent developments in neuroscience. Several new ideas and views for further research came up:

- Terman and Rubin presented their work on modelling the neuronal substrate of Parkinson's disease and in particular the effect of deep-brain stimulation to relieve the symptoms of Parkinson's disease.
- In the past there was the question whether rhythmic activity (in particular gamma-activity) was the result of intrinsic properties of the inhibitory network (ING-model) or whether the gamma activity arises due to the external input to the excitatory cells, which are coupled to the inhibitory cells (PING). Presumably, the solution is that both mechanisms are responsible and that the ING and PING are compatible with the top-down and bottom-up contributions, respectively, to generate the gamma rhythm.
- The role of Ca_{2+} induced Ca_{2+} release in the mitochondrial network is relevant. Ca_{2+} handling is an important element in the pathology of diseases such as diabetes, neurodegeneration and Parkinson's disease.
- The channel-rhodopsin technique to manipulate specific cell types might be a good tool to study rhythmic activity as it allows onset and/or offset of particular cells in the neuronal network architecture. It has been decided at the conference to work this point out and to incorporate it in a FOM grant proposal.

The atmosphere at the workshop was more than enthusiastic. The boat trip was a great success, not only because of the beautiful weather, but also due to the mutual friendly behaviour of the participants. The contribution of the staff of the Lorentz center is invaluable. The constant smile of Auke Planjer is a joy for everybody. We are grateful for the support of the Lorentz Center and for our sponsors: BMTI (UT), Donders Institute (RUN), NDNS+ and MRI.

C. Gielen (Nijmegen, Netherlands)
S. van Gils (Enschede, Netherlands)
M. van Putten (Enschede, Netherlands)
D. Terman (Columbus, USA)

En Route to Jupiter and Saturn

June 29 – July 3, 2009

Goals of the workshop
After successful missions to Titan, Mars, and Venus, the European Space Agency (ESA) has plans to embark on another planetary mission. Following ESA's Cosmic Vision call for plans for space missions to be launched in the 2015-2020 timeframe, planetary scientists in Europe and elsewhere collaborated on writing several mission proposals. In close collaboration with NASA, ESA selected from these proposals two large missions that it thought to be interesting: one to Jupiter and two of the Galilean moons, and the other to Saturn and its largest moon, Titan. In the spring of 2009, ESA and NASA announced that the Jupiter mission, now called the Europa-Jupiter-System-Mission (EJSM), had their priority, and that the Saturn mission, the Titan-Saturn-System-Mission (TSSM), might be launched later.

In this workshop, we brought together scientists from both missions to identify and discuss the missions' science cases and instruments. The focus of the workshop was EJSM, because this mission has been prioritized and will likely play a major role in planetary sciences for decades to come. Fostering collaborations between planetary scientists from the different missions (note that some scientists were involved in both missions) is not only important for improving the scientific output of the mission, but is also essential for the next phase of ESA's selection procedure: EJSM still has to be approved for launch.

Workshop participants
Besides planetary scientists from several European countries, we also invited Dutch scientists that are currently working in the field of Earth Sciences, in order to stimulate their interest in the growing field of Planetary Sciences in the Netherlands and to improve the exchange of knowledge between the two fields. Furthermore, students that take courses on Planetary Sciences in the Netherlands were encouraged to attend the workshop, in order to increase their enthusiasm for the field by confronting them with outstanding scientific questions and with the several technical issues surrounding the development of planetary missions.

Description of the missions to Jupiter and Saturn
The Europa-Jupiter-System-Mission will consist of two spacecrafts that will each start their exploration of the Jovian system (after arriving around 2026) by orbiting the gas giant Jupiter for several months. Then, NASA's Jupiter-Europa Orbiter (JEO) will get into orbit around the moon Europa, while ESA's Jupiter-Ganymede orbiter (JGO) will start orbiting the moon Ganymede. The mission's science objectives for Jupiter itself are to study the composition, structure, chemistry, and dynamics of the planetary atmosphere, and the structure of the planet's huge magnetic field and associated intense radiation field. The scientific interest in Europa is mainly driven by the layer of water ice that completely covers this large moon. There are indications of an ocean of liquid water below this ice layer, and astrobiologists have argued that this ocean might harbor life. Ganymede, a moon that is larger than our own moon, is the only moon with a magnetosphere, which hints at the presence of subsurface liquid layers, and has striking surface features that could be caused by tectonic activity.

The Titan-Saturn-System-Mission would consist of a spacecraft to orbit Saturn, and a montgolfiere (a hot air balloon), that would float for months through the thick atmosphere of the moon Titan. The scientific objectives of the Saturn orbiter would be to study the

atmospheric composition, structure, chemistry, and dynamics. From the instrumentation tethered to the balloon, the composition, structure, chemistry, and dynamics of Titan's atmosphere would be studied and they would offer the opportunity to observe and map the moon's surface, which is hidden from observers on Earth and in space by a thick, photochemical smog.

Workshop program
Because of the broad scientific objectives of the Jupiter and Saturn missions, the workshop program covered various topics, spread over the week:
- A scientific overview of the Jupiter and Saturn-missions
- An overview of the instruments proposed for the missions
- The atmospheres of Jupiter, Saturn, and Titan
- The internal structures of Jupiter's moons Europa, Ganymede, Io, and Callisto
- Properties of planetary ices
- Astrobiological prospects of Europa
- Surface features of Jupiter's moons

The last day was spent on summarizing the results from the workshop, on discussing the open scientific issues for the Europa-Jupiter-System-Mission and the Titan-Saturn-System-Mission.

Concluding remarks
Few of the international participants had known about the Lorentz Center before the workshop. They as well as the other participants were very enthusiastic about the available facilities and the excellent assistance of the Lorentz Center staff. The atmosphere at the workshop was very relaxed and fruitful.

Acknowledgements
The organizers are very grateful to the Lorentz Center staff that supported the workshop, to the financial sponsors of the Lorentz Center, and to TNO, DutchSpace, NSO, and SRON Netherlands Institute for Space Studies for the additional financial support.

Wim van Westrenen (Amsterdam, Netherlands)
Gareth Davies (Amsterdam, Netherlands)
Tanja Zegers (Noordwijk, Netherlands)
Bert Vermeersen (Delft, Netherlands)
Daphne Stam (Delft, Netherlands)

Statistical Mechanics of Static Granular Media

July 6 – 10, 2009

Scientific background

The large number of particles in granular systems makes a statistical treatment very tempting. Classical statistical mechanics is based on the existence of a distribution that is left invariant by the dynamics (e.g., the microcanonical ensemble), and then assume that this distribution will be reached by the system, under suitable conditions of "ergodicity." Unfortunately, because energy of granular systems is lost through internal friction and through dissipative collisions, and eventually gained by a nonthermal forcing such as tapping or shearing, the dynamical equations do not leave the microcanonical or any other known ensemble invariant. Can one construct another statistical theory for compact, slowly moving powders and grains?

Almost 20 years ago, Edwards and co-workers proposed a possible step in this direction, raising the fascinating perspective that such systems have a statistical mechanics of their own, different from that of Maxwell, Boltzmann, and Gibbs, allowing us to have some information while still neglecting dynamic details. The focus of the theory is on granular systems in static (jammed) configurations. The original theory and its following developments have introduced "thermodynamic" parameters, such as compactivity and angoricity, which play the same role that usual thermodynamic parameters such as temperature and pressure play in classical statistical mechanics.

The aim of this workshop was to explore the prospects and boundaries of a statistical mechanics approach to granular media in the spirit first laid down by Edwards and co-workers in their seminal papers from 1989. This was also a unique occasion to celebrate the 20th birthday of this pioneer work.

Highlights of the workshop

The workshop had a high attendance. There were 59 registered participants, and most of them were present the whole week. Nearly all the prominent scientists in the field had agreed to participate, with a surprising low number of cancellations – in the end only 1 invited speaker could not come, which is a good measure of the perceived importance of the workshop in the community.

During the workshop, talks and discussions have been organized around four themes:

- Force space
- Configurational space
- Exploring the phase space, ergodicity
- What physics do granular temperatures describe?

The level and intensity of scientific discussion was extremely high while remaining very collegial and accessible to PhD students and Postdocs. This was made possible by the presence of world-leading experts in all the fields covered by the workshop, some well known for their clarity and deepness of thoughts.

Following a format common in the economic community, and experimented with success last year by the "Dynamical heterogeneities in glasses, colloids and granular media" workshop (Lorentz Center, Leiden, NL, August 25 – September 5, 2009), the workshop has been organized with long talks (40 min), followed by a commentary of a "discussant" (20 min) and by an open discussion (20 min). The goal of the discussant was that of putting the previous talk in a general perspective, commenting on relations with other works, open questions, weak points. We selected the speaker-discussant combinations well before the beginning of

the workshop, and asked each speaker to provide relevant papers and a preliminary presentation to his discussant.
This format most frequently led to rich discussions and animated debates, lasting the whole allocated time. It was indubitably a success. The format could be possibly improved by reducing to 35 min the length of the invited talks. Particular care should be taken when selecting the speaker-discussant combinations, in order to promote an interesting discussion and not one which is too technical.
All the participants had the possibility to present their ideas and results during two poster sessions and a poster announcement session. Following requests from most of the audience, we also organized two unplanned topical seminars, one led by Prof. H. Makse, and one led by Prof. B. Chakraborty.

Outcome
Among the outcomes of the workshop, there is the identification of emerging areas of investigation. Among others, we mention the following:

1) The density of state of granular packing: from very loose packings to the ideal glass. Particular attention has been given to the theoretical/experimental measure of the "granular entropy". How it is possible to determine the number of jammed states at any given value of the density? What is the relation between the granular entropy and special values of the density such as random loose and random close packings?
2) What can we learn and measure from fluctuations?
   The relation between the fluctuations (mostly volume fluctuations) and thermodynamic parameters introduced in the statistical mechanics of granular system has been discussed. Particularly, the measure of the fluctuations could provide a way to understand whether there is a kind of zeroth law of the thermodynamics for granular systems.
3) Characterisation of the structure: towards the determination of the volume function.
   The determination of the volume function emerged as debated and open question in the development of the statistical mechanics of powders. At the hearth of this problem there the fundamental issue of the identification of the degree of freedom of the system. Possibilities include degrees of freedom determined geometrically, such as Voronoi cells, or relying on the structure and intensity of the contact forces between grains. A important open question regards the real independence of the proposed degrees of freedom.

The organizers also plan to organize another workshop on the same subject in 2011 or 2012. Overall, the workshop surely stimulated new ideas and collaborations among the participants, especially among the younger ones.

Acknowledgements
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Massimo Pica Ciamarra (Napoli, Italy)
Patrick Richard (Rennes, France)
Matthias Schröter (Goettingen, Germany)
Brian Tighe (Leiden, Netherlands)

Distribution of Mass in the Milky Way Galaxy

July 13 – 17, 2009

This workshop organized by the capable people at the Lorentz Center (and Auke Planjer in particular) has been a sounding success. It was attended by about 50 participants, with a good mix of experts from Dutch institutes (Leiden, Groningen) and international speakers. We are pleased that we managed to bring together a good combination of junior and senior astronomers, theorists and observers to update us on the latest developments on the Milky Way. We also had a good mix of talks and posters. Many felt that the workshop helps them to build new collaborations.

Many people from the outside were impressed with the facility and efficient organization of the Lorentz Center. The social events and the lunches ran very smoothly. It is good to arrange the afternoon to start with a talk (to gather people from lunch), and finish the day with a short talk. Among things to note for organizing future workshops, it might help to motivate the program by spending an extra 10 minutes in the beginning to open the talks, and reserve a slot for a summary talk at the end.

Anatoly Klypin (New Mexico, USA)
HongSheng Zhao (St Andrews, UK)
Antony Brown (Leiden, Netherlands)

with the help of
James Binney (Oxford, Netherlands)
Leo Blitz (Berkeley, USA)

Optimizing Drug Design

July 20 – 23, 2009

The workshop 'Optimizing Drug Design' was focused on how novel multi-criteria optimization and decision making algorithms can be applied and adapted to the field of *de novo* drug discovery. This emerging field of research in cheminformatics holds high promises for the future as it will allow the chemical expert to perform a more focused search in the vast search space of possible chemical compounds. Moreover the integration of models, data, and semi-automatic search techniques may allow the expert to come up with new ideas for molecule designs.

The workshop brought together about 40 experts from more than ten different countries, working in academia or industry on optimization algorithms, cheminformatics and medicinal chemistry. It was one of the main intentions of the workshop to establish contacts and exchange between the experts from computer science and chemistry; on the one hand to improve the understanding of the drug design field by the computer scientists, and on the other hand for the medicinal chemists and cheminformaticians to learn about the state-of-the art approaches and recent trends in the field of optimization techniques. The response from the participants of the workshop indicated that this exchange was really fruitful and needed, and many new contacts were established. From this point of view the workshop was a big success.

Each day of the workshop was devoted to a general theme; starting with presentations on that particular topic and ending with a discussion session:
The purpose of the first day was to provide an overview of the field: A general discussion of the tools that are already available, their benefits and shortcomings and directions for future developments. The event started with a keynote presentation by C. Nicolaou, one of the pioneers in applying multicriteria evolutionary optimization in the domain of drug design. The subsequent presentation on the state of the art De Novo Design techniques in drug discovery by N. Brown set the scene for the subsequent interactive session: In a card-game the participants had to comment on their view of state-of-the-art, problems, goals, and promising approaches in optimizing drug design. The notes were collected on sheets of different colors and collected on a pinboard, so that each of the participants could form a picture on the current opinion in drug design. Talks by J. Holliday and P. Bonnet rounded up the first day with a discussion of novel techniques in virtual screening and conformational search.

The second day was focused on the topic of dealing with uncertainty in the models and in the goal formulations. The keynote presentation of C. Poloni and D. Di Stefano provided insights gained in studies on robust optimization achieved in collaboration between design optimization experts and the pharmaceutical industry. Later on, in the presentations on diversity based search and desirability indexes as well as the discussion of novel robust multicriteria optimization algorithms, the state of the art of uncertainty handling in algorithms was discussed. Among others presentations were given by E. Zitzler and H. Trautmann, two leading experts in multicriteria algorithm design. The design of algorithmic approaches to deals with various types of uncertainties were discussed in four subgroups, and the results were subsequently presented and discussed plenary. One of the results was that often synergies between the different approaches can be exploited, i.e. by combining desirability functions with robust hypervolume-based optimization. Moreover the point of

view of chemists on constraints such as the Lipinsky rule of 5 was discussed and further clarified.

The third day focused on the topic of 'the role of the expert'. The interaction between the computer and the human expert is of major importance in the knowledge intensive domain of drug design, where a fully automated search is deemed to fail. After two presentations by A. Goldblum and O. Shir presenting new algorithmic ideas, the keynotes by I.C. Parmee and M. Seagull both emphasized on interactive search and they presented techniques on how to design human-centric design workflows for exploring chemical space. As on the previous day, an interactive session invited the participants to discuss this topic in subgroups and present the results in a summary session then. It was one of the results that optimization is often used as a learning tool, which requires additional features in the algorithmic design, such as explaining why a solution performs well or was rejected by an algorithm. Moreover, there were interesting ideas about how to exploit the knowledge on possible chemical reactions in order to design more realistic transformations in search.

Besides the topic oriented discussion, the software demo and poster session was a highlight of the third day. The day was rounded up by a boat-cruise with dinner on the Kaag lakes north of Leiden, along meadows, boathouses, and windmills.

On the final day of the workshop, case studies for drug discovery, in which experts used existing tools to search for drugs on specific targets were in the center of interest. The talks held by PhD students in the field gave interesting insights on how the existing tools perform in practice and how they can be further improved. The summary discussion took a second look at some of the research problems stated on the first day in the light of the results of the results of the workshop. It was a consensus among most of the participants that by discussing these issues in a interdisciplinary and very focused forum brought the field one step further to the solution of these problems and made the participants more aware of what the real important questions are. For the future also the many new established contacts will help to achieve future progress.

Presentations and abstracts of the participants, as well as the summary slides of the discussions are now available online for those who want to recapitulate the results. The scientific organizers want to express their gratitude to Corrie Kuster and Martje Kruk from the Lorentz Center, for their assistance in making the workshop a great event. Also we express our gratitude to the people working in the Pharma-IT platform for their assistance and contributions. Last but not least, we acknowledge the financial support of TI Pharma and the Lorentz Center.

Michael Emmerich (Leiden, Netherlands)
Andreas Bender (Leiden, Netherlands)

Giant Fluctuations in Population Dynamics

August 3 - 7, 2009

The workshop "Giant Fluctuations in Population Dynamics" was devoted to stochastic phenomena in population and evolutionary dynamics. Among objectives of the workshop were a critical comparison of different theoretical methods and perspectives and bridging gaps between different communities of physics, mathematics and biology.

The workshop was attended by 34 scientists from 8 countries, with an approximately even mixture of senior and junior participants. The talks were delivered by senior scientists and a select number of junior scientists. Nearly all workshop participants contributed in one way or another with nearly all the junior scientists presenting a ten-minute contributed talk and a poster.

The talks were largely well prepared, well delivered, and well attended, as evident from the active and enthusiastic nature of the questions and follow-up discussions, from the fact that attendance remained almost constant until the very last talk, and from the fact that nobody brought his/her laptop to the conference room....

The topic areas in this workshop were focused and included evolution processes, population spread, infection, diffusion, swarming and flocking. Several themes emerged as central. The role of traveling fronts in evolutionary processes was introduced via a more mathematical approach by Baake and further discussed in the talks of Hallatschek, Kessler, Krug and Levine. The role of finite population size and stochastic fluctuations was introduced from a physics perspective by McKane and was further discussed by Ben-Naim, Doering and Waddell. Dykman, Meerson and Schwartz discussed different aspects of giant fluctuations as described by instanton-like trajectories.

Overall, the workshop succeeded in highlighting the state of the art in the field in terms of theoretical techniques and numerical methods. Much more work needs to be done, however, for the concepts and results discussed in this workshops to be incorporated into the methodologies of theoretical and observational biology, and to be appreciated by the wider scientific community.

In our assessment, this workshop helped further define the field of stochastic population/evolution dynamics and shape the course of future research in this field. As this sentiment was expressed by several participants, we expect that a sequel workshop would be held in the near future.

There are a number of new collaborations that appear to have been generated by this meeting: between scientists who worked together previously, between scientists who have met here for the first time, between senior and junior scientists, etc. In our perspective, this is one of the very positive outcomes of the workshop.

E. Ben-Naim (Los Alamos, NM, USA)
B. Meerson (Jerusalem, Israel)

New Computational Methods in Quantum Many-Body Theory

August 10 – 14, 2009

Scientific Background

The last few years have seen extraordinary advances in the numerical solution of the equations of interacting particle quantum mechanics. In particular, new developments in continuous-time Quantum Monte Carlo (CT-QMC) and density matrix renormalization group (DMRG) methods have made it possible to obtain comprehensive, numerically exact solutions to some of the basic model systems of quantum condensed matter physics. These successes have revolutionized quantum many-body physics, opening a broad spectrum of problems including simulations of magnetic nanosystems on metallic surfaces, the Mott transition in multiorbital systems and the Hubbard-Holstein problem and these successes can be combined with traditional electronic structure methods to study previously inaccessible compounds such as plutonium, heavy-fermion systems, strongly correlated thermoelectric compounds and novel high-temperature superconducting pnictides as well as to the fundamental question of the nonequilibrium properties of nanosystems and solids.

Workshop

These successes make it highly desirable and timely to gather together the inventors and practitioners of the new techniques, to consolidate the success, identify the open problems and formulate the next steps in the field. Equally important is to involve experimentalists (to identify the important open physics problems which the theoretical community could tackle) and practitioners of other areas of electronic structure and many-body physics, for cross-fertilization of ideas and a wider perspective on the theoretical issues. The Lorentz Center workshop " New Methods in Quantum Many-Body Theory" was held in response to this need. It featured 41 scientists who gathered for a program of 3 seminars per day—one by an experimentalist and two by theorists. We also had two formal discussion sessions as well as many lively discussions inside and outside of the seminar room.

The participating scientists were a mix of "numerical correlated electron" specialists who have devised and are now using the new techniques, theorists from the wider field of electronic structure and quantum chemistry, and experimentalists. Talks presented recent achievements made possible by the new methods and led to discussions which clarified the relative strengths of the different methods. A crucial issue for the field is that the new developments pertain mainly to the solution of model systems; some of the talks indicated methods for moving beyond model systems towards a quantitative description of real materials

The interactions between people coming from different fields were very useful. Thus, one success of the workshop was the approximately one talk per day from theorists outside of the correlated electrons community. These talks provided valuable insights into the broader classes of problems that should be addressed with the new methods. Another highlight was a discussion session in which the participating experimentalists formulated a list of important frontier physics issues that were raised by new generations of measurements and that could be addressed by the new techniques. This list will be the basis of a range of planned new work. While there was a large amount of extremely interesting material to present and the lectures were of high quality, in retrospect we feel that a slightly less heavy program would have been even more beneficial, allowing the participants more time to interact informally.

Mikhail Katsnelson (Nijmegen, Netherlands)
Alexander Lichtenstein (Hamburg, Hamburg)
Andrew Millis (New York, NY, USA)

Flow of Foams

August 17 – 21, 2009

This workshop concerned the Flow of Foams, and brought together experimentalists, theorists and numerical experts working on foams and related disordered media. The format of the workshop was heavily aimed towards discussions. Each day, a single 45 minute overview talk was followed by a 15 minute commentary and a 15-20 minute open discussion. The five overview talks concerned:

- Plasticity and Copological Changes
- Micromechanical Constitutive Equations
- Surface Effects and Rheology
- Shear Banding
- Dynamics of Yield Stress Fluids

In all cases, the format of main presenter and discussant led to lively discussions, both in public but often extending into the coffee breaks.

From 12.00 – 12.30 hours we had reserved a slot for hot topics, where several 10 minute presentations where held, and twice we had a slot from 16.00 – 17.00 hours with four invited brief talks each. Apart from this, subjects for one hour public discussion sessions where spontaneously organized by the participants --- sometimes even two sessions in parallel. These led to very lively discussions, and the organizers and participants felt the open format to be working very well.

Important new issues that were discussed during the workshop include the role of attraction between bubbles - possibly caused by film drainage - for causing shear banding, the role of disorder and surfactant in setting the foam rheology, new theoretical ideas concerning jamming and the role of fluctuations and non-local rheology.

At the end of the meeting, a public discussion/brain storm session was held, where in particular the role of fluctuations in slow foams flows, and the connection between the microscopic bubble interaction and macroscopic rheology where singled out as important issues for further work.

Moreover, there was a perceived need for more sharing of the (large) data sets obtained either by tracking of the bubble motion in experiments, or by numerical simulations. In short, the present situation is characterized by individual groups doing their preferred analysis on their own data. In order to grow to a situation with more cross fertilization, various people indicated to be willing to share their tracking data sets. Rut Besseling (Edinburgh) and Martin van Hecke (Leiden) will explore the possibilities of setting up a blog to make such data exchange possible.

Simon Cox (Aberystwyth, UK)
Benjamin Dollet (Rennes, France)
Martin van Hecke (Leiden, Netherlands)

Universe in a Box:
LHC, Cosmology and Lattice Field Theory

August 24 -28, 2009

Motivation
The main goal of the meeting was to identify the most promising among several emerging avenues of research in the broad field of numerical simulations of field theory. Numerical simulations of field theories are now in a very mature stage. Not only it is possible to explore many aspects of the standard model of particle physics. Also applications beyond the standard model are becoming feasible. In pursuing these not yet standard applications it is particularly important to work in close connection with phenomenologists and experimentalists. And, at the same time, to discuss with computer scientists the computational needs and opportunities.

Attendance
The meeting had 39 registered participants, most of them present for the entire period. The attendance was very well balanced between phenomenologists and lattice theorists. Concerning the specific field of applications, most represented were Technicolor-like theories. We had a broad geographic distribution, with a significant local attendance.

Format
The initial plan of the organisers was to have a restricted number of talks including some reviews. When the number of talks grew above 30, due to a positive response which went beyond our expectations, the organisers decided to accommodate all the talks, asking some of the speakers to include a short pedagogical introduction. This still left room for two main reviews on computational physics, and on dark matter.
We opted for a very short question and answer session at the end of each talk, and for longer discussion sessions (one or two each day) in the conference room. This worked very well with animated discussions, and proposals for new studies.

Outcome
The original invitation was broad range, and extended to colleagues working in many subjects ranging from quantum gravity to supersymmetry, either numerically or analytically. The number and the quality of the contributions and the content of the discussions clearly selected Technicolor and Technicolor-like models as the most promising avenue of research. We can certainly conclude that our primary goal - to identify most relevant developments - has been reached.
In addition to this, other outcomes are initiated discussions on a new European network, planned medium term visits among the participants and/or attendance to similar meetings, and exchange of raw data between different group, leading to comparative analysis on similar data sets. While this might or might not lead to joint publications, it will certainly greatly help resolving a few controversial aspects.
We can conclude that we have reached our main goal, together with other interesting developments.

Elisabetta Pallante (Groningen, Netherlands)
Maria Paola Lombardo (Frascati,ITaly)
Francesco Sannino (Odense, Denmark)

Context, Causes and Consequences of Conflict

August 31 – September 4, 2009

Aim of the Workshop
Social conflict is rooted in genetic and physiological capacities which are modulated by environmental factors from the prenatal period into adulthood. The aim of the 4C workshop was to instigate and document an interdisciplinary discussion on factors that cause, aggravate or alleviate social conflict and its consequences.

Cross-talk on Conflict
Violent conflicts inflict an awesome burden on victims and society. After conflict, victims, perpetrators, bystanders and society in general, need to cope with its consequences. It is increasingly clear that conflict should be conceptualized within the wider social context that produces it. Many different disciplines advanced our understanding of conflict, but limited interdisciplinary exchange impedes progress on this subject.

Coping with Conflict
All social species have an interest in preserving social structure. Human survival in particular requires elaborate social cooperation, especially after serious conflict. Mechanisms to preserve social structure in the face of social conflict enlist capacities for attachment, empathy, reconciliation and group support. Absence of such factors promotes conflict and violence, disrupting social structure. During development environmental factors modulate the capacity to cope with conflict, causing direct and long lasting changes in brain systems controlling social behavior.

Participants
47 persons from 13 countries attended(1). Together the participants covered virtually all fields studying conflict: i.e. molecular biology, neurochemistry, behavioural genetics, neuroscience, pharmacology, endocrinology, ethology, primatology, psychiatry, criminology, social and developmental psychology, educational science and cultural anthropology. All participants had experience in at least two of these fields. There was a good mix of well-established specialists and young talented students. Many had a record in both animal and human studies. Invitation was conditional on full meeting participation.

Format of the workshop
All presentations were plenary. Twelve long talks, 15 short talks and 10 flash talks were presented along with 12 posters. Mornings were devoted to short and long plenaries on the general theme of the particular day. After lunch, the audience split into 5 discussion groups of 9 participants. Participants were balanced with regard to seniority and discipline into multidisciplinary groups. Each group prepared some crucial questions for the plenary discussion later in the afternoon. Plenary discussions were moderated by an experienced senior scientist. At the end of each day a keynote speaker introduced next day's central theme.

Emerging Themes
Societies and Reconciliation
Human and non-human primate societies spend a great deal of time and effort on preventing conflict, on reconciliation, and on supporting and comforting victims. Studies of contemporary hunter-gatherer societies, discredit the accepted wisdom that the "natural"

human condition is warlike. Such societies are not without conflict, but they do have an impressive array of customs to prevent escalation and restore peace. Conduct disordered children suffer from failure to reconcile, rather than from failing aggression control. Comparison of primate societies shows that ecological conditions affect social structure, which requires various elaborate strategies to refrain from conflict and retain and regain stability.

Genetics, Development and Environment

Already 70 genes are known to be involved in aggression and the number is still rising. One group of genes is related to serotonin signaling, and affects impulse control. A 2nd group is involved in vasopressin signaling, affecting both social bonding and fighting. A 3rd group, related to oxytocin signaling, seems to affect social recognition, empathy and caring. However, the function of most other genes is not yet known. Genetic variation in some genes suggests that they confer a risk for antisocial behavior. However, the effects of such "risk" genes, becomes only apparent in a disadvantaged social environment. Moreover, carriers of such "risk" genes often perform better than non-carriers in excellent social environments. Also, even in healthy individuals, situational factors such as hierarchy and social pressure can overrule "good" genetics and an excellent upbringing. Moral competence is a universal human characteristic, but it takes a situation with specific developmental and environmental characteristics to canalize this competence into actual pro-social performance. Young children are often supposed to be less aggressive. However, detailed observations show that they are actually most aggressive before the school going age. They acquire more sociable attitudes towards the end of pre-school. An interaction between heritability and disadvantaged social environment determines whether children acquire that attitude. Adverse maternal environments change the expression of specific genes, indicating that an epigenetic mechanism mediates this gene-environment interaction.

Mechanisms and Stress

Signaling systems in the brain involved in controlling aggression such as vasopressin, corticosteroids and serotonin mediate a two-way positive interaction between aggression control and stress regulation. Conflict activates the stress response, and the stress response in turn often supports an aggressive response. The precise timing of transmitter and hormonal actions during conflict determines outcome and consequences. Badly timed or absent signals produce psycho-pathology. By changing gene expression, these signals mediate gene-environment interaction, preparing the individual for future conflict. Accordingly, early stressful deprivation in rodents, or repeated conflict, affects aggression control mechanisms in brainstem and forebrain, and exacerbates aggression later in life.

Ostracism, Empathy and Imaging

Belonging to a group or rejection by a group (ostracism), is an important modulator of conflict. Ostracism can be perceived as aggression and increases aggression by reducing empathy. Hostility in Dutch, Turkish and Moroccan adolescents exposed to experimental ostracism depends on their own status and identity, as well as on the status and identity of the excluding group. The psychological pain of rejection is dependent on the same brain mechanism that mediates physical pain. Brain imaging suggests deficits in emotional processing and aggression control in the brainstem and forebrain of children with conduct disorders. Individual genetic differences in sensitivity to social stressors can be visualized as changes in serotonin, opioid, and stress hormone signaling in the brain. The trauma of conflict depends on reconciliatory options, and on empathy and social support received afterwards. The observation that in couples of veterans traumatized by military action, the

familial violence is often perpetrated by the female partner, rather than by the traumatized husband, is a vivid reminder that conflict needs to be studied in its wider social context.

Perspectives
The data and ideas presented, demonstrate the importance of interdisciplinary exchange on the context, causes and consequences of conflict. All participants spontaneously expressed their profound appreciation in E-mails afterwards. New workshop proposals and an application for a NIAS Lorentz fellowship emerged from the workshop. An edited transcription of all plenary discussions and abstracts will be made available to all participants in early 2010.

Acknowledgments
The workshop was generously sponsored by The Lorentz Center, NIAS, KNAW, and the JJ Groen Stichting voor Interdisciplinair Gedragswetenschappelijk Onderzoek (SIGO).

M.R. Kruk (Leiden, Netherlands)
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J. Schaafsma (Tilburg, Netherlands)
S. van Goozen (Cardiff, UK / Leiden, Netherlands)
K. Williams (West Lafayette, United States)

Note 1:
Netherlands 14;
USA 10;
UK 5;
Hungary 3;
Germany 3;
Canada 2;
Finland 2;
Croatia 1;
Ireland 1;
Spain 1;
Ireland 1;
Russia 1;
24 ♀; 23 ♂

Physics goes DNA:
From Base-Pairs to Chromatin

September 7 – 11, 2009

Scientific background and motivation

DNA carries the genetic information and is thus at the heart of many biological processes like transcription, replication and DNA repair. The picture in recent years has moved away from considering DNA just as a passive carrier of information and it is appreciated more and more that the physical properties of DNA have a strong impact on its function. To give an example: very recently it has been discovered that there is a second "code" superimposed on top of the classical genetic code (codons of three bases encoding for amino acids). This second code is possibly due to the redundancy of the genetic code (64 codons but only 20 amino acids) and controls some of the mechanical properties of the DNA chain. This is crucial since three quarters of our DNA is wrapped around protein spools, so-called nucleosomes, and this second code is largely responsible for the location of the nucleosomes. The spacing of the nucleosomes along the DNA in turn controls the larger scale structures of the resulting so-called chromatin complex: presumably the geometry and stability of a 30 nm wide chromatin fiber and maybe even the structures of its whole chromosome. The necessity for this complex hierarchical structure lies in the fact that the DNA chains have macroscopic lengths but need to fit into the micron-sized cell nucleus. By neatly folding it all the necessary processes can take place but how this works in detail is hotly debated and subject of current research.
With structures ranging from nanometer (basepair) to micrometers (chromosomal domain in a nucleus) there is the necessity for a wide range of experimental and theoretical methods. Since all the different length scales are strongly intertwined, it is not possible to understand DNA in its biological environment by just focusing on a single length scale. The purpose of this workshop was to bring together experts that work on the biophysics of DNA on different length scales and to foster a discussion between them.

The workshop

In the five days of the Lorentz Center workshop, 22 invited speakers presented their work. The meeting was attended by further 29 participants. The talks were arranged in a logical progression, starting from the microscopic scale, the level of base-pairs, up to the scale of entire chromosomes and the level of the nucleus:
Day 1: Base-pairs
Day 2: DNA as a polymer
Day 3: DNA-protein interaction
Day 4: Chromatin
Day 5: Chromosome
The days usually started with a series of lectures and a short break for discussions. After lunch, a longer break was left for extended discussions, before the session resumed with talks. Participants confirmed that they very much appreciated the program which allowed to the reflect the physical properties of DNA beyond a single scale. The program also had a fair contribution of more chemical and biological nature, notably on the first and fourth day. Exchanges between the participants after and between talks were lively throughout the meeting. All in all, both participants and organizers believe that the chosen format is worth repeating in the future.

Acknowledgment
The workshop could run its smooth course thanks to the excellent setup of the Lorentz Center, allowing the speakers the possibility to interact and to retreat into their offices at will. The Lorentz Center staff is acknowledged for its highly motivated and professional assistance, both in the preparatory phase and during the meeting. Finally, the funding of the meeting was provided by the Lorentz Center, without which the meeting could not have been organized.

R. Blossey (Villeneuve, France)
R. Metzler (Munich, Germany)
H. Schiessel (Leiden, Netherlands)

Stellar Merges

September 21 – October 2, 2009

The merger of two stars is a process which touches many branches of modern astrophysics and is responsible for some of the most spectacular astronomical phenomena. From the explosion of massive stars to the formation of helium subdwarfs, stellar mergers provide key insight into the physical processes which govern the structure and evolution of stars. The study of these events has advanced rapidly in the last few years. The number and quality of observations is continually increasing and will continue to do so. Modern techniques such as astroseismology and high-resolution spectroscopy provide stellar modellers with more questions than they are able to answer. Simulations are moving forward at a similar speed, due to improvements in both computing power and hydrodynamical algorithms. This Lorentz Center workshop brought together many of the world's leading experts in this fast-moving field in order to compare progress, especially at the interfaces between different methodologies, and to plan the next steps in developing a coherent science.

A total of 47 scientists took part in various stages of the workshop, with an average participation of around 40 each day. The programme designed around discussion of a major theme on each day, typically commencing with two or three invited talks (28 in total), a working session in the afternoon, with additional contributed talks as the programme allowed. There was sufficient flexibility to allow new topics to be introduced as the workshop progressed. The daily themes were as follows:

1. Merger channels
2. Clusters as merger sites
3. Massive star mergers
4. Merger simulations
5. Mergers in population synthesis / Collisions vs mergers
6. Fundamental theory
7. Compact object mergers
8. Evolution of merger products
9. Merger signatures
10. Planetary mergers

The invited talks were of a consistently high standard, and provoked many valuable discussion sessions. The latter were led either by members of the scientific organizing committee or by acknowledged experts in the appropriate fields. Some discussions were carried out in parallel, with the leader giving a summary in the following plenary session. Most discussion sessions were directed towards quite specific questions, including:

- Which stars were born in a merger?
- What are their observational properties?
- Do mergers constrain common-envelope physics?
- What post common-envelope binaries are there?
- Which mergers lead to an explosion?
- How well established is the theory behind mergers and what is poorly understood?
- What are the most appropriate methods for modelling mergers, and how can they be improved?
- How do we retain stellar memory through the model merger?
- What physics do we need to model mergers?
- How do we test the models?
- What will future observational surveys tell us?

Amongst new insights, the discussion of how a ”common-envelope” evolves was of particular value. For binary stars ultimately to merge, the majority must pass through a phase in which they come into contact and then shed angular momentum by unbinding the envelope which surrounds both stars. The end product is either a direct merger, or the formation of a compact binary which may later merge. The physics of this process, and how to model it numerically, is far from obvious.

Other highlights included the presentation of B[e] and other exotic stars as likely candidates of massive star mergers, current efforts to simulate the evolution of entire stellar populations, and to determine what fraction of binaries will eventually merge, and the extreme conditions close to the Galactic center that create an environment in which stellar collisions are significantly more likely than even the dense cores of globular clusters.

In addition to the formal programme, the workshop format provided space and time for smaller group discussions and for longer-term collaborative projects to be progressed. The benefit from these will be realised over a period of time.

The organizers are indebted to the Lorentz Center for covering most of the costs, and to NOVA, NWO and KNAW for additional support for accommodation and travel. Overall, these funds were used (in order of magnitude) to fund accommodation for invited speakers, administrative overheads, coffees and lunches for all delegates, a social programme, and travel for a few speakers without other funding. In particular, they wish to express their thanks to Corrie Kuster and the rest of the staff at the Lorentz Center for facilitating all aspects of the workshop.

E. Glebbeek (Ontario, Canada)
R.G. Izzard (Bruxelles, Belgium)
C.S. Jeffery (Armagh, Ireland)
G. Nelemans (Nijmegen, Netherlands)
O. Pols (Utrecht, Netherlands)
E. van den Heuvel (Amsterdam, Netherlands)

Frobenius lifts

October 5 – 9, 2009

The purpose of this workshop was to introduce to the broader community in arithmetic algebraic geometry a new point of view based on lambda-rings and Witt vectors, two natural concepts which arise in the systematic study of Frobenius lifts. The program was centered around four series of four lectures, by Cartier, Buium, Hesselholt, and Borger. Scanlon and Davis also gave a lecture each on related topics.

Cartier's lectures gave a classical introduction to the subject. The advantage of the classical point of view is that it is completely explicit and requires no category theory. The drawback is that the key concepts are hidden in the mass of formulae.

Buium gave an overview of his research over the past two decades. The central concept is that of an arithmetic jet space, which is a certain dual construction to the Witt vector construction. He also discussed many applications of his theory to number-theoretic questions outside of his theory.

Hesselholt gave an exposition of the de Rham-Witt complex. He allowed the so-called big Witt vectors and worked in the absolute context. The relative version of this complex can be viewed as the de Rham complex in lambda-algebraic geometry.

Borger gave an introduction to the basics of lambda-algebraic geometry. Most of the time was spent defining the basic concepts (lambda-structures) and constructions (Witt vector spaces and arithmetic jet spaces) in the context of schemes rather than rings. He also discussed some applications to class field theory. In his final lecture, he explained how the themes of the different lectures were related in the big picture of lambda-algebraic geometry.

Scanlon's lecture was about his applications of model theory to arithmetic algebraic geometry. This approach is very similar to the point of view from lambda-algebraic geometry. Davis's lecture reported on recent joint work with Langer and Zink on an overconvergent version of the p-typical de Rham-Witt complex.

The atmostphere of the conference was very pleasant, no doubt due in some part to the excellent facilites provided by the Lorentz Center. A number of participants remarked that having their own office and computer made their stay much easier. The workshop was attended by several international experts, in addition to the speakers, and many junior mathematicians, some of whom remarked that the focused style of the workshop, rather than the standard conference format of loosely related one-hour talks, made it possible to learn the subject in a deeper way. The formal program was complement by many informal discussions. For all these reasons, we believe most participants considered it a successful workshop.

James Borger (Canberra, Australia)
Bart de Smit (Leiden, Netherlands)

Microbes in Ecosystems:
Weaving Intracellular Processes into Ecological Networks

October 12 – 15, 2009

Ecosystems often contain thousands of microbial species, each with their own geno- and phenotypes. Ecosystem functioning relies on interactions among these microorganisms and between microorganisms and their environment. For a long time it was very hard to study microbial community structure and functioning at high spatial and temporal resolution. Recent technologies now allow for the generation of large data sets on complex microbial communities and the cellular composition of these communities, by addressing genomic information on the species present and their genes (metagenomics), their gene expression (metatranscriptomics), proteins (metaproteomics) and metabolites (metametabolomics). However, the field of microbial ecology still is largely descriptive. Through integration of the emerging fields of microbial ecology and systems biology and cross-fertilisation by assembly theory, we wanted in this workshop to address the question how to move microbial ecology towards a scientific discipline that yields a more quantitative and mechanistic understanding of microbial community structure and functioning.

Within general ecology, a number of theories have been developed on community assembly and ecosystems stability and functioning. Few of those concepts have so far been applied to microbial ecology. Systems biology is another rapidly developing field and aims at understanding how dynamic interactions between components of living systems, but also between living systems in interaction with their environment, give rise to their functioning. This is achieved by an iterative approach of modeling and experimentation integrating large data sets into mathematical models to quantitatively describe and predict system functioning. Systems biology approaches focused so far almost exclusively on molecular interactions within individual species. This has led to fundamental new insights into the functioning of individual species. Systems biology has the ambition to go beyond intracellular processes and aims at connecting different levels of biological organization, from the functioning of genomes to communities and ecosystems. Cross fertilization between microbial ecology and systems biology should aid in designing approaches to modulate community structure development and functioning, which will contribute to combating environmental (e.g. climate change), societal (e.g. energy shortage, pollution) and health (e.g. human diseases) threats.

To achieve our goal, we brought together 41 academics from seven countries and with various backgrounds ((theoretical) ecologists, microbial physiologists, microbial ecologists, bioinformaticians, biogeochemists and systems biologists) to present and discuss integrative approaches and concepts to study multi-species interactions in simple artificial experimental systems and in real environments. The majority of the participants were senior scientists, but during the first two days also about 10 junior scientists (PhD students, post docs) attended the workshop.

The workshop consisted of two well-connected parts: during the first two days four major, interrelated topics were introduced, while in the last two days we discussed how those topics should be integrated scientifically. The four topics were:

1. Quantitative understanding of community functioning from molecular data.
2. Analysis of fluxes through ecosystems.

3. Community assembly and structure.
4. Microbial controls on ecosystem processes

For each topic, three plenary lectures were presented, introducing the status of the field and visions for the future. The presentations were in general of high level and led to lively discussion afterwards. The presentations also nicely reflected the multidisciplinary character of the workshop. The third and fourth day were spent on discussing the four topics, in order to proceed towards a concept that allows for better understanding of community functioning, in particular the distribution and control of fluxes in microbial networks and the associated resistance and resilience towards disturbances. Twenty-six invited senior participants were divided over four small working groups. Each group discussed a particular topic on basis of three statements and prepared a presentation. These presentations were discussed, and subsequently the working groups were changed: all participants moved to another working group in order to allow all participants to contribute to two different topics. During the fourth day the discussion was centered around one plenary discussion. The workshop ended with an excellent presentation by Ian Head.

We observed that the participants could roughly be divided into two groups: those who work top-down and try to understand ecosystems by the application of large scale meta-omics techniques, and those who work more bottom-up and try to understand ecosystems starting from simple, controlled systems. These differences in approaches and visions could not completely be reconciled, but a proposal was presented in the final discussion on how these two approaches can be brought closer together in order to achieve better understanding on microbial ecosystem functioning. We aim to write a perspective paper on the outcome of the workshop, together with other participants of the workshop. We feel that the workshop brought many scientists closer to each other, and will lead to new research cooperations.

We thank the Lorentz Center, in particular Auke Planjer and Pauline Vincenten, for the excellent organization, facilities and suggestions they provided us with. We also thank the Lorentz Center, the Netherlands Institute of Systems Biology and KNAW for financially supporting the workshop.

Wilfred Röling (Amsterdam, Netherlands)
Peter van Bodegom (Amsterdam, Netherlands)
Nico van Straalen (Amsterdam, Netherlands)

Scale Transitions in Space and Time for Materials

October 19 – 23, 2009

One of the goals of the workshop, i.e. to bring together researchers of different fields working on scale transitions, was well achieved. The research disciplines represented by the speakers and participants were mathematics, physics, bio- and chemical engineering, theoretical and applied mechanics as well as computational and material sciences. The workshop lasted one full week with 50 participants from within and outside the Netherlands. One of the key challenges in scale transitions is to retain the relevant physical parameters by either coarse-graining or homogenizing the fine scale variations. Different methodological approaches and terminologies are used in various fields, and it was obvious throughout the workshop that the respective communities are often not aware of the work done in neighbouring areas. Among the originally scheduled issues were: nonlinear behaviour, defects, discreteness, interfaces and surfaces, non-affinity, and time-dependent behaviour. The program was scheduled through a daily focus on different themes:

1. spatial scale transitions,
2. temporal scale transitions,
3. discrete to continuous transitions,
4. scale transitions with space-time interactions, and
5. complex fluids, soft matter or granular matter.

Within these topics, special sessions were organized for (i) flash-poster presentations, followed by a poster session; (ii) definition of the goal and presentation of open questions beforehand; (iii) an interactive session in small groups on the definition of homogenization versus coarse-graining; (iv) an interactive session in small groups on particular difficulties characterizing soft-matter and the importance of handling inhomogeneities in scale-transitions, and (v) the concluding session, revealing the "Lessons Learned".
Scale transitions in space and time are typically presented in a space-time diagram, as shown below for the particular case of metals:
Among the Lessons Learned are the results of the interactive workshop 1:

W1-A: The terminology used in various fields and their characteristic differences evolved into the summary in the Table below.
Homogenization (mostly in space) leads to the same type of eqs. (possibly with a reduced set of dofs [degrees of freedom]). In contrast, CG [=coarse-graining] generally applies to timedependent phenomena and is based on ensemble averaging and can lead to different equations, reduced dofs. It relies on the correlation between fine scale fluctuations, which should NOT be averaged out but, instead, lead to irreversibility and emergent behavior. Other terms and methods were discussed – Hierarchical Multiscale Modeling (HMM), up-scaling, micro-macro transitions – but they can be classified in one of these two main groups.

W1-B Q2: The second main question was: "What is the methodological complexity that discriminates upscaling in time from upscaling in space?" Discussions among participants indicated that length-scale jumps are easier to identify; thinking in terms of length-scales is more intuitive for the majority of researchers working on solids. Multi-scale in time invokes the correlation of fine, rapidly varying phenomena; the community working on small oscillatory and wave phenomena is likely to be more familiar in this respect. Furthermore, the role of discreteness for time-scaling vs. discrete phenomena in space was discussed.

Discreteness seems to bring a coupling between space and time. A general problem is the infinite propagation speed in some models, which assume quasi-static deformations. Discretization is an approximation that makes propagation-speeds finite. The participants seemed to indicate that the history-dependent behaviour is the main complexity to handle in time-scale transitions in solids. However, within GENERIC (see below), basic ingredients to do so seem to be well in place if time scale separation holds.

W2-A: Among the results from Workshop 2 are the different interpretations of soft-matter (versus solids) and what makes soft materials special. The following issues can be special for soft-matter: fluid- and solid-like behavior is important at the same time; different time- and length-scales are involved; the systems are highly heterogeneous/disordered; energy/k_BT is around unity; they display long time tails; small changes can lead to big effects.

W2-B: The role of inhomogeneities for scale transitions needed first a definition of non-affinity vs. inhomogeneity (what comes first and leads to the other?). Then the size/scale of inhomogeneities is linked the scale-jump and possibly determines its upper-limit. The question what one can do when the length-scale of inhomogeneities changes (sometimes rapidly) during a process remained unclear. In any case one has to be careful with smoothing out inhomogeneities, since they make the system behavior change with their presence and state. The length scale set by inhomogeneities can lead to new state-variables and parameters like porosity, a structure tensor or, e.g., pair-correlation functions.

The outcome of all discussions during the lectures and the various discussion sessions were summarized in the Lessons Learned session, which can be summarized as follows:

- Mathematical tools exist that justify the limit passage from micro to macro, for homogenization of energy-driven systems. A "smart" Γ-limit ('smart' indicating that the "right" variables were chosen) but there is no general recipe (except for special/trivial cases). There seems to be, however, a (partially unexplored) connection between GENERIC (see below) and the mathematical tools at hand.

- GENERIC received extensive attention in the programme and was profiled as a very powerful methodology, enabling systematic scale transitions relying on coarse graining and correlation of fluctuations. The scale separation in time is thereby essential (Hütter). Understanding the link between the handling of the entropy terms versus some proposed stochastic methods (with particular probability distribution functions) remains open but seems feasible.

- The notion of history was often mentioned as a really complicating factor in time scale transitions, but this does not seem to be justified completely. Handling history dependent behaviour can be done by incorporating the related micro-information into a state variable and thereby avoiding (as for example in Maxwell fluids) the memory kernel. The choice of the "right" state variable is essential and requires a good physical insight in the system studied.

- There is no essential contradiction between kinetics (evolution) controlled solution methods vs. equilibrium-driven methods. The equilibrium-driven methods usually only provide a necessary condition and hence a lower-bound for the real evolution path. The kinetics controlled methods are more rich and detailed and incorporate the physics of the evolution. Phase field models are well developed methods to resolve several energy driven-kineticslimited microstructure evolution processes. They are

nowadays mature and reach out now to coupling to other scales and more complex mechanical behavior (kinetics in mechanics and materials science do not refer to inertia!).

- Dissipation is inherently coupled to fine scale fluctuations. The precise definition of dissipative events can be scale-dependent, e.g. where systems may be either considered as open or closed. The issue of a fluctuation-dissipation theorem and related emergence of entropy was not worked out to the end.

- Biophysical systems are characterized by complexity. To handle this, use is made of an efficient scale separation map. This map classifies each of the processes at different spatial and temporal scales. Model for each of the processes being available, most emphasis is given to the coupling between different processes (= resolving multiple processes at different scales). This is not a true scale transition (= resolving a single process across the scales), and the methods used therefore more focus on solving the materiomics loop.

- Peridynamics was presented as a promising method, based on solving integral equations rather than PDEs. The method seems to show great promise for problems that present discontinuities, but there are still many challenges ahead before its potential can be fully exploited. It was applied to non-local elasticity, but how to go beyond (finding the kernel for nonlinear material behaviour) is an open issue. The numerical implementation and solution seems very convenient, relying on a discrete (MD-like) solution strategy. Problems to be resolved are the proper handling of various types of boundary conditions and interface conditions (resolving heterogeneities). At this stage, its relation to large scale transitions and to SPH (smooth particle hydrodynamics) was not yet fully clear.

- GENERIC (General Equation for the Non-Equilibrium Reversible-Irreversible Coupling): For this promising method, the most important aspect is the choice of internal variables, for which a healthy insight and intuition is required. For a scale transition in time, time-scale separation is required.

- Spelling checkers: Some mathematical tools exist now that allows for a proof of the limit passage. In a primitive form, GENERIC can be used as a spelling checker, but this methodology seems more powerful than just that.

- An inherent space-time coupling seems to exist upon studying the same process at different scales. This does not exclude the existence of fast-large and slow-small processes (as exemplified for bio-systems). A true scale transition (for the same process) perpendicular to the diagonal in the x-t-diagram does not seem trivial (if it exists at all). More importantly, a space-time coupling may abruptly change due to the occurrence of instabilities (e.g. microstructure evolution, strain bursts, dislocation avalanches, etc., where a rapid evolution occurs at a larger length scale). Such instabilities may seriously compromise the scale separation assumed up front and hence may render several methods inapplicable (e.g. homogenization for localization of deformation). This implies that, even when one succeeds to develop a macro-model based on a micro-model, the occurrence of an instability may call for the explicit incorporation of the finer scale that controls the physics of the instability.

Many of the original questions that were posed by organizers and participants (see sheets on the website) were discussed and partially answered. In summary, a better focus and improved insight was gained, but also many new questions were raised and challenges for further work and future collaborations could be identified.

Some pending issues discussed that were unresolved at this stage:

1. Does time-scale separation hold in metal plasticity?
2. How to extend and handle interfacial problems and heterogeneities in GENERIC (seems feasible though)?
3. Does it make sense at all to treat scale transition in time separate from those in space?
4. What are the conceptual differences for different CG methods, in particular since some CG methods only resolve a small iterative step, which is insufficient.

We thank all participants for their contributions, input and active participation. Financial support is acknowledged from the Lorentz Center and the Delft Center for Materials. Furthermore, the organizers strongly acknowledge the hospitality at the Lorentz Center and the efficient and competent help of the local staff.

K. Bertoldi (Enschede, Netherlands)
H. Steeb (Enschede, Netherlands//Bochum, Germany)
S. Luding (Enschede, Netherlands)
M. Geers (Eindhoven, Netherlands)
E. van der Giessen (Groningen, Netherlands)

Metabolic Pathways Analysis 2009

October 26 – 30, 2009

A main aim was to establish an official mixed consortium of researchers from Systems Biology, Computational Biology, Computer Science and Mathematics to work together on understanding biological networks in all its different aspects. At the workshop about 50 researchers from the various disciplines discussed limitations of current approaches, open problems, and standards for algorithms, models and data exchange in the field of Metabolic Pathway Analysis. Although the name referred to an earlier workshop, Metabolic Pathway Analysis 2005 in Jena, Germany, the workshop was more focused on the methodological aspects of Stoichiometric Network Analysis.

Many of the participants expressed their very positive perception of the workshop. The Lorentz Center appeared to be the ideal environment for the setting we had in mind: the days starting with invited lectures by experts in the mornings, followed by a long lunch-break with discussion groups in the various meeting rooms, and finished by a late afternoon session with contributed lectures.

The workshop started on the Monday with four extended lectures of keynote speakers, with the double aim of providing an introduction for possibly interested other researchers from outside the field (there were no more than 1 or 2 of those) and to set a common reference for all participants for the rest of the week. The keynote speakers were: Nathan Price, Alexander Bockmayr, Bas Teusink, and Stefan Schuster. That day was closed with the Wine & Cheese Party as a wonderful social event. Also the combined diner/boat trip on wednesday was an enormous success.

During the week, new collaborations were initiated. By coincidence, exactly during the week Marie-France Sagot, one of the organisers, received the message that she had been awarded the prestigious ERC-grant. Last but not least, as a result of the workshop a proposal for a Marie Curie Initial Training Network (ITN)\PATHENGINEER" in the 7th Framework Program of the EU has been submitted by the end of December, comprising 11 of the research groups participating in the workshop, together with some industrial partners.

We gratefully acknowledge financial support of the Lorentz Center, the French INRIA, the Dutch Mathematics Cluster DIAMANT, and the Netherlands Institute on Systems Biology.

Frank Bruggeman (Amsterdam, Netherlands)
Marie-France Sagot (Lyon, France)
Brett Olivier (Amsterdam, Netherlands)
Stefan Schuster (Jena, Germany)
Leen Stougie (Amsterdam, Netherlands)

Cavity Enhanced Spectroscopy
Recent Developments and New Challenges

November 2 – 6, 2009

The Cavity Enhanced Spectroscopy Lorentz Center meeting consisted of two parts: a two-day winter school and a three-day workshop. The aim of the winter school was to train the next user generation in the application of cavity enhanced spectroscopic techniques. The workshop was the eight meeting in a series and aimed at bringing together the leading scientists in the field to discuss new developments.

In a typical 'cavity enhanced' experiment a sample is put inside an optical cavity consisting of two very highly reflective mirrors. Monochromatic light, typically generated by pulsed or cw lasers, is coupled into the cavity and trapped for tens of μs, steadily leaking out and exhibiting an exponential decay that can be characterized by a so-called 'ring down time'. The latter is a measure of the time that the light remains in the cavity. Consequently, a molecular absorption results in a shorter ring down time and by monitoring the ring down time as function of the laser frequency direct absorption spectra are recorded. The very long path lengths that are achieved in this way in combination with the fact that a rate of absorption is measured, rather than an absolute value, makes cavity ring down spectroscopy the most sensitive direct absorption technique currently available. In the last decennium many sophisticated detection schemes have been designed using both monochromatic and broadband light sources. Applications of cavity enhanced techniques are currently found in many different directions ranging from trace-gas and breath analysis to analytical chemistry, plasma and laboratory astrophysics. Both gas phase, fluids and the solid state samples are studied with more and more advanced cavity enhanced setups, such as evanescent wave detection, and the field is literally booming.

The winter school was visited by 40 students. Six lecturers (Engeln, Berden, Orr-Ewing, Sigrist, Ruth and Linnartz) introduced the field, overviewed the different detection schemes, discussed applications in atmospheric, trace-gas and medical applications as well as astro-chemistry, and compared the use of broad-band techniques with monochromatic light sources.

The workshop comprised six invited speakers (Hancock, Picque, Loock, Harren, Bründermann, Venables) and thirteen hot topic presentations, as well as a poster session with 19 contributions and an industrial session. A special focus was on recent developments in the field (e.g. the use of frequency combs for cavity enhanced experiments, the extension to the THz domain, and the use of micro-cavities) and new challenges (e.g. the application of broad band techniques for analytical purposes, the use of cavity ring down experiments to derive atmospherically relevant parameters or to search for the presence of explosives). In the industrial session information was provided on mirror preparation and quality management. A special session was dedicated to the use of cavity enhanced techniques in undergraduate research work. During the meeting the newest book on cavity ring down spectroscopy (Eds. Berden, Engeln, Wiley 2009) was presented.

With 70 participants this workshop was a 'full house'. After subsequent meetings in Heeze (NL), Lille (F), Düsseldorf (D), Eindhoven (NL), Oxford (UK), Cork (I) and Greifswald (D), this

eight workshop in Leiden will be followed by a new workshop in Canada in two years from now.

We look back to a very successful meeting.

Harold Linnartz (Leiden, Netherlands)
Wim Ubachs (Amsterdam, Netherlands)
Andy Ruth (Cork, Ireland)

Evolution of Galaxies from Mass Selected Samples

November 9 – 13, 2009

The workshop brought together several groups working on galaxy evolution and galaxy formation. This is a topic which is developing very rapidly with new observational capabilities and new theoretical insights. On the observational side, the workshop was focussed on near-ir selected samples. These samples are the only samples which can lead to proper mass selected samples. Many presentations were given highlighting the newest results in the field, especially those using medium band filters to determine accurate photometric redshifts and spectral energy distribution of the galaxies. In addition, "hot" results from the WF3 camera, recently installed on the Hubble Space Telescope, were reported.

Theoretical and interpretational results were reported which help us to understand these results. Ample time was left open for work and discussions (about half the time). These work sessions were extremely productive: thanks to the fact that all participants had a desk and internet connection, they could immediately follow up new ideas and suggestions. Overall, the workshop was very successful. The fantastic facilities of the Lorentz Center allow this unique combination of informal presentations, discussions, and actual work - and the meeting was a true "workshop" in that regard. It is a pleasure to thank the staff of the Lorentz Center for their excellent support, and it is a pleasure to thank the Lorentz Center for the overall support for this meeting.

P. van Dokkum (New Haven, USA)
M. Franx (Leiden, Netherlands)

Subdivide and Tile:
Triangulating Spaces for Understanding the World

November 16 – 20, 2009

The purpose of this workshop was to bring together researchers with different areas of expertise to exchange knowledge on various aspects of geometric computing in a variety of different spaces. The multidisciplinarity of the participants was an important aspect of the workshop. Participants came from areas like mathematics, computational geometry, software engineering, astronomy, molecular biology, physics, chemistry, and fluid dynamics.

Topics addressed at the workshop include tessellations and tilings, point distributions, discrete differential geometry, computational topology, geometric inference, engineering geometric software, CGAL, and applications of these in various scientific fields.

The program contained a variety of invited reviews, centered around a few longer tutorials. Half of the first day consisted of a tutorial on tessellation applications in fluid dynamics, with Daniel Duque covering Voronoi fluid particle dynamics, while Volker Springel presented an fabulous review on his new Arepo computational fluid dynamics code.
During the second day Jean-Marc Schlenker, Stephen Hyde and Vanessa Robins presented tesselations of hyperbolic surfaces. John Sullivan gave a very nice tutorial on the combinatorics of tesselations related to discrete curvature.
The third day saw a dedicated session on chemistry and material science applications, marked by the reviews of Michael O'Keeffe on tessellations in crystal chemistry and by Niels Kruyt on tessellations and granular materials. Already during the second day Julie Bernauer had presented a nice introduction to computational structural biology. More theoretical issues were adressed by Dirk Siersma and by Joachim Giesen, who presented reviews on Morse theory and how to connect and infer these on the basis of tessellations. Highly interesting was the theoretical tutorial by Frederic Chazal on Geometric Inference, in particular as it contained a large number of examples of applications in various fields. One of the most tantalizing concerned the study of the large scale galaxy distribution, which has also been the subject of the review by Marc Neyrinck. A purely industrial view was forwarded by Martin Held, who reviewed his work on the use of Voronoi and Delaunay tessellation software for instrument steering, and by Andreas Fabri. The latter discussed, amongst others, the commercial prospects for the CGAL library.
Wednesday afternoon was devoted to a special poster and demo session, where many participants demonstrated and exchanged their latest scientific results and their views on tessellation based software. The meeting was closed with an hour long panel discussion on applications and social relevance of the topics covered during the workshop.

In total, some 46 participants from various countries (Australia, Austria, Germany, Spain, UK, United States, France, the Netherlands) attended the workshop. Our goal in organizing this workshop has been to provide a setting in which junior and senior researchers in mathematics, computer science and related application areas could mingle, both during the talks and off line, during lunches and breaks. The offices, available to the participants, are one of the attractive features of the Lorentz Center, and served the purpose of informal scientific discussions very well.

The workshop was generously supported by the Lorentz Center. We are very grateful to Gerda Filippo for the impeccable organization, and to Martje Kruk and Mieke Schutte for their guidance during the preparation of the program. Financial support was also provided by the INRIA Associate Team OrbiCG, a collaborative program of the workshop organizers.

Monique Teillaud (Sophia Antipolis, France)
Gert Vegter (Groningen, Netherlands)
Rien van de Weygaert (Groningen, Netherlands)

Powerful Radio Galaxies:
Triggering and Feedback

November 23 – 27, 2009

There is increasing speculation that powerful AGN activity may be intimately linked to the overall galaxy evolution process, both via the gas accretion events that trigger the activity, and via the feedback effects of the AGN-driven outflows. However, there remain considerable uncertainties about the exact nature of the links between the evolution of AGN and their host galaxies. Radio galaxies are particularly important in this regard because they drive powerful jets and are invariably associated with early-type host galaxies. Over the last few years a wealth of data has been gathered for radio galaxies using HST, Chandra, Spitzer, and various radio and 8m class optical telescopes. In the near future our ability to detect and observe such objects will be vastly improved with the introduction of a new generation of radio, sub-mm, infrared and optical facilities. Therefore, the aim of the workshop was to review the latest results and takes a holistic approach to this important subset of AGN.
The following issues were addressed in the workshop.

- What are the dominant modes of triggering of powerful radio galaxies?
- How do the triggering modes, local ISM and host galaxy properties relate to the AGN and jet properties?
- To what extent can the luminosity functions and evolution of the radio source populations be reconciled with the evolution of galaxies in general?
- How can we deduce the kinetic powers of the relativistic jets using radio and X-ray observations?
- How significant are the warm and cool gas outflows driven by the jets and AGN?

The workshop attracted 62 participants from around the world, with a good mix of PhD students (23%), young postdocs (34%), and permanent academics (43%). The workshop included 19 invited review talks (30+5 min), 21 contributed talks (20+5 min), and 6 shorter (5 min) talks. As well as the 5 minutes allowed at the end of each longer talk, discussion was facilitated by the plenary discussion sessions at the end of each day (~30–45 min), intended to cover "open questions" and raised by participants collected by the session chairs, and the extended 2 hour lunch breaks, which incorporated 1 hour for informal discussion; much discussion also took place in bar of the Bastion hotel at the end of each day!
Despite the relatively packed programme, the workshop worked well, with plenty of lively discussion and interaction. This was aided by the excellent facilities and organisation of the Lorentz Center, the timeslots specifically set aside in the programme for discussion, and the fact that the speakers kept to their allotted times, allowing valuable discussion at the end of each of the longer talks. The broad programme also succeeded in bringing together observers and theorists, as well as astronomers working in a wide range of wavelength regions.

Although successful, the workshop would have been improved by having a free afternoon (on the Wednesday) and a session specifically set aside to advertise posters.

Raffaella Morganti (Dwingeloo, Netherlands)
Clive Tadhunter (Sheffield, UK)
Philip Best (Edinburgh, UK)
Joanna Holt (Leiden, Netherlands)
Martin Hardcastle (Hatfield, UK)
Nicole Nesvadba (Orsay, France)

.Astronomy 2009
Networked Astronomy and the New Media

November 30 – December 4, 2009

More than 40 participants from 8 countries gathered at the Lorentz Center to explore, exchange and learn about networked technologies and the new media used for astronomy research and outreach. A press release announced the meeting (http://tinyurl.com/nova-dotastronomy).

The following themes were explored: citizen science, web-based research, visualisation and new media for outreach and education. During the mornings keynote speakers gave talks that were streamed on the Internet and recorded. The online following trebled the audience of the morning sessions with peaks at 140 viewers. The online recordings have received almost 500 viewings since the event, at time of writing. Dutch astronomy was well represented with two talks about Dutch-based facilities, Jive (e-VLBI) and LOFAR.

We held 'unconference' sessions in the afternoons: talks, workshops and discussions were user-generated and organised organically during the week. The Lorentz Center set-up with well-equipped meeting rooms was particularly suitable for this format. The unconference sessions were dedicated to hands-on group discussions on the impact of new technologies on research (Open Science, Virtual Worlds, Podcasting) and '101s': introduction sessions to new technologies (Android phone programming, Remote telescope controllers, Lego NXT), etc. The final programme can be browsed at http://www.dotastronomy.com/programme/.

We reserved one day mid-week for a 'Hack day' devoted to making new astronomy tools, giving new projects a head start and testing new ideas. Participants spontaneously formed groups and started working on new projects, of which some were achieved during the day and some are work in progress. At the end of the meeting prizes were given to participants, which were donated by O'Reilly Media. The meeting was sponsored by the Lorentz Center, NWO, ASTRON, RadioNet, the British Council/Platform Beta Techniek's Partnership in Science programme and the Royal Astronomical Society.

What characterised this meeting was a dynamic and notably young group of participants. The collaborations were intens and resulted in concrete outcomes. The diversity and complementarity of skills present ensured that everyone contributed significantly to the meeting, demonstrating the collaborative nature of networked astronomy projects.

Being an official meeting of the International Year of Astronomy (IYA2009) made this meeting the chosen time and place to make announcements (http://dotastronomy.com/press/) .Astronomy2009 saw the following announcements:

- GalaxyZoo reaching 50 million galaxy classifications.
- Launch of Chromoscope (http://www.chromoscope.net/). Chromoscope is a web-based visualisation of the Milky Way in all wavelengths from gamma ray to microwave. It is zoomable and searchable. It is free and downloadable, allowing it to be used offline.
- Announcement of the continuation of the 365 days of astronomy podcast (http://www.365daysofastronomy.org/) in 2010. This podcast is the official podcast of the IYA2009 and is the first ever entirely community-contributed podcast.

Other projects/products were started or advanced at the workshop, which will be released in 2010:

- Firetwitter is a real-time geo-coded visualisation tool for twitter messages related to astronomical events.
- BuriedData is a new service where unused astronomical data can be uploaded for others to use, reduce and publish.
- An iPhone application for Chromoscope.
- A Wordpress plug-in for Microsoft's World Wide Telescope (WWT). Wordpress is a versatile blogging platform and the WWT incorporates visualisation and exploration of the sky linked directly with scientific data.
- A brainstorming session on citizen science yielded several potential new projects on the GalaxyZoo model.
- An ambition to try and make astronomy a more open science. Discussions were had throughout the week on how to create a sustainable, accessible open model for astronomy using networked technologies.
- Progress on publication metrics. During the week's informal sessions there was much debate on how to use the Internet to measure publication and citation metrics more easily and openly. This was pinpointed as topic for the next conference.

A. Allan (Exeter, UK)
C. Odman (Leiden, Netherlands)
S. Kendrew (Leiden, Netherlands)
R. Simpson (Cardiff, UK)
S. Lowe (Manchester, UK)
C. Lintott (Oxford, U UK K)

New Directions in Dynamical Systems

December 7 – 11, 2009

The aim of this workshop was to bring together various research groups, within the Netherlands and abroad, of people working broadly within the field of dynamical systems. Over the last 30 years dynamical systems has become more and more a mature subject with groups of researchers specialising in specific topics. This workshop aimed to give overviews on a number of active research areas within dynamical systems, ranging from Hamiltonian systems, bifurcation theory, ergodic theory, problems related to statistical mechanics and coupled maps. One result of this approach was that researchers within the Netherlands in related fields had an opportunity to learn what others were doing and to interact. To facilitate communication between different directions in dynamical systems the talks were scheduled for 1 hour (including discussion). As a result the relevance of theory developed in these areas to the other areas was highlighted.
The final day was partly devoted to complexity. It started with a presentation by Prof. MacKay, head of the complexity centre in Warwick University, on the relevance of dynamics to complexity. Prof. Doelman, director of the Lorentz Center, reviewed the developments in the Netherlands. This was followed by a lively panel discussion on complexity and future directions in dynamics. Discussions centred around the difficulties of working in an interdisciplinary fashion (where the publish, how to understand each other's language). It was extremely pleasing that the discussion became rather constructive, trying to find solutions to these challenges rather than to focus only on the difficulties. Also specific areas on which mathematics should concentrate were proposed and discussed.
The organizers carefully selected speakers so that they reflected the interests of Dutch mathematicians, but that also internationally prominent strands of research would be represented. There were about 66 participants, about one third were Dutch mathematicians, both junior and senior researchers.
The organizers are planning to publish proceedings of the workshop, dedicated in honour of Prof. Broer's 60th birthday. The editors of "Regular and Chaotic Dynamics" have agreed to publish these proceedings.
Many junior researchers from the Netherlands attended the workshop, and found the opportunity to ask questions to leading researchers very useful.
Most participants had extremely lively discussions during the workshop, and a few people even started new research projects during the workshop. One of the outcomes of the workshop was that many researchers met people in related fields, got a different perspective on their own work, and most likely several people's research will be influenced by discussions during the workshop.
Participants were enthusiastic about the hospitality and facilities provided by the Lorentz Center. The organizers want to thank the staff at the Lorentz Center for making it so easy to organize this meeting. Financial support was provided by KNAW, Stieltjes Institute, NDNS+, Foundation Compositio Mathematica, FOM and the Lorentz Center.

H. Hanßmann (Utrecht, Netherlands)
A.J. Homburg (Amsterdam, Netherlands)
G.B. Huitema (Groningen, Netherlands)
S.J. van Strien (Coventry, UK)
F. Takens (Groningen, Netherlands)

Boundary Relations

December 14 – 18, 2009

Boundary value problems are usually associated with problems involving ordinary and partial linear differential operators. In order to describe such problems in a systematic way the theory of boundary triplets has been introduced by Derkach and Malamud, building on earlier work mainly from the Russian or Ukrainian schools. An attractive feature of this approach is that a so-called Weyl (operator valued holomorphic) function connected with the boundary triplet is carrying all the spectral data of the boundary value problem. Recently the theory of boundary triplets has been extended by Derkach, Hassi, Malamud, and de Snoo to what is now called the theory of boundary relations: this theory offers a much greater flexibility in assigning boundary values allowing unbounded multivalued Weyl functions. Almost simultaneously new concepts have been developed in the theory of passive and conservative state/signal systems by Arov and Staffans which appear quite close to the concepts of boundary relations. In this connection also the notion of Dirac structures (van der Schaft and Zwart) should be mentioned.

The aim of the workshop was to make explicit what these different theories have in common and to point the direction of future work to connect the various approaches. During the workshop there were main lectures by Arlinskii, Derkach, and Malamud on boundary triplets and their generalizations and there were double main lectures by Grubb (on boundary value problems for partial differential operators) and by Staffans (on systems theory). Furthermore there were lectures concerning extension theory, operator theory, and applications in analysis (Szafraniec).
There were 8 posters (including posters by Hassi and by de Snoo); a special poster session was organized in which 6 PhD students could outline their posters. The schedule of the lectures provided a substantial opportunity for discussions and joint work. The 37 participants of the workshop, including 9 PhD students, came from Austria, Denmark, Finland, France, Germany, Hungary, Israel, Netherlands, Poland, Romania, Russia, South Africa, Sweden, Ukraine, and the U.K. Visitors included Haase (Delft) and Kaashoek (Haarlem).
The organizers are discussing with a publisher about the proceedings of this conference. The main speakers have agreed to provide survey articles in their respective areas.

The workshop at the Lorentz Center was sponsored by several organisations: the Johann Bernoulli Institute for Mathematics and Computer Science of the University of Groningen, the Department of Mathematics and Statistics of the University of Vaasa, the Institute of Mathematics of the Polish Academy of Sciences (European Marie Curie project TODEQ), and the Dutch Institute of Systems and Control (DISC). We thank all these institutions for their support.

The conference at the Lorentz Center with its unique facilities was much appreciated by the participants. We thank the Lorentz Center for providing us with this opportunity and their support; and also for helping us with getting the conference in shape. We also want to thank the staff of the Lorentz Center for their impressively smooth professionalism. In particular, we would like to mention the contributions of Auke Planjer and Pauline Vincenten.

Seppo Haasi (Vaasa, Finland)
Henk de Snoo (Groningen, Netherlands)
Franek Szafraniec (Krakow, Poland)

Funding Sources

General Lorentz Center Funding

Lorentz Center funding, assigned to workshops after consultation of the program advisory boards, is provided by the following institutions:

OCW Ministerie van Onderwijs, Cultuur en Wetenschap	Workshops in Astronomy, Computer Sciences, Life Sciences, Mathematics, Physics, as well as Interdisciplinary workshops
FOM Stichting voor Fundamenteel Onderzoek der Materie	All workshops (partly) in Physics
NWO Nederlandse organisatie voor Wetenschappelijk Onderzoek	Workshops in Astronomy, Computer Sciences, Life Sciences, Mathematics, Physics, as well as Interdisciplinary workshops

Other funding sources

Additional funding for specific workshops was provided by:

Sponsor	Workshop	Date
ASTRON	• Powerful Radio Galaxies • Dotastronomy 2009	23 – 27 November 30 Nov. – 4 Dec.
BMTI	• Brain Waves	22 – 26 June
British Counsel	• Dotastronomy 2009	30 Nov. – 4 Dec.
Compositio Mathematica	• Counting Points on Varieties • Géométrie Algébrique en Liberté • Frobenius Lifts • New Directions in Dynamical Systems	14 – 24 April 8 – 12 June 5 – 9 October 7 – 11 December
Delft Center for Materials	• Scale Transitions in Space and Time for Materials	19 – 23 October
DIAMANT Cluster	• Counting Points on Varieties • Frobenius Lifts • Metabolic Pathways Analysis	14 – 24 April 5 – 9 October 26 – 30 October
Donders Institute	• Brain Waves	22 – 26 June
EPS	• Statistical Mechanics of Static Granular Media	6 – 10 July
GATE	• Rich Cognitive Models for Policy Design and Simulation	12 – 16 January

GQT Cluster 	• Géométrie Algébrique en Liberté • Monodromy and Geometric Phases in Classical and Quantum Mechanics	8 – 12 June 15 – 19 June
Groningen University 	• Subdivide and Tile: Triangulating Spaces for Understanding the World	16 – 20 November
INRIA 	• Subdivide and Tile: Triangulating Spaces for Understanding the World	16 – 20 November
Kavli Foundation	• Spin Caloritronics	9 – 14 February
KNAW 	• Spin Caloritronics • Counting Points on Varieties • Monodromy and Geometric Phases in Classical and Quantum Mechanics • Context, Causes and Consequences of Conflict • Stellar Mergers • Microbes in Ecosystems • New Directions in Dynamical Systems	9 – 14 February 14 – 24 April 15 – 19 June 31 Aug. – 4 Sept. 21 – 25 September 12 – 16 October 7 – 11 December
Laser Center VU 	• Cavity Enhanced Spectroscopy	1 – 4 November
Layerttec	• Cavity Enhanced Spectroscopy	1 – 4 November
Leiden Observatory 	• From Disks to Planets: Learning from Starlight	16 – 20 March
Leiden University 	• Solar Biofuels from Microorganisms	30 March – April 3
Lorentz Fonds 	• Statistical Mechanics of Static Granular Media • Giant Fluctuations in Population Dynamics • Flows of Foam • Universe in a box • Physics Goes DNA	6 – 10 July 3 – 7 August 17 – 21 August 24 – 28 August 7 – 11 September
Marie Curie 	• The Chemical Enrichment of the Intergalactic Medium	25 – 29 May

Mathematical Research Institute (MRI)	• Counting Points on Varieties • Géométrie Algébrique en Liberté • Brain Waves	14 – 24 April 8 – 12 June 22 – 26 June
NBVKI	• Rich Cognitive Models for Policy Design and Simulation	12 – 16 January
NDNS+ Cluster	• Mathematical Challenges in Climate Science • Experimental Design in Systems Biology • Monodromy and Geometric Phases in Classical and Quantum Mechanics • Brain Waves • New Directions in Dynamical Systems	9 – 13 March 2 – 5 June 15 – 19 June 22 – 26 June 7 – 11 December
NIAS	• Rich Cognitive Models for Policy Design and Simulation • Context, Causes and Consequences of Conflict	12 – 16 January 31 Aug. – 4 Sept.
NISB	• Microbes in Ecosystems • Metabolic Pathways Analysis	12 – 16 October 26 – 30 October
NOVA	• Deep IR Studies of the Distant Universe • From Disks to Planets: • Interactions in the Dark • Distribution of Mass in the Milky Way Galaxy • Stellar Mergers • Cavity Enhanced Spectroscopy • Evolution of the Galaxies from Mass Selected Samples	2 – 6 February 16 – 20 March 6 – 9 April 13 – 14 July 21 – 25 September 1 – 4 November 9 – 13 November
NWO (additional)	• Mathematical Challenges in Climate Science • Experimental Design in Systems Biology • Monodromy and Geometric Phases in Classical and Quantum Mechanics • Stellar Mergers • Dot Astronomy 2009	9 – 13 March 2 – 5 June 15 – 19 June 21 – 25 September 30 Nov. – 4 Dec.
Pharma IT	• Optimizing Drug Design	20 – 23 July
RAS	• Dot Astronomy 2009	30 Nov. – 4 Dec.
Radio Net	• Dot Astronomy 2009	30 Nov. – 4 Dec.
SIGO	• Context, Causes and Consequences of Conflict	31 Aug. – 4 Sept.

SIKS	• Rich Cognitive Models for Policy Design and Simulation • Design of Collective Intelligence	12 – 16 January 23 – 27 February
SRON (Dutch Space?)	• En Route to Jupiter and Saturn	29 June – 3 July
Thomas Stieltjes Institute for Mathematics	• Counting Points on Varieties • Géométrie Algébrique en Liberté • Frobenius Lifts • New Directions in Dynamical Systems	14 – 24 April 8 – 12 June 5 – 9 October 7 – 11 December
Thermo Fisher	• Cavity Enhanced Spectroscopy	1 – 4 November
Tiger Optics	• Cavity Enhanced Spectroscopy	1 – 4 November
TNO	• Active Beam Spectroscopy for Control of the Fusion Plasma	24 – 27 March