Scientific Report 2005

Lorentz Center
P.O. Box 9506
2300 RA Leiden

Visiting address:
Niels Bohrweg 2
2333 CA Leiden

Tel. +31 71 527 5400
Fax +31 71 527 5415
www.lorentzcenter.nl

Contents

Press releases (in dutch)

Mission Concept and Support

The Lorentz Center is an international center aiming to coordinate and host workshops in the sciences, based on the philosophy that science thrives on personal interaction between creative researchers. Lorentz Center workshops focus on new collaborations and interactions between scientists from different countries, fields, and levels of 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 20 to 50 junior and senior researchers, typically for a period of one to two weeks, in a stimulating environment with working space for all participants: offices with a desk, personal computer, white boards, meeting rooms. Through a combination of informal talks, working sessions, tutorials 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. The Lorentz Center actively promotes the public awareness of science and is also open to workshops addressing this issue.
Workshops can be proposed and organised by any researcher from any country. Workshops organized by researchers from different backgrounds and nationalities are encouraged. The proposals for the workshops and their scientific programs are reviewed by Program Advisory Boards. Currently there are Advisory Boards for astronomy, computer science, mathematics and physics, but the Center is also open to proposals outside these fields. 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 nearby, the Lorentz Center welcomes proposals for interdisciplinary workshops that bring together one or more disciplines of the Lorentz Center with those of the NIAS. Lorentz Fellowships are awarded by NIAS to scholars who are engaged in research across the boundaries of the humanities, the social sciences and the natural sciences. 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.

Support

The Lorentz Center is supported by
Leiden University,
FOM, the Dutch Physics Funding Foundation "Fundamenteel Onderzoek der Materie",
NWO, Research Council EW.
The Lorentz Fonds regularly supports workshops in Physics

Foreword by the director

The year 2005 was an important year for the Lorentz Center – our day to day life dominated by preparing and running workshops went smoothly and did not change very much from previous years, but behind the scenes we have been working hard to ensure the continued growth and prosperity of the Lorentz Center in the future.

Discussions with the Royal Dutch Academy of Sciences (KNAW) about the importance of *Advanced Study Institutes* for the sciences and humanities in the Netherlands eventually lead to the conclusion that the KNAW would neither sponsor nor have formal links with the Lorentz Center. Nevertheless, an important outcome of the various plans and discussions has been that the KNAW-institue NIAS *(Netherlands Institute for Advanced Studies),* a nearby advanced study center for the humanities and social sciences, will establish in 2006 a cooperation with the Lorentz Center to organize joint interdisciplinary activities. NIAS has created two *Lorentz Fellowships* to host fellows who will use their stay at the NIAS to study a subject which touches on or has strong links with the sciences, and the Lorentz Center will host several cross-disciplinary workshops each year. The first two workshops of this type, are planned for 2006: a workshop on "Perspectives on Scientific Practice from Science and the Science Studies" and one on "Geometric Patterns in Islamic Art". A third one on "Social Software" is in the making for October 2006.

We are glad that the Gebiedsbestuur Exacte Wetenschappen of NWO has decided in the fall of 2005 to renew our grant to support workshops in astronomy, computer science and mathematics for the years 2006-2010, and that likewise the FOM foundation has renewed our grant for physics workshops for the same period. These budgets are crucial for the Lorentz Center to be able to start the organization of workshops which have been approved by our program advisory boards. At the same time, our present funding of workshops is still not internationally competitive, which makes it difficult to advertise abroad with an open call for proposals. We are exploring several ways to increase our workshop budgets and are hopeful to make a step forward in this regard in 2006. As soon as we will succeed in increasing our funding level, we intend to expand also into the biosciences – our aim is that in a few years the Lorentz Center will operate year round with workshops in the sciences, including the cross-disciplinary workshops together with the NIAS.

The essential part of this report is composed of the personal impressions and reports that the organizers have written about their workshops. In comparison with most other workshop centers in the sciences, a special feature of the Lorentz Center is the fact that we are not rooted in one single scientific discipline, but are present at least in four: astronomy, computer science, mathematics and physics. All these fields have slight differences in their way of working and their style. When you will read through the report you will see that this is reflected in our workshops, which range from open-ended workshops, aimed mostly at exchange of ideas and discussions, to more project-oriented meetings, centered around e.g. a particular telescope.

Having a basis in various disciplines also gives the Lorentz Center already now a very good basis to promote interdisciplinary workshops, not only workshops between our core disciplines but also activities which branch out beyond these. To illustrate this, let me simply draw your attention to some of the interesting workshops that were held in the past year:

- At the workshop "The multiscale nature of spark precursors and high altitude lightning" atmospheric scientists came together with discharge physicists to discuss the recent development on sparks and the so-called "sprite discharges" above thunderstorms.
- The impact of the first data coming from the Spitzer telescope on our understanding of star and planet formation were actively discussed at the workshop "Star and Planet formation with the Spitzer Space Telescope".
- The local environment of people today is more and more dominated by networks, sensors and actuators. The problems these systems pose to modern software engineering were one of the topics at the successful computer science workshop "Distributed Embedded Systems".
- The first workshop of the "Dynamics of Patterns" program of the NWO and FOM brought together mathematicians and physicists to discuss projects of common interest.
- In a similar vein, modern mathematics and high energy physics came together at the "Arithmetic Geometry and High Energy Physics" workshop.
- With support from the Philips company (among others), recent advances in optimization problems were discussed at the workshop "Model order reduction, coupled problems and optimization".
- On the first day of the successful workshop "Hydrodynamics of Bubbly flows" it was announced that Lohse, one of the organizers of the workshop, was awarded a Spinoza award.
- The new insights from the workshop *Nucleosynthesis in Binary Stars* were summarized by one of the organizers and two participants in a *Perspectives* article in *Science*.

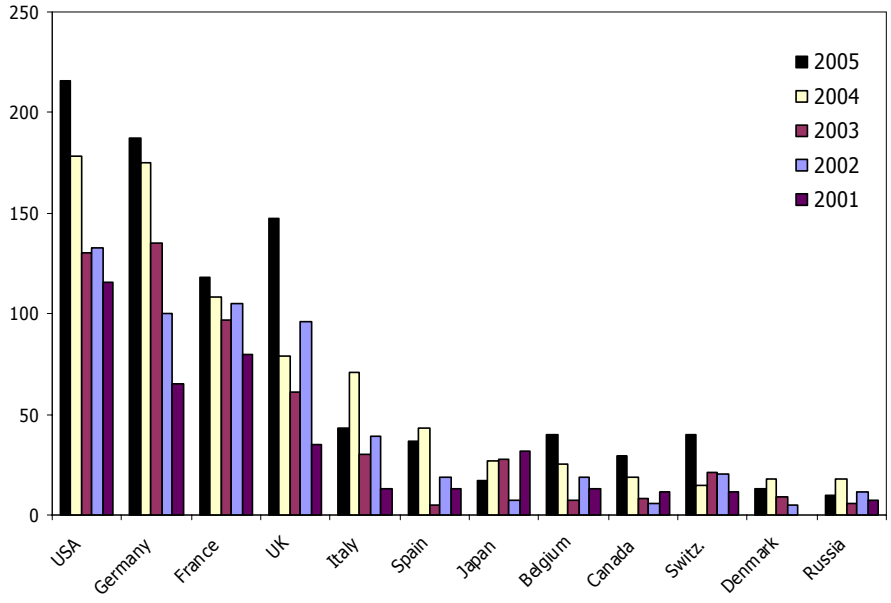
In 2005, our four program advisory boards each met once to discuss the functioning of the Lorentz Center and to brainstorm about suitable topics for future workshops. While so far proposals have been evaluated by the boards on an individual basis, members of the boards have expressed the desire to rank proposals in the future. One of the changes that we will therefore implement in the near future will be to have three evaluation rounds for workshop proposals per year. We intend to take a go/no-go decision on each workshop within a month after the deadline of each evaluation round.

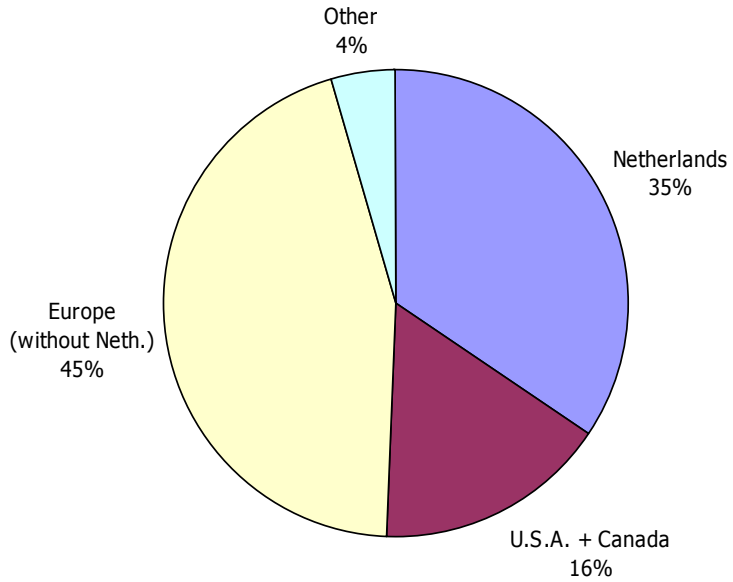
In December 2005, dr. Henriette Jensenius joined the staff of the center as the new science coordinator. She succeeded dr. Eppo Bruins, whose two jobs unfortunately did not leave him enough time for his Lorentz Center activities. With the appointment of dr. Henriette Jensenius the center can now properly support the program advisory boards and the development of new workshops.

I am happy to mention that in the fall of 2005, the nearby Bastion Hotel opened a new wing that was added especially to accommodate our guests. As a result, at most workshops all our visitors share the same hotel. Moreover, they can even meet each other in the Lorentz Lounge in the hotel, a place to meet and socialize specifically for our guests. Free wireless internet in the Lorentz Lounge and hotel rooms adds to the attractiveness of the housing in this hotel.

YEAR	2000	2001	2002	2003	2004	2005
Number of Meetings	23	31	34	31	38	41
Number of Workshops	**15**	**21**	**23**	**22**	**31**	**35**
Number of Visitors	880	1002	1421	1436	1640	1761
Reg.workshop participants	**640**	**735**	**1005**	**1007**	**1133**	**1562**

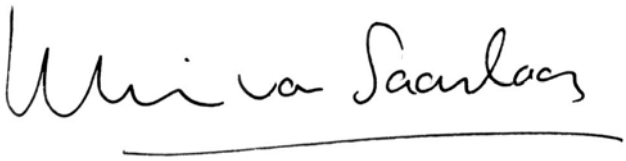
The table above illustrates our continuous growth and expansion of activities. The number of workshops grew slightly while the number of registered participants grew substantially with about 35%. 42% of the registered participants belonged to the group of young researchers of PhD students and postdocs.





At the same time, the distribution of the countries of origin of our participants, shown in the figures above, is remarkably stable over the years. This stability I consider as evidence that our workshops appeal to the international science community and that the topics of our workshops are at the forefront of the worldwide scientific developments.

In order to emphasize our role as a national center with an international outlook, the Lorentz Center has changed its web address to www.lorentzcenter.nl.



Wim van Saarloos
Director Lorentz Center

April 2006

Program Boards as of 01-01-2006

Program Board for Astronomy

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D. van der Marel	University of Genève
C.J.M. Schoutens	Universiteit van Amsterdam
H.T.C. Stoof	Universiteit Utrecht

Legacy Surveys with the James Clerk Maxwell Telescope

January 24 – 26, 2005

The James Clerk Maxwell Telescope (JCMT) at Mauna Kea, Hawaii, is the largest filled-aperture submillimetre telescope in the world. This telescope will in the coming years be equiped with new state-of-the-art instrumentation, dramatically increasing its observing speed and survey power. In an era when pointed observations with ALMA will play a major role, survey power is an essential capability. For these reasons the JCMT Board has issued a call for Legacy Survey proposals, in order to maximally exploit the capabilities of the new instrumentation and to provide a lasting scientific heritage.
This call for proposals met with an overwhelming response: the total available lifetime of the telescope was oversubscribed by more than 500%. The January workshop at the Lorentz Center was organized in order to develop a coherent, comprehensive, and well-organized Legacy Survey program, that would optimize the use of the JCMT in the years to come. The workshop was attended by 50 submillimetre astronomers from all over the world, but mostly from the JCMT partner countries (UK, Canada and the Netherlands), and the attendance represented the bulk of the JCMT user community. As such the meeting was already unique.

The meeting was structured as follows:
1. a set of introductory talks, outlining the survey program, the instrumental parameters, the purpose of the present meeting, and further steps after the meeting;
2. a set of introductory talks outlining the various surveys proposed so far; this included cosmological surveys, nearby extragalactic surveys in continuum and lines, surveys of the galactic plane and of high and low-mass star forming regions, spectral surveys, and a survey of debris disks around nearby stars;
3. following this, the participants split up into several groups, coordinating surveys, identifying overlap, and sharpening the scientific case;
4. finally, on the last workshop day, every team gave a brief final presentation on the results of the process.

The workshop was highly successful: it resulted in a coherent and balanced set of Legacy Survey programs, with well worked-out science cases and clearly defined technical requirements. These survey plans were (after the workshop) refereed by a team of 10 international and impartial experts, who were uniformly impressed by the high quality of the program. With input from these referees, a final survey program was finally put together by the JCMT Survey Steering Group, which was subsequently approved by the JCMT Board in the summer of 2005. In total 55% of the available JCMT time will be set aside for the Legacy program from mid-2006 onwards. Not only has this workshop resulted in an extremely powerful survey program, it has also demonstrated the vital importance of the JCMT and its instrumentation to various funding agencies, in a time when financial pressure was high. As a result, the JCMT and its instrumentation and survey programs are now in a scientifically and financially healthy state, and we are looking forwards to an exciting future for the JCMT and to its Legacy products.

P.P. van der Werf (Leiden University, The Netherlands)

Scientific Report

Electronic and Spin Transport in Superconductor / Ferromagnet Nanostructures

February 20 – 25, 2005

The field of superconductor / ferromagnet nanostructures is moving rapidly, which new concepts emerging such as (phase-shifting) π-junctions, the superconducting spin switch, or the spin-triplet order parameter. At the moment, the community is confronted with an increasing amount of observations, which is even outdone by the number of contributions from theory. It was therefore the aim of the workshop to bring together experimentalists and theorists working in the field, in order to help identify the key questions and experimental verifications. In order to have enough time for discussions, the program typically showed three longer contributions of 45 min and two shorter ones of 30 min each day. In total there were six long plus eight short talks on theory, and 4 long plus 5 short talks on experiments. The total number of participants was 38.

The main subjects singled out for the 5-day meeting were ***SFS junctions / LOFF states*** (contributions from v. Harlingen, Ryazanov, Strunk, Kontos, Blamire (experimental), Kupriyanov, Buzdin, Tanaka, Annett, Keizer (theory)); ***triplet superconductivity*** (Volkov, Eschrig, Fogelström, Kadigrobov (theory)); ***non-local effects*** (Melin, Feinberg (theory), Russo, Beckman, Chandrasekhar (experiment); ***spin-injection / interfaces*** (Radovic, Morten, Löfwander (theory); Pratt (experiment)).

The program clearly reflected the status of the field. The questions about SFS junctions are now quickly moving to quantitative comparisons between theory and experiments, with as big unknowns the effects of spin scattering, both in the bulk of the F-layer and at the interfaces. This was also emphasized in the contributions on spin injection and interfaces, and it is clearly one area where focused experiments are needed. With respect to triplet superconductivity, theorists largely agree about the existence of a triplet channel for pairing, for instance caused by inhomogeneous magnetization, but there is no single measurement yet, and there was much discussion about possible controlled experiments. For non-local effects (crossed Andreev reflections) interesting confusion exists, with different predictions and contradictory measurements.

The participants were very enthousiastic about the workshop, both because of the scientific level and because of the excellent facilities of the Lorentz Center. It may not be a surprise anymore for the staff of the Lorentz Center to hear that the facilities and the organizational support very much contribute to an atmosphere where the full focus can be on science. Furthermore, a grant from Leiden University allowed a number of junior researchers to be present, which was much appreciated.

J. Aarts (Leiden University, the Netherlands)
W. Belzig (University Basel, Switzerland)
A. Golubov (Technical University, Twente)

Scientific Report

Size-Dependent Mechanical Properties

February 28 – March 4, 2005

This workshop was organized partly within the EU Marie-Curie Research and Training Network SIZEDEPEN. As intended, the workshop attracted participants with a mixture of backgrounds, ranging from mechanical engineering to statistical physics, and from various types of institutions. A total of 9 countries were represented: Netherlands (17), Belgium (2), Germany (7), UK (6), France (3), USA (3), Hungary (2), Austria (2), Spain (1).
The program consisted of 11 invited, keynote presentations of one hour, a number of slots for ad-hoc talks, all interspersed with discussion periods of flexible duration, and a poster session. The ad-hoc presentations were proposed during the week, in response to discussion topics. In line with the proposal, four main themes were addressed:

1. Dislocations and strain gradients
2. Surfaces, interfaces and friction
3. What do applications want from us?
4. Fracture

In each of the themes, presentations were invited that offered up-to-date and conflicting/supplemetary views. This led to intense discussions, with new viewpoints provided sometimes from unexpected areas.During the workshop a number of ideas for future work, especially within SIZEDEPEN, were gathered and discussed in a final plenary session. Among these ideas is the plan to develop a number of three-dimensional benchmark problems for size-dependent (sub-)micron plasticity that should be studied experimentally, by means of discrete dislocation plasticity and by the dislocation field theories under development. In doing so, interaction with industrial representatives was instrumental.
A CD-ROM containing all presentations has been distributed among the participants.

Peter Gumbsch (University of Karlsruhe/FhG-IWM), Germany
Erik van der Giessen (University of Groningen, the Netherlands)

Scientific Report

Transport through Single Molecules

March 7 – 12 2005

There is beauty and power in the idea of building electronics using single organic molecules as the elementary components. Several researchers have proposed such ideas already many years ago, but attempts towards realising this goal have met with many practical problems. More recently a number of experimental techniques have been developed that allow applying electrical contacts to individual molecules. This has revived the interest of the community of theoretical physicists and chemists. Apart from possible electronic applications single-molecule bridges could serve as nanosensors of a wide variety of stimuli.

Although the applications provide a motivation for the research, at this moment the work is still largely exploratory and provides many interesting fundamental problems. It brings together teams with very different backgrounds, from physics, chemistry, computational science and molecular biology. One of the aims of the workshop held at the Lorentz Center was to bridge the gaps between these communities of science by providing a stimulating environment for scientists to have open discussions and learn from each other by tutorial lectures and reports of the latest developments. The subjects of study addressed at the workshop include the synthesis of target molecules, computational modeling, and measurement techniques. Some of the questions addressed are: Which are the interesting molecules that we should focus on? How can we connect the molecules reliably to the macroscopic world? How do we know we are measuring the properties of just a single molecule? How do we model transport properties theoretically, and how realistic are these models?

The workshop was co-sponsored by the ESF-EUROCORES program and the meeting combined two goals: (1) a platform to bring together three projects of the EUROCORES program on Self-Organising Nanostructures (SONS), (2) an opportunity for open discussion of directions of research in this new field, and an introduction into the field for PhD students.

The workshop was attended by 59 registered participants from 8 European countries. There were 5 tutorial lectures, 5 keynote lectures, 24 brief contributions, and 2 plenary discussion sessions. The program allowed for ample time for individual discussions. The conclusions of the meeting were summarised at the closing session and some of the main points raised were:

1. The ideal experimental technique has not yet been found. Also we will probably have to live with limited control of the coupling of the molecules and the local environment. Therefore it will be important that several groups study the same types of molecules with different approaches. Several benchmark molecules were selected for further studies.
2. There are still large uncertainties regarding the outcomes of calculations for these systems based on Density Functional Theory. There is need for more well-defined experimental results against which the calculations can be fine-tuned.
3. Many of the interesting molecular junctions are formed by thiol end groups linked to gold metal electrodes. However the proper chemistry and conditions for forming this thiol-gold bond are not widely known. Some recipes have been used that should not work but give results nevertheless. We should pay more attention to the conditions of bond formation and search for the most reliable methods.

Scientific Report

The workshop has achieved its goal in view of the many stimulating discussions, the many ideas that evolved for collaborative research work and the contacts forged between scientists from different fields. There are plans to organise a follow-up meeting next year, which will be chaired by the FUN-SMARTs consortium of the EUROCORES SONS program.

J.M. van Ruitenbeek (Leiden University, The Netherlands)
N. Agraït (Universidad Autónoma de Madrid, Spain)

Scientific Report

Stochastic Systems

March 16 – 19, 2005

Aim
Stochastic models are applied in fields as telecommunication, manufacturing, service operations and computer science. The development of theoretical and computational approaches in stochastic systems is of great practical interest for the design of complex systems. Intensive research in the past decades has provided a firm theoretical framework for attacking many of these problems. The implementation of theoretical results into computationally feasible methods links this research to parts of computer science and the design of complex systems.

The earlier and notorious 'curse of dimensionality' nowadays plays less a role in computer implementations itself due to ever-increasing computer power. However, there is still a need for the development of new methods for explicit computation or approximation of the desired performance measures. Such methods often exist for low dimensional examples, but are still largely non-existent in more practical situations of complex and high-dimensional stochastic systems. This research has involved various disciplines in mathematics: stochastic processes, combinatorics, numerical analysis, optimization and control.

The aim of this workshop was to focus on this high-dimensionality problem, by bringing together international experts in different areas of stochastic models in operations research and applied probability. By exchanging recent developments and ideas from these fields, the workshop aims to stimulate new research in the interface of the different areas of stochastic models.

Participants
The workshop was attended by 42 participants, of which 15 were invited by the organizers. The participants came from Australia, Czech Republic, France, Germany, Israel, The Netherlands and United States.

Programme
The workshop was structured via 15 invited lectures, addressing as main topics Markov decision chains, queueing theory and applied probability.

The following talks were presented:
Onno Boxma (Eindhoven, The Netherlands): *The G/M/1 queue revisited*
Hans Daduna (Hamburg, Germany): *On throughput in large queueing networks*
Eugene Feinberg (Stony Brook, USA): *Optimality of Nonrandomized Policies for Certain Constrained MDPs*
Jerzy Filar (Adelaide, Australia): *Doubly Stochastic Matrices & The Hamiltonian Cycle Problem*
Ted Hill (Atlanta, USA): *Algorithms for Constructing Probability Measures at Random*
Arie Hordijk (Leiden, The Netherlands): *Multi-modularity and Regularity; recent applications*
Ulrich Rieder (Ulm, Germany): *Portfolio-Optimization with Different Information Structures*
Rhonda Righter (Berkeley, USA): *Staffing Decisions for Heterogeneous Workers with Turnover*
Volker Schmidt (Ulm, Germany): *Fitting and Simulation of Models for Telecommunication Access Networks*

Karel Sladky (Prague, Czech Republic): *Variance Selection Rules in Markov Decision Processes*
Adam Shwartz (Haifa, Israel): *Large Deviations for Queues: recent extensions*
Sandy Stidham (Chapel Hill): *On the Optimality of a Full-Service Policy for a Queueing System with Discounted Costs*
Henk Tijms (Amsterdam, The Netherlands): *Approximations for multi-server queues with finite waiting room*
Uri Yechiali (Tel-Aviv, Israel): *Controllling an oscillating Jackson-type network having state-dependent service rates*

On Wednesday evening (March 16) a discussion was organized about several themes, anonymously proposed by the participants.

On Saterday (March 19), there was a special session on the occasion of the 65th birthday of Arie Hordijk with contributions by some of his former PhD students:
Ger Koole: *On the edge of queueing and decision making*
Dinard van der Laan: *Optimal Open-Loop Polling*
Ad Ridder: *The minimium cross-entropy method for rare event estimation*

Outcome
The workshop was highly successful. At the end of the workshop, we got positive replies from everyone. The participants were all enthusiastic about the workshop, the scientific level and they were very pleased with the excellent facilities of the Lorentz Center. Furthermore, they enjoyed the social interaction, which provided a fertile opportunity for further discussions and cooperation.
As a measure of success, we would like to point out that the highly qualified *International Journal Mathematical Methods of Operations Research* (published by Springer) will devote a special issue to the contributions of this workshop. After a referee procedure this issue will appear at the end of 2005.

Acknowledgements
The workshop organizers would like to express their thanks to the Lorentz Center and Martje Kruk and Wies Groeneboer for the excellent facilities and support. The workshop was generously sponsored by Leiden University, NWO (Netherlands Organization for Scientific Research), KNAW (Royal Dutch Academy of Sciences), MRI (Mathematical Research Institute) and the Thomas Stieltjes Institute for Mathematics.

Lodewijk Kallenberg (Leiden University, The Netherlands)
Ger Koole (Vrije Universiteit, Amsterdam, The Netherlands)
Ulrich Rieder (University of Ulm, Germany)
Floske Spieksma (Leiden University, The Netherlands)

Principles of Magnetohydrodynamics

With Applications to Laboratory and Astrophysical Plasmas

March 21 – 24, 2005

This workshop, named after the 2004 Cambridge University Press book by Hans Goedbloed and Stefaan Poedts [ISBN 0 521 62347 2 or ISBN 0 521 62607 2], brought together experts from various disciplines sharing an interest in applications of – as well as fundamental theory of – magnetohydrodynamic (MHD) plasma modeling. It was attended by 52 participants, and was held partly as a tribute to Hans Goedbloed, who will become emeritus in summer 2005.

In an introductory session on identifying current fundamental issues in laboratory and astrophysical plasma modeling, Eric Priest presented us with a modern view of our Sun, provided by the rich amount of data and stunning images coming from space missions like SOHO, TRACE, etc. From the MHD modeling point of view, the coronal tectonics model where heating events are driven by continuous reconnections in current sheets formed as photospheric flux sources move about and trigger topological changes above them is a striking new viewpoint on coronal heating. In a fusion context, Jeffrey Freidberg gave us his views on still unresolved issues in the MHD modeling of tokamak plasmas. For steady-state tokamak operation, theorists and modelers must investigate ways to stabilize resistive wall modes, control Edge Localized Modes, further study neoclassical tearing modes, and look seriously at flow stabilization mechanisms.

The remainder of the workshop was organized around 5 themes, with both promising young researchers (pursueing a PhD or having at most 2 years of postdoc experience) and experts contributing to each theme. In the session on MHD spectroscopy, Hans Goedbloed and Sasha Lifschitz presented recent findings from HD and MHD spectral theory, with emphasis on flowing (stationary) equilibria and how this significantly influences the linear waves and stability properties. Specific examples for magnetorotational overstable modes in accretion disks were given by Jan Willem Blokland, while Jesse Andries showed calculations for solar coronal loops, where global kink modes can act as diagnostic tool for inferring loop internal properties. This session ended with a lively discussion on the pros and cons of coronal seismology, led by panel members Valery Nakariakov, Thomas Bogdan, Leon Ofman, and Hans Goedbloed.

Day two started the session on laboratory MHD, with Guido Huysmans presenting MHD spectroscopic analysis of tokamak discharges, and showing us glimpses of near future modeling capabilities of full 3D discharges with his JOREK code. Later that day, Nick Young gave a presentation on MHD spectroscopy for tokamak plasmas, where Toroidal Alfven Eigenmodes measured experimentally can be identified precisely in spectral computations, and lead to improved reconstructions of the governing Grad-Shafranov equilibrium. Niek Lopes Cardozo presented recent experimental achievements in tokamaks, including the potential to stabilize in real-time developing neoclassical tearing modes by localized Electron Cyclotron Resonance Heating schemes. A panel discussion with Hugo de Blank, Dalton Schnack, Jeffrey Freidberg and Guido Huysmans closed off the session, stressing the fact that effects like plasma turbulence in magnetically confined plasmas couple in kinetic plasma effects which are near impossible to handle fully self-consistently on current and future supercomputers.

Scientific Report

In the solar MHD session, Alan Hood presented 3D simulations of kinking coronal loops, possible precursors to violent coronal mass ejections. Zoran Mikic showed how they now routinely predict the coronal structure at upcoming eclipses by producing MHD models fed with photospheric magnetogram data. Impressive progress in full 3D CME modeling, all the way to 1 Astronomical Unit, is made by coupling coronal with interplanetary models. James McLaughlin presented the intricate MHD wave patterns occurring in the vicinity of a magnetic null point.

In a session on astrophysical MHD, Bob Rosner concentrated on reconnection, and illustrated how current laboraty experiments (MRX at Princeton) are providing new insights on non-steadiness of `fast' magnetic reconnection, which is ubiquitously invoked in many astrophysical phenomena. Kanaris Tsinganos presented a clear overview of both analytical as well as new numerical models (venturing into the relativistic MHD domain) of outflows and jets throughout the universe. Anders Johansen discussed PENCIL simulations of magnetorotational turbulence in the shearing box model for local accretion disk dynamics, and how it influences dust diffusion processes.

In the final session on computational MHD, Gabor Toth impressed the audience by the achievements from the Centre for Space Environment Modeling: faster than real time computations of Coronal mass ejections, their propagation to 1 AU, and coupling it with current magnetospheric models to provide predictive capabilities for space weather forecasting. Henk van der Vorst gave a historic overview on the Jacobi-Davidson generalized eigenvalue solution method, allowing us to accurately compute interior (e.g. Alfvenic) eigenmodes of ever larger dimensional problems. The session and the workshop closed with a panel discussion on computational MHD, with contributions from Robert Rosner, Gabor Toth, Stefaan Poedts and Rony Keppens.

Together with the social activity (boattrip and dinner), the workshop was a great success, and has been lauded by all participants. The professional support and organization by the Lorentz Center staff is extremely appreciated. We gladly acknowledge financial support from CPS, FOM Rijnhuizen, and the Lorentz Center

Rony Keppens (FOM-Instituut voor Plasmafysica Rijnhuizen, The Netherlands)
Niek Lopes Cardozo (FOM-Instituut voor Plasmafysica Rijnhuizen, The Netherlands)
Stefaan Poedts (Centrum voor Plasma-Astrofysica, K.U. Leuven, Belguim)

Scientific Report

Nucleosynthesis in Binary Stars

April 4 – 15, 2005

The aim of this workshop was to assess the contribution that binary stars make to the synthesis of elements in the Universe. It has been realized for a long time that binary stars cause some of nature's most violent explosions, novae and Type Ia supernovae, which play a major role in enriching the interstellar medium. However, there are many other indications that binary stars are instrumental in affecting stellar abundances. Many stars showing abundance peculiarities, such as barium and CH stars, form in binary systems as a result of mass transfer. The same is apparently the case in many extremely metal-poor stars that are carbon- and s-process enriched. Other types of star, such as R- and J-type carbon stars, are still poorly understood but there are strong indications that duplicity has played a key role. The workshop brought together 34 astrophysicists working in the divers fields of stellar nucleosynthesis, binary star evolution, novae and supernovae, stellar abundances and presolar grains from meteorites. In a series of review talks the present state of affairs in these fields was discussed and, in particular, the currently open questions were addressed. The program and length of two weeks of the workshop allowed for plenty of informal discussion between talks and for the participants to work, using the facilities offered by the Lorentz Center, on many of the problems discussed.

Here are some of the highlights discussed and achievements made during the workshop. (1) We realized that many of the chemical peculiarities (enhanced carbon and s-process elements) observed in stars have a common origin in mass transfer from an asymptotic giant branch star to a binary companion and that this process was probably very common among early stellar generations at very low metallicity. The chemical abundances observed in some ultra-compact binaries, such as GP Com, also indicate that these are descendants of such extremely metal-poor carbon stars. (2) It emerged that there is an evolutionary sequence in which both R- and J-type carbon stars result from the merger process of a binary. Many details still defy explanation but it was concluded that much progress can be expected from several proposed observational tests and from 3-dimensional stellar evolution modelling such as the Djehuty project at the Lawrence Livermore Laboratory. (3) Work was initiated to implement an extensive nuclear network in a detailed binary evolution code and thus to model nucleosynthesis in binary stars with detailed codes. (4) The opportunity of having many stellar modellers together in one place was used to compare stellar models calculated with different codes: it emerged that substantial differences arise from different ways of modelling convective, and particularly semi-convective, mixing but that otherwise the models are remarkably similar.

The meeting was very successful in bringing together scientists from different fields and the, often informal, interactions and contacts established have brought forth several new ideas and collaborations. A summary article on the highlights of the workshop will be submitted to a leading astronomical journal and the possibility of starting an EU network on the topic was discussed. It was agreed that in about two years a follow-up meeting of several days should be organized at which the results of work initiated by this workshop will be shared.

All participants immensely enjoyed the excellent facilities and informal atmosphere offered by the Lorentz Center and the friendly and efficient organization of Wies Groeneboer, the program assistant, and Martje Kruk, the executive manager. The organizers are very grateful for the generous financial support by the Lorentz Center, NWO and NOVA, which made possible the participation of leading experts in the field as well as a large number of young researchers and PhD students, without which the workshop could not have taken place. The

meeting was organized under the auspices of the International Astronomical Union's Working Group on Abundances in Red Giants (WGARG).

Onno Pols (University of Utrecht, The Netherlands)
Robert Izzard (Carolune Institute for Quality Astronomy, United Kingdom)
Christopher Tout (University of Cambridge, United Kingdom)

Scientific Report

Ground Layer Adaptive Optics

April 26 – 28, 2005

From April 26 to April 28 2005, 34 international experts and graduate students in the field of Adaptive Optics gathered at the Lorentz Center in Leiden to discuss the benefits and challenges of implementing Ground Layer Adaptive Optics (GLAO) into the future generation of AO systems. GLAO is a novel but as of yet unproven concept that has attracted much attention within the AO community recently. Its aim is to provide future AO instruments on astronomical telescopes with a new mode of turbulence compensation. By correcting only low-altitude turbulence, GLAO offers low-order compensation over a much larger field of view than conventional AO.

The workshop was divided in 4 connected sessions, each discussing a separate element of GLAO: GLAO Projects, GLAO Wavefront Sensing Concepts, GLAO Modeling and GLAO experiments and Verification. Each session featured a small number of talks on key elements with ample opportunity for discussion, followed by a more general discussion on the topic. A separate general discussion was held to allow for a more global discussion of GLAO.

It became quickly clear that GLAO is not a miracle technique that delivers diffraction limited imaging under all conditions. GLAO is to be seen as a seeing improvement technique, with the most improvement, obviously, when most of the turbulence is found in the ground layer. Simulations indicate that factors of 1.5-2x increase in encircled energy are possible, leading especially for background limited observations to a proportional decrease in exposure time required for the same signal-to-noise ratio. It should be pointed out to funding agencies that GLAO should become a standard part of the telescope, to improve general observing conditions. The rewards of including a GLAO facility into a new—or existing—telescope design should be seen equal to the rewards of good site characterization for new telescope sites.

Turbulence characterization was considered to be one of the most important problems to be tackled. Since GLAO heavily depends on the nature of the turbulence profile good knowledge (or at least statistics) is essential to evaluate the value of GLAO for specific sites. Questions to be answered are, e.g., what is the strength of the Ground Layer Turbulence, and, what is the correlation between seeing and turbulence in the ground layer? Measurements at different sites connect bad seeing with the presence of a strong ground layer, indicating that application of a GLAO system would in this case lead to the largest improvement: GLAO works as the ultimate seeing stabilizer. Another element discussed was the need for continuous turbulence characterization during observations: Characterization of the turbulence profile at the beginning of the night would enable dynamic rescheduling if GLAO would not give large benefits due to the absence of a strong ground layer, while during the GLAO observation information about the turbulence profile might allow for optimization of the AO correction.

The last item highlighted is the shape of the point spread function as delivered by the GLAO system. Since the correction provided by GLAO depends on the location of the guide stars, the point spread function can vary over the field of view. Most GLAO systems use laser guide stars, both to provide a better sky coverage, as well as to provide a more uniform correction: Laser guide stars can be positioned anywhere in or near the field of interest, in any pattern, while natural guide star asterisms can naturally not be changed and lead to larger variations over the field of view. When using a GLAO system one has to make a trade-off between maximum correction and maximum homogeneity. The information about the wavefront as collected by the GLAO system could be used in post-processing for further deconvolution of

the PSF. Neither the question if a relatively poor PSF stability is acceptable when sufficient knowledge is available for reconstruction, nor the question if real-time correction, e.g. using GLAO, leads to more uniform correction than using post-processing, have been answered. The workshop succeeded in connecting people from the various groups working on GLAO-related projects. The focused workshop, with ample room for discussion, both on group as well as individual level, allowed for intense interaction discussion. Participants of the workshop seemed enthusiastic and interested and felt that the relaxed atmosphere made sure that everybody had a chance to bring forward their points. We evolved a better appreciation of the various GLAO methods proposed and I believe we have defined a better strategy to promote GLAO in current and future generations of telescopes.
The excellent facilities of the Lorentz Center and the efficient help of Wies Groeneboer and Martje Kruk greatly contributed to the success of the workshop. The organizers acknowledge the financial support of the Lorentz Center and NOVA, without which this workshop would not have been possible.

Remko Stuik (Leiden Observatory, The Netherlands)
Andreas Quirrenbach (Leiden Observatory, The Netherlands)
Ralf Flicker (Keck Observatory, United States)

Scientific Report

The Multiscale Nature of Spark Precursors and High Altitude Lightning

May 9 – 13, 2005

Motivation

In large volumes of non-ionized matter that are exposed to strong electric fields, narrow conducting filaments can form. These so-called streamers extend at their tip in their self-enhanced electric field. This is a generic dynamic phenomenon that occurs in many natural and technological phenomena. The proper exploration of these phenomena challenges a number of methods, from modern plasma diagnostics to geophysical observation campaigns on the phenomenological side and from microscopic modeling, large scale computations, model reduction up to pattern formation questions on the theoretical side. Typically, these developments are spread over many disciplines: electro-engineering, geophysics, applied physics, computational science and nonlinear dynamics.

Participants and topics

The workshop has succeeded in attracting relevant international researchers in the respective fields.

- Research on geophysical sprite discharges was presented in talks by Dave Sentman (Fairbanks, Alaska), Torsten Neubert and Olivier Chanrion (Copenhagen), Victor Pasko (Penn State), Elisabeth Gerken (Menlo Park, CA) and Martin Füllekrug (Bath, UK).
- Classical lightning research was presented by Earle Williams (MIT) and the authors of the classical Russian textbooks Yuri Raizer and Eduard Bazelyan (Moscow). Lightning induced run-away electrons and gamma radiation was covered by Bob Roussel-Dupre (Los Alamos) and Gennady Milikh (College Park, US).
- Modeling, applications and plasma diagnostics of electric discharges were presented by Jean-Pierre Boeuf (Toulouse), Anne Bourdon and Jean Paillol (Paris), Hans-Erich Wagner (Greifswald), as well as by members of our Dutch-Russian NWO-RFBR project: Sergey Pancheshnyi, Masha Nudnova, and Andrei Starikovskii, and by the Dutch Ph.D. students Tanja Briels, Bernard Meulenbroek and Carolynne Montijn. An excursion to the plasma-experimental facilities at the faculties of physics and electro-engineering at TU Eindhoven complemented this part of the program.
- Finally, pattern formation and nonlinear dynamics were presented by Martine Ben Amar (Paris), Alan Dorsey (Orlando) and Gianne Derks (Surrey, UK).

Course of the workshop

In total, there were 49 participants from Belgium, Denmark, France, Germany, The Netherlands, Russia, Spain, UK, and USA. In accordance with the phenomena of investigation, the topics and methods were wide spread, and this was much appreciated. Many participants felt that the workshop has contributed substantially to building an international cross-disciplinary community able to tackle these difficult phenomena. I received many very positive to enthusiastic responses.

Getting people in contact was accomplished by the following program parts: a general introduction round on Monday afternoon where every participant got 2 minutes to present him/herself and his/her interests, followed by a poster session and a wine and cheese party; and organized discussion rounds on specific topics on the early afternoon on Tuesday through Thursday. Every afternoon, an experimental and a theoretical session took place in parallel.

There were many elements contributing to the appropriate mixture of official talks and unofficial thought exchange. First of all, the smooth support of the Lorentz Center and its spatial facilities. Second, the joined short walks from the Lorentz Center to the nice and atmospheric lunch facilities of Hotel Witte Huis, together with two boat tours (a short one through the inner city and a long one over Kager Plassen etc.). The weather was in favor of us.

The whole workshop experience was so productive that it certainly should be repeated in spring 2007.

Publicity and financial support

The workshop and its topics were covered by a half-page article in the Volkskrant and one in Natuur Wetenschap en Techniek.
The following groups and organizations financially supported the workshop: the Lorentz Center, a Dutch-Russian NWO-RFBR collaboration grant, the research theme MAS3 of CWI, the capaciteitsgroep EPG of TUE and the research school CPS.

Ute Ebert (CWI Amsterdam and TU Eindhoven, The Netherlands)

Scientific Report

Intelligent Data Analysis

May 18 – 20, 2005

Supported by the UK-Netherlands Partnership Programme in Science and Lorentz Centre at the University of Leiden, the workshop on Intelligent Data Analysis (IDA) took place at the Lorentz Centre on 18-20 May 2005. The main purpose of this workshop was to bring together a number of researchers from statistics, machine learning, computer science, pattern recognition, and other areas to discuss important issues in IDA and identify those challenging and fruitful areas for further research, especially in the context of bioinformatics. Moreover, it was intended to bring together mostly young and talented researchers but also a few well-established leading researchers in the area from the Netherlands and UK to facilitate interactions and collaborations between the two countries. The workshop placed a special focus on the discussion of challenges in analysing high-dimensional data collected from high-throughput devices such as DNA and protein arrays. The topics discussed include synergy between various disciplines, experimental design, data analysis strategies, data quality (noisy, missing, inconsistent, outlying data), image processing, data visualization, novel algorithms and methods for challenging applications such as genomic medicine and systems biology.

We are pleased to report that the workshop has been a great success. About 35 participants took part in the workshop, most of whom were young researchers, ranging from PhD students and post-doctoral research fellows to new-blood lecturers. This, together with a number of well-established researchers in the field, has provided an ideal mix for fruitful discussions. Rather than having many oral presentations, we decided to focus much more on interactions, and our program reflected this emphasis. During the three-day workshop, we only arranged four keynote speeches and three short-talk sessions, and the rest was devoted to discussion, debate and problem solving. For example, we had two special bioinformatics sessions where biologists present challenging research questions in their fields, the participants were then divided into a number of groups to address each challenge, and each group then reported their findings to the whole workshop audience. Other sessions include debate on controversial issues in microarray analysis and key issues in intelligent data analysis. This emphasis on discussion, interaction and problem-solving has provided participants with ample opportunity to explore interesting problems in depth and start collaborating with each other on challenging issues. This is reflected by the fact that there were still several group discussions exploring collaborations between British and Dutch scientists AFTER the workshop had officially ended on the 20th!

In short, the workshop has been a great success in stimulating joint research between British and Dutch scientists, judged by the feedback we get from the participants. We understand some have already started writing research papers together, and others have already proposed research topics for possible EU funding. We are most grateful to the UK-Netherlands Partnership Programme in Science and the Lorentz Center for supporting this workshop.

Details of the workshop can be found in:
http://www.lc.leidenuniv.nl/lc/web/2005/20050518/info.php3?wsid=148

Joost Kok (Leiden University, The Netherlands)
Xiaohui Liu (Brunel University, DISC, United Kingdom)

Oscillations and (In-)Stability: Control Near and Far from Equilibrium in Biology

May 23 – June 3, 2005

In a living cell and in a network of cells a plenitude of different processes takes place at different time scales in different parts of the cell or network. One of the central problems in understanding the functioning of a single cell or of a network of coupled cells is to incorporate these many detailed processes of intra- and intercellular interactions in a unified framework. Against this background, the aim of this workshop was to gather theoreticians (from mathematics and physics) and experimentalists (from physics and biology/ neuroscience) to

- explore basic concepts underlying the dynamics of and transitions between states in cells and networks of cells;
- define new, testable hypotheses about neural dynamics;
- establish new collaborations for testing these hypotheses.

The form of the workshop was twofold. In the first three days experts in the field gave tutorial lectures (1½ hour plus discussion). Four lectures per day were offered in order to level the theoretical background of Ph.D. students and post-docs working in the field. We started with a general introduction on basic principles of stability in nonlinear systems and on stochastic differential equations (Daffertshofer), followed by applications in the domain of neuro-imaging (Jensen and Stam) and in the regulation of gene-expression and protein synthesis (Domany). Sneyd discussed how rapid changes in chemical and electrical equilibria allow information transfer without disturbing osmotic processes and without toxic effects. Gielen, Coolen, and Longtin discussed how stochastic processes in cell networks with various types of coupling affect the stable behavior of the network. All the tutorials were highly appreciated by the Ph.D. students and post docs. The relaxed atmosphere stimulated lively debates and many students discussed results from their own projects with the lecturers. During the second part of the workshop each day two presentations on specific topics were given (seven days in total), starting from a broader perspective and focussing on the main problems within that sub-field. This form worked extremely well and, frequently, discussions went on until late at night.

Among the immediate results of the workshop two new collaborations were initiated. Fries, Kopell, and Gielen developed some novel ideas to explain the spontaneous generation of neuronal oscillations due to stimulus-driven (bottom-up) and attention-driven (top-down) mechanisms. Notice that this is a very actual topic in the field, first, because there are various undecided hypotheses about the functional role of neuronal oscillations per se and, second, because this issue touches questions like: how is it possible that the brain changes between stable states without postulating some "homunculus" or puppeteer that pulls the strings. A second collaboration developed between research groups in Auckland and Nijmegen on the coupling between Calcium oscillations and electrical activity and on propagation of electrical activity in excitable cells. This problem is highly relevant for studies on propagation of electrical activity in the heart (ten Tusscher and Panfilov). Tentative plans for future projects include a more general discussion about stochastic differential equations with delay and possible impacts thereof on models in neural systems (Longtin and Daffertshofer).

Without exception all participants were very excited about the workshop. One of the surprising results of the workshop was to see how the same principles for the control of stability apply to sub-cellular processes, to intercellular communication between neurons, and to stable propagation of electrical activity in the heart. During the workshop a manuscript was finished with valuable help from James Sneyd (submitted to *Biophysical Journal*). The outline for two more papers was developed and there will be a frequent e-mail correspondence to finalize these papers. This illustrates that the workshop clearly reached its aforementioned goals.

Stan Gielen (Radboud University Nijmegen, The Netherlands)
Andreas Daffertshofer (Free University Amsterdam, The Netherlands)

Scientific Report

Hydrodynamics of Bubbly Flows

June 6 – 16, 2005

With their ubiquitous occurrence in a multitude of fluid systems bubbles occupy a very important place in contemporary science and technology. One can readily cite a multitude of examples: the production and transport of oil (where bubbles are purposely injected to help lift heavy oil to the surface), energy generation (where boiling is the key process in producing the steam to drive turbines), the chemical industry (where gas-liquid reactors rely on bubbles to increase the contact area between the phases), the oceans (where breaking-wave generated bubbles are important sinks for atmospheric CO2), piezo-electric ink-jet printing (where they are just disturbing), bubble chambers in high-energy physics (where they used to signal the traces of energetic particles), and many others.
Due to the improved experimental and computational techniques there has been rapid progress in the field in the last decade. E.G., simulating a few rising, deformable bubbles in still water is meanwhile possible. Also a lot of theroretical insight has been gained. However, many questions have remained open. This holds both for a single bubble, e.g., what is the lift force on a single bubble in shear or rotational flow, and for many bubbles, e.g., how do many bubbles in turbulent flow modify the spectrum? Various experimental and numerical results on these questions have been obtained, but they often seem contradicting to each other, presumably as the exact conditions are different.
The goal of the Euromech colloquium 465 and of the workshop at the Lorent Center was to allow for an exchange of ideas on the recent developments in this field.
There were altogether about 50 participants and about 35 presentations, among them seven key-note lectures, namely of John Blake (Birmingham), Christophe Clanet (Marseille), Alfonso Ganan-Calvo (Sevilla), Jacques Magnaudet (Toulouse), Yoichiro Matsumoto (Tokyo), Andrea Prosperetti (Johns Hopkins), Gretar Tryggvason (Worcester), see also the list of participants and the full program. Most importantly, there was a lot of time for informal discussions between the participants who all were allocated in offices equipped with computers and white boards.
Reoccuring issues addressed in the talks and informal discussions were:

* *Bubble path instability of a rising bubble*
Both optical and acoustical measurements and numerical calculations were presented. The latter allow to study "artificial" cases such as rising bubbles of fixed nonspherical shape or bubbles with pure slip of pure no-slip boundary conditions. Quite some fraction of the parameter space of interest has meanwhile be explored. For a bubble with a Reynolds number around 800 the series of events is (i) straight path, (ii) zigzag, and (iii) spiralling. In the latter case the mean rise velocity is visibly smaller. Several models have been presented which explain the zigzagging with the lift force on the bubble caused by its own wake. The ultimate aim would be to obtain expressions for the wake induced forces and torques to model the movements of freely moving bubbles through a set of ordinary differential equations.

** Lift force on bubbles*
Reliable effective force models for bubbles in flow are crucial for any numerical simulations of bubbly flow. Whereas drag and added mass are reasonably understood, this is not the case for the lift force. In several talks it was shown that even the sign of the lift force can change under certain conditions, e.g., for strongly deformed bubbles or for bubbles in vortical flow.

** Introduction of two and more rising bubbles*
Available analytical studies and numerical simulations predict that an homogeneously rising bubbly suspension is not possible because of the formation of clusters, essentially because of a lack of repulsive forces in existing models. Indeed, clustering was observed in experiments reported during the colloquium, however to a much lesser extend than predicted by theory. A possible explanation, brought forward during the workshop, is that the trailing vortices, which accompany spiralling bubbles (see above), induce velocities in neighboring bubbles, leading to effective repulsive forces. Statistical methods indeed indicate that artificially introduced fluctuating velocities prevent clustering.

** Wake of a bubble swarm*
Here the central question is: Is there a difference between the near-field – dominated by the wake of individual bubbles – and the far-field? There seem to be various indications for such a difference, namely, different probability distribution functions of the velocities and different rise velocities of individual bubbles in the far field as compared to the near field, but a final proof is missing. The scaling exponent of the energy spectrum in bubbly turbulence presumably is also connected with this question: In the far-field the Kolmogorov –5/3-scaling would only be slightly flatter, whereas in the near-field the spectrum may be pronouncedly steeper.

** Microbubble generation*
Several nice methods to generate microbubbles in a controlled way were presented. This holds both for individual bubbles (flow focusing methods) and for microbubbles in large concentrations, where cavitation can be employed.

** Bubbly drag reduction*
Meanwhile there is consensus in the community that in some regimes the infection of bubbles into turbulent flow can lead to drag reduction. Such a drag reduction has been seen both experimentally and in numerics. There is much less consensus on the mechanism; Is the drag reduction mainly due to the effective compressibility achieved through bubble accumulation in vortices, or is the bubble deformability responsible for the drag reduction. Moreover; Is bubble drag reduction a boundary layer effect or does it also occur in the bulk? How important is the statistical stationarity of the flow? Also the method how to address these question was extensively discussed; Can we learn anything on drag reduction by flow visualizations of the boundary layer or will a statistical physics type approach, starting from averages of the relevant terms in the transport equations, be more successful. The analogy to drag reduction through polymers was also discussed and the recent progress on that question reviewed.

We thank the Lorentz Center and Euromech for making the Meeting possible, and for all the financial and organizational support.

D. Lohse ((University Twente, The Netherlands)
L. van Wijngaarden (University Twente, The Netherlands)

Scientific Report

Interface Disorder in Nanosystems

June 20 – 24, 2005

The purpose of this interdisciplinary workshop was to bring together scientists working on the effect of surface/interface disorder on physical properties of various micro- and nanosystems. The participants included theorists, experimentalists, computational physicists, material scientists, etc. The goal was to delineate common problems and approaches and, ultimately, to initiate collaboration between the groups working on the effects of surface modulation in such diverse areas as optics**,** electronic transport, low dimensional systems, etc. Physicists and material scientists working in these seemingly different fields often face a common challenge – to deal with and benefit from natural or artificial surface and interface disorder. Despite the commonality of problems, researchers are often unaware of progress beyond their narrow area of expertise. The proposed workshop addressed this gap over a wide range of fields.
Usually, the surface/interface disorder aspects of these issues are discussed, often as an afterthought, within the corresponding topical conferences. As far as we know, this workshop was the first attempt to bring together researchers based on their work on surface/interface and bulk disorder irrespective of the application areas. We gave time for researchers from different fields to get acquainted with each other and to initiate interdisciplinary discussions / collaborations. The workshop was considered as very successful by the participants and the organizers. We decided to try to arrange a follow-up meeting as a conference symposium at the EMRS 2006 fall meeting.
The invited speakers were chosen keeping a proper balance between experimentalists, theorists, and computer simulation experts within all fields. A relatively small number of the talks provided ample opportunities for extended discussions which, at times, turned out to be very lively. Though this was not an explicit goal, the participants provided a wide geographic diversity and a healthy balance between the international and Dutch scientists. The breadth and the interdisciplinary character of discussions are underscored by the variety of the presentation titles:

Keynote talks
A.A. Maradudin, *The design of randomly rough surfaces with specified scattering properties*
D.G. Stavenga, *Nanostructure and colour of insect surface layers*
H. Dosch, *In situ x-ray scattering on solid-liquid interfaces*
Toh-Ming Lu, *Physical self-assembly and 3D integrated nanostructures*
A.E. Meyerovich, *Quantum systems with modulated interfaces*
L. Dobrzynski, *Disorder effects in simple plasmon nanomultiplexers*
F. Izrailev, *Surface scattering in quasi-1 D structures: from chaos to disorder*
N.M. Makarov, *Delocalization and anomalous ballistic transport in nanostructures with correlated disorder*
V. Freilikher, *Propagation and localization or radiation in waveguides with surface disorder*
J. Barnas, *The role of interface in giant magnetoresistance and current induced switching in magnetic multilayers*
V. Dugaev, *Anomalous Hall-effect in disordered magnetic nanostructures*
W. Schwarzacher*, Kinetic roughening of electrodeposited films*
S. Krompiewski, *Metal/carbon-nanotube interface effect on electronic transport*
E. Polturak, *Role of interfaces in a high temperature superconductor–normal conductor coupled system*

R. Jochemsen, *The influence of boundary scattering on the properties of liquid 3He in nanotubes*
P. Koenraad, *Intermixing, decomposition and segregation during the formation of self-assembled nanostructures in III/V semiconductors*
E. Wang, *Kinetic-driven atomic processes in formation and decay of surface-based nanostructures*
Y.-P. Zhao, *Designing nanostructures by oblique angle deposition and their applications*
M. Urbakh, *Rough electrified interfaces: structure and dynamics*
M.J. Rost, *Seeing thin films evolve with real-time, in situ STM: film growth and grain growth*
M. Kotrla, *Surface roughness and nanoscale pattern formation during growth*

Short talks / Invited posters
M.C.M. van de Sanden, *The growth of thin amorphous films from reactive gas phase species: In situ studies to unravel the growth mechanism*
I.E. Arfaoui, *Hydrogen-bonded nanostructures of Au55 clusters on a on a functionalized self-assembled monolayer*
P. Paruch, *Nanoscopic studies of ferroelectric domain walls in epitaxial perovskite thin films*
G. Palasantzas*, Growth and properties of magnetic nanoparticles*
B.J. Kooi, *The role of the interface structure in the giant magneto-resistive properties of granular systems*
F. Perez-Rodriguez, *Optical properties of excitons in quantum wells with interface disorder*
M. Marszalek, *Different aspects of surfactant influence on interface disorder in multilayered structures*

Last but not least we should point out that this workshop would not have been a success without the financial support, excellent organizational help, and the pleasant working atmosphere provided by the staff of the Lorentz Center. Indeed, all of the participants were impressed by the high quality of services and asked us to express our appreciation to the Lorentz Center staff. In addition we would like also to thank the Materials Science Center (MSC) at the University of Groningen for financial support, which contributed to the success of the meeting.

A. E. Meyerovich (University of Rhode Island, USA)
G. Palasantzas (University of Groningen, The Netherlands)
J. Barnas (Adam Mickiewicz University and Academy of Sciences, Poznan, Poland)

Specialized Colloque AMPERE "EPR and ENDOR Spectroscopy of Metal Proteins and Spin-Labelled Proteins"

June 29 – July 1, 2005

This workshop was held from June 29 till July 1 2005 and preceded the large European Conference on Magnetic Resonance "EUROMAR", which took place in Veldhoven. The meeting brought together 45 scientists, who discussed two subjects, which presently are in the center of ESR research worldwide.
- ESR and ENDOR spectroscopy on metal proteins. Metal proteins play an important role in electron-transfer processes and one of the important challenges is to try and develop a quantum-mechanical description of these processes. To this end it is essential to obtain a good insight in the electronic structure of the metal center. It has been demonstrated that with ESR on single crystals of these proteins it is possible to determine the so-called g-tensors of the paramagnetic metal center and with ENDOR the spatial distribution of the electronic wave function. On the other hand there has been a considerable progress in the theoretical description of the electronic structure with the help of so-called DFT methods. The workshop brought together ESR experimentalists and DFT theorists to discuss this subject.
- Distance measurements in "spin-labelled" proteins. This subject is of great importance to study the conformation and dynamics of proteins in relation to their function. Presently it is possible to introduce stable nitroxide radicals with an unpaired electron spin on well-defined positions in proteins. With the help of pulsed ESR techniques one can determine very precisely the distance between two of these spin labels by taking advantage of their dipole-dipole interaction. This kind of distance measurements can also be performed with FRET (Fluorescence Resonant Energy Transfer) techniques by using donor and acceptor labels that have been introduced on specific positions in the proteins. Besides EPR spectroscopists one expert from the optical field was invited, which stimulated discussions concerning the possibilities and limitations of the two competing techniques.

The scientific programme consisted of 22 presentations of which 7 were given by invited speakers. In addition 12 posters were presented. The meeting was characterized by intensive discussions among the participants, which even continued after the social events organized in the evenings. Both the experienced and the young scientists have highly appreciated the very focussed discussions, which have resulted in several active research collaborations.

E.J.J. Groenen (Leiden University, The Netherlands)
P. Gast (Leiden University, The Netherlands)
J. Schmidt (Leiden University, The Netherlands)

Scientific Report

Protoplanetary Disk Evolution

July 7 – 8, 2005

On July 7-8 a two-day workshop took place associated with the 2005 J.H. Oort professor, Anneila Sargent from the California Institute of Technology. The topic chosen by professor Sargent was "Protoplanetary disk evolution". About 30 experts from Europe and the US gathered in Leiden to discuss various new results in this rapidly developing field.
It is well known that the formation of stars from collapse of a slowly rotating cloud core inevitably leads to the formation of a circumstellar disk. This disk plays a critical role in the subsequent evolution of the system. Matter is accreted from the envelope through the disk onto the growing star, and the formation of planets occurs in the disk through coagulation and settling of the grains. The workshop focused on three aspects of disk evolution: (i) Disks in the embedded phase; (iii) Grain growth and grain settling, and (iii) Mixing processes in disks. These topics were particularly timely because of exciting new data from the Spitzer Space Telescope, large ground-based optical telescopes, infrared interferometers, and millimeter interferometers was just becoming available.
Studies of disks in the embedded phase have become possible with millimeter interferometers, which can separate the envelopes from the disks. First results from an SMA survey of Class 0 protostars were presented, including determinations of the disk mass and submillimeter slope. New data from Spitzer showed that very low-mass disks can now be detected, even around forming substellar objects. A clearly emerging picture is that not all disks are born equal: depending on the initial properties of the collapsing core and its angular momentum, the disks may have very different sizes and evolve at different rates. Also, turbulence may affect disk evolution, since the material feeding onto the disk may be lumpy and arriving from one side only.
Evidence for grain growth around pre-main sequence stars is becoming more and more convincing. Spitzer and ground-based spectra of large samples of Herbig Ae and T Tauri stars show clear flattening and shifts toward longer wavelengths of the 10 and 20 micron silicate profiles. Also, spatially resolved millimeter interferometry data provide definite proof of a flattening of the submillimeter spectral slope, indicative of grain processing. Similar effects are even seen in disks around brown dwarfs, demonstrating that the processes responsible for grain growth depend little on mass. A particularly exciting result was the detection at cm wavelengths of the TW Hya disk, showing that more than 99% of the dust may be in cm-sized grains.
Fascinating data from VLT-MIDI interferometry indicate that the fraction of crystalline material changes with position in the disk, and that some of it must be transported from the hot inner disk (where the material is annealed from amorphous to crystalline form) to the cooler outer disk. Disk models including grain growth and settling are being developed by various groups. Because of the short timescales for coagulation, the observed spectral energy distributions can only be reproduced if a steady-state abundance of small grains is maintained by collisional destruction of aggregates followed by some level of vertical mixing.

The Lorentz Center setting stimulated ample discussion among the participants, both during the formal sessions as well as during a delightful outing to the Mauritshuis and Indonesian Restaurant Garuda in the Hague.

Ewine van Dishoeck (Leiden University, The Netherlands)

Scientific Report

Star and Planet Formation with the Spitzer Space Telescope

July 11 – 29, 2005

The three week workshop brought together over 40 participants in the Legacy program of the Spitzer Space Telescope, "From Molecular Cores to Planet-forming Disks", known by the nickname, c2d. The project has recently received the bulk of its data from the spacecraft, and attention at the meeting was on the implications of the data.

The formation of stars and planets is largely hidden from view at the wavelengths of visible light, making the infrared capabilities of Spitzer crucial to progress. The project aims to collect a coherent and consistent database by selecting a wide range of interstellar molecular clouds for complete mapping. In addition, we have added a sample of dense molecular "cores" within larger clouds, as well as more evolved young stars, known as "weak-line T Tauri stars" for imaging and photometry with two Spitzer instruments, IRAC and MIPS. Finally, a large number of spectroscopic measurements were made with the third instrument, IRS. About half of these were toward pre-selected targets, with the remainder reserved for follow-up studies of objects found in the imaging surveys. While much of the payoff will come from detailed comparison of the large statistical sample, we already have a few surprising results. We have found several luminous objects in dense cores that were thought to be starless; this phenomenon of very low luminosity objects may give us clues to the formation of substellar objects, such as brown dwarfs. We also detected warmed ices in a nearly edge-on disk, and another such disk may show gas-phase lines from complex molecules. These observations are allowing us to probe the nature of materials in nascent planetary systems in new ways.

The first two weeks of the meeting concentrated on the large molecular clouds, integrating the lessons learned from the imaging with those from the spectroscopic work. This was particularly important, as the two groups have previously worked largely independently. The facilities of the Lorentz Center were particularly helpful in fostering close communication between these two groups The last week was devoted to the dense cores and the weak-line T Tauri stars, though work continued on issues raised during the first two weeks. Five working groups were activated to pursue science that cut across the various components of the program. The flexibility of the Lorentz Center, with multiple meeting rooms and large offices greatly assisted this cross-group work.

While the main goal of the meeting was to accelerate the working group agendas, many other goals were achieved. A number of technical issues with the data were raised and resolved. Several papers were submitted, and many others defined more clearly, with common standards for analysis and presentation of the data for the five large clouds and the dense cores. New collaborations began in several areas to combine the information coming from different instruments into a coherent picture for the formation of stars and planets. The physical layout and excellent personnel of the Lorentz Center were essential to the highly productive meeting.

Neal Evans (The University of Texas at Austin, United States)
Ewine van Dishoeck (Leiden University, The Netherlands)

Scientific Report

Complex Behavior in Correlated Electron Systems

August 01 – 19, 2005

This workshop has explored the physics complex inhomogeneous states that have recently been discovered in strongly correlated electron materials. These compounds exemplify some of the most fascinating phenomena in condensed matter physics, including colossal magneto-resistance, high-superconductivity, and glassy behavior of electrons near metal-insulator transitions. Most strongly correlated electronic systems display many competing phases and are characterized by strong frustration. These effects, especially in presence of disorder, often lead to formation of inhomogeneous phases, many meta-stable states, and show even some glassy features such as slow relaxation and aging.

In the last couple of years, a qualitatively new phenomenon common to all of these compounds has been unveiled. They manifest quasi-static or dynamic fluctuating nano-scale inhomogeneities (clusters), driven by interactions at the microscopic level. These clusters appear in the best of crystals, and the suggestion that they may be intrinsic to the ground state of correlated electrons in these materials, a remarkable and novel possibility, is gaining ground. The understanding of this crucial phenomenon is only at the early stages and a huge effort worldwide is currently under way to study its implications. It is widely believed that this is a fundamentally new type of quantum-mechanical ordering driven by the competition between spin exchange, kinetic energy, lattice effects, and long-range Coulomb interactions. In addition to transition-metal oxides, this phenomenology is also emerging in two-dimensional metal-insulator transitions, doped semiconductors, frustrated magnets, quantum Hall systems (striped phases), organic systems close to the Mott transition, and others.

The emergence of complicated patterns due to interactions and frustration was previously studied in the context of soft matter, but its presence in systems of correlated electrons is a novel concept that is rapidly reaching the forefront of condensed matter theory investigations. One focus of recent theoretical and experimental efforts is whether the inhomogeneities are self-organized in the ground state of Hamiltonians for periodic correlated systems, or driven by weak random fields due to the proximity of these systems to magnetic or superconducting phase transitions. What is certain is that disorder amplifies the nano-scale fluctuations significantly, and intentionally adding impurities can lead to a better understanding of ground state properties of these materials. Semiconductors containing dilute magnetic impurities, with potential applications in spintronics, are also part of the target family of compounds that have been studied in the workshop, with interacting spins and carriers. Workers from other areas of research (including hexaborides, nickelates, cobaltites, ferroelectrics, ruthenates, spin and electron glasses) where similar ideas are being discussed, have also contributed to the success of the program.

All the fields mentioned above have been extremely active in the past few years, but their development and progress has been more in parallel than in unison. In organizing this workshop, we felt that the time was ripe for a program that will bring together theorists in these many communities, along with a select group of experimentalists known for their strong interaction with theorists. Several researchers at Lorentz Center have also been interested and have participated in this program, as well as some experts in computational physics, due to the relevance of simulations in inhomogeneous systems.

Scientific Report

Following the tradition of the Lorentz Center, the workshop has provided ample time for informal discussions. Each participant has been given a desk and access to a computer. Three to four talks were given each morning, which have served to keep a focus during the three weeks, and to help catalyze and inspire the informal discussions. Typically, the afternoons were left open for free discussion and collaboration, leading to the very fruitful interaction between experts working in very diverse areas.

The workshop organizers and participants would like to extend their most sincere gratitude to Dr. Martje Kruk-de Bruin and Drs. Stephanie Hessing for their terrific hospitality, generous help, and fantastic efficiency, which have made organizing this workshop not only a great success, but also a veritable joy. In addition to generous funds provided by the Lorentz Center, additional travel expenses for selected participants were covered by the National High Magnetic Field Laboratory at Florida State University, which contributed US$10,000 as a co-sponsor for this workshop. I2CAM (International Institute for Complex Adaptive Matter) also serve as co-sponsor, contributing US$20,000, which made possible to bring a number of junior participants (graduate students and post-docs), who otherwise would not be able to participate at this workshop.

V. Dobrosavljevic (Florida State University, United States)
E.R. Dagotto (UniversityTennesee & Oak Ridge Nat. Lab., United States)
S. Sachdev (Yale University, United States)
J. Zaanen (Leiden University, The Netherlands)

Scientific Report

QSO Hosts: Evolution and Environment

August 22 – 26, 2005

A 5-day, international, high-profile workshop was held from Monday August 22 through Friday August 26, on the topic of QSO Host Galaxies, bringing together observational and theoretical astronomers and cosmologists. The cosmologically evolving QSO population, the possible connection to the evolving starburst activity, within the grander scheme of galaxy evolution were foci of the work.

The topic of QSO Host Galaxies has seen a rapid development. Imaging studies with the Hubble Space Telescope, global investigations using data from the Sloan Digital Sky Survey, and detailed radio studies at centimeter and millimeter wavelengths of line and continuum emission have yielded substantial advances in our knowledge and understanding of the stellar and interstellar properties as well as the environments of the host galaxies of these high-power AGN. Massive hosts are implied by the observations, with an as yet uncertain level of ongoing or recent star-formation. Supersolar abundances are found, within a gigayear after the Big Bang. The importance of QSOs and also lower-luminosity AGN in cosmology and galaxy formation has been emphasized by the discovery of black hole – bulge correlations in active and non-active galaxies, while the possibility of an intimate AGN-starburst connection is becoming increasingly likely. Theorists are eagerly awaiting more data constraining the cosmological evolving black hole, QSO and QSO host populations.

The latest observational and theoretical progress on these issues were presented and discussed during the workshop, which drew a large group of participating astronomers. Whereas the organisers Barthel (Groningen) and Sanders (Hawaii) were expecting 30 – 40, in the end 62 participants were counted, from all over the globe. These included many key players in the field of QSO astronomy. All research components were represented: observations, interpretation, theory, modelling. Many splinter/working groups met during and after the regular program that consisted of 12 invited reviews, 26 contributed talks and 18 posters.

The workshop represented the logical next step in a continuing series of conferences devoted to the topic of QSO Hosts, after the August 1996 ESO/IAC Conference (Tenerife, published by Springer) and the January 2001 Andalucia (Granada, published by Kluwer) Workshop. It is expected that the Proceedings of the Lorentz Center Meeting, currently being edited by Barthel and Sanders, and to be published by Elsevier in their New Astronomy Reviews series will be a highly valuable contribution.

The group excursion to The Hague, concluding the workshop on Saturday August 27 definitely contributed to the relaxed atmosphere. The workshop was rated "excellent" by many participants; this rating was prominently based on the hospitality, support, and overall facility of the Lorentz Center.

P.D. Barthel (Kapteyn Institute, The Netherlands)
D.B. Sanders (Institute for Astronomy, University of Hawaii, United States)

Scientific Report

Arithmetic Geometry and High Energy Physics

August 29 – September 2, 2005

The focus of this workshop, interdisciplinary between mathematicians and mathematical physicists, was on the increasing and surprising role of arithmetic and number theory in high-energy physics. Topics included: holography and uniformization (AdS/CFT, Liouville action), quantum field theory and motives (renormalization, motivic galois theory, multiple zeta values, dilogarithms), and string theory and automorphic forms.
Four lecture series of 2 x 60' gave a survey of automorphic forms in string theory (Waldron/Pioline), (mathematical) holography (Aldrovandi), non-commutative geometry in renormalisation (Connes) and braid groups in rational conformal field theory (Gannon). There were further research talks about renormalisation, both in theory (Marcolli, Kreimer) and practice (Weinzierl, Moch), holography (Krasnov), string theory duality (Dijkgraaf,Yui), thermodynamics in class field theory (Ha) and RCF-theory and modular forms (Zagier). There were two "general mathematics/physics audience" lectures on combinatorial identities (Schilling) and motives in physics (Cartier).

There were 23 invited participants, 25 further registered participants from Dutch universities and quite a few further occasional visitors. This shows the indeed large interest at Dutch mathematics/physics institutes in learning about these recent developments. We would also like to note that about half of the lecturers were aged under 40.

The atmosphere at the workshop was very good and interactive: we witnessed many less formal interactions, to name but a few: a group of people worked on non-commutative aspects of uniformisation; another group on reformulating the OSV-conjecture; another on polylogarithms; and there were many lively discussions about theoretical versus explicit renormalisation computations.

It will take some time to digest this very timely material, but we can certainly expect significant progress in the future.

Finally, working conditions, though hindered by some outside factors, were excellent as usual.

G.L.M. Cornelissen (Utrecht University, The Netherlands)
M. Marcolli (Max-Planck-Institut für Mathematik, Bonn, Germany)
A. Waldron (University of California at Davis, United States)

Scientific Report

Screening, charge inversion and condensation of macroions

September 5 – 8, 2005

This workshop focused on current topics in electrostatics and the physics of screening in room-temperature electrolytes, with particular emphasis on applications to biological systems. Screening already features prominently in such diverse fields as polymer physics, microfluidics, colloid science, self-assembly of nanostructures and biophysics. Recent insights – resulting largely from work on molecular-scale systems – however indicate that screening can lead to qualitatively new behavior that is not accounted for by 'conventional' descriptions. A notorious example is screening by multivalent ions, which results in counter-intuitive phenomena such as reversal of the effective charge of macroions and attraction between like-charged macroions.

The aim of the workshop was to bring together experimentalists and theorists from the range of disciplines interested in the physics of screening and related phenomena. The main themes were (1) double-layer structure, (2) charge inversion, (3) attraction between like-charged objects, (4) biopolymer condensation, and (5) ionic transport in nanoscale channels. In addition, the physics and chemistry of polyelectrolytes and polymer networks featured prominently.

There were five talks per day. In order to stimulate discussion, we had set ample time aside for discussion. This formal arrangement however proved quite unnecessary as a vigorous, interactive atmosphere very quickly developed (for which the invited session chairs justly deserve part of the credit). The talks were supplemented with a poster session that carried on informally throughout the duration of the workshop.

The logistics aspects of the workshop were very successfully handled by the professional staff of the Lorentz Center. Several participants stressed that the physical arrangements (offices, meeting areas) greatly added to their comfort and effectiveness during their visit.

Because of the spectrum of topics and ideas discussed at the workshop, it is difficult to draw simple overarching conclusions. One observation is that a gap currently appears to exist between theory and experiment: while the role of correlations in screening has become broadly accepted in the theory community and dynamical effects are increasingly seen as the main area of interest for future research, many of the predictions for equilibrium systems yet have to be thoroughly investigated experimentally.

S. Lemay (Delft University of Technology, The Netherlands),
B. Shklovskii (University of Minnesota, United States)

Scientific Report

Model Order Reduction, Coupled Problems and Optimization

September 19 – 23, 2005

The demand for coupled simulations has initiated new areas of research in numerical mathematics. Simulations of individual aspects are already quite time consuming, so that a coupled simulation of various aspects can be expected to be computationally infeasible or at least extremely time-consuming. For this reason, other approaches are being pursued to enable coupled simulations. Model order reduction is one of these approaches: the results of simulations are summarized in automatically generated low order models, which are then coupled to obtain a model of the behaviour of the fully coupled model. The field of model order reduction is a very active one, with many new techniques being developed. There are clear relations to methods from linear algebra, and to the field of systems and control engineering.
In this workshop, we aimed at bringing together researchers working on model order reduction, coupled problems, optimization and space mapping. New developments, open problems, and various applications were discussed. It turned out that the workshop provided a very nice survey of the area of model order reduction, and the participation of both numerical analysts and researchers from the systems and control area was appreciated very much. The workshop was also used as a forum for extensive discussions between experts. Besides the informal discussions in the common room and the offices, there were daily plenary discussions about a variety of topics. The character of these discussions was lively, with contributions from many people. The minutes of these meetings have been published on the website.
Characteristic of this workshop was the enthusiasm of all participants. Despite the busy schedule, almost all presentations were attended by virtually all participants, even on the final day of the workshop. Compliments were made frequently, especially about the nice infrastructure of the Lorentz Center and the facilities being made available.
One of the plans developed during the workshop is to publish a book, with many contributors, containing the state of the art as far as model order reduction is concerned. The discussions revealed there is a real need for this, and a plan for the book has already been sent to the potential authors. Foreseen publication date is the summer of 2006.
The workshop can be considered as a continuation of a sequence of workshops that were organised in the context of the European network "MACSI-net", which was active from November 2001 until April 2004. One of the working groups was WG02 on "Coupled problems and model reduction", chaired by Wil Schilders. This group organised 5 workshops during 2001-2004, thus building up a network of researchers working in the field of model order reduction, coupled problems, optimisation and applications. The workshop at the Lorentz Center demonstrated that there is a real need for such a network, and that efforts such as this workshop are highly appreciated.
As for some statistics, there were 57 attendees, of which 10 from the USA and Canada, 1 from Japan, and 46 from 9 European countries. From the 24 Dutch participants, a considerable number is doing a Ph.D. in one of the research schools contributing to the workshop. They were given the opportunity to present their work in short 20-minute presentations. The number of invited lectures was 24.

The organisers would like to express their sincere gratitude to the Lorentz Center, for offering the excellent facilities and their financial support. In particular, we would like to

thank Martje Kruk and Wies Groeneboer, for their very professional assistance and guidance. This contributed greatly to the success of the workshop.

Henk van der Vorst (Utrecht University, The Netherlands)
Wil Schilders (Philips Research & Eindhoven University of Technology, The Netherlands)

Scientific Report

High dimensional quantum dynamics: Challenges and opportunities

September 28 – October 1, 2005

The program of the workshop was organised in six scientific sessions. There were 44 participants. Of the lectures, six were keynote talks, and there were 8 additional invited talks, and 10 contributed talks. In addition, there was a poster session.

Scientifically, the workshop was a big success. The most important conclusions drawn from the scientific sessions are summarised below. Extra information can be found at the website of the workshop (www.lc.leidenuniv.nl/lc/web/2005/20050928/info.php3?wsid=166) where the program, the list of participants, abstracts of talks, and electronic versions of talks and posters, which were provided by speakers and poster presenters on a voluntary basis, have been made available.

The scientific sessions
The first session was entitled "Applications to reaction dynamics". The keynote and invited speakers were Uwe Manthe and Rob van Harrevelt. The most important developments were reported by van Harrevelt. He communicated that the "Correlation Discrete Variable Representation" (CDVR) is now also applicable in calculations using "mode-combination". This has been made possible by the development of a multi-dimensional DVR method, on the basis of a direct diagonalisation algorithm. This means that one can now work on big systems for which no potential is available that can be expressed as a sum of products of functions of one or just a few coordinates. Although several difficulties have yet to be overcome, this development can be counted as a possible breakthrough.

The second session was entitled "Other high-dimensional quantum dynamics methods". The keynote speaker was Joel Bowman, and the invited speakers were Ove Christiansen and Tucker Carrington, Jr. An approach with possibly very important applications in the MCTDH-method is the so-called n-mode representation method discussed by Joel Bowman. In this approach, the potential energy surface for a system with many degrees of freedom is expressed as a sum of products of n functions at the most, where the functions depend on just one degree of freedom. The method can already achieve a high accuracy with n=5 for many systems. A big advantage of the method is that the potential coupling matrix becomes sparse, and in the MCTDH-method the approach could lead to an efficient evaluation of the potential in the time propagation, which would represent a solution for a bottle-neck of MCTDH.

The third session was entitled "Applications to scattering dynamics and spectroscopy". The keynote speaker was Fabien Gatti, and the invited speakers were Horst Köppel and Oliver Kuhn. Gatti discussed different types of coordinate systems. Recently, in spectroscopic applications much success has been achieved with so-called polyspherical coordinates. Normal mode coordinates are useful for the description of rate constants in chemical reactions, but these coordinates are insufficient for the description of motion through a large part of coordinate space (as is necessary in for instance the calculation of "initial-state resolved reaction probabilities"). The so-called "POTFIT" method was a topic in the general discussion. In this method the potential is expressed as a sum of direct products of functions

of one or more degrees of freedom, where each product involves all degrees of freedom. This method can be used for systems with up to 6 degrees of freedom.

The fourth session was entitled "Potential surface fitting". The keynote speaker was Michael Collins, and Bastiaan Braams was the invited speaker. Collins reported a very interesting method for fitting the potential of large organic molecules. In this method the potential energy of a big molecule is built as the sum of the potential energies of fragments of the molecule, minus the energies of smaller fragments. This method yields very reliable potential energy surfaces, and points the way to a very efficient evaluation of the potential.

The fifth session was entitled "MCTDH: new directions". The keynote speaker was Graham Worth, and Matthias Nest was the invited speaker. Worth discussed new methods for the efficient treatment of high-dimensional systems. The selected CI approach makes a distinction between configurations that are and that are not taken into account. For this method more research is needed as to how the selection should be performed. The so-called "cascading" approach considers the single-particle functions in which the MCTDH wave function is expressed again as MCTDH wave functions, and propagates these single particle functions (multi-layer single particle functions). This is generally seen as a very promising approach, but calls for one man-year of effort for the implementation in a MCTDH code. Parallellisation was also discussed. Manthe has parallellised his MCTDH-code, and this code now runs on a shared memory machine. Parallellisation is very useful for the evaluation of potential in the time propagation, which uses 95% of the time. A good parallel machine for MCTDH consists of opteron nodes using up to 16 processors per node.

The sixth session was entitled "System bath-methods and applications". The keynote speaker was Peter Saalfrank, and the invited speaker Brett Jackson. In this approach an attempt was made to describe big systems by separating them into a "system", in which the most relevant dynamics takes place, and a "bath", to which energy is dissipated. A system-bath separation is also possible in the MCTDH approach.

G.J. Kroes (Leiden University, The Netherlands)
H.D. Meyer (University of Heidelberg, Germany)

Scientific Report

The Outer Edges of Disk Galaxies: A Truncated Perspective?

October 4 – 7, 2005

We have in recent years come to view the outer parts of galaxies as a vital clue to study their formation and evolution.
Star counts in the outskirts of M31, star formation measurements in the outer disk of M83 and other nearby galaxies, the on-going controversy of stellar disk truncations, the latest Spitzer and Galex data, high-z measurements and many other new and exciting results motivated us to plan a workshop to provide a platform where the experts in the field could interact, discuss and try to put together a consistent picture of the outskirts of spiral galaxies.
The workshop brought together experts from over the world to discuss these issues, and more than a small workshop it was a full meeting with a lot of interaction among the participants.
Regarding the format, we organized discussion forums involving all the participants and not only small working groups. This turned out to be the key part for the success of the workshop. The format was the following: Every morning started with a talk session lasting for around 3 hours. After that, during the coffee break, the session chair and two co-chairs got together to point out the key questions and write them on the board. The discussion session of around one hour followed, which centered its activity in trying to answer or to give clues toward the approach needed to solve the most relevant question. This format relies completely on the skills of the chair and co-chairs, and considering the excellent group we had, it was an easy task to choose them.
The discussions were centered on the origin of the distribution of matter in the outer parts of disk galaxies. There were five discussion sessions. In the first three sessions, on the radial distribution of disks, there was unanimity on the fact that the gas in the outer parts is not primordial. There was a large discussion on the observational effects that produce the different shapes of the stellar radial profiles with no general agreement on why, for example, the edge-on systems do not show certain radial profiles that seem to appear in face-on galaxies. After the workshop, everyone did agree that truncations, or break radii, are not always related to morphological features such as bars, spiral arms, etc. Another problem brought up in the discussion was why M33 shows a radial break while the radial profile of the otherwise so similar galaxy NGC300 extends up to 10 scale-lengths. This problem leads to a discussion on the definition of the end of the disks. The agreement after the discussion was that we need to obtain kinematic observations in the outer parts, although that is observationally challenging. The different tracers can help us to understand the origin and evolution of the profiles. Second, there was a wide discussion on the origin of dust and metals.
Pollution, accretion and in-situ chemical evolution might equally play a role in this. There was agreement that understanding the dust in the outer parts will help us to understand the origin of the breaks in the radial profiles. It became clear that the intergalactic UV background cannot be the only ingredient to produce the break in the galaxy radial distribution. It must; however, certainly play a role. Third, the session on the vertical distribution put into the picture the merging and internal processes in the disk as shapers of the outer disk. And finally, when discussing the role played by the interactions, it was obvious that one has to be careful, again, when defining a disk, since the accreted matter has different properties than that of the outer disk and there is evidence that there are no

breaks in the radial profile when there are signatures of debris in the outskirts of galaxies. In summary, this field is becoming very active and multi-wavelength studies are necessary to understand the distribution of matter in the outer parts of disk galaxies. After the success of this meeting, it was proposed to have a second workshop to report on the state of the field in two or more years time.
We are very grateful for the financial help by the Lorentz Center, NWO and NOVA which allowed us to cover the lodging cost for a large amount of participants (all the students and post-docs) and part of the travel expenses for the people coming from abroad with more financial difficulties.

We thank the Lorentz Center, especially Martje Kruk and Wies Groeneboer for their fantastic job in helping to organise this workshop. The facilities and the friendly atmosphere of the Lorentz Center were a key ingredient for this exciting and successful meeting

I Pérez Martin (University of Groningen, The Netherlands)
R.F. Peletier (University of Groningen, The Netherlands)
M. Pohlen (University of Groningen, The Netherlands)

Scientific Report

Chemistry for Physicists

October 10 – 14, 2005

With the development of nanoscience and nanotechnology, the boundary between physics and chemistry in different research areas is gradually disappearing. As a consequence, many physics PhD students face the need to acquire substantial chemistry-related knowledge, in order to carry out their research work effectively (e.g. on molecular (opto-) electronics, semiconducting nano-wires, and novel nano-materials). For most physics PhD students, the acquisition of specific knowledge in Chemistry through self-study is not efficient, due to the nearly complete lack of undergraduate education on this subject. Nevertheless, many useful Chemistry concepts can be learnt very rapidly and effectively, if their introduction takes full advantage of the knowledge that physics PhD students have already acquired (e.g., quantum mechanics, statistical physics, thermodynamics). These considerations provide the motivation and the aim of the PhD workshop "Chemistry for Physicists": *teaching efficiently to physics PhD students concepts in chemistry of nano-electronic materials*. It was our aim that, at the end of the workshop, the participants have a critical knowledge of relevant chemistry concepts in the area of electronic nano-materials and that they will be able to deepen this knowledge efficiently by self-study when needed.

The duration of the workshop was one week. During this week, the PhD students attended lectures and participated in exercises (approximately six hours per day). The lectures were given by (national and international) experts, active in Chemistry research subjects with a large physics component. This enabled bridging the gap between lecturers and students permitted establishing more easily a "common language", which is essential for the efficient transfer of Chemistry knowledge to physicists. Most lecturers were available throughout the workshop and participated in many discussions with the participants.

The "Chemistry for Physicists" workshop is an initiative of the Delft-Leiden Casimir Research School. It was also open to PhDs and postdocs from other Dutch universities. The workshop was attended by 18 participants from Leiden, 11 from Delft, and 12 from seven other Dutch Universities. The total number of participants, including 6 lecturers was 47. A brief survey showed that participants and lecturers were enthousiastic about this format and we have the intention to repeat the workshop after two or three years.

J.M. van Ruitenbeek (Leiden University, The Netherlands)
A. Morpurgo (Leiden University, The Netherlands)

Scientific Report

Science Requirements for a Far-InfraRed Mission (FIRM)

October 17 – 19, 2005

The far-infrared region is currently one of the last wavelength regions where lack of spatial resolution and lack of sensitivity hinders progress in science. While the upcoming Herschel and SPICA missions will provide major steps forward in sensitivity, these two observatories lack the high spatial resolution necessary for detailed studies of individual objects. In the coming decade ALMA and JWST, which have high spatial resolution as well as high sensitivity, will be major facilities to be used by the astronomical community. However, the wavelength region in between is not covered by any comparable instrument yet, so in fact there exists a "Far-Infrared Gap".

The existence of this gap was identified by the astrophysical community as well as by the European Space Agency's Astronomy Working Group. In the ESLAB 2005 symposium, as part of the Cosmic Vision process, a high spatial resolution (0.1-0.02 arcsec at 100 micrometer) far-infrared observatory was listed as one of the major priorities of the astronomy program. Since the Cosmic Vision process ends early next year, it is time to make an inventory of the science to be done with a FIRM.

In this workshop 50 European astrophysicists and engineers, joined by representatives from the USA, Canada, Japan and China, have defined the key requirements for such a future observatory. Especially the following topics were discussed:

- Star- and planet-formation
- Evolution of (the ISM in) galaxies
- The nature of the far-IR background, star-formation throughout the history of the Universe
- Three concepts for a FIRM

The outcome of the meeting was not only the above mentioned requirements, which will be captured in a science requirements document, there also was a strong preference for an interferometer, which has to be free-flying at these wavelengths.

The workshop has been instrumental in bringing together the far-infrared community, defining the science requirements and come to a first conclusion on a FIRM concept. We thank the Lorentz Centre board and staff for providing this opportunity.

F.P. Helmich (SRON, Groningen, The Netherlands)
R.J. Ivison (Royal Observatory Edinburgh, United Kingdom)

Scientific Report

Extragalactic Herschel Open Time (ExtraHOT) meeting

October 20 – 21, 2005

The ExtraHOT consortium was established at the Herschel Space Observatory (HSO) Extragalactic Open Time Discussion Meeting at Sussex 21-23 September 2004 and is open to anyone in the international astronomical community.
Aim of the consortium is to coordinate the formulation of a number of extragalactic key programmes for submission in response to the Herschel Open-Time call for proposals, and to provide an environment in which large proposals can be successful. Aim is also to optimise the scientific effectiveness of the HSO by pooling resources in the planning, preparation, execution and analysis of observing programmes, by addressing a relevant theoretical underpinning, and by identifying, supporting and coordinating complementary ground-based observing programs.
This workshop was aimed at generating and coordinating large Herschel Open Time extragalactic proposals. It brought together 30 extragalactic infrared astronomers.
The meeting was structured as follows:

1. a set of introductory talks, which outlined the proposal process and the guaranteed time program;
2. two talks outlining key questions for HSO from a theoretical point of view;
3. this was followed by an extensive set of short talks outlining various ideas for open time extragalactic programs;
4. following this, the participants split up into several groups, coordinating programs, identifying overlap, and sharpening the scientific case;
5. finally, on the last workshop day, every team gave a brief final presentation on the results of the process.

The workshop was highly succesful: it resulted in a number of key areas identified which are not addressed in the Guaranteed time program. These include a very wide SPIRE survey, a very deep PACS survey, and surveys of well-defined AGN samples. Teams have been set up to prepare observing programs for all of these for the Open Time Key Program call. These teams are currently working by email and ad-hoc telecons and face-to-face meetings.
The coordinated approach initiated at this Lorentz Center workshop will lead to much more valuable data and science products than when several teams were competing for the same science goals.

P.P. van der Werf (Leiden University, The Netherlands)

Scientific Report

Biology for Physicists

October 24 – 28, 2005

During the week of October 24-28, a Fall Graduate School "Biology for Physicists" was run, generously funded by the Casimir Research School. Organizers of the school were dr. Nynke Dekker (TU Delft) and prof.dr. Herman Spaink (Leiden University).

The goal of the Fall Graduate School was to bring together Ph.D. students from around the country with interests in biophysics and biochemistry. The School was particularly aimed for students with backgrounds in the physical sciences, to provide them with insight into the applicability of the physical sciences to biology and to deepen their knowledge of the biological sciences themselves. Every effort was made to encourage speakers to prepare pedagogical and interconnected lectures, since the number of relevant lecture courses is limited and research articles treat material quite compactly.

Ten speakers, both local and international, prepared lectures to introduce students to biology. Both physcists' and biologists' viewpoints were represented. The school attracted a wide range of attendees, ranging from Master students and Ph.D. students to professors interested in topics outside their direct research areas. The participants (approximately 35, predominantly from the Delft and Leiden Casimir Research School, but also coming from Amsterdam, Groningen, and Wageningen) formed an enthusiastic bunch, constantly peppering the lecturers with questions!

Equally importantly, there was time for the participants and lecturers to ask more detailed questions and to get to know each other. Discussions took place during the coffee breaks, the poster session, and the conference dinner at the Malle Jan. Several students also requested posting of the speakers' lectures on the Web for more careful study, which the majority of speakers graciously complied with.

Given the enthusiastic response, we plan to make "Biology for Physicists" a recurring event. We expect the next session to be held in 2007.

Nynke Dekker (Delft University of Technology, The Netherlands)
Herman Spaink (Leiden University, The Netherlands)

Scientific Report

The Study of Near-IR Selected High Redshift Galaxies

October 31 – November 4, 2005

We brought together several groups of astronomer who are working in the field of galaxy evolution, specifically the evolution of galaxies selected in the Near-IR. The program was flexible, and presentations filled the program for about half the time. Since the meeting was meant to be a workshop in the true sense of the word, many presentations concerned "work in progress", in contrast to "work done previously". The participants brought expertise in Near-IR photometry, space-based studies using Spitzer and the Hubble Space Telescope, and emission line studies. Many informal discussion sessions were organized. At the end of the week, we planned new projects and new collaborations.

The Lorent Center is one of the few places in the world where this kind of meetings can be organized. The meeting rooms are "cozy" and allow for of easy interaction, participants can do "true" work in their offices, and there is ample space for discussions in small groups. The lounge is a great place to bring together everybody and allow for easy informal discussions.

It is a pleasure to thank for the support of the staff of the Lorentz Center: all the local arrangements were done very efficiently and very well, and hence the coordinator did not have to worry in any way about this significant task.

The financial support of the Lorentz Center is greatly appreciated.

Marijn Franx (Leiden University, The Netherlands)

Scientific Report

Dynamics of Patterns

November 7 – 11, 2005

The workshop *Dynamics of Patterns* which was held at the Lorentz Center from November 7-11 was the first workshop organized by the national program *Dynamics of Patterns* which was established in 2004 by the Dutch Science Foundations NWO-GBE and FOM. The purpose of this program was to strengthen collaborations and interactions between mathematicians and physicists studying the dynamics of "real life" patterns in physics, the natural environment, biology, etcetera. The purpose of this very first meeting was to get people from the Dutch research community to know each other and their projects, and to explore possibilities for future collaborations.

At the workshop about 50 scientists from various fields – fluid dynamics, oceanography, physics, mathematics, biology – came together. In view of the national character of the program *Dynamics of Patterns*, the majority of participants (about 80%) came from the Dutch research community. About half of them were senior researchers and half of them postdocs and graduate students. Two senior scientists from abroad, P. C. Hohenberg (New York University, USA) and B. Sandstede (Surrey, UK) had been invited as external participants whose special role was to stimulate discussions, to serve as moderators, to point out connections and to advise the Dutch research community on future directions.

Each day, there were four 45 minute talks in the morning, while the afternoon program was left open till 4pm for informal discussions. The themes of the morning sessions were *Patterns and Building blocks* (2 sessions)*, Patterns in biology* (2 sessions)*, Fluids* (3 sessions)*,* and *Superconductors and Lasers* (2 sessions). The formal program ended each day with a *Conclusions/plenary discussions* session. In order to stimulate interactions and cross-fertilization senior researchers were stimulated to `interview' junior researchers about their work during the informal discussions session, and then to give a brief presentation about the outcome during the *plenary discussions* session. While this setup did stimulate many informal discussions between participants who did not know each other before, at the suggestion of the participants this format was changed somewhat during the meeting: three participants were invited to give instead informal blackboard type introductions to three common themes: *bifurcations and symmetry breaking* (J. Lamb), *defects* (B. Sandstede) and *diffusion limited growth problems* (W. van Saarloos).

The workshop was very lively and gave rise to many discussions between researchers from different subdisciplines, and stimulated several new collaborations in a way which would not have been possible without the stimulating atmosphere and facilities of the Lorentz Center. It was felt by many participants that the workshop contributed a lot to *community building*, and indeed the last plenary discussions sessions was used to formulate several initiatives to capitalize on the momentum gained from the workshop:

1) It was decided to organize a two-day conference of the Dynamics of Patterns program in the spring of 2007, and another workshop in the fall of 2008.
2) A proposal was made to have a national meeting of one day or half a day in Amsterdam every two to three months, and to possibly merge these meetings with mathematics meetings like *Nonlinearity in Amsterdam*.
3) There was extensive discussion of the implications of the observation that within physics the field seems to disperse rapidly due to the increased focus on specific applications.

The danger is that due to this, the common body of knowledge which has accumulated over the last two decades when the field was focused more on general issues, is not being transferred properly to the junior researchers. This same body of knowledge is essential for mathematicians, but it is not part of the standard curriculum in mathematics. Moreover, within mathematics the research field is relatively young and strongly developing. It was suggested that the *Dynamics of Patterns* program organizes a graduate course, or a related activity.

In conclusion, the workshop was considered to be a great success and an important step towards community building and the establishment of an educational program.

O. Diekmann (Utrecht University, The Netherlands)
A. Doelman (CWI, Amsterdam, The Netherlands)
J. Hulshof (VU Amsterdam, The Netherlands)
B. Mulder (AMOLF, Amsterdam, The Netherlands)
W. van de Water (TU/e Eindhoven, The Netherlands)
W. van Saarloos (Leiden University, The Netherlands)

Scientific Report

Astro-Wise Workshop

November 14 – 18, 2005

Early 2006 the OmegaCAM panoramic imager will start observations on the ESO VLT Survey Telescope at Paranal, Chile. AstroWise is the European consortium, coordinated by OmegaCEN in Groningen, that will provide the innovative software and hardware to run and analyze several large survey projects. Each one will produce Terabytes of data on which complex analysis has to be performed to meet the science goals. The main goals of this workshop were (i) to give the nine partners in the Astro-Wise consortium a tutorial with hands-on experience on the Astro-Wise software environment, (ii) obtain an inventory for further developments and improvements of the software environment, (iii) plan the export and federation of the full software to institutes associated with the Astro-Wise project and (iv) start preparations for the survey projects on OmegaCAM using the Astro-Wise software environment.

Forty participants joined the workshop which was the maximum number possible. The morning sessions of the workshop from Monday through Thursday were devoted to tutorials. This started with a general overview followed by presentations on data reduction, astrometry, photometry, database querying and data mining and target quality control, source variability measurements and determination of photometric redshifts. The afternoons were set aside to work on exercises with the Astro-Wise software in groups. The series of office spaces available in the Lorentz Center proved to be perfect for this set-up. This helped to make the exercises a success as exemplified by the fact that everybody showed up late at the welcoming reception on Monday in order to finish their exercises. All processing was done remotely on computing facilities provided by OmegaCEN at the Kapteyn Institute, Groningen. At the end of each day all participants reconvened in the Gratama room to wrap up issues and discussions resulting from the day. On Friday morning program coordinators for the large surveys presented their plans taking into account the experience with the AstroWise system obtained during the week. These projects are KIDS (Leiden, Bonn), VESUVIO (Groningen, Napoli), VST16 (Heidelberg), and OmegaWhite (Nijmegen), all in which the Netherlands is a partner. The Friday afternoon was used to meet in subgroups to discuss next steps for the Astro-Wise program, the surveys and the export and federation of the Astro-Wise environment and finally to wrap up the workshop.

The workshop was a success in several respects. Both novice and advanced users of the software were happy with the offered program. The crucial interaction between software developers and users was intense. Splinter meetings in the Lorentz Center offices were important for that. A long list of actions items on future development of the software environment was thus established. Lastly, the principal investigators of the Astro-Wise consortium were gratified by the success of this meeting and expressed their desire to hold a new Astro-Wise workshop in one year's time, when OmegaCAM has started operations. These successes have been achieved thanks to the generosity, infrastructure and outstanding organization of the Lorentz Center and of the people working there. The workshop organizers express their special thanks to dr. Martje Kruk and Wies Groeneboer for their help prior to and during the workshop.

Edwin Valentijn (Kapteyn Institute, Groningen, The Netherlands)
Erik Deul (Leiden Observatory, Leiden, The Netherlands)

Scientific Report

Distributed Embedded Systems

November 21 – 24, 2005

The Lorentz Workshop on Distributed Embedded Systems was held from November 21-24, 2005. The organizers were Prof. Dr. Ed F. Deprettere, head of the Leiden Embedded Research Center (LERC), Leiden Institute of Advanced Computer Science (LIACS), department of Mathematics and Natural Sciences, Leiden University, and Prof. Dr. Lothar Thiele from the ETH Zurich, Switzerland.
The workshop was sponsored by the Lorentz Center, the Pascal-Chair (LIACS), the Leiden University, the Dutch Research Program on Embedded Systems and Software (PROGRESS), and the European Network of Excellence ARTIST II.
The first two days of the workshop were devoted to state-of-the-art lectures by invited distinguished experts in the field. The last two days were devoted to actual comparisons of different performance analysis methods by working out benchmarking examples.
Approximately 60 people from various countries (Europe and USA) attended the workshop.

Major challenges in Distributed Embedded Systems are abstract modeling, performance analysis, and design space exploration. These three topics are necessary investigations to cope with the complexity of today's embedded systems. They aim at predicting functional and timing behaviors of these systems prior to their implementations and realizations.
The state-of-the-art lectures presented on November 21 and 22 were focusing on precisely these three challenges: Modeling, performance analysis, and design space exploration. The approaches depend on the domain of application: Hard real-time control dominated applications (automotive) versus soft-real-time streaming data (multimedia) applications.
The performance analysis methods that have been considered on November 23 and 24, are not only application domain dependent but are also differing in terms of whether they are based on continuous time or discrete time models, and whether they are based on analytical or computational (simulation) methods. A surprisingly many Ph.D. students, both from The Netherlands and other European countries were enthusiastically involved in this part of the workshop. They proposed and discussed case studies, and worked them out using their own methods and tools. All examples as well as the performance analysis results have been posted on the internet, thereby inviting colleagues to come up with other examples and/or competing analysis results.

The organizers of the workshop are very satisfied with the active participation of the attendance. This is partly due to the strict focusing of the workshop objectives, and also due to the unique facilities offered by the Lorentz center. Many participants expressed to be surprised that such a facility was not available in their own country. Some of them were wondering whether they could organize similar workshops at the center.
The organizers wish to thank the Lorentz center staff, in particular Dr. Kruk, and her assistant Drs. Hessing for the superb support in pre-workshop organization, on-workshop and after-workshop assistance. There is no Center like the Lorentz Center.

E. Deprettere (Leiden University, The Netherlands)
L. Thiele (ETH Zürich, Switzerland)

Scientific Report

Spitzer's View on Mass-Losing AGB Stars

November 28 – December 2, 2005

This workshop was organised to discuss the recent results obtained on mass-losing Asymptotic Giant Branch (AGB) stars with the NASA infrared satellite, called Spitzer. The final evolution of low- and intermediate-mass stars is a rapid transition from the AGB via a so-called post-AGB phase towards a Planetary Nebula (PN), before the stellar remnant cools down as a White Dwarf (WD). In these late phases, mass loss governs the stellar evolution and one of the key ingredients is that in the cool circumstellar envelope of AGB stars, dust grains are formed. It is well known that this accumulated mass-loss of lower mass stars is one of the major contribution to the interstellar medium enrichment in gas and dust.

In 2003, the NASA infrared Spitzer satellite was launched. Spitzer offers three scientific instruments: the InfraRed Array Camera (IRAC), the InfraRed Spectrograph (IRS) and the Multiband Imaging Photometer for Spitzer (MIPS). Due to the sensitivities offered by the Spitzer detectors it is now possible to observe very different AGB populations within our Galaxy and beyond, so that the effects of metallicity on the dust formation can be studied.

About thirty people from institutes in Europe, the United States and South-Africa participated in the workshop. There are about 15 Spitzer programs on mass-losing AGB stars in the Guaranteed Time or from the first call for Open Time proposals (February 2004). All these projects have already obtained their data and the analysis is ongoing. In the course of this year, the first results were published. Representatives of almost all of the projects participated in the workshop. The timing of our meeting was excellent for a "Lorentz Center" type of workshop.
All teams presented their first results, but still a lot of analysis has to be done and the discussions between the people of the different groups were very stimulating. The facilities at the Lorentz center are excellent for this as they include several meeting rooms and offices with computer facilities so that people could also sit together and work on the data. We also had a special session on the data reduction of the InfraRed Spectrograph led by a member of the IRS team (Dr Greg Sloan). At relatively early stages of an infrared space mission many instrumental effects can hamper the analysis of the data, so that the inputs of an instrument expert are very useful.

Several collaborations were started to write new proposals for follow-up on the present projects. This can be seen as evidence of the fact that we had a successful and stimulating workshop. We like to thank the Lorentz Center staff, Dr. Martje Kruk and Gerda Filippo for the professional and friendly support.

Joris Blommaert (Institute for Astronomy, KU Leuven, Belguim)
Harm Habing (Leiden Observatory, The Netherlands)
Peter Wood (Research School of Astronomy and Astrophysics, Australian National University, Australia)

Scientific Report

Optimising Tools for Science with HIFI

December 5 – 8, 2005

It was the goal of this workshop to bring together the team that develops HIFI operations, the HIFI Instrument Control Center (ICC), and the teams that are preparing the Herschel-HIFI guaranteed time key programs.
The ICC is making rapid progress in the development of work packages that concern instrument operations and data processing, and the involved instrument experts have to take important strategic decisions which will affect the overall scientific utilization of HIFI. The Herschel-HIFI Key Program teams are getting into the final definition of their proposals. They need to know a.o. which are the optimum observing modes and Astronomical Observing Templates (AOT), which will be the user defined parameters in the AOT's, what standard products and processing tools can be expected from the HSC and the ICCs, how is calibration dealt with inside the AOT's, etc. Also there are in the various KP teams already ideas about further needs for analysis tools and how to develop these.
Therefore a second goal of this workshop is to make an inventory of the need and availability of scientific analysis tools to maximize the science output, and to prepare in an implementation plan.
The topics that were addressed were:
- Data processing from levels 1-3, and other scientific analysis software,
- Observing modes and AOTs; Calibration and AOT's
- Spectral data bases: overview, priorities for Herschel and access tools,
The workshop was concluded with a ICC progress meeting

The workshop was organized with presentations, followed by discussions and conclusions at the end of each session. Furthermore there was a summary team that summarized the outcome of the day one discussions and presented an overview the next day. The lay-out for the workshop was:
Day 1 Data Processing; presentation by ICC and KP teams, with discussions.
Day 2 Morning: Data Processing; presentations and general discussion.
Day 2 Afternoon: AOTs and Calibration; presentations by ICC and KP teams, with discussions
Day 3 Morning: Demonstration of HSPOT
Day 3 Afternoon: Spectral Data Bases; Together with the workshop "the Molecular Universe" (EU-FP6) that was held from 7-9 December
Day 4: Progress status of the HIFI ICC;

The number of participants depended on the subject of the day. The number of participants ranged from 25-50 persons, with an average of about 40. The participants were: HIFI-(co-)PIs, lead co-Is and Herschel mission scientists, Key Program PIs and their data processing and calibration experts, HIFI ICC Calibration scientists and Instrument scientists and other experts of the HIFI subsystems and system, members of the Herschel Science Center and external ICC-WP leaders.
The workshop reached the goals. Requirements were defined and ranked. Action items were distributed. A USER group, with representatives from all key programs and HIFI co-PI's, was constituted to be a permanent body for consultation and testing of ICC user issues.

Th de Graauw (Leiden University, The Netherlands)
E. Caux (CESR/CNRS, France)

F. Helmich (University of Groningen, The Netherlands)
V. Ossenkopf (University of Cologne, Germany)
R. Shipman (University of Groningen, The Netherlands)
P. Roelfsema (University of Groningen, The Netherlands)

Scientific Report

The Molecular Universe

December 7 – 9, 2005

The Molecular Universe is a highly interdisciplinary network of European researchers in 21 institutes in 9 countries studying the physics and chemistry of molecules in space. The network combines experts in the areas of laboratory spectroscopy, laboratory astrochemistry, molecular quantum mechanical studies, and astronomical modelling of species of astrophysical relevance. This consortium has been selected under the European Community's Sixth Framework Program as a Marie Curie Research Training Network. The network contract was concluded between the European Commission and the consortium on October 1st, 2004 with a duration of 48 months.

The network meeting was attended by ~60 scientists representing all teams involved in the network activities. Specifically, the newly appointed Early Stage Researchers and Experienced Researchers attended this meeting. The network meeting has provided a forum for discussions on the progress in the various scientific objectives and milestones of the network. These comprise topics in Molecular Complexity in Space, The Chemistry in Regions of Star Formation, and Data Bases and Web Tools. Overall, progress on these milestones was impressive and deliverables for the first year were generally met. The network meeting also provided an opportunity to chart the future in these areas. In addition, managerial, organizational, and financial aspects of the network were discussed. In a short presentation, each Early Stage Researchers and Experienced Researchers appointed by the network summarized their projects. The training coordinator reviewed the individual Personal Development Plans with the ESR/ER and their team leader. The ESR/ER also had an independent splinter meeting during this workshop to discuss their own science goals and develop collaborations among themselves. Finally, a joint meeting was organized with the HIFI calibration tools workshop to discuss progress in the development of Data bases and Web Tools geared towards HIFI, the heterodyne instrument that will fly on Herschel, the far-infrared/sub-millimeter space mission that will be launched by the European Space Agency later this decade.

The meeting was held at the Lorentz Center in Leiden, The Netherlands. All organizational detail was handled by the highly competent staff of the Lorentz center and the meeting went very smooth.

X. Tielens (University of Groningen, The Netherlands)
F. Helmich (SRON, Groningen, The Netherlands)

Scientific Report

Cosmological Radiative Transfer Comparison Project

December 12 – 14, 2005

Recent years have seen an increase in the interest of modelling radiative transfer in a cosmological setting, mostly driven by the quest to understand the Epoch of Reionization, during which ultra-violet radiation from the first galaxies ionized the intergalactic medium, but also to understand the surroundings of young, forming galaxies and the behaviour of Ly-alpha absorbers.
This has led to the development of various numerical methods to study radiative transfer (of ionizing radiation) in a cosmological context, each using different techniques, and different approximations. Some years ago a first attempt was made to set up a set of tests, which would validate the different codes being used. This attempt was revitalized at the beginning of 2005, and a first meeting was held at CITA in Toronto in May 2005. A website was set up to coordinate our efforts: http://www.mpa-garching.mpg.de/tsu3. Realizing that most progress is made when people are physically together and have time to work on the various issues, a second meeting was planned and we were happy to be able to use the facilities of the Lorentz Center for this.
The program consisted of a mix of discussions of the various test problems and the submitted results, and science presentations by participants, in which they showed some of the results obtained with their method. In total there were 11 such science presentations. Some 18 people participated in various parts of the workshop.
On the test problems for the comparison project we made a lot of progress and the first paper (on purely radiative transfer problems) is currently being written. We found some important differences between the different rates being used by the various groups, especially for the recombination cooling. Some tests were partly redefined after reviewing the results. The discussions were lively and informative, with active participation from people outside the comparison project. In fact, we spent so much time discussing the radiative transfer only test problems, that we had no time to address the second set of tests, dealing with the combination of radiative transfer and hydrodynamics.

In all, everyone was very satisfied with the meeting, and the support and facilities offered by the Lorentz Center.

G. Mellema (ASTRON, Dwingeloo The Netherlands)
J. Ritzerveld (Leiden Observatory, Netherlands)
I.T. Iliev (CITA, Toronto, Canada)

Dubbelsterren Bepalen Samenstelling Heelal

Astronomen komen van 4 april tot 15 april bijeen in het Lorentz Center (Leiden) in een workshop over bijzondere nucleaire processen in dubbelsterren.
De huidige generatie grote telescopen geeft gedetailleerde gegevens over de samenstelling van sterren. Met grote precisie kunnen ook de zeldzamere elementen worden gemeten. Het blijkt dat dubbelsterren op dit punt afwijken van andere sterren. Ze hebben bijvoorbeeld vaak meer koolstof, en zware elementen zoals barium. Dat zijn aanwijzingen dat de vorming van atomen binnen dubbelsterren anders verloopt. Sommige elementen, zoals ijzer, blijken voornamelijk bij explosies in dubbelsterren te worden aangemaakt. Dubbelsterren kunnen daarom een belangrijke invloed hebben op de samenstelling van het heelal.
Veel van de bijzondere nucleaire verschijnselen die zich in dubbelsterren afspelen, zijn echter nog nauwelijks bestudeerd. De theorie loopt wat dat betreft ver achter bij de waarnemingen. Modelvorming en rekentechnieken staan nog in hun kinderschoenen. Bovendien zijn de nucleaire processen lastiger te berekenen dan bij enkelvoudige sterren. Een complicerende factor is bijvoorbeeld de materie, die in een dubbelster van de ene naar de andere ster wordt gezogen. De berekeningen vergen ook meer rekenkracht, die pas recent beschikbaar is gekomen.
Verschillende instituten zijn onlangs onderzoeksprojecten begonnen, zoals de Universiteit Utrecht, het Institute of Astronomy in Cambridge (GB), het Carolune Institute for Quality Astronomy (www.ciqua.org) en Monash University (Aus). Zij onderzoeken bijvoorbeeld de invloed van massa-overdracht en rotatie op de nucleaire processen. Of de evolutie van dubbelsterren, waarbij het nog onduidelijk is wanneer ze eindigen als zwart gat of wanneer ze ontploffen met een uitbarsting van gamma-stralen of als supernova. Ook blijkt het nog lastig om rekenresultaten en waarnemingen met elkaar te vergelijken. Het gaat daarbij niet alleen om waarnemingen van dubbelsterren, maar ook van sterrenstelsels, sterhopen en meteorieten, die aanwijzingen kunnen geven over de evolutie van de elementen in het heelal.
Vele betrokkenen bij dit onderzoek komen bijeen op de workshop in Leiden om hun kennis uit te wisselen en nieuwe onderzoekslijnen uit te zetten. Het wordt een workshop waar vooral veel gewerkt wordt. Na een introductie over ideeën en technieken, zetten de deelnemers zich aan het rekenen. Computermodellen staan daarvoor ter beschikking. In onderlinge discussies worden nieuwe onderzoeksideeën uitgewerkt. Dagelijks worden tussenresultaten en doorbraken gepresenteerd. Na twee weken moeten er samenwerkingen zijn ontstaan, met een onderzoeksprogramma voor het komende jaar.
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'Nucleosynthesis in Binary Stars wordt van 4 april tot 15 april 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen. Voor inhoudelijk informatie kunt u contact opnemen met de coördinatoren.
Onno Pols, docent/onderzoeker aan het Sterrenkundig Instituut van de Universiteit Utrecht. Hij doet onderzoek naar de evolutie van sterren, dubbelsterren en nucleosynthese. E-mail: O.R.Pols@phys.uu.nl. Tel (030) 2535209
Christopher Tout is John Couch Adams Astronomer aan de University of Cambridge (GB). Hij doet onderzoek naar alle aspecten van sterevolutie. E-mail: cat@ast.cam.ac.uk. Tel. +44 1223 337502
Rob Izzard promoveerde vorig jaar in Cambridge op nucleosynthese in dubbelsterren en is nu research fellow van het Carolune Institute, rgi@carolune.net. Tel. +44 1223 562720

Helder zicht voor Nieuwe Telescoop

Astronomen komen van 26 april tot 29 april bijeen in het Lorentz Center (Leiden) in een workshop over een nieuwe waarneemtechniek, waarmee scherper kan worden waargenomen.

Turbulenties in de atmosfeer vormen een belangrijke beperking voor astronomische waarnemingen. Ze zorgen ervoor dat lichtstralen worden uitgesmeerd. Een 4 meter telescoop ziet daardoor even scherp als een amateurkijker met een lens van 20 cm doorsnede. Het heeft dus geen zin om lenzen en spiegels te vergroten om scherper waar te nemen. Kleine details gaan toch verloren in atmosferische vertroebeling. Grote kijkers worden alleen gebouwd om meer licht te verzamelen, zodat ook zwakkere objecten zichtbaar worden. Je ziet meer, maar niet scherper. Ruimtetelescopen, zoals de Hubble Space Telescope, hebben geen last van de atmosfeer en zien dus wel scherper. Maar die zijn 20 maal zo duur als de grootste telescopen op aarde.

Rond 1990 deden telescopen hun intrede met zogeheten adaptive optics, die de atmosferische vertroebeling automatisch corrigeren. Het spiegeloppervlak van zulke telescopen beweegt mee met de turbulenties in de atmosfeer. Honderden kleine pinnetje duwen tegen de achterkant van de spiegel en zorgen zo voor precies de goede vervorming. Dat maakt dat de storende effecten gecompenseerd worden. Een computersysteem dirigeert de pennetjes. Daartoe wordt in real time de atmosferische verstoring berekend, aan de hand van de waarnemingen van een heldere ster. Met die gegevens worden de pinnetjes 100 keer per seconde bijgesteld. Een aantal grote telescopen werkt inmiddels met adaptive optics, bij voorbeeld de Keck telescoop op Mauna Kea (Hawaii) en de VLT in Paranal.

Nadeel van dit systeem is dat zo'n telescoop maar een beperkt blikveld heeft. De atmosferische verstoringen variëren namelijk van plaats tot plaats. Als je corrigeert voor de turbulenties in het midden van het beeld, heb je daaraan niets voor de randen. Als je kijkt naar één klein object is dat niet erg. Maar astronomen willen vaak ook de omgeving bestuderen, of meerdere objecten tegelijk volgen.

Recent zijn er technieken bedacht om het blikveld te verruimen. Dat kan door bij de compensatie alleen rekening te houden met turbulenties in de onderste lagen van de atmosfeer. Die turbulenties zijn namelijk dichterbij de telescoop, en daardoor bepalend voor een breed deel van het blikveld. Door alleen voor de turbulenties in de onderste luchtlagen te corrigeren, blijft er altijd een restant vertroebeling over, veroorzaakt door de hogere luchtlagen. Maar daar staat een breder blikveld tegenover.

Deze zogeheten 'Ground Layer Adaptive Optics' (GLAO) is het onderwerp van de workshop in het Lorentz Center in Leiden. Astronomen uit de hele wereld komen samen om de mogelijkheden van dit nieuwe concept te bestuderen.

De nieuwe correctietechniek is vooral belangrijk voor grote inventarisaties, die nodig zijn om de vroege geschiedenis van sterrenstelsels in kaart te brengen en de evolutie van het heelal te bestuderen.

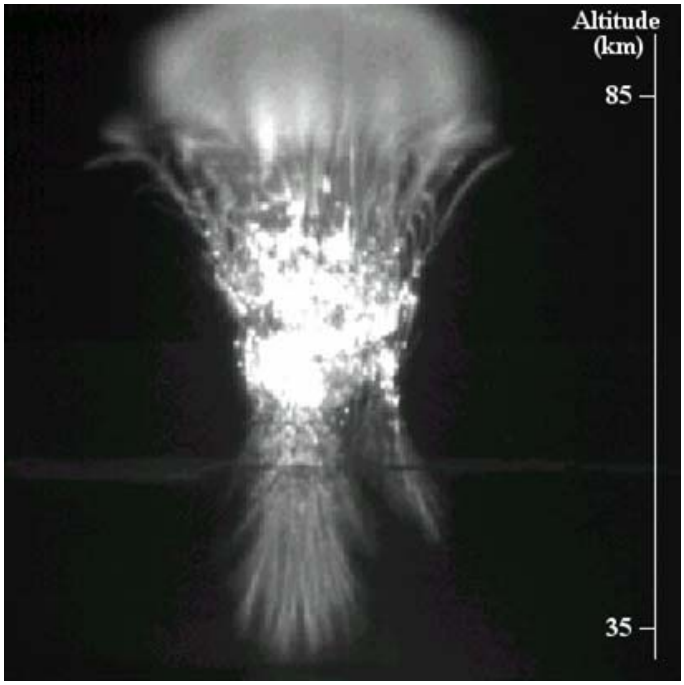
Belangrijk gespreksonderwerp zullen de technieken zijn, waarmee de turbulenties in de lage delen van de atmosfeer gemeten kunnen worden. Zulke meettechnieken zijn nodig om de spiegel om de goede manier te kunnen vervormen. Daarvoor liggen er verschillende voorstellen.

Zo kunnen er in de atmosfeer kunstmatige sterren worden aangebracht, bijvoorbeeld door een plek laag in de atmosfeer te beschijnen met een laser. Het licht van die kunstmatige ster wordt niet beïnvloed door turbulenties hoger in de atmosfeer. Waarnemingen van die laser-ster kunnen dus dienen om turbulenties in de lage luchtlagen in kaart te brengen.

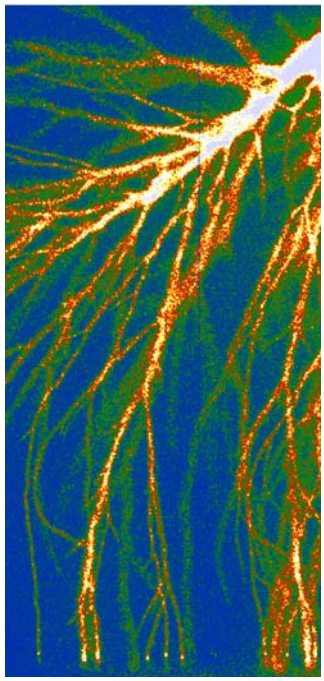
Tijdens de workshop zullen dergelijke technieken verder worden uitgewerkt. De astronomen zullen proberen de potentiële prestaties van GLAO te schatten en de waarde voor de astronomische gemeenschap in kaart brengen.

Verschillende onderzoeksgroepen werken inmiddels aan GLAO-instrumenten, die over enkele jaren ingezet kunnen worden.
Een uitgebreide inleiding over adaptive optics staat op:
www.eso.org/projects/aot/introduction.html
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'Ground Layer Adaptive Optics' wordt van 26 april tot 29 april 2005 gehouden.

Opwaartse Bliksem en andere Ontladingsverschijnselen



Grote sprite, op 18 november 1999 waar genomen boven Nebraska (VS). Foto: H.C. Stenbaeck-Nielsen, Geophysical Institute, University of Alaska, Fairbanks.



"Groeiende vonken" (streamers) in het lab Foto: Tanja Briels, Eddie van Veldhuizen et al., TU Eindhoven.

Vooraanstaande internationale wetenschappers komen van 9 tot 13 mei bijeen in het Lorentz Center (Leiden) in een workshop over vonken, bliksem en tientallen kilometers hoge 'opwaartse bliksem' in de bovenlagen van de atmosfeer.
'Opwaartse bliksem' boven onweerswolken is nog maar recent waargenomen. De eerste beelden dateren uit 1990. Extreem snelle bliksem-achtige verschijnselen kunnen nu door nieuwe experimentele technieken in het lab veel nauwkeuriger onderzocht worden dan vroeger. In de workshop in Leiden komen voor het eerst wetenschappers bijeen uit alle disciplines die te maken hebben met zulke ontladingen. Niet alleen geowetenschappers, maar ook natuurkundigen, elektro-ingenieurs, en wiskundigen. Zij zullen waarnemingen en modelvorming met elkaar bespreken.
De foto's van de 'high altitude lightning' laten een spectaculair verschijnsel zien, een reusachtige korenschoof van licht die tientallen kilometers boven een onweerswolk uitgroeit. In een brede bundel zoeken tienduizenden individuele ontladingen parallel aan elkaar hun weg. De naam 'sprite'- ontlading is ontleend aan Shakespeare's Midzomernachtsdroom. Dit stuk heeft ook de namen van nog talrijke andere ontladingsverschijnselen of 'transient luminous events' boven onweerswolken geïnspireerd, zoals blauwe 'jets' (gigantische ontladingen, die rechtstreeks van de wolk tot 30 km omhoog schieten), 'elves' (uitdijende ringen op 90 km hoogte), en 'trolls' (kleine rode jets) en ook 'pixies' en 'gnomes'. De verschijnselen spelen zich af tussen onweerswolken en de ionosfeer op 90 kilometer hoogte, vaak te hoog voor vliegtuigen en hete-luchtballonnen, maar zeker te laag voor satellieten. Omdat dit gebied zo moeilijk toegankelijk is voor observaties, wordt het ook wel aangeduid als 'ignorosphere'. We moeten het doen met waarnemingen op afstand. Om die reden zijn

laboratoriumproeven en theoretische modellen extra belangrijk om het verschijnsel te begrijpen.
In de workshop komen al deze benaderingen aan bod. Verschillende experimentele groepen zullen elkaar ontmoeten. De deelnemers zullen het experimenteel werk aan ontladingen in de laboratoria van de faculteiten toegepaste natuurkunde en elektrotechniek in Eindhoven bezoeken. Er zullen verschillende benaderingen voor computermodellen en theoretisch begrip aan bod komen, die onder meer aan het Centrum voor Wiskunde en Informatica in Amsterdam ontwikkeld worden, werk dat vorig jaar bekroond werd met de Minervaprijs.
Davis Sentman (Fairbanks, Alaska, VS), een van de eerste waarnemers van 'opwaartse bliksem', zal uitvoerige optische waarnemingen laten zien van het hele sprookjesbos van Transient Luminous Events in de bovenlagen van de atmosfeer.
Victor Pasko (Pennsylvania State Univ., VS) zal ingaan op waarneming en verklaring.
Elisabeth Gerken (Menlo Park CA, VS) zal haar telescopische opnames van de inwendige structuur van sprite ontladingen vertonen.
Torsten Neubert (Copenhagen, Denmark) zal een overzicht geven van de gecoördineerde Europese waarnemingen.
Earle Williams (MIT, VS) zal het paradoxale verband tussen gewone bliksem en opwaartse bliksem toelichten.
Martin Füllekrug (Bath, Engeland) zal vertellen over een nieuwe manier om de sprites op afstand waar te nemen door de radiogolven die zij veroorzaken. Door een netwerk van antennes op verschillende continenten kan hij de sprites precies lokaliseren.
Ute Ebert (CWI, Amsterdam), één van de coordinatoren van de workshop, en haar medewerkers zullen op drie gebieden vorderingen laten zien: computermodellen (promovenda Carolynne Montijn, Amsterdam), theoretisch-fysisch inzicht (promovendus Bermard Meulenbroek, Amsterdam) en experimenten (promovenda Tanja Briels, Eindhoven).
Het programma van de workshop is te vinden op
http://www.lc.leidenuniv.nl/lc/web/2005/20050509/info.php3?wsid=155
Voor publicatie zijn ook foto's beschikbaar van een sprite in de atmosfeer en van een ontladingsproef bij de Technische Universiteit Eindhoven.
Veel gegevens over de ontladingsverschijnselen zijn te vinden op de website van Ute Ebert:
http://homepages.cwi.nl/~ebert/streamers.html
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'The multiscale nature of spark precursors and high altitude lightning ' wordt van 9 tot 13 mei 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

Kraken van Biologische Gegevens

Vooraanstaande internationale wetenschappers komen van 18 tot 20 mei bijeen in het Lorentz Center (Leiden) in een workshop over het analyseren van grote hoeveelheden gegevens. Nieuwe biologische databanken stellen nieuwe eisen aan de analysetechnieken. De laatste jaren zijn enorme hoeveelheden biologische gegevens in computers opgeslagen. En dat neemt nog steeds sterk toe. Voor de analyse van al die gegevens zijn krachtige computers allang niet meer voldoende. Evenmin kun je uit de voeten met alleen statistiek. Ook in andere vakgebieden is gegevensanalyse alleen mogelijk als technieken uit verschillende disciplines gecombineerd worden. Patroonherkenning, technieken uit de kunstmatige intelligentie, speciale hardware, het is vaak juist de combinatie die maakt dat de datavloed kan worden getemd. Uit die aanpak is het nieuwe vakgebied Intelligent Data Analysis (IDA) ontstaan. Met een multidisciplinaire aanpak lukt het om bijvoorbeeld de grote hoeveelheden gegevens over het menselijk DNA de baas te worden. Maar er zijn ook nog veel belangrijke, moeilijke en onopgeloste problemen in het vakgebied.
Zo worstelen onderzoekers met de analyse van bijvoorbeeld complexe biologische netwerken, of van meetgegevens uit zogeheten microarrays (een meettechniek voor DNA-gegevens). Een aantal deelnemers maakt tevoren een complexe analyse van micro-array-onderzoek. Tijdens de workshop zal de aanpak van de verschillende deelnemers worden bediscussieerd.
Bijzonder bij biologische gegevens over bijvoorbeeld het DNA is ook dat de databases wereldwijd verspreid zijn. Het gaat er vaak om gegevens uit verschillende databases te combineren. Daarom worden schaalbare, gedistribueerde rekentechnieken ontwikkeld om informatie te ontlenen aan die databases.
Bij een recente bijeenkomst van de Britse Royal Statistical Society bleek dat statistici soms vrezen dat hun vakgebied wordt ingehaald door brute rekenkracht. Dat wordt een belangrijk discussiepunt tijdens de workshop. Want voor echt complexe problemen zijn beide vakgebieden nodig. En beide deelgebieden beïnvloeden elkaar ook. Kennis over brute computerkracht kan gebruikt worden voor de ontwikkeling van nieuwe statistische technieken, en omgekeerd.
Een ander discussiepunt is de kwaliteit van gegevens in databases. Hoe ga je om met onnauwkeurige, incomplete en inconsistente gegevens? Er is een sterke behoefte aan praktische en effectieve technieken om verschillende kwaliteitsproblemen in grote databases aan te pakken.
Al dit soort problemen zullen in de workshop worden besproken. Onderzoekers uit de statistiek, machine learning, patroonherkenning, bioinformatica, systeembiologie en andere gebieden zullen gezamenlijk proberen nieuwe paden te betreden.
David Hand (London, GB) zal tijdens de workshop een overzicht geven over het vakgebied Intelligent Data Analysis.
Hong Yan (Kowloon, Hong Kong) zal de problemen van spectrale analyse van microarray-gegevens toelichten.
Ernst Wit (Glasgow, GB) gaat in op het ontwerpen van experimenten met het oog op netwerk-analyse.
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'Intelligent Data Analysis' zal worden gehouden van 18 tot 20 mei 2005. Wetenschappers kunnen de lezingen kosteloos bijwonen. Inlichtingen en inschrijving: Wies Groeneboer, tel: + 31 71 527 5400. groeneboer@lorentzcenter.nl. Zie ook http://www.lorentzcenter.nl.

Signalen in en rond een Lichaamscel

Natuurkundigen, biologen en wiskundigen komen van 23 mei tot 5 juni bijeen in het Lorentz Center (Leiden) in een workshop over biologische regelmechanismen in en rond cellen.
Er heerst vaak een grote bedrijvigheid in en rond een cel. Signalen gaan heen en weer, complexe biomoleculen worden op commando aangemaakt, er is een voortdurende spel van actie en reactie. Regelmechanismen zijn vaak complex, met een onderlinge samenhang die lang niet altijd duidelijk is. Bijvoorbeeld de manier waarop een cel commando's van buitenaf ontvangt en intern verwerkt. Een signaal (bijvoorbeeld om DNA af te lezen en een eiwit te synthetiseren) wordt opgevangen bij het membraan van de cel en wordt vervolgens omgezet in een intern signaal, dat van de membraan naar de celkern gaat. Er is slechts een drietal stoffen, dat als second messenger het signaal naar de celkern kan transporteren. Samen moeten die drie stoffen honderden verschillende boodschappen overbrengen. Dat lukt alleen met een complexe codering, waarbij ook pulsen en golven belangrijk zijn in het coderen van het signaal. De voortplanting van deze secundaire signalen is sterk niet-lineair, met instabiliteiten die belangrijk zijn voor het overbrengen van de boodschap. Op veel andere plaatsen in biologische systemen komt zo'n complexe dynamica voor. Bijvoorbeeld ook in de manier waarop de signalen vanuit het oog naar de hersenen worden getransporteerd en daar worden verwerkt. Vaak worden delen van zo'n signaalketen wel begrepen, maar het geheel vertoont veelal onbegrepen eigenschappen. Er zijn uitvoerige simulaties en vaak meer metingen nodig om die eigenschappen te begrijpen.
Biologen, fysici en wiskundigen proberen in de workshop samen nieuwe wegen te vinden op dit punt. De workshop begint met drie inleidende dagen, waarin de betrokkenen elkaar inwijden in hun kennis en jonge onderzoekers hun inzichten meegeven. Na deze tutorials volgt de eigenlijke workshop, waarin onderzoekers een aantal onbegrepen fenomenen willen aanpakken en nieuwe onderzoekslijnen willen opzetten. Er is volop ruimte voor discussie in het programma. Een aantal wetenschappers neemt ook de eigen simulatie-software mee, zodat aanpak en resultaten ter plekke kunnen worden vergeleken.
Daarbij zullen de betrokkenen onder meer spreken over de dynamica van gekoppelde oscillatoren, stabiliteit en evenwicht, fase-overgang in niet-evenwicht, kritische fenomenen, en de invloed van ruis.
De biofysicus Stan Gielen van de Radboud Universiteit in Nijmegen zal onder meer spreken over de signaalverwerking tussen zenuwcellen en over genoemde secundaire signalen, waarbij de calcium-huishouding in de cel een belangrijke rol speelt.
De wiskundige Bard Ermentrout (Pittsburgh, VS) zal spreken over synchronisatie bij gekoppelde oscillatoren, waarbij hij resultaten van zijn simulaties zal laten zien.
De bioloog Pascal Fries (eveneens uit Nijmegen) zal spreken over de coherentie in signalen van zenuwcellen, zoals die onder meer een rol speelt bij de communicatie tussen oog en hersenen.
Het volledige programma is te vinden op
http://www.lorentzcenter.nl/lc/web/2005/20050523/info.php3?wsid=152
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'Oscillations and Instability; control, near and far from equilibrium in Biology' wordt van 23 mei tot 3 juni 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

Het Mysterieuze Gedrag van Bubbels en Gasbelletjes

Vooraanstaande internationale wetenschappers komen van 6 tot 16 juni bijeen in het Lorentz Center (Leiden) in een workshop over gasbelletjes in stromende vloeistoffen. Er blijken zich verschijnselen voor te doen die het wetenschappelijk inzicht tarten.

Pas onlangs werd het mogelijk om het gedrag van gasbellen in cola en in deeltjesversnellers te berekenen en theoretisch te begrijpen. Althans gedeeltelijk, want er zijn nog veel open vragen in de wetenschap van bubbels en bellen.

Gasbelletjes spelen een cruciale rol in veel technologieën. Bij de productie en het transporteren van olie helpen bubbels om zware bestanddelen naar de oppervlakte te brengen. Bij de opwekking van elektriciteit worden bubbels gevormd als water gekookt wordt om stoom te maken. In de chemische industrie worden reacties versneld door een gas als bubbels in een vloeistof te spuiten. Bij inkjetprinters kunnen bubbels de inktstroom verstoren. En in de hoge-energie-fysica worden vanouds bellenvaten gebruikt om de sporen van hoog-energetische deeltjes zichtbaar te maken.

De laatste jaren heeft de bubbel-wetenschap veel vooruitgang geboekt. Zo is het tegenwoordig mogelijk om met een computer te simuleren hoe afzonderlijke belletjes in stilstaand water opstijgen, en daarbij van vorm veranderen. Maar het krachtenspel op belletjes in bewegende vloeistof is nog te lastig. Vooral als er veel bellen zijn, en turbulentie een rol speelt, zijn de berekeningen te complex. Er zijn wel simulaties en theoretische inzichten, maar die spreken elkaar gedeeltelijk tegen, waarschijnlijk omdat de omstandigheden in de verschillende experimenten en berekeningen niet helemaal vergelijkbaar zijn. Het is belangrijk om op dit punt vooruitgang te boeken, want juist belletjes in bewegelijke vloeistoffen zijn essentieel voor een aantal toepassingen.

In de workshop komen wetenschappers uit verschillende vakken bijeen om recente inzichten uit te wisselen op dit gebied. Experimentatoren, theoretici, en simulatie-experts zullen hun kennis over 'bubbly flow' delen.

Enkele key-note sprekers:

John Blake (Birmingham), 'Singularities in Bubble Dynamics'

Andrea Prosperetti (Baltimore), 'Gas-Vapor Bubbles in Flow and Acoustic Fields'

Gretar Tryggvason (Worcester), 'Direct Numerical Simulations of Bubbly Flows'

Het programma van de workshop is te vinden op
http://www.lorentzcenter.nl/lc/web/2005/20050606/info.php3?wsid=132

Tijdens de eerste drie dagen worden er veel voordrachten gehouden. De week daarna is er veel ruimte voor discussie en gemeenschappelijk werk. De deelnemers krijgen tijdens de workshop een kantoor en computertoegang.

In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.

Het Lorentz Center organiseert deze workshop samen met Euromech, de European Mechanics Society, een internationale non-governmentele, non-profit wetenschappelijke organisatie (zie http://www.euromech.cz)

De workshop 'Hydrodynamics of Bubbly Flows' wordt van 6 tot 16 juni 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

De Mysterieuze Aard van Quasars

Vooraanstaande internationale wetenschappers komen van 22 tot 26 augustus bijeen in het Lorentz Center (Leiden) in een workshop over de aard van quasars. Er zijn verschillende opvattingen over de interpretatie van recente waarnemingen. In Leiden proberen ze het eens te worden.

Quasars zijn de helderste objecten in het heelal, en daarom ook de verst verwijderde objecten die nog zichtbaar zijn. Recent zijn er waarnemingen gedaan van de directe omgeving van quasars, die astronomen voor een raadsel zetten. Sterrenkundigen denken al lange tijd dat quasars de kern vormen van een sterrenstelsel. Waarschijnlijk licht de kern alleen op in een bepaalde levensfase van zo'n sterrenstelsel. Als gaswolken in het sterrenstelsel zich samentrekken en daardoor sterren vormen, groeit het sterrenstelsel en neemt kort daarna ook de activiteit in de kern toe. Dat is althans de theorie, want tot voor kort kon alleen de stralende kern worden waargenomen. Die kern is energierijk door de aanwezigheid van een zwart gat. Materie wordt aangetrokken door het zwarte gat in het centrum, en gaat daardoor intens stralen. Die intense straling zien wij als quasar.

Pas recent kan ook het sterrenstelsel rond de quasar worden waargenomen. Die waarnemingen zijn buitengewoon lastig. De extreme helderheid van de quasar overstraalt alles in de omgeving. De Hubble Space Telescope heeft de omgeving van een grote groep quasars bestudeerd. De ruimtetelescoop heeft zo'n grote gevoeligheid, dat het instrument bijzondere activiteit rond de quasars zou moeten zien. Maar er werd niets gevonden. Ook de infrarood ruimtetelescoop ISO nam alleen leegte waar. Waarnemingen met radiotelescopen laten wel activiteit zien, vooral in observaties van moleculaire wolken. Het is daarom nog een raadsel hoe de quasar in de kern gevoed wordt door de omgeving, en hoe het ontstaan van een quasar samenhangt met stervorming in het sterrenstelsel. De waarnemingen wijzen verschillende kanten uit. Er is een school van astronomen die denkt dat de omgeving van een quasar een heel normaal sterrenstelsel is, zonder bijzondere activiteit. In dat geval is het licht van het sterrenstelsel te zwak om door de Hubble te kunnen worden gezien. Een andere school denkt dat er wel veel stervorming direct rond de kern plaatsvindt, maar daarbuiten niet. Ook in dat geval ziet de Hubble niets, want dat is te dicht bij de heldere quasar in het centrum.

Tijdens de workshop komen astronomen uit beide scholen bijeen om het eens te worden over de interpretatie van de waarnemingen. Daaraan doen ook theoretici mee, die de stervorming en processen in het vroege heelal modelleren. In de workshop komen dus astronomen uit verschillende richtingen bijeen om hun inzichten uit te wisselen.

De belangstelling voor de workshop is groot. Alle toponderzoekers, die wereldwijd met dit onderwerp bezig zijn, komen. De organisatie moest uitwijken naar een grotere conferentiezaal.

Enkele key-note sprekers:

Peter Barthel, Kapteyn Astronomical Institute, Groningen. Hij is één van de coördinatoren van de workshop, en heeft veel infrarood en radio waarnemingen gedaan van quasars.

David Sanders, Institute for Astronomy, University of Hawaii, VS. Hij is één van de coördinatoren van de workshop, en deed infrarood waarnemingen aan quasars.

Zoltan Haiman, New York, VS. Hij bestudeerde de eerste zwarte gaten in het universum, en stelde vast hoe die in de kern van hun sterrenstelsels zwaarder werden.

Timothy Heckman, Baltimore, Maryland, VS. Zijn team bestudeerde meer dan 120.000 sterrenstelsels, en toonde daardoor aan dat het ontstaan van superzware zwarte gaten samenvalt met de geboorte van nieuwe sterren in dat stelsel.

Het programma van de workshop is te vinden op
http://www.lorentzcenter.nl/lc/web/2005/20050822/info.php3?wsid=149

Press Releases

In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op. De workshop 'QSO Hosts: Evolution and Environment' wordt van 22 tot 26 augustus 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

Als Lading Vreemd Gaat

Een brede groep wetenschappers komt van 5 tot 8 september bijeen in het Lorentz Center (Leiden) in een workshop over merkwaardige elektrische effecten, zoals die bijvoorbeeld rond grote moleculen in lichaamscellen worden waargenomen. Er is daarvoor nog geen eensluidende verklaring. In Leiden proberen experimentatoren en theoretici het met elkaar eens te worden.

Elektrische ladingen doen soms vreemde dingen. Zo bleek onlangs dat een negatief geladen stukje DNA een onverwacht grote, positief geladen ionenwolk kan aantrekken. Zo'n stuk DNA wordt door die ionen afgeschermd en lijkt dan van buitenaf positief geladen. Dat zou een manier zijn waarop het DNA andere, doorgaans negatief geladen biologische moleculen naar zich toe kan halen. Zo zijn er meer opvallende ladingsafschermingen in zoutoplossingen. Vooral op de kleine schaal van moleculen blijkt dat dergelijke afscherming kan leiden tot nieuwe verschijnselen, die niet verklaard kunnen worden met de conventionele theorieën. De afscherming van DNA is daarvan een voorbeeld, maar ook de onverwachte aantrekking tussen ionen met dezelfde lading. Ook spelen dit soort effecten een rol in uiterst kleine kanaaltjes, waarin materie door ladingsverschilen kan worden getransporteerd.

Theoretici zijn het nog niet eens over de verklaring daarvan. Recente berekeningen laten zien dat er een misschien universele verklaring is voor een grote verscheidenheid aan dit soort effecten. Deze ideeën motiveren experimentatoren op hun beurt weer om met hun proeven de grenzen van de kennis op te zoeken. In de workshop van het Lorentz Center komen theoretici en experimentatoren om deze inzichten met elkaar te bespreken. Dat zijn vooral natuurkundigen en chemici. Het gaat immers om fundamentele interacties tussen grote moleculen. Niet alleen de wetenschappers die zich met biomoleculen bezig houden, maar ook deskundigen op het gebied van polymeerfysica, nanostructuren een vloeistoffen. Want afschermingsverschijnselen blijken in uiteenlopende situaties voor te komen. Samen zullen zij meer solide, kwantitatieve informatie bijeenbrengen. Maar vooral het contact tussen theorie en experiment is belangrijk, zodat er overeenstemming kan ontstaan over de mechanismen die een rol spelen. Het is de bedoeling dat tijdens de workshop nieuwe experimenten bedacht worden om de theoretische inzichten te toetsen. Experimenten zijn moeilijk, omdat het steeds gaat om het gedrag van enkele moleculen temidden van een grote hoeveelheid water. De thermische bewegingen van het water zijn veel sterker dan de subtiele elektrische effecten waarnaar de experimentatoren op zoek zijn. Zij moeten dus uiterst gevoelige metingen doen.

Beter inzicht in de interacties tussen biomoleculen heeft belangrijke consequenties. Zo is het tot nu toe een raadsel hoe een DNA-streng, die 2 meter lang kan zijn, zo klein opgerold kan worden dat deze in een cel past. Elektrische interacties spelen daarbij waarschijnlijk een belangrijke rol. In het algemeen geldt dat de samenstelling van biologische moleculen vaak wel bekend is, maar niet hun onderlinge interactie. Het onderzoek naar ladingsafscherming moet de regels voor deze interacties opleveren.

Een ver verwijderd, en misschien nooit haalbaar, perspectief is gen-therapie. Vernieuwen van het genetisch materiaal maakt het misschien mogelijk om kanker te bestrijden of de afweer van het lichaam te versterken. Maar daarvoor is het nodig om nieuw DNA in de cel te brengen. Wanneer je gericht kunt manipuleren met ladingen, wordt het makkelijker om negatief geladen DNA in negatief geladen lichaamscellen te krijgen. Dat brengt de mogelijkheid van gen-therapie dichterbij.

Enkele deelnemers en sprekers:

Serge Lemay, Delft Voert experimenten uit van ladingsafscherming rond DNA en elektrische detectie van moleculen in water. Eén van de coördinatoren van de workshop.

Boris Shklovskii, Minneapolis, VS Zijn belangrijkste bijdrage wat de berekening hoe ladingsafschermingkan leiden tot een omkering van de effectieve lading van grote

moleculen, bijvoorbeeld bij de afscherming rond DNA. Eén van de coördinatoren van de workshop.
Christian Holm, Mainz, Duitsland Doet computersimulaties van complexe ladingsverschijnselen
Gerard Wong, Urbana, IL, VS Doet experimenten die zichtbaar maken hoe microscopische ladingen zich rangschikken rond grote biomoleculen.
Eric Raspaud, Orsay, Frankrijk Deed een aantal van de eerste baanbrekende experimenten met lading rond DNA
Roland Netz, Garching bij München, Duitsland Verwierf belangrijke theoretische inzichten in de bewegingen van complex geladen objecten als reactie op externe stimuli.
Philip Pincus, Santa Barbara, CA, VS Is eeen van de belangrijke senior onderzoekers in dit vakgebied.
Het programma van de workshop is te vinden op
http://www.lorentzcenter.nl/lc/web/2005/20050905/info.php3?wsid=161
Voor publicatie is ook een illustratie beschikbaar, die laat zien hoe DNA in een klein volume wordt opgerold. Het opgerolde 'condensaat' is het lichtgrijze ringvormige object in het midden. Het oprollen is alleen mogelijk, omdat het negatief geladen DNA bijeen gehouden wordt door positieve ionen. Het DNA op de afbeelding is afkomstig uit virussen (de 11 donkere vlekken die rond het DNA zichtbaar zijn). Bron: 'Gelbart WM, Bruinsma RF, Pincus PA, Parsegian VA, 'DNA-inspired electrostatics', Physics Today 53 (9): 38-44 SEP 2000 (Adapted from O. Lambert et al., Proceedings of the National Academy of Sciences (USA), volume 97, page 7248, 2000.)
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op. De workshop 'Screening, charge inversion and condensation of macroionst' wordt van 5 tot 8 september 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

De Overeenkomst tussen DNA en Bliksem

Wetenschappers uit sterk uiteenlopende vakgebieden komen van 7 tot 11 november bijeen in het Lorentz Center (Leiden) voor een workshop over patroonvorming.
Een hartstilstand, een bliksemschicht en het voortplanten van een bacterie hebben veel gemeenschappelijk. Patronen ontstaan en verdwijnen vaak volgens vaste wetmatigheden. Dat geldt voor het vormen of het wegspoelen zandbanken, maar ook voor de overgang van een vast hartritme naar onregelmatig bonken of het vertakken van een bliksem. Natuurkundigen en wiskundigen komen in de Leidse workshop samen om de onderliggende wetmatigheid van dit soort patronen te bestuderen. Patronen ontstaan vaak doordat verschillende processen elkaar beïnvloeden. Bij het bestuderen gaat het daarom om de samenhang van processen, die elkaar tegenwerken of versterken. Het helpt daarbij niet om een situatie te ontrafelen in afzonderlijke fundamentele processen, zoals de wetenschap eeuwenlang gedaan heeft. Voor een beter begrip moeten juist verschillende bouwstenen worden samengebracht, en moet bestudeerd worden hoe die op elkaar inwerken. Het geheel is wezenlijk anders dan de som der delen. Daarom is het lastig om de vorming van patronen te doorgronden.
Tijdens de workshop zal bijvoorbeeld worden gesproken over de regelmaat van het hartritme. Soms gaat het mis in ons hart, en wekt het hart zelf a-ritmische patronen op. Deze zogeheten spiraalgolven voel je als hartkloppingen. Die spiraalgolven zijn eerst nog coherent, maar ze kunnen overgaan in een chaotisch gedrag, met meestal de dood als gevolg.
Patronen worden op heel andere schaal gevormd bij het oprollen van DNA. De meterslange DNA-streng wordt opgewonden in verschillende tussenstadia. En het opwekken van patronen blijkt ook belangrijk bij het delen van een cel. Bepaalde patronen zorgen ervoor dat de cel precies in het midden wordt ingesnoerd, zodat er twee gelijke helften ontstaan.
Andere patronen ontstaan bij vonkvorming in de bovenlaag van de atmosfeer: een spectaculair verschijnsel waarbij een reusachtige korenschoof van licht tientallen kilometers boven een onweerswolk uitgroeit. In een brede bundel zoeken tienduizenden individuele ontladingen parallel aan elkaar hun weg. Door combinatie van computersimulaties, laboratoriumproeven en nieuwe wiskundige technieken zijn hier de recent veel vorderingen gemaakt.
De afgelopen jaren zijn verschillende nieuwe wiskundige technieken ontwikkeld om dit soort complexe situaties te analyseren. Die technieken zijn bruikbaar is sterk verschillende situaties. De rekenmethoden die fysisch oceanografen gebruiken om de vorming van zandbanken te bestuderen, blijken verrassend veel te lijken op de vergelijkingen die vijftig kilometer verderop worden opgelost door een natuurkundige die de bliksem bestudeert. Soms gebruiken ze ook dezelfde software om hun problemen op te lossen. Dat is een belangrijke reden waarom onderzoekers uit uiteenlopende vakgebieden samenkomen in één workshop. Het is de bedoeling dat de wetenschappers elkaar vinden in de achterliggende mechanismen, rekentechnieken en experimenten.
De workshop is daarmee ook een startschot voor het NWO-programma 'Dynamics of Patterns', waarin wetenschappers uit verschillende vakgebieden complexe patroonvorming zullen bestuderen.
In de workshops van het Lorentz Center komen vooraanstaande wetenschappers uit binnen- en buitenland samen om in gezamenlijke afzondering te werken aan een actueel wetenschappelijk probleem. Discussie en interactie staan centraal in de workshops. De samenballing van uiteenlopende kennis levert vaak in korte tijd een grote vooruitgang op.
De workshop 'Dynamics of Patterns' wordt van 7 tot 11 november 2005 gehouden. Wetenschappers kunnen de lezingen kosteloos bijwonen.

Press Releases

Voordrachten en discussies bij het Lorentz Center staan open voor alle geïnteresseerde journalisten. Het is een goede gelegenheid om in korte tijd een aantal internationale deskundigen te spreken. Bijvoorbeeld:
Arjen Doelman (Centrum voor Wiskunde en Informatica, Amsterdam) concentreert zich op de theorievorming over patronen en schokgolven in situaties waarin reacties en diffusie samengaan.
Wim van Saarloos (Universiteit Leiden) bestudeert instabiliteiten en patroonvorming in polymeerstroming.
Martin Howard (Royal Society University Research Fellow, Imperial College London) zal op de workshop vertellen hoe ruimtelijke patronen de aanzet vormen voor deling van cellen.
Helmut Schiessel (Max-Planck-Institute for Polymer Research, Mainz) vertelt over het oprollen van DNA.
Ute Ebert (Centrum voor Wiskunde en Informatica, Amsterdam), zal op drie gebieden vorderingen laten zien op het gebied van vonkontladingen: computermodellen, theoretisch-fysisch inzicht en experimenten.