March 2002

It is a particular pleasure for me to introduce the scientific report of the Lorentz Center for the year 2001.

The Lorentz Center at Leiden University has been operating since 1997 as an international visitor center with the aim to host and coordinate interactive workshops in the fields of astronomy, computer science, mathematics and physics. While it is strongly rooted in and supported by the Dutch research communities in the participating fields, the Lorentz Center strives to be a truly international center that welcomes proposals for workshops from any country. In the last few years, generous support from the physics funding foundation FOM, the Research Council Physical Sciences (GBE) of the Dutch National Science Foundation NWO, and the Lorentz Fund have helped to achieve this goal and to steadily expand the scientific programs. For further details on the Lorentz Center, its mission, facility and previous scientific programs, we refer to our web page *http://www.lc.leidenuniv.nl*.

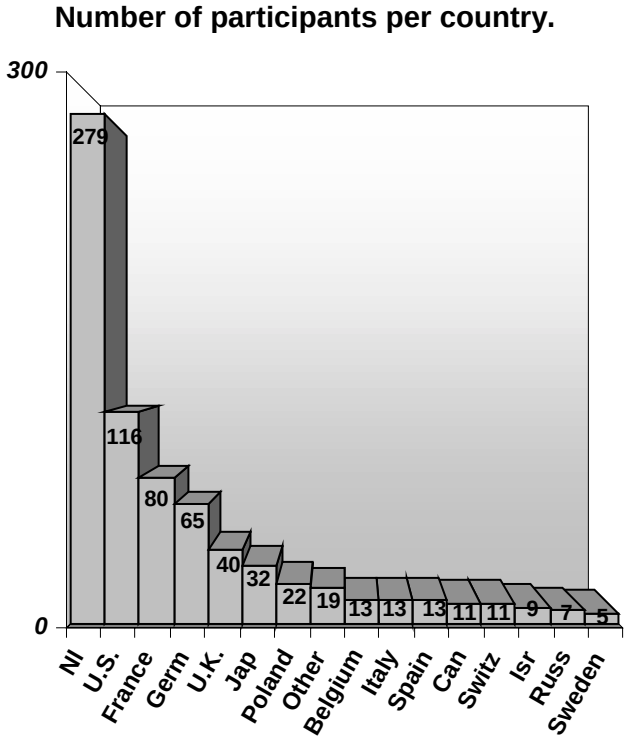
This report marks the start of a new way of reporting on the activities of the Lorentz Center: from now on, we will publish separate financial and scientific year reports. This first scientific report for the year 2001 essentially consists of the individual reports that the organizers of the main scientific events have written. In asking the organizers to write a short summary of their workshop, we have adhered to the same philosophy that we know our organizers and participants appreciate, namely to minimize the organizational or bureaucratic work needed to organize a workshop. For this reason, we have not prescribed a particular format or word processor, and deliberately chosen not to force the organizers and participants to track the number of new collaborations or papers that were initiated at the center. As a result, the individual reports have become a collection of short but very illuminating personal accounts of the workshops, their highlights and, occasionally, their weaknesses.

The type of workshops that are organized at the Lorentz Center has in the last two decades become an effective way of stimulating interaction and exchange of ideas in mathematics and physics, but is less well known in other fields like biology or computer science. That the concept is also promising to become popular in these fields is clear from the feedback from some of the workshops that were held in 2001 at our center. To quote from the report by Howard (Harvard) on the biophysics workshop “Design and control of biochemical networks”:

"Very few of the particpants had ever been to a meeting of this kind before. Biologists are used to conferences with many speakers per day, even more posters, and very little time for discussion. A format with only two talks per day is unheard of. Some of these people came wondering what they would do with their spare time. But there was no spare time. The talks were discussed intensively and at length, and the excitement grew as the week went on. There was a balance between older and younger investigators. There were common interests yet diverse points of view, with ample time to listen, inquire and ponder. New things were learned, and collaborations were born. The setting was ideal, in that it provided adequate space in a dedicated environment, with an experienced support staff. To quote one of the younger participants, ‘one of the most stimulating scientific meetings I have ever been to.' “

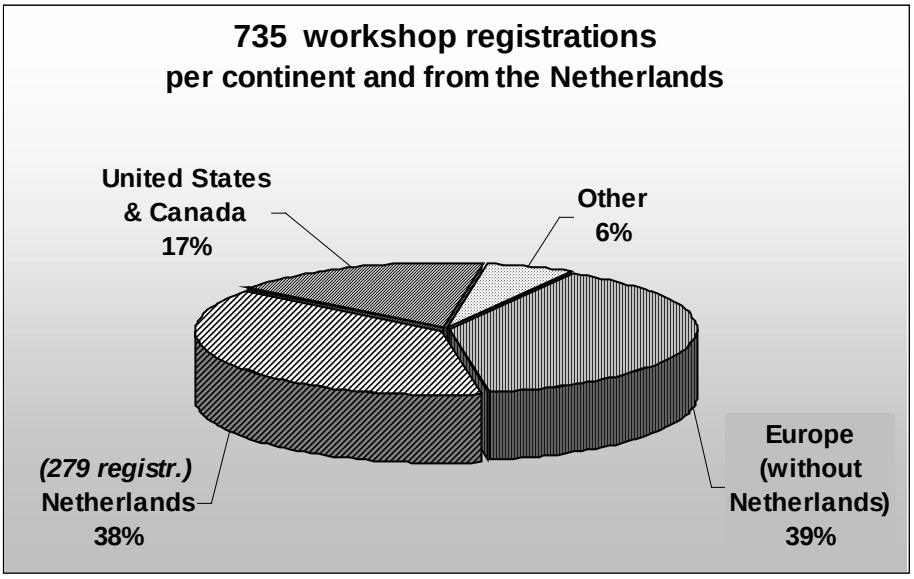
I invite you to compare these remarks to those made e.g. in the reports on the workshop “Multiresolution Analysis of Global Internet Measurements”, where the organizer also reflects on the usefulness and impact of their computer science workshop — they illustrate how each field is finding its own optimal way of using the center, even though the common denominator is the same for all.

The international character of our workshops is illustrated in the graph below, where we list the affiliations of our participants by country.

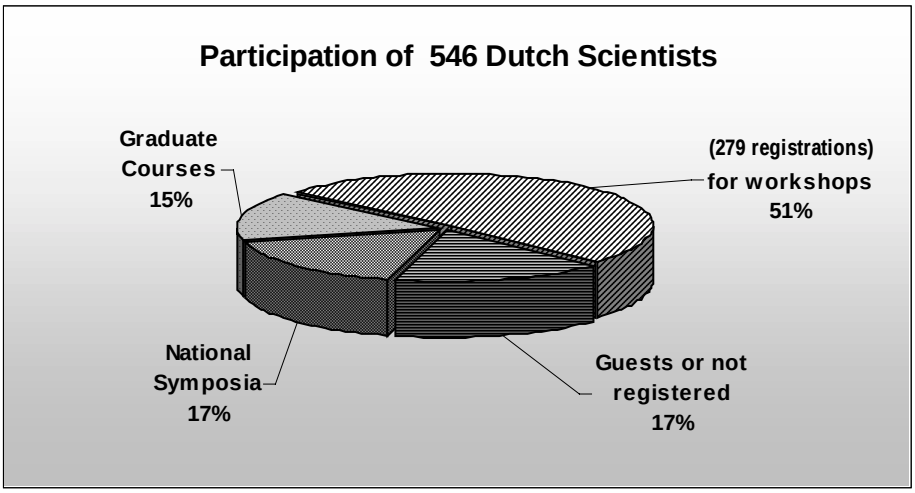


Although there are significant differences between individual workshops, overall about 25 % of our participants come from the three main European countries, and about 15% from the US.

The chart below illustrates the affiliation of our participants by continent.



This chart only includes registered participants from the Netherlands at international workshops. Of course, our workshops and programs are open to anyone interested, so many scientists from Dutch universities and institutes just come over for a day or more to participate in discussions or attend a talk without registering. We simply ask them to sign our guest book. In addition, the Lorentz Center helps organizing a number of national meetings. The impact of these activities is illustrated in the second chart below about the Dutch participation. In addition the Lorentz Center has hosted several panel evaluations for the foundation FOM.



The tragic events of September 11 also have had their impact on our international workshops in the fall: Several of the American participants of the internet workshop that took place at that time could not return home as planned, while there were several cancellations for the workshops that were planned in the months following the events. We hope that the Lorentz Center will help to re-establish international contacts and collaborations between scientist from all countries in 2002.

Wim van Saarloos
Director of the Lorentz Center

SCIENTIFIC REPORT

VIIth Dutch-Polish Colloquium on Condensed Matter Physics - "Spin Dependent Phenomena on Various Scales", 9-10 February 2001, Lorentz Center, Leiden University

The above workshop had a record number of participants -23 from Poland and more than 25 from The Netherlands. The program consisted of 23 invited talks and 10 posters equally divided between the two countries. Focus topics were the latest developments in spintronics and mesoscopic spin devices and layers which ranged from fundamental device physics to engineering materials to the theoretical descriptions. Here spin and its control and measurement played the major role in the presentations. Emphasis gradually shifted to magnetism -the macroscopic manifestation of spin phenomena. Topical issues such as quantum tunneling and spin glasses and new probes of magnetism such as AF resonance and non-linear magnetic optics were discussed. Two sessions gave the latest theoretical results on strongly correlated systems and quantum magnets. A selection of new materials was treated and various theoretical models were used to describe their behavior. Especially interesting were the oxide compounds where new spin dependent effects are constantly being observed and require novel physical interpretations.

The Organizing Committee deemed the workshop a scientific success, and voted to continue these colloquia with the VIIIth to take place in Wroclaw, February 2002 with the title "New Materials".

John A. Mydosh, *March, 2001*

Scientific Report

Dutch Astrophysics Days

On 1 and 2 March, 2001, the Theory Group at Leiden Observatory organised the first Dutch Astrophysics Days at Leiden's Lorentz Centre.

We sent around an open invitation to all people we knew to be interested inastrophysics, including some physicists, and requested that they spread the invitation around to like-minded people.

Our goals were: to reinforce our contacts; to show each other in precise and professional detail just what we are doing; to confer about outstanding theoretical challenges; to have a `free software swap'; and whatever else would strengthen our studies. Above all, we wished to foster a spirit of enjoyment in our work. We aimed this initiative at everyone who feels that (s)he `belongs in that number'. We intended to put Dutch astrophysics more squarely on the map.

To make things even more lively, we were fortunate that professor Daan Frenkel consented to give a public lecture about his work on the afternoon of the first day, followed by a communal dinner in town. For those who wished to stay overnight in Leiden, the Lorentz Centre provided their usual support.

Just under 40 people attended, close to our ideal number. Contributed talks were the following:

Carsten Dominik:
Modeling young circumstellar disks

Gerd-Jan van Zadelhoff:
Radiative transport and chemistry in
circumstellar disks

Fredrik Larsen:
Radiative transport in circumstellar
environments

Hans Goedbloed:
Transsonic magnetohydrodynamic flows
about 'generic' astrophysical objects

Peter Hoyng:
Application of the theory of stochastic
processes to mean field dynamos for Sun and Earth

Yvonne Simis:
Mass loss variability on the AGB

Marco Spaans:
The polytropic equation of state of

interstellar gas clouds

Garrelt Mellema:
Compression of gas clouds in the bow shocks of jets

Rien van de Weygaert:
The structure of the local universe and the coldness of the cosmic flow

Ellen Verolme:
Anisotropic axisymmetric galaxies with a cusp and a central black hole

Tim de Zeeuw:
Black holes in Galactic Nuclei

Vincent Icke:
The unreasonable effectiveness of regular hydro grids</FONT></B>

In addition, a general discussion was held on ``New Directions in Theoretical Astrophysics''. The result of the meeting was quite positive; one of its consequences was a collaboration between Van de Weygaert (Groningen), Langer (Utrecht) and Icke (Leiden) on computational astrophysics, a new initiative which has meanwhile been partially funded by NWO. We intend to have another instalment of the Dutch Astrophysics Days in 2002.

V. Icke

Report on

Singular limits of reaction-diffusion systems: Interfaces and spikes

This conference was held at the Lorentz Center from March 12th to March 23rd, 2001. The number of participants was around 45, of which quite a large number came from France, Japan and the Netherlands, but there were also other participants from Canada, Germany, Switzerland, U.K. and U.S.A.

There were four theme days, the first on *spikes*, the second on *waves*, the third *on Gray-Scott type models* and the fourth on *free boundary problems*. In addition to these theme days we had two to four lectures every day as well as a poster session, on such subjects as stability of spatial patterns, regularity of interfaces that appear in the singular limit, as well as various other singular perturbation problems.

This conference was well-focused on a number of timely subjects, but at the same time we tried to make the scope of the conference not too narrow. In fact, the participants included physicists and engineers in addition to mathematicians, all of whom joined the discussion of the same themes. Much to our expectation, this plan has worked well and has spurred stimulating interactions among people of different disciplines.
For instance, a physicist Wim van Saarloos of Lorentz Center and a mathematician Masayasu Mimura of Hiroshima University have both presented a talk on the so-called `resource consumer' type diffusion systems using different approaches, and, after exchanging their ideas, they have started to jointly pursue a new approach for better understanding the mechanism of fingering patterns.

Another important aspect of our conference is the encouragement of research collaborations among the participants. We carefully planned the conference program so that participants sharing similar research interest could have ample time for discussions during the two-week long conference. In doing so, the advice from Wim van Saarloos, director of the Lorentz Center, was very helpful. This has created ideal opportunities for starting new research collaborations among the participants and for further developing the existing ones. Examples of such collaborations are abundant: for instance, new collaborations have been started for the study of travelling waves in heterogeneous media, sigular limits of diffusion equations involving anisotropic tensors, motion of spiky patterns and so on.

Some participants have also interacted with various research groups in the Netherlands during and after the conference: for example, Masayasu Mimura of Hiroshima University and Yasumasa Nishiura of Hokkaido University presented seminars at the University of Utrecht on March 19th whereas Tasso Kaper of Boston University and Michel Langlais of University of Bordeaux were invited to a satellite workshop held at the Free University in Amsterdam on March 23rd.

Summarizing, our conference was very successful in providing an opportunity for intense interdisciplinary exchanges and promoting new research collaborations among the

participants. The latter, in particular, was made possible largely thanks to the Lorentz Center, who offered us ample office space, efficient facilities and adequate secretarial support.

After the conference, we received very positive response from many of the participants and quite a large number of them showed strong enthusiasm for attending a similar conference in the near future if there is any. Encouraged by this response, we have decided to explore the possibility of organizing a similar conference in two or three years, if possible at the Lorentz Center again. In order to realize such a plan, we would be happy, if necessary, to make every effort to find complementary sources of financial support from outside of the Lorentz Center.

Hiroshi Matano
Danielle Hilhorst

Workshop on Interstellar Silicates

Held at the Lorentz Center,

April 17-20, 2001

The workshop on *Interstellar Silicates* was hosted at the Lorentz Center of the Leiden University in the week of April *17th,* 2001. The workshop was made possible by generous grants from the Nederlandse Onderzoekschool Voor Astronomie (NOVA) and the Lorentz Center. The Space Reserach Organization of the Netherlands (SRON) also provided financial support.

This workshop brought together 37 scientists representing 9 different countries. The wide range of interest and expertise of the participants -all in some way related to silicates in space - is reflected in the wide range of talks presented at the workshop. The aim of this meeting was to bring together scientists involved in all aspects of studies of interstellar silicates. One central theme throughout this meeting was to confront laboratory studies and theory with the most recent observations. The highlight of the meeting were the presentations of infrared observations of interstellar silicates using the Short Wavelength Spectrometer (SWS) on board of the Infrared Space Observatory (lSO). This spectrometer, build by SRON/Groningen, provided for the first time a complete inventory of interstellar dust and the interpretation and analysis of this data has dramatically altered our understanding of the origin and evolution of the dusty universe. In particular , it was instrumental in discovering the widespread occurance of crystalline silicates in regions around protostars, newly formed from interstellar material, and stars in the latest stages of their evolution which return much of their mass to the interstellar medium. In contrast, in the interstellar medium itself, crystalline silicates are notoriously absent. These observations provided thus direct evidence for the complex processing of silicates during the life cycle of dust in the universe. Laboratory studies on the infrared characteristics and the processing of interstellar silicates were therefore extensively discussed at the workshop,including thermal processing, FUV-irradiation, and particle bombardment. Finally, the latest results on theoretical mode1s for the infrared emission from and evolution of interstellar dust were reviewed.

The interpretation and analysis of this data is the subject of some 5 PhD thesis' in the Netherlands and e1sewhere and this workshop has provided the graduate students with the opportunity to present their exciting results to an international forum of experts in the field of interstellar dust. A number of new avenues of research were opened up this way and some collaborative follow up projects have resulted; some of which, I expect, will materialize in the form of postdoctoral positions for the graduate students involved. Besides the regular scheduled talks listed in the program, there was also ample time for informal discussion, group-wise or one-on-one, on various topics, including the interrelationship of interstellar and solar system silicates and the physics of the crystalline-amorphous transition. In the words of one of the participants, except for the scenic backdrop, the Lorentz center compares favorably with the Aspen center for physics workshops. In particular, the set-up at the Lorentz is eminently suitable for this type of informal work-focussed, multidisciplinary workshop with separate offices, equiped with workstation/PC, for the participants and, multiple meeting rooms.

Lastly, we are very grateful to the dedicated staff of the Lorentz Center, in particular Reini Cremer and Martje Kruk, for their professional and expeditious organization, which made this workshop a pleasure to attend and to organize.

Xander Tielens
Groningen, June 26, 2001

'Oort Meeting' on Galaxy Formation

workshop in the Lorentz Center, 9-11 May 2002

Report

We organized the Oort workshop on Galaxy Formation at the Lorentz Center, on May 9 - 11.

This workshop was sponsored by the Oort foundation, and the Lorentz Center. The scientific organizers were profs J. Peebles (Princeton, Leiden , Oort professor), D. Hogg (New York), M. Fukugita (Tokyo), and M. Franx (Leiden). The Lorentz Center provided all local support for hotel reservations, office space, etc.

The purpose of the meeting was to consider what is securely known and established about galaxy formation and evolution from observational and theoretical points of view, and how research might advance our understanding. Thirty researchers participated from abroad, and 10 from the Netherlands. The workshop was focussed on discussions. Hence only brief presentations were given, with many hours of discussion following. The Lorentz Center is ideally suited for such an unusual format.
A scientific report about the meeting is currently written to be submitted to Nature.

It is a pleasure to thank the Lorentz Center for the fantastic support they could provide, both financially and organizationally.

Marijn Franx

Workshop on the Science Case for Extremely Large Ground-Based Telescopes.

Lorentz Center May 14-25, 2001

Scientific Report

The workshop was organised by the large telescopes working group of the European "OPTICON" network. The OPTICON network comprises operators and representative users of European astronomical facilities who meet to foster discussions of topics of mutual interest. The workshop's objective was to identify specific scientific rationales for the development of very large, ie 100m diameter, optical telescopes. Since this is a subject of considerable importance to other communities, for example in the United States, Canada, Australia and Japan, a number of senior astronomers from outside Europe were active participants on the meeting.

The first week of the meeting brought together a varied group of astronomers from around Europe and from the United States to review current large telescope projects (such as the European OWL and the US Giant Segmented Mirror Telescope) and some relevant space projects.Typically each day's activities featured some review talks by internationally known speakers followed by small discussion groups intended to flesh out the details of scientific breakthroughs that might be possible with very large telescopes. Three specific subject areas were identified (Planets and Stars, Stars and Galaxies and Galaxies and large scale structures) and the participants devolved into one of these three groups. Members of these groups worked individually on items related to their specific interests and skills, using the facilities of the center for access to relevant background material and running computer simulations of the performance of a hypothetical 100m telescope. The provision of individual offices with excellent computing access allowed the participants to carry out detailed, quantitative work as necessary, something which is not normally possible at a more general scientific conference. Each group also used the small meeting rooms to reconvene on a frequent basis to review their results and simulate further discussion. Valuable informal interaction between the groups occured in the common room, during daytime coffee breaks and at the end of each day, and in the cafeteria where we benefited by mixing with members of Leiden's wider astronomical community.

Several topics generated particular interest. One of these was the question of whether such a telescope could detect Earth-sized planets around nearby stars. Further demonstrating the incredible power of such a telescope is that fact that it can resolve many galaxies into individual stars, so that detailed studies of stellar evolution outside the Milky Way will be possible for the first time. Cosmologically, a 100m telescope offers the potential to study star formation in the very early Universe which can today only be probed by studies of quasars.

During the second week a subset of the participants produced a document,of approximately 100 pages which was an advanced draft of the scientific case for an ELT. This document is expected to be available in final form in time for the Joint European Astronomy Meeting in Munich in September 2001. Once it is complete it will be available to the international community (it will be maintained as a virtual document on the WWW) who will be able to use the details it contains to promote the development of such a telescope through their own national agencies, perhaps leading to a multinational approach to this huge undertaking.

A telescope with main mirror 100m in diameter would have ten times the collecting area of every other telescope ever built. The technology to develop it either already exists or is expected to be within reach within a few years. This meeting demonstrated not only that such a telescope could be built, but that there are scientific issues which require that it should be built.

John Davies
Joint Astronomy Centre, Hilo, Hawaii
jkd@jach.hawaii.edu

More details of OPTICON are at www.astro-opticon.org and the ELT working group is at www.astro-opticon.org/ELT

Design and control of biochemical networks

A workshop with this title was held at the Lorentz Center 5-9 June 20001. It was organized by Howard Berg (Harvard, Biology & Physics / Lorentz Insitute) and Robijn Bruinsma (UCLA, Physics / Lorentz Institute). The emphasis was on sensory transduction (processing of signals in bacterial chemotaxis), function of genetic networks (oscillatory circuits; promoter activities in the flagellar regulon), metabolic control (amino-acid synthesis in growing bacteria; metabolic networks more generally), embryonic patterning (dorsal-ventral differentiation in flies), and relevant features of engineering control theory.

There were two speakers per day, Tuesday through Saturday morning: *Tuesday*: Dennis Bray (Cambridge, Zoology), "Protein molecules as computational machines," and Jose Vilar (Princeton, Molecular Biology), "Networks with noise." *Wednesday*: John Doyle (Caltech, Systems Engineering), "Systems engineering and biochemical networks," and Måns Ehrenberg (Uppsala, Molecular Biology), "Control mechanisms in growing bacteria." *Thursday*: Tom Duke (Cambridge, Physics), "Ultrasensitive signal transduction," and Naama Barkai (Weizmann, Physics of Complex Systems), "Robustness in embryonic patterning." Naama also talked about robustness in bacterial chemotaxis. *Friday*: Uri Alon (Weizmann, Molecular Cell Biology), "Reverse engineering of genetic networks," and Michael Elowitz (Rockefeller, Molecular Biology), "The repressilator: an oscillatory genetic network." Michael also talked more generally about noise in gene expression. *Saturday*: Hans Westerhoff (Free University Amsterdam, Biology), "Macromolecular intelligence." Five of these speakers are well

established (full professors); four are young investigators (postdoctoral fellows or assistant professors).

There was one discussion leader per day: Howard Berg, Robijn Bruinsma, Johan Paulsson (Princeton, Molecular Biology), Albert Goldbeter (Free University Brussels, Theoretical Chronobiology), and David Fell (Oxford Brookes University, Biology & Molecular Science).

There were about an equal number of participants who did not appear on the program, mostly from The Netherlands but also from England, Israel, and France.

Very few of the participants had ever been to a meeting of this kind before. Biologists are used to conferences with many speakers per day, even more posters, and very little time for discussion. A format with only two talks per day is unheard of. Some of these people came wondering what they would do with their spare time. But there was no spare time. The talks were discussed intensively and at length, and the excitement grew as the week went on. There was a balance between older and younger investigators. There were common interests yet diverse points of view, with ample time to listen, inquire, and ponder. New things were learned, and collaborations were born. The setting was ideal, in that it provided adequate space in a dedicated environment, with experienced support staff. To quote one of the younger participants, “one of the most stimulating scientific meetings I have ever been to.”

So we are grateful to the Lorentz Center for making this possible. It is a unique facility, well worth international support.

Howard Berg, Leiden, 18 June 2001

Concepts of Financial Mathematics and Risk Applied to the Oil Industry

Workshop in the Lorentz Center 5-7 June 2002

Scientific Report

The original intention of the meeting was to establish if there were possible mathematical models that could evolve from discussion between myself (Univ. Utrecht) and Dr. Chechelnitsky (Shell) and Dr. van Driel (Shell). As was already suspected, there were some ideas which could be built upon.

During the three days spent as guests at the Stieltjes institute, Dr. Chechelnitsky and I discussed for the most part coupled Markov processes. The importance of these processes lies with the simulation certain random processes based on which decisions in the oil industry are made. The idea was to find the right way of simulating processes in time, for example "perceived presence of oil", and coupling this to a randomized decision process, for example, "how to proceed with exploration and production based on the perceived levels of oil". Although it may seem strange to randomize a decision processes, this is in fact quite natural given the uncertainty associated with the incoming information (such as perceived presence of oil) based on which the decisions are made. Keeping with the afore mentioned example, the idea was that perceiving a low presence of oil (which may be subject to error because of poor data) will result in a number of possible options to continue, but one should consider the next decision a random entity and the *chance* of each decision being made to depend on the low perception of oil. Consequently, depending on what (random) decision is made, the process representing the perception of presence of oil will also change its evolution (for example if one decides to abandon further exploration then the perception of oil presence remains effectively at 0 even if there is a rich supply available).

The remarks in the previous paragraph are rather specific to the example given there, however the principle can extend to a much more complicated model of interacting processes representing a more complete picture. One of the end goals of Shell is to be able to make estimates of managerial demands such as "what is the probability of success". Being able to simulate information and decision processes in a coupled and Markovian way would give them a completely different way of producing answers to demands for such estimates and in a more qualitative and structured way.
There would also seem to be some advantages to this approach over their
current methods using decision trees. Most of all is the Markovian nature of the models which allow one to easily simulate from a variety of starting points in both status and time and that the models can offer distributional information about the whole life cycle of decision processes rather than just an end point (success/fail). Further, the Markov processes that are used in the simulations can be better tuned to prior experience as more data becomes available.
There was a second issue that was discussed without so much success.This concerned a way of evaluating risk. This is a very broad concept with a lot of controversial discussion around it. Some light suggestions were made, but nothing concrete.
Dr. Chechelnitsky was keen to pursue ideas discussed in the three day meeting. It was also discussed putting a proposal to NOW for a postdoc position for 2 years jointly

funded with Shell to expand on the ideas discussed. A proposal will be written up by Dr. Chechelnitsky and presented first to Shell Management, to convince them that there are some options which can be explored giving a new angle on old and yet still pertinent problems. If a positive response is given by the Shell research committee Dr. Chechelnitsky and I will explore further possibilities for a joint venture between academia and Shell.

We would like to thank the team of the Lorentz Center on behalf of the three of us for the very hospitable environment that was provided for us. It was truly an excellent venue from which we can definitely say progress was made.

Andreas E. Kyprianou
Mathematisch Instituut
Universiteit Utrecht

Global Analysis of Dynamical Systems

Workshop in the Lorentz Center, 25-29 June 2002

Scientific report on the workshop

The workshop

This workshop has been organized for researchers in Dynamical Systems and related fields. The general aim was to present the state of the art of the field. On the one hand participants presented recent scientific results, on the other hand there was plenty of space for informal discussion. The field was approached from various points of view: geometrical (topological), analytic, ergodic and numerical.

The field of Dynamical Systems has benefitted a lot from the scientific contributions of Floris Takens, in whose honour this workshop was organized.
Takens belongs to the founding fathers of the actively evolving field of Dynamical Systems. He managed to build up a great scientific reputation and many international contacts, which also had great impact on the Dutch mathematical community has. At the end of the sixties, Takens came into contact with René Thom and David Ruelle. This collaboration strongly affected his further development. With the latter he wrote the celebrated paper "On the nature of turbulence", published in the Communications of Mathematical Physics, 1971. This paper was a real break-through. A new idea was created, contradicting standardized views of Landau and Lifschitz regarding the onset of turbulence in a fluid motion. The new idea was called strange attractor, later on associated with the term chaos.
By the work of Poincaré on celestial mechanics, geometrical methods had been introduced in dynamical systems research. In the 1960's and 70's the area of Dynamical Systems gained further momentum in this direction by the impact of the Fields Medal Winners Stephen Smale (University of California at Berkeley) and René Thom (IHES), both originating from topology. Thom later became famous by his catastrophe theory. One of the members of Takens's own generation is the Brazilian mathematicaian Jacob Palis, who did his PhD with Smale. Since 1971 these two are having an extensive and extremely fruitful scientific cooperation.

The strong impact Takens had on the field of Dynamical Systems was reflected by the presence of many prominent researchers at the workshop, who shared their deep insights with the many participants. Their talks provided both overviews and presentations of state of the art research on topics like (Partial) Hyperbolicity, Intermittency and Time Series, Bifurcation- and Unfolding Theory, KAM-Theory and Resonances, (Near) Conservative Dynamics, and One-Dimensional Dynamics. Apart from the many interesting lectures, the mix of celebrities on the one hand and young researchers on the other hand provided a unique setting for fruitful scientific discussions. Furthermore, the international program committee of the workshop consisted of renowned mathematicians: J. Mather (Princeton), S.E. Newhouse (Michigan State), J. Palis (IMPA), D. Ruelle (IHES), Ya.G. Sinai (Princeton), and J.-C. Yoccoz (Collège de France). The organizers are grateful for their contribution to the high scientific level of this event.

The Lorentz Center

Our goal in organizing this workshop has been to provide a setting in which junior and senior researchers in Dynamical Systems could mingle, both during the talks and off line, during lunches and breaks. The Lorentz Center provides an excellent environment for realizing this goal, not matched by any of the other conference centers elsewhere in The Netherlands. The offices, available to the participants, are one of the attractive features of the Lorentz Center.

We have seen discussions going on from early in the morning to late in the evening, many of which have resulted in drafts of joint scientific papers by workshop participants. We cannot imagine such a productivity resulting from workshops at other conference sites in The Netherlands.

Many participants explicitly expressed their appreciation of the well-equipped offices: easy access to e-mail, printing and internet services, white boards for scientific discussions and a quiet atmosphere were greatly appreciated.
Without the professional support by the workshop coordinators, Mrs. R. Cremer and Dr. M. Kruk, this event would definitely have proceeded less smoothly. The generous support of Prof. W. Saarloos in an early stage is also greatly appreciated. For this excellent organization we are very grateful.
Many credits also should go the Dutch Science Foundation (NWO) for funding this excellent scientific facility. We are convinced that many astronomers, computer scientists, physicists and astronomers who organized a workshop at the Lorentz Center will share our opinion.

Sponsors
The support of several organizations is gratefully acknowledged:
* The Lorentz Center, Leiden (supported by the Dutch Science Foundations FOM and NWO)
* European Science Foundation Project Prodyn
* Mathematical Research Institute (Dutch Research School)
* The Thomas Stieltjes Institute for Mathematics (Dutch Research School)
* Institute for Mathematics and Computing Science (Groningen University)
* FOM Programme Mathematical Physics
* Johann Bernoulli Foundation for Mathematics (Groningen)
* Royal Netherlands Academy of Arts and Sciences (KNAW)

Henk Broer, Bernd Krauskopf and Gert Vegter
Groningen, October 17, 2001.

Dynamics of Galaxies

Workshop in the Lorentz Center, 2-13 July 2002

Scientific report

In the first two weeks of July, the Lorentz Center hosted an extended meeting of the SAURON team, attended by nearly twenty participants from France, Germany, England, Spain, Chile and the Netherlands, including nearly 15 graduate students and postdocs.

The SAURON team is carrying out a comprehensive census of the kinematics and linestrength distributions of 72 nearby early-type galaxies (ellipticals, lenticulars and bulges) with a unique custom-built panoramic integral field spectrograph called SAURON, funded in part by NWO, built at the Observatoire de Lyon, and operated as a private instrument on the 4.2m William Herschel Telescope on La Palma. The SAURON data are supplemented with imaging and spectroscopy obtained with OASIS on the Canada France Hawaii Telescope on Mauna Kea, and with the Hubble Space Telescope. The data are analyzed with
state of the art dynamical models to determine the intrinsic shapes and the asses of central black holes. Stellar population modeling reveals the spatial distribution of age and metallicity in the galaxies, and constrains the history of starformation in these systems.

During the two week meeting all aspects of the project were addressed, including the freshly reduced results obtained in a spectacular 12 night observing run in March 2001. All participants presented talks and/or tutorials on components of this large project, ranging from development of data reduction tools, to higher level interpretative analysis, dynamical model construction, and analysis of individual galaxies. Typically half the time was spent on exchange of software
and work on analysis and manuscripts. Three papers were completed during the meeting. This was the first time the survey had progressed to a point where the next set of papers could be planned on the statistical results of the survey, as well as on individual galaxies with peculiar properties. As the team is dispersed geographically, this intense two-week interaction period contributed greatly to the
success of the project, and was in particular valuable for the younger members of the team.

Tim de Zeeuw

Faint InfraRed Extragalactic Survey Meeting

workshop in the Lorentz Center 9-13July, 2002

Organizer: M. Franx, Leiden University

Scientific report

We have organized a workshop concerning the evolution of galaxies, and deep infrared imaging. During the workshop, participants from Europe and the US collaborated on many aspects of our observational program.

The format of the workshop was a mix of presentations, and collaborations in small groups on various topics. The workshop lasted for a week. The scientific focus was on the first data analysis and interpretation of our results. The participants were specialists in many different fields, and very stimulating discussions were the result of that. Plans for new projects were made during the meeting. Future visits and meetings were also scheduled as a result of the workshop.

The facilities of the Lorentz Center were very much appreciated, especially the common room for informal discussions, the separate offices with computers for work during the meeting, and the large room for presentions and project capabilities. The computers were used for analysis of data and literature during the meeting, and allowed for rapid progress on several topics during the meeting.

As usual, the support from the Lorentz center was excellent. It is a pleasure to thank the Lorentz center, and the funding agencies, for their support.

Marijn Franx

Workshop Symplectic and Contact Topology

Organisers: Ya. Eliashberg (Stanford), H. Geiges (Leiden)

Lorentz Center, Leiden,

6 -17 August 2001

Speakers: P. Biran (Tel Aviv), D. Castelvecchi (UC Santa Barbara), T. Ekholm (Uppsala), D. Gay (University of Arizona, Tucson), V. Ginzburg (UC Santa Cruz), B. Gurel (UC Santa Cruz), E. Kerman (Toronto), V. Kharlarnov (Strasbourg), D. Kotschick (LMU, Miinchen), F. Lalonde (UQAM, Montréal), K. Mohnke (SUNYat Stony Brook), L. Polterovich (Tel Aviv), F. Presas (Universidad Complutense, Madrid), D. Salamon (ETH Zürich), K.F. Siburg (Ruhr-Universitat Bochum), I. Smith (Oxford), A. Stipsicz (Bu- dapest), C.B. Thomas (Cambridge), R. van der Vorst (Leiden).
Other participants: P. van Baal (Instituut Lorentz, Leiden), F. Ding (Leiden), K. Kiso (Matsuyarna), 0. van Koert (Leiden), M. van Manen (Utrecht, student of D. Siersma), K. Niederkriiger (Leiden), F. Pasquotto (Leiden), A. Van de Ven (Leiden).

Summary of the activities:
This workshop brought together some of the leading researchers in symplectic geometry, as well as several younger mathematicians, including Ph.D. students, with already quite original results to their name. The first week of the workshop concentrated on some more analytical aspects of symplectic geometry, the emphasis in the second week was on topological questions.
Here are two of the outstanding results presented during this workshop, chosen for this summary also because they can be phrased in relatively intelligible terms for the non-expert:

1. K. Mohnke reported on his result that there are no Lagrangian embeddings of the Klein bottle in the complex plane. Lagrangian embeddings are a special type of embeddings, important in symplectic geometry, of n- dimensional manifolds in a $2n$-dimensional symplectic space. The problem of Lagrangian embeddings of surfaces in the complex plane had been solved for all surfaces many years ago, with only the Klein bottle refusing to yield to existing methods. There had been preliminary work on this question by several outstanding mathematicians (Audin, Givental, Hofer, Lalonde, Polterovich), and the recent final solution by Mohnke (and independently by Nemrovski) received considerable attention.

2. Ginzburg, Gurel and Kerman reported on various counterexamples to the Hamiltonian Seifert conjecture. The original Seifert conjecture from 1950 (never actually stated in this form by Seifert) says that any nonsingular vector field on the 3-sphere must have a periodic orbit. A C^1-smooth counterexample was first found by P.A. Schweitzer in 1974. A celebrated breakthrough came with the work of the Kuperberg family in the mid 1990's, giving both a C^∞ counterexample and a C^1 volume-preserving one. The Hamiltonian Seifert conjecture is concerned with the existence of periodic orbits of a more restricted class of vector fields (on spheres of arbitrary odd dimension) appearing in symplectic geometry and Hamiltonian dynamics. Kerman described smooth counterexamples in dimension ≥ 5, simplifying an earlier construction of Ginzburg, and using a plug construction due to Wilson, adapted to the Hamiltonian setting, that was also used by the Kuperbergs (a plug does pretty much what its name suggests: it kills a periodic orbit without introducing new ones). Ginzburg and Gurel, on the other hand, returned to Schweitzer's original construction and showed that this can also be made to work in the Hamiltonian setting, even in dimension 3, at the expense (as in Schweitzer's work) of only getting a C^1-smooth counterexample.

The atmosphere of the workshop was characterised by intense discussions between several of the participants and informal lectures in the common room. Mohnke, for instance, lectured for several days on his proof to an audience including Ekholm, Kharlamov and Lalonde. Biran, Polterovich and Salamon were actively working on a joint publication. Other 'teams' were Ginzburg/Gurel/Kerman, Siburg/Polterovich,

Ding/Gay/Stipsicz, and there were countless other interactions, for instance by Lalonde/Kharlamov/Kotschick on symplectic and algebraic geometry. The organizers were actively engaged either as members of one or the other team, or as sounding board (Eliashberg with Biran, Ekholm, Lalonde, Polterovich, Siburg; Geiges with Ding, Ekholm, Gay, Stipsicz, Thomas)

Several of the talks were also enormously beneficial to the graduate students, who had been prepared for these research level talks by a seminar on the Hamiltonion Seifert conjecture in the previous semester, for instance. Some speakers, like Gay, gave previews of their lectures to the graduate students.

The workshop met with less interest from the Dutch mathematical community than the organizers would have wished, which can partly be explained by it taking place in the summer vacation. But we were pleased to have at least a few outside participants, including a theoretical physicist, and some that we may not have spotted in the audience.

The response from the participants to the workshop was incredibly positive. It was very much appreciated that the scheduling of talks was light (two per day), which left ample room for discussion. It was also very welcome that each participant had his or her personal workspace, which made such discussions possible. Typically at mathematics conferences there is very little time for discussions outside formal talks, and even given the time, one is usually forced to scribble on paper napkins in noisy restaurants. Several of the participants described this as the best workshop they had ever attended, which was clearly meant as more than just a polite remark (in particular in view of the dreadful weather we had to cope with in the first week). While it is impossible to measure progress within the space of two weeks, we are confident that we shall see several papers written as a result of the discussions that were made possible by this workshop.

Ya. Eliashberg, H. Geiges
20 August 2001

PATTERNS AND WAVES –
MATHEMATICS AND NONLINEAR CHEMISTRY

Workshop in the Lorentz Center, August 30 - September 7, 2001.

Scientific Report

Chemical reactions are extremely rich and relevant nonlinear dynamical systems. For instance, the Belousov-Zhabotinskii reaction is a well-known representative model that has influenced and activated many disciplines of applied mathematics, especially pattern formation theory and dynamical system theory. Recent sophisticated measurements reveal a variety of new dynamical patterns. Such measurements not only give exotic examples of nonlinear dynamics, but also provide challenges for theoreticians to build up new frameworks by which these dynamics
can be understood.

This was the first workshop that brought together (experimental) chemists, physicists, and mathematicians. The workshop was highly international, with participants from Belgium, Canada, France, Germany, Japan, the Netherlands, the UK, and the US.

The Lorentz Center provided this multi-disciplinary group of participants with a stimulating infrastructure and atmosphere in which the different points of view -- experimental, computational,
mathematical -- could be brought together and interact.

The first week (2 days) focused on the mathematical aspects of instabilities of spiral waves, and of interacting patterns, especially pulses and spots. It is well-known that spiral waves can destabilize
in many different ways. B. Sandstede showed in his two lectures the effectiveness and limitations of linearized analysis to understand these instabilities. This is not a simple spectral analysis, in fact it gave a partial answer to the long-lasting question in what sense the dynamics on large but finite domains is a good approximation of the dynamics on the extended system. Another mportant topic was the study of interactive dynamics among localized patterns. One of the recent important discoveries is that, even in dissipative systems, pulses and spots can behave like elastic objects upon collision. Moreover, depending on parameters, more exciting patterns as self-replication pulses can be observed. Starting from a rigorous analysis of weak-interaction in 1D-space, the discussions extended to more complex behavior, such as 2D-spots and spatio-temporal chaos for
the Gray-Scott model, Gierer-Meinhardt model, and CO-oxidation model.

There were five themes in the second week:

1.Experiments, Models, and Simulations
2.Spirals, Chaos, and Defects
3.Autocatalytic Reactions
4.Nano-Structures and Self-Entrainment
5.External Forces
6.Closed Systems and Polymer Morphology

Apparently, there are big gaps between realistic chemical mechanisms and mathematical `toy models'. Nevertheless it was pointed out that there are several factors, such as 3D effects, imposed gradients, bounded vs infinite domains, that can be understood in the context of `toy models' and that may effect the real chemistry at the qualitative level. It should be emphasized that these problems were presented by the chemists/physicists in explicit mathematical form.
There was also a long discussion about the issue "Phenomenological Models vs Experiments and Models based on the First Principle" in the context of the nano-structures theme. Since most of the models in dissipative systems are phenomenological, they have been regarded as "metaphors" and do not have enough predicative power for experiments. Some models (due to A.K. Mikhailov and his collaborators) are effective up to the nano-level and match the experiments. We would like to deepen the discussions in this direction in the future.

Another important topic was the effect of external forces. There was a shift from "Spontaneous" to "External" in pattern formation theory at least in several directions. There were many reports and
discussions about the subtle dynamics coming from the interplay between intrinsic and extrinsic tendencies. Noise effects were also discussed.

There are two fertile but uncultivated research areas: one is the study of the interactions between no nlinear kinetics and advection/convection effects, the other is the field of so-called transient dynamics. From mathematical point of view, both areas are still in a completely premature stage of their development. However, there are a couple of relevant examples that can be analyzed mathematically.

At the end of the workshop, there was a stimulating panel discussion, led by Steve Scott, on the links and possible interactions between experimentalists and mathematicians. One of the conclusions was that there is a need for two-way communication between the two groups and
that this workshop served as an excellent first step in that direction.

Y. Nishiura
A. Doelman

Multiresolution Analysis of Global Internet Measurements

Workshop in the Lorentz Center, 10-14 september 2001

Report

Organizers:
G. Cybenko (Dartmouth, USA)
A.T. Ogielski (Renesys, USA)

First of all, we owe all of the staff at the Lorentz Center many thanks for giving us the environment to make our last workshop so successful, despite the international problems that happened in this timeframe.

Please let me say first a few things why in my opinion our Leiden workshops have worked so well, and how much the environment of your Center helped to make it so.

The strategy that I used in my workshop agenda planning was this: be very flexible with timing and give every speaker as much time as needed to answer every question from the audience until everybody understood the key new insights and new ideas.This kind of agenda planning is somewhat novel to most researchers (at least in the US), and it has proven to be extremely popular among our Leiden workshop participants, and also intellectually very productive (for a proof, that's a model that kc claffy wants to follow).

As you know, most workshops are done in the equalizing doctrine of "you have exactly 30 minutes to talk", and I realized that such an approach leaves most scientists very unsatisfied when they get cut off from an opportunity to explore difficult new subjects at depth. Too much of an "equal talk time" doctrine should not apply when a particularly fascinating speaker or subject deserve more time than the others, and I applied a free market principle to let the participants decide how long each speaker should go on.

The common principle of the organizers allocating more time to "established" speakers is not only somewhat undemocratic, but in my experience often tends to limit exposure to really new ideas coming form less-established scientists. It is interesting to notice that some of our speakers were asked by all participants to give more talks beyond the scheduled agenda - I think proving the sanity of our approach to workshop organization. But also one less gifted speaker was asked by the workshop participants to cut his talk short - again, free market of ideas at work.
Of course, most likely you have seen this in other workshops, but still I think it was the environment of the Lorentz Center that helped to create such a free market atmosphere of research sharing.

Again, as in the previous year, this workshop has seeded new hot research directions; and I was also lucky to get a larger share of European and Dutch participants in the Internet research areas where there are still rather few European research centers.

And, needless to say, your extra help with letting the stranded US participants call home from the Center, or to stay a day or two longer when their flights got delayed was a very generous and warmly received gesture.

I got extremely nice follow-up notes from the participants. Many thanks again.

There was no separate institutional US funding specifically devoted to my workshops. Each participant who has not received travel funds from the Lorentz Center has covered his or her travel from their own funding sources; and each participant covered their own other living expenses from their own sources as well.
My take on this is that it was extremely conducive to assemble the workshop with the Lorentz Center funding the hotel costs, and the travel costs for the few people who could not come without it, and of generously offering the office space - these were great contributions from your Center that were absolutely critical for most to participate. But all people came without expectations for any per-diem, and moreover we plainly told everybody that if they can cover their travel costs, they should pay for it and leave the Lorentz Center funds to those in need. I think this worked OK.
My attitude is that a good workshop does not need extravagant funding, just some very critical seed funding, help for the truly needy, and space to help it happen.

I think it could actually be nice to set up a mechanism for joint Dutch-US workshops in this area, they could also kick-start some more action in Dutch universities and corporations to build up more your domestic resources. Everybody will gain.

But if I were invited to organize another workshop, I would likely follow the formula that worked so well so far - this formula mixed academic and corporate research quite well, for everybody's benefit.

Andy Ogielsky

L-functions from Algebraic Geometry

Organizers: H. W. Lenstra, Jr (Leiden / Berkeley), P. Stevenhagen (Leiden)

workshop in the Lorentz Center, 17-21 september 2001

Scientific Report

In 2000, the Clay Mathematics Institute published a list of seven one-million dollar Millennium Prize Problems. These problems, selected by a panel of leading mathematicians, are widely regarded as the most important open problems in mathematics. One problem on the list is the Riemann Hypothesis, which concerns the location of the zeroes of the so-called Riemann zeta function. A proof of the Riemann Hypothesis would have major implications for many questions in number theory, notably on the distribution of prime numbers. Another Clay problem is the conjecture of Birch and Swinnerton-Dyer. It asserts that one can obtain very precise information about the arithmetic of an elliptic curve---or, in plain terms, about the rational solutions to cubic equations in two variables---by analytic means; namely, by examining a special value of the Hasse-Weil L-function associated to the curve.

Both the Riemann zeta function and the Hasse-Weil L-functions are examples of L-functions, and their occurrence on the Clay list illustrates the central role that L-functions play in number theory in general and in arithmetic algebraic geometry in particular. `Arithmetic algebraic geometry' is the modern name for the age-old theory of diophantine equations, with an emphasis on the use of tools from algebraic geometry.

To many objects in arithmetic algebraic geometry one can attach an L-function. L-functions are analytic in nature, but they encode important arithmetic information about the object in question; for example, they may assist in counting the number of rational solutions to systems of equations and estimating their size. It is hoped that they provide the key to a deeper understanding of arithmetic properties of algebraic varieties, but they are still largely shrouded in mystery.

During the workshop general arithmetic and analytic properties of L-functions that arise from algebraic varieties were explored. It was organized on the occasion of a visit that Daqing Wan paid to the Mathematisch Instituut of the Universiteit Leiden during the month of September, 2001.

Daqing Wan recently achieved a breakthrough in the area of p-adic zeta functions of varieties, by viewing them from an entirely new perspective. In his lectures at the workshop he explained his work from a relatively elementary point of view. It is often felt that new perspectives may also lead to breakthroughs for other types of L-functions, and accordingly the workshop had a significant speculative component.

The workshop was partially financed by Lenstra's 1999 Spinoza Award.

Hendrik Lenstra

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Comments
From: Daqing Wan <dwan@math.uci.edu>

Dear Hendrik and Peter:

Thanks for organizing the Lorentz center workshop last September. I very much enjoyed it. I think that both the mathematical program and the organization were extremely successful. I particularly liked the friendly atmosphere of the workshop and the

openness of the diverse participants from different backgrounds with intersecting interests. Everybody was there to learn and to have genuine scientific discussions. In particular, I myself learned and benefited a lot mathematically during the Lorentz center workshop.

The facilities at the Lorentz center were quite adequate. Everybody had a nice office with a computer and white board. The offices are close to each other, to the nice well furnished common room (often with plenty of cookies and drinks) and also close to the lecture rooms.

These make it convenient and pleaseant for the participants to talk to each other. The secretarial assistance was also great so that the participants were worryfree and could completely focus on the scientific side.

In summary, I feel that the Lorentz center workshop last September was a great success. This type of workshop should be better known and generalized to the rest of the mathematical world. The only possibly "negative" feeling I had is that it rained too often during the workshop, and non-Dutch people might not get used to it initially and it might cause a slight inconvenience for some participants to get to hotels from the Lorentz center.

Best wishes,

Daqing Wan
Department of Mathematics
University of California
Irvine, CA 92697-3875
U. S. A.

Computer Algebra for Geometric Computing

workshop in the Lorentz Center, 1-5 October 2001

Scientific report on the workshop

The workshop

Methods from Computer Algebra have become increasingly relevant to other scientific disciplines, like Robotics, Computer Vision, Operations Research and Computational Geometry. The aim of this workshop was to present basic computer algebraic methods that have applications in the field of geometric computing. Several experts have presented tutorials on:

* symbolic numeric methods for solving polynomial equations (Bernard Mourrain, INRIA)
* sparse elimination theory (Ioannis Emiris, INRIA)
* Groebner bases and algebraic computation in geometry (Franz Winkler, RISC Linz)
* Roots of polynomials: Sturm theory and computing with algebraic numbers (Chee Keng Yap, Courant Institute, New York)
* geometric predicates and robustness (Kurt Mehlhorn, MPI, Saarbruecken)
* an introduction to Singularity theory (Gert Vegter, Groningen)
* the geometry of conflict sets (Dirk Siersma, Utrecht)

Apart from these tutorials, there were several short presentations on geometric problems, related to curves and surfaces. Furthermore, there was be plenty of time for informal discussions.

The workshop also served as a kickoff meeting for the joint research program Effective Computation Geometry (ECG) of curves and surfaces. This research program is sponsored by the European Commission, and is carried out by a consortium consisting of computer scientists from INRIA (Sophia-Antipolis, France), Eidgenössische Technische Hochschule (Zürich, Switzerland), Freie Universität (Berlin, Germany), Groningen University (Groningen, The Netherlands), Max Planck Institut für Informatik (Saarbrücken, Germany), and Tel Aviv University (Tel Aviv, Israel).

The Lorentz Center

Our goal in organizing this workshop has been to provide a setting in which junior and senior researchers in Computational Geometry and Computer Algebra could mingle, both during the talks and off line, during lunches and breaks. The Lorentz Center provides an excellent environment for realizing this goal, not matched by any of the other conference centers elsewhere in The Netherlands. The offices, available to the participants, are one of the attractive features of the Lorentz Center.

Many participants explicitly expressed their appreciation of the well-equipped offices: easy access to e-mail, printing and internet services, white boards for scientific discussions and a quiet atmosphere were greatly appreciated. `Hard to improve', was a commonly expressed opinion.

Without the professional support by the workshop coordinators, Mrs. R. Cremer and Dr. M. Kruk, this event would definitely have proceeded less smoothly. The generous support of Prof. W. Saarloos in an early stage is also greatly appreciated.
For this excellent organization we are very grateful.

Many credits also should go the Dutch Science Foundation (NWO) for funding this excellent scientific facility.

Sponsors

The support of several organizations is gratefully acknowledged:
* The Lorentz Center, Leiden (supported by the Dutch Science Foundations FOM and NWO)
* Mathematical Research Institute (Dutch Research School)
* Institute for Mathematics and Computing Science (Groningen University)
* Johann Bernoulli Foundation for Mathematics (Groningen)

Gert Vegter,
Groningen, December 16, 2001.

The HIFI Science workshop
October 16-19, 2001
&
The Herschel Prepatory Science workshop
October 22-24, 2001

Scientific report

Herschel is the next cornerstone mission build by the European Space Agency, ESA. This space observatory geared towards far-infrared and submillimeter observations is slotted to be launched in 2007. It will contain three instruments, PACS, SPIRE, and HIFI which are built by three consortia of national (European, USA, and Canada) space agencies and universities. The Dutch Space organization, SRON, is the PI institute for the heterodyne instrument, HIFI. Two workshops were organized back to back at the Lorentz Center centered around this mission.

The HIFI Science workshop was organized from October 16-19, 2001. The goal of this workshop was to start defining the guaranteed time program of the HIFI intrument and to get organized in working groups. Because of "political" concerns, he meeting was strictly by invitation only to participants from the member institutes/countries. There were 32 participants representing the 10 countries involved in HIFI.

During the first two days, the group met in a plenary meeting to outline the program in four different science areas - star formation, stellar evolution, interstellar medium, and extragalactic observations. On the third day, splinter groups met to start defining detailed observing programs. These were further coordinated during the last day of the
meeting. A draft observing proposal will be circulated among the full consortium by spring 2002 and will be discussed by the full consortium in June 2002.

The Herschel prepatory science workshop was organized at the Lorentz center, October 22-24, 2001. This workshop was organized in order to reap the full benefits of the Herschel mission and to guide development efforts and instrument characteristics. It had a dual purpose: first, to bring the needs of the Herschel mission to the attention of a wide (interested) science community and, second, to arrive at a ``workplan'' to address the most important of these needs/issues. Among the topics discussed at this meeting were:

Laboratory studies on the spectral characteristics of astrophysically relevant atoms and molecules in the far-IR and submillimeter

Modelling of spectral line data in astrophysical settings, such as protostars

Laboratory studies on the spectral characteristics of interstellar dust analogs

Modelling of spectral energy distribution of dusty objects

Theoretical studies on the excitation of astrophysically relevant molecules, including collisional cross sections, dipole moments, and transition frequencies

Prepatory observational studies

There were 52 participants representing 10 countries. The format was informal with ample time for discussion. Summaries of all the talks are available through the web at the Lorentz site.

The end goals of this meeting are, first, to prepare a white paper "Preparatory Science for Herschel". The goal is to have the report adopted by ESA as a science policy document. Subsequently, it can then serve as a guideline for national funding agencies to support the science required for a successfull mission. The first draft of this report is due by Xmas 2001 and will be iterated upon during the winter of 2002. Secondly, working groups in each of these areas were initiated, linked together through a steering committee. These working groups will draft a workplan by March 2002.

Overall, these were very successfull meetings, largely because of the setting at the Lorentz center which with its multiple meeting rooms and separate offices allows a variety of simultaneous splinter meetings ranging in size from 10's of people to one-on-one. Moreover, the access to the web through dedicated PCs and laptop ports, made available to the participants, allowed them to keep in close contact with their respective groups. This is of particular importance for the space community where project concerns on timelines (and the politics involved) require regular contact.

Last but not least, we want to take this opportunity to thank the Lorentz center for their dedicated and professionel effort in organizing these workshops. Over the years, we have organized some dozen workshops. It has never been as easy as at the Lorentz center.

Xander Tielens
Frank Helmich

Strongly Correlated Electron Systems

Workshop in the Lorentz Center, 29/10/01 - 09/11/01

Report

General description

At least to the taste of the organizers, this meeting was remarkably succesful as a workshop. Beforehand this was less clear. Given the time of the year (in the middle of the semester) and given the busy schedule of meetings in the preceding summer period it took quite some effort to lure core-players to come to Leiden. In addition, the unfortunate events in New York in september caused further concerns to the point that it was seriously considered to cancel this meeting. However, the number of cancellations associated with `911' turned out to be manageable, and altogether some 30 international guests participated in the meeting. In hindsight these problems turned into a blessing. Instead of the 15+5 minute time slots which seem to become mandatory at international meetings, we could allocate ample time to every speaker (up to 1.5 hours) with the effect that vivid discussions sprung up all the time, both during and after the talks. Instead of the usual business of running advertisements, the focus was much more on trying to help each other with the problems. This was a workshop in the old-fashioned sense which clearly not only pleased the organizers but also the participants.

Without exception, the participants were enthousiastic about the setting offered by the **Lorentz Center** which was percieved as unique, very well organized and very well suited for events of this kind.

The scientific content.

This was in first instance a workshop, focussed on high Tc superconductivity, although also considerable attention was paid to related fields like the manganites and other orbital physics systems (Oles, Feiner, Palstra, Keimer), the ruthenates (Rice), charge density wave systems (Castro Neto) and BEC systems (Zhou, Stoof). It was in first instance focussed on theory, with however a strong emphasis on the latest developments in experiment. The most important experimental subfields were represented by at least one representative: STM and tunneling (Lang, Davis group; Oda), Neutron scattering (Bourges, Tranquada, Keimer), optical measurements (van der Marel), Photoemission (Uchida; Shen unfortunately cancelled).
In the context of high Tc superconductivity, one could discern clearly some main underlying themes, coincident with the themes which are at present on the forefront in the worldwide research effort:

(a) Stripes.
Two presentations were dedicated to the microscopic theory (Oles, Ogata) and it was a recurring theme in the phenomenological/field theoretical work (Morais-Smith, Pryadko, Sachdev, Nussinov). However, this development continuous to be driven by experiment and several novelties were presented at the workshop. Tranquada presented convincing evidence that the high temperature state of the nickelates corresponds with a metallic-

like stripe liquid. Uchida presented a vigorous case that somehow nodal fermions do survive in uncompromised fashion in systems which are very close to the stripe instability; he

conjectured that the insensitivity of the electrical transport for the stripe charge order is due to the presence of these nodal fermions. The breaking news was presented by Sachdev: the charge order associated with the stripes has been observed directly by STM in the vicinity of the vortex cores of highly doped 2212 By the Davis group. Sachdev demonstrated that the details of these structures are in close agreement with the theoretical predictions following solely from the assertion that superconducting- and stripe orders can coexist.

(b) Magnetic resonance. Bourges' experimental presentation triggered a very lively discussion regarding the interpretation of the data in either an RPA-language, or in terms of the collective excitations of a disordered stripe like state. This theme recurred later in several theoretical talks (Chubukov, Vojta, Morais-Smith).

(c) Impurities and inhomogeneities.
With regard to the latter, it is becoming a common believe that the inhomogeneities observed by STM (Lang) are likely due to oxygen chemistry although part of it is intrinsic due to the small coherence length of the superconductor (Balatsky). Vojta presented new numerical results regarding the Kondo effect in the d-wave superconductor and during the discussions it became clear that potential- and Kondo scattering cannot be strictly distinguished, thereby resolving a controversy. Morr added another layer of insight by approaching matters from a more field-theoretical perspective.

(d) A variety of new theoretical results and ideas:
Tesanovich with his QED3,
Hanke with numerical results on an SO(5) model and
Phillips with large d like expansions.

Leiden/Los Alamos, 15/11/01

J. Zaanen
A.V. Balatsky

Correlation effects in electronic structure calculations

workshop in Lorentz Center at 12-23 November 2001.

Report

The workshop had an aim to bring together the people from two communities: model Hamiltonian field and band structure calculation methods based on Local Density Approximation (LDA) in order to facilitate developing of the approaches capable to describe electronic structure of strongly correlated systems.

In total there were present 33 participants approximately equally distributed between those two communitites: 12 large (1 hour) talks were given, 14 small (20-30 minutes) talks and 12 discussion sessions (1-2 hours) on specific subjects.

The format of the conference: small number of participants, relaxed program of talks giving plenty of time for discussion sessions and for the informal discussions between participants, allowed the very efficient exchange of recent results and opinions on important subjects. In contrast to the standard conference with a tightly packed program, there was not a feeling of the pressing deficit of time and all raised questions could be discussed till saturation.

The organization of the workshop by the personal of Lorentz Center was very efficient and the conditions of office space, computers, conference rooms, canteen and coffee breaks produced extremely comfortable atmosphere where people do not become tired and even can relax sometime. I would like to express the deepest gratitude to the people of the Lorentz Center for there constant readiness to help.

In the result the workshop was highly successful and all participants were satisfied.

Vladimir Anisimov

Anabelian number theory and geometry

Organizers: F. Oort (Utrecht) and P. Stevenhagen (Leiden).

Lorentz Center, December 3-5, 2001

Report

THEME.
Galois showed how the concept of a group lets one describe properties of field extensions. This tool, Galois theory, has been one of the most powerful ingredients of algebra and number theory since then. Independently geometers studied coverings of topological spaces. These are described by a group, the fundamental group. In 1961 Grothendieck showed that these are disguises of one and the same concept. The notion of the algebraic fundamental group is central in many aspects of arithmetic geometry.

A CONJECTURE.
Around 1981 Grothendieck formulated the startling idea that large classes of algebraic varieties over number fields are characterized by their fundamental groups.

RESULTS.
Independently from this in number theory this philosophy was proven valid by Neukirch and Uchida. In 1970 - 1999 these "Grothendieck anabelian conjectures" were proved to be true for algebraic curves by Nakamura, Tamagawa and Mochizuki.

In the workshop these results in number theory and in arithmetic algebraic geometry have been discussed in 9 long and technically difficult lectures.

Previously these methods were unknown in The Netherlands; we are happy that now these techniques have been incorporated in the knowledge of a large group of scientists working in number theory and/or algebraic geometry.

The Workshop was a big success, thanks to efforts of the speakers, and thanks to the efficient help of the staff and the pleasant atmosphere of our host institute, the Lorentz Center.

Peter Stevenhagen & Frans Oort

Speakers:

Frits Beukers
Gunther Cornelissen
Hendrik Lenstra
Ben Moonen
Frans Oort
Peter Stevenhagen
Jaap Top
Marius van der Put
Torsten Wedhorn