Lorentz center

Scientific Report 2015

Workshops

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www.lorentzcenter.nl

Scientific Report 2015

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Cover: The image was used for the announcement poster of the workshop 'ICT with Industry' that was held at Lorentz Center@Oort in December 2015.
The image is symbolic for connecting state of the art ICT with modern industry. The workshop brought together ICT researchers and industrial R&D. They obtained creative solutions for challenging industrial problems and/or found new approaches, which could lead to such solutions.

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Contents

Scientific Reports 2015

Preface by the Director

The year 2015 has become another crucial transitional year for the Lorentz Center. The foundation of the Lorentz Center and its workshop program has been secured for another five years and new activities that will significantly increase both the Lorentz Center and its program have been initiated.

First of all, NWO – the *Netherlands Organization for Scientific Research* – decided to continue its support of the Lorentz Center for the period 2016–2020. Of course, the evaluation of the Lorentz Center in 2015 had an excellent outcome, and this provided a perfect motivation for the decision by the General Board of NWO. Nevertheless, the Lorentz Center is very proud of this continued support and the continued confidence in the Lorentz Center expressed by NWO – especially since almost all NWO divisions participated in this new investment of NWO in the Lorentz Center. It is stimulating to know the divisions ALW (*Earth and Life Sciences*), CW (*Chemical Sciences*), EW (*Physical Sciences*), FOM (*Physics*), GW (*Humanities*), MaGW (*Social Sciences*) and STW (*Technology Foundation*) all recognized the relevance and added value of the Lorentz Center for scientific research in the Netherlands.

Secondly, the Executive Board – het *College van Bestuur* – of Leiden University decided in 2015 to directly invest in the Lorentz Center, an investment with a well–defined aim: to enable the Lorentz Center to significantly increase its program in the social sciences and the humanities. In fact, by this initiative, the Lorentz Center now has become open for the organization of workshops in all subfields of the social sciences and humanities – yet another step in the direction of our long term ambition of becoming a national center for the organization of workshops in all academic, technological and R&D research fields.

This is also why I consider 2015 as a transitional year: the Lorentz Center has entered into a next phase and has started to grow into a larger organization. We have to be very careful that these rapid developments do not lure us away from our core business: the organization of great workshops. However, given the richness of the scientific ideas (potential) organizers are bringing to the Lorentz Center and the fantastic, active, role played by our Advisory Boards, there is no doubt in my mind that this core will only be strengthened in the upcoming years.

With the growth of our social science and humanities program, our collaboration with the NIAS – the *Netherlands Institute for Advanced Study in the Humanities and Social Sciences* – also is flourishing. The second NIAS–Lorentz Theme Group organized the stimulating workshop *Social Support TAT: Theory, Applications, and Technology*, thereby bringing together different – biological, neurological, psychological – perspectives on social support. The Distinguished Lorentz Fellow Cars Hommes (co–)organized the very successful workshop *Socio–Economic Complexity* that directly led to a publication – *Complexity theory and financial regulation* – in the prestigious journal *Science*. The year 2015 also was the first year in which the Lorentz Center (co–)organized a workshop outside Leiden, the CECAM–Lorentz workshop *Virus as a whole: meso– and macroscopic structure and dynamics at all atom resolution* at the CECAM – *Centre Européen de Calcul Atomique et Moléculaire* – headquarters at the *École Polytechnique Fédérale de Lausanne* in Switzerland. It was very good to hear from our friends at CECAM that – with our input – CECAM indeed succeeded in organizing an open and interactive workshop `in the spirit of the Lorentz Center'. Of course we were also very happy with the workshop *Transformations in Optics*, co–organized by the Lorentz Chair John Pendry in which mesoscopic physics, mathematical information processing, and metamaterial technology were brought together. There are many other workshops I would like to mention – 2015 also was a year in which our astronomy program was especially strong – but I restrict myself to only mentioning one of my personal favorites, the workshop *Mathematical Pharmacology,* co–organized by mathematicians and pharmacologists during which a novel and extremely relevant research field has been opened up.

`Growing into a larger organization' also literally implies that new positions have been created and new people joined the staff of the Lorentz Center. I'm very glad that Mieke Schutte has taken up the challenge of becoming *Head Social Sciences and Humanities*, and thus of becoming the driving force behind the realization of our expansion into these fields. Although 2015 also has been quite a

turbulent year for the Lorentz Center team, its dedication and commitment again made it truly a pleasure to be part of the team. Together we are building a firm foundation for the bright future of the Lorentz Center.

Arjen Doelman
Director Lorentz Center

July 2016

About the Lorentz Center

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

The Lorentz Center's scientific program is broad in scope, covering all disciplines. Our workshops may be monodisciplinary or interdisciplinary, bringing together researchers with different perspectives and backgrounds. Since 2015 we also organize workshops in the social sciences and humanities, building on our collaboration with the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS). In addition, the NIAS-Lorentz Program includes Distinguished Lorentz Fellows and NIAS–Lorentz Theme Groups, where fellowships at the NIAS campus are combined with a workshop at the Lorentz Center. The Lorentz Center organizes other scientific meetings as well, like summer schools, consortia meetings, or study groups on industrial problems.

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

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

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

Funding and Figures for 2015

The Lorentz Center's total workshop budget in 2015 was near € 1.162.801,91, of which a third was raised by the workshop organizers from additional funds. We are supported by the Netherlands Organization for Scientific Research (NWO), the Foundation for Fundamental Research on Matter (FOM), the Technology Foundation STW, and Leiden University. Other sponsors include the Royal Netherlands Academy of Arts and Sciences (KNAW) for the NIAS–Lorentz Program and the Lorentz Fund for theoretical physics workshops.

Lorentz Center funding average per week@Oort	€	13.385
Lorentz Center funding average per week@Snellius	€	9.642
Funding by organizers average per week@Oort	€	8.031
Funding by organizers average per week@Snellius	€	7.494

Applications	83
Weeks of occupancy	59
Weeks@Oort	38
Weeks@Snellius	20
Workshops	56
Study groups with industry	3

Participants	2.454
Women	591
PhD students	539
Dutch	954
Different nationalities	47

Board members	104
Poster designer	1
Intern students	4
Staff	10

Workshop posters	53
Notebooks	6.086
Pens	6.880
Mugs	2.050
Cups of coffee	31.000
Cookies	32.800
Kilograms of cheese	145
Boat trips	32
Conference buses	37
Taxi rides	380
Bicycles	302
Hotel nights	7.052

Scientific Advisory Boards of the Year 2015

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Visscher, Luuk	VU University Amsterdam

Lorentz 'This Week's Discoveries' Lectures 2015

27 January
Macro–Economics of the Cell
Vincent Danos, University of Edinburgh

3 February
When Galaxies Merge, What Happens to Their Supermassive Black Holes?
Tamara Bogdanovic, Georgia Technological University

27 March
Managing Socio-Economic Complexity
Cars Hommes, University of Amsterdam

13 April
Amyloid Aggregation: Unraveling a Knotty Problem
Vinod Subramaniam, University of Twente

26 May
Models and simulation in contemporary option valuation
Karel in 't Hout, University of Antwerp

6 October
How the Tropic Structure of the Economy Amplifies Growth
Doyne Farmer, University of Oxford

27 October
Words as a Window on Our Past
Russell Gray, Max Planck Institute for the Science of Human History

30 November
Modelling and Simulation in Drug Discovery and Development
Pinky Dua, Pfizer BioTherapeutics

15 December
Powerful Outflows from Supermassive Black Holes in the Early Universe
Debora Sijacki, University of Cambridge

Lorentz public lectures 2015

December 14, 2015
NLeSC–Lorentz eHumanities Day
Mieke Schutte, Tobias Blanke, Sally Wyatt

November 12, 2015
Moduli Spaces and Arithmetic Geometry Celebrating FO80
Aise Johan De Jong, Don Zagier

October 16, 2015
The Future of Protein Research
Prof. Dr. Thijs Aartsma, Prof. Dr. Marcellus Ubbink

October 8, 2015
BINC: Societal Impact of New Technology
Dr. Lene Anderson, Prof. Steen Rasmussen

August 20, 2015
One Hundred Prisoners and a Light Bulb
Barteld Kooi, Hans van Ditmarsch

March 19, 2015
Relaties, Technologie en Gezondheid
Berry Aarnoudse, Margaret Clark

February 27, 2015
Authorship in Transition: Towards a Common Research Agenda
Paul Wouters

Shock acceleration: From the Solar System to Cosmology

5 – 9 January 2015 @Oort

In most shocks associated with astrophysical sources the shocks are moving through low density gas/plasma (1–100 atoms cm^{-3}), and since the collisional length scales are then long compared to the sizes of the shocks systems these shocks are called "collisionless". One of the common properties of collisionless shocks is particle acceleration: some particles become very energetic. These particles may be a small fraction of all particles, but may contain a substantial amount of the overall internal energy of the plasma.

Interestingly particle acceleration appears to take place in sources with a wide variety of length scales. In our solar systems particle acceleration is associated with planetary bow shocks and shocks induced by coronal mass ejections. In supernova remnants we observe these particles in the form of radio–, X–ray and gamma–ray radiation, caused mainly by synchrotron radiation from accelerated electrons, but in gamma–rays also from accelerated atomic nuclei. These particles are probably the origin of what we on Earth detect as "cosmic rays". Finally, on very large scales (megaparsecs) shocks are observed in the tenuous plasma inside clusters of galaxies, and some of them are associated with radio emission from accelerated electrons. There was also a prominent role for researchers doing particle–in–cell (PIC) simulations, showing particle acceleration at work on the level of individual particles being heated and accelerated.

During the workshop shock acceleration in these very different systems were discussed, bringing together key researchers from three different communities: solar system scientists, specialists on supernova remnants, and astrophysicists working on non–thermal emission from cluster of galaxies. A key question was whether despite the different sizes the underlying phenomena were the same.

The workshop had scheduled talks in the morning and discussion time in the afternoon. However, due to the lively atmosphere and many discussion during and after the talks, the workshop became very informal, which was really appreciated by the attendees.

What the people working on clusters of galaxies gained was a sense of the complexity of collisionless shocks as revealed in detailed in our local neighbourhood: the solar system. In supernova remnants a new level of complexity was discussed in the sense that shocks may be partially neutral, giving rise to much more complicated shock structures. Finally, the old idea that the electron–ion ratio of accelerated particles is about 1%, may actually not always hold, as there are hints for electron rich particle acceleration in clusters of galaxies, and PIC simulations show that this ratio is likely to depend on the angle between magnetic field and the plane of the shock. We know of already one project that came out of the workshop on joint PIC and cosmological simulations.

The workshop was well received, for example one reaction we had was: "Thanks for organizing the meeting at the Lorentz Center. It was much more successful than other cross–disciplinary meetings I've gone to, probably because of the size, the venue and the choice of participants, most of whom I did not know, and a good percentage of women."

Marcus Brüggen (Hamburg, Germany)
Mark Dieckmann (Linköping, Sweden)
Olga Verkhoglyadova (California, USA)
Jacco Vink (Amsterdam, Netherlands)
Gary Zank (Alabama, USA)

HART - Human-Agent-Robot Teamwork: Tools and Methods for Designers

5 – 9 January 2015 @Snellius

The Lorentz Workshop on Human Agent Robot Teamwork of January 2015 encountered some setbacks. Most of our international keynotes speakers had the flu. They did arrive in Leiden, some could even give their presentation, but then had to lay low in their hotel rooms waiting for the flu to run its course. Luckily, none of them missed their return flights.

Content–wise the workshop was still a success. We had great discussions on methods, initiated by the presentations by Mark Goodrich, Frank Dignum, and Matt Johnson. The debate was so intense and constructive that we re–planned our workshop to be able to continue with more plenary sessions talking more about methods and tools. Virginia Dignum spoke about OperA, and Mark Goodrich said more about his sCET, Jurriaan van Diggelen gave a great demonstration and talk about his tools for workflows and planning for HART.

Catholijn Jonker made a strong case for design for values and argued that design–time we should design for run–time solutions for value conflicts. She also argued that most designers think that they design the whole system, whereas with the advance of the Internet of Things, many teams will design for the same or almost same problem or application, but not at the same time, and not being aware of the other teams. The brings the problem of how to design for open systems in a value–sensitive way to the fore.

There was a great discussion about how all these tools and methods could fit together in a complementary way, and the hope was to continue that discussion of relationships among tools (as well as gaps) even after the workshop.

The impact of the workshop has been that within the Netherlands, in the collaborations for setting up Zwaartekracht and Perspective proposals the roboticists are in agreement that we should shift our focus from fully autonomous systems to robots that are designed for co–activity, and for sharing control. Really fascinating connections grew out of these concepts, including our overall insight that the three levels of expertise are closely linked to shared (haptic) control, co–activity, and having the flow of control go to the team member that has the best expertise for the current task of the team work. Questions of how to deal with responsibility and accountability will be returning topics of concern and research.

Jeffrey Bradshaw (Florida, USA)
Virginia Dignum (Delft, Netherlands)
Catholijn Jonker (Delft, Netherlands)
Matthew Johnson (Florida, USA)
Maarten Sierhuis (California, USA)

Quantitative Biology of Auxin Transport

12 – 16 January 2015 @Snellius

Polar transport of the plant hormone auxin (PAT) directs patterning of embryos and tissues, initiation of new organs, and environmental responses. This workshop brought together a team of experts and young researchers to make a start with developing new quantitative modeling–experimental approaches, with a focus on aspects of PAT that are still poorly understood.

In smaller working groups, the following topics were discussed:

- Intracellular auxin transport: vesicles vs cytoplasmic streaming;
- Auxin and coordinated cell polarization;
- Long–distance polar auxin transport;
- Subcellular PIN polarity establishment and maintenance.

As a spin-off of the discussions in the group that discussed Topic 1, a set of experiments was conducted by Matous Glanc as member of the research group of Jiri Friml and in collaboration with Eva Zazamilova as follow–up to the workshop. These experiments were designed to test some of the model predictions that were found during the workshops. At the time of writing of this report the experimental data are being assessed in order to draw conclusions on the possible contribution of vesicles to the overall cell–to–cell transport of auxin.

The discussion among members of the topic 2 group has led to the recognition that a greater uniformity is needed in the mathematical description of the models, and that quantification of some of the parameters in these models requires more emphasis. As such the workshop has been successful in bringing together modellers and to stimulate their collaboration, and the unification of their models. Along the same lines, Dr. Hille will visit Drs. Greiniesen and Marée in Norwich, UK, to present details of the mesoscopic model and discuss the possibility that this model may be used as a basis for the more detailed cellular model they are generating as a spin-off from Topic 3.

As a typical *Snellius* workshop, we focused on discussions in small groups and made a start in implementing our ideas in working mathematical and computational models. This worked well, resulting in enthusiastic and open discussions, and late working hours. The ease by which participants felt comfortable to share ideas and start new collaborations was particularly remarkable, because of the competitive nature of the auxin field. The limited overall size of the workshop, in combination with the small size of the working groups (around six to seven participants), and the balance between senior and junior participants contributed to this.

Bert van Duijn (Leiden, Netherlands)
Sander Hille (Leiden, Netherlands)
Eric Kramer (Great Barrington, USA)
Roeland Merks (Amsterdam, Netherlands)
Remko Offringa (Leiden, Netherlands)

Music Similarity: Concepts, Cognition, and Computation

19 – 23 January 2015 @Oort

The aim of this workshop was to bring together experts on music similarity from Computer Science and the Musical Sciences in order to discuss overarching and cross–disciplinary strategies on the theoretical and computational modeling of music similarity. The dramatic increase in the digitization of music calls for the development of computational methods in Music Information Research, where similarity poses serious challenges because of its context dependence. For music scientists who study similarity in listening, composition/improvisation, and analysis of scores/performances, the complexity of the musical material and lack of established formal models for the music domain pose serious challenges that cannot be met by one discipline alone, hence our multidisciplinary approach. The following paragraphs summarize participants' responses to the post–workshop feedback form.
(1) A goal of the workshop was to develop a roadmap document on music similarity research, providing an overview of achievements, current challenges, future short and long term goals on modeling music similarity. (2) Networking at the workshop has led to numerous expressions of intent to submit future joint grant and workshop proposals, such as EU COST Action and Horizon 2020 framework ICT 16 Big Data proposals. (3) A special issue of the Journal of New Music Research will be dedicated to outcomes of the discussions at the Lorentz workshop; numerous attendees have formed partnerships to jointly submit proposals to co–author articles in the special issue.

Participants appreciated learning about the state–of–the–art on music similarity from multiple unexpected perspectives, and mention breakthroughs, or progress towards discoveries in the following areas: [1] *Definition of similarity*: the concept of similarity as a category rather than a measure; [2] *Scope of similarity*: recognition that similarity extends beyond music features to include affect, physical motion, and other multimodal elements. [3] *Evaluation of similarity*: the current paradigm of testing algorithms/systems against ground–truth was increasingly challenged, especially given the importance of user context. Finally, one participant wrote, "We need a flagship program The Human Ear Project (cf. The Human Brain Project)."

Learning about others' work in a wide range of disciplines produced a host of "aha" moments, including [1] *the value of alternate views*: (a) realizing that categorical definition of similarity is necessary and complementary to distance–based definitions; (b) similarity and contrast are essentially related; (c) that acoustic and symbolic approaches are complementary and necessary; (d) the concept of priming might offer a way to explain 'context'; [2] *the extent of academic exclusivity*: (a) information processing models of similarity dominate research in the area; (b) the lack of meaningful evaluation of similarity assessment; (c) discussions of embodiment and performance analysis was highly interesting; and, [3] *the inter–connectedness of the disciplines*: (a) similarity extends to timbre, motion, affect, and other modes; (b) that computer science and psychology methods of assessing quality of similarity measures are closely related; (c) that researchers in other fields also think about music similarity and in a variety of different ways.

The workshop had a limited number of plenary sessions, each with two speakers, interspersed with as many group brainstorming activities based around participant–chosen topics. Most participants found the format to be excellent and enjoyed the balance of lectures vs. working groups, as well as the blend of experienced and starting researchers. While many applauded the inclusive nature of the "big tent" approach, and appreciated the high–level and abstract nature of many of the discussions, some yearned for clearer goals and greater depth (perhaps over fewer topics), and for concrete results like a catalog of definitions, methods, and evaluations.

Many participants applauded the organization both by the scientific team as well as the Lorentz Center. All found the center to be a most enjoyable venue, and were extremely impressed with the running of the Center and its openness to humanistic research in tandem with its focus on scientific research. Participants appreciated very much the conceptualization of the workshop - the mixture of people with technical and musicological/psychological backgrounds - and found the networking aspect of the workshop especially worthwhile. Several wrote that it should be repeated again in the future

whenever possible. The only very minor quibbles were that signage to the Lorentz Center could be improved, and there was not sufficient time to enjoy Leiden. One participant wrote, tongue in cheek, that the number of coffee machines could be halved to increase the amount of informal contacts. On a more serious note, the workshop highlighted the challenges of "interdisciplinary research, and the importance of such workshops so that we can all be in agreement (or at least be aware of non–agreement) regarding the science of the [music similarity] field."

Christina Anagnostopoulou (Athens, Greece)
Elaine Chew (London, United Kingdom)
Elizabeth Margulis (Arkansas, USA)
Anja Volk (Utrecht, Netherlands)

Integrative Cell Models – Bridging Microbial Physiology and Systems biology

26 – 30 January 2015 @Oort

Originally, we thought of cellular regulation merely in terms of the molecular mechanisms underpinning point–to–point information flows. But growing evidence now points to the major impact that global trade–offs in the physiology of cells have on the execution of sub–cellular processes. Predictive models in systems biology need to incorporate these new insights and take into account global physiological effects alongside the sub–cellular processes to understand the emergent behavior of cells. For this to happen, a prerequisite is to measure and quantitatively understand the deep couplings between a cell and its various processes. The associated experiments and the new insights will be guided by and rely on the currently existing cell models. The broad ambition of this workshop was to chart the landscape of available cell models, their underpinning concepts, and associated tools, and to promote the further development and use of these models. The specific goals were to:

- Gather the experts who pioneered different approaches to integrative cell modelling and form a European cell–model community;
- Harvest the available cell models and identify the salient variables that determine the cellular physiology and globally impact sub–cellular processes;
- Plan the development of a cell model standard to serve as a 'plug-and-play' environment to integrate models of sub–cellular processes.

The workshop proceeded successfully as per the program on the workshop website. The sessions included talks by both experimentalists and modelers, and across different fields, focusing on one specific area per day, and were followed by afternoon break–out sessions. The break–out sessions formed an important part of the meeting, fostering the interactions among participants and allowing them to concentrate the discussions around specific topics underlying the current challenges/bottlenecks. Speakers and participants jointly decided on break–out topics based on the questions triggered by the lectures and subsequent questions–and–answers. Each break–out group summarized the main conclusions of the brainstorm and these were presented to all other groups in a general session at the end of the afternoon.

Overall, participants discussed the state–of–the–art, key bottlenecks and future perspectives for cell models, and they debated on how to build upon and overcome them. Participants, presentations and discussions covered the many required disciplines from theoretical/biological conceptual underpinnings in microbial metabolism and physiology, to the mathematical aspects necessary to building cell models, to the more pragmatic aspects of existing and future computational and experimental tools. A recurring topic of discussion was the philosophic divide between 'minimal' models to address specific problems and novel 'holistic' approaches aimed to provide general tools and repositories of knowledge. This divide was not fully overcome, but the workshop helped in bringing both parties closer and appreciate the respective other's objectives.

Participants jointly decided on a spontaneous change of program dedicating one of the afternoon sessions to voluntary short talks by participants. This session gave a broad overview of the diverse research related to cell modelling and led to further discussions. During the last session of the week, the main directions, bottlenecks and potential solutions, as well as perspectives were discussed in plenary. It was jointly planned to place these discussions on a perspective/opinion/trending paper to be submitted to a journal of impact within the area. The editor of the journal Molecular Systems Biology was contacted and responded positively to the concept. The tentative layout of the potential paper agreed at the meeting is shown below.

As an outcome of the meeting, several participants teamed up to organize further events such as the 2016 Summer School on whole–cell models (http://www.wholecell.org/school–2016) organized by 2 participants and including 4 other participants as speakers), and a course on multi–algorithm whole–

cell modelling paired with a course on mechanistic cell modelling (http://tinyurl.com/cri–2016–wc & http://tinyurl.com/cri–2016–mechcell organized by 3 participants).

The Lorentz Center provided an excellent venue to hold this workshop allowing organizers and participants to solely focus on the science and giving space for both plenary and small discussions.

Paper layout:
Why context–dependence, both for models and experiments?

- Coarse- and fine-grain as examples of the same process;
- Coarse-grain modelling; data needed;
- Fine-grain modelling; data needed;
- Interfacing between different granularities;
- Organization of community.

Frank Bruggeman (Amsterdam, Netherlands)
Vincent Danos (Edinburgh, United Kingdom)
Vítor Martins dos Santos (Wageningen, Netherlands)
Diego Oyarzún (Imperial College London, United Kingdom)
Peter Swain (University of Edinburgh, United Kingdom
Andrea Weiße (University of Edinburgh, United Kingdom)

Compact Objects as Astrophysical and Gravitational Probes

2 – 6 February 2015 @Oort

Gravitational–-wave astronomy and novel techniques to scrutinize compact astrophysical electromagnetic sources will revolutionize our understanding of the Universe before the end of this decade and will provide us with precious information on the nature of nearby massive black holes like SgrA* and M87. In recent years, significant progress has been made in understanding the formation and cosmological evolution of massive black holes, by measuring their spins and by studying their interplay with the gas present in galactic centers. It is thus an exciting period for strong-field gravity and the recent flurry of activity calls for a joint effort between previously disjoint communities embracing areas as diverse as high–energy astrophysics, electromagnetic observations of compact objects and tests of General Relativity with gravitational-wave detectors.

The main goal of this workshop was to bring together leading experts and young researchers in these areas, with the goal of stimulating new collaborations and discussing the potential of gravitational–wave detectors such as Advanced Virgo/LIGO and eLISA, and electromagnetic ones such as Athena+, GRAVITY and the Event Horizon Telescope, for the following specific themes: *(i) The role of the black hole spin; (ii) Physics of jets and outflows; (iii) Properties of compact objects and tests of gravity*.

The workshop brought together around 60 participants from different communities working on gravitational–wave astronomy, high–energy astrophysics of compact objects and fundamental physics. The most critical aspect of the organization was to devise specific measures in order to facilitate discussions and foster collaborations between the gravitational-wave community and the astrophysical compact object community. Indeed, such communities are historically rather disjoint although they have various points of common interest and they could benefit enormously from mutual interaction.

On each day, the workshop's program was opened by five senior moderators (one per day) whose duties actually started one month before the workshop. Indeed, moderators have been asked to collect questions and open problems from all participants, especially those of common interest between the different communities and those that would particularly require a joint effort and a share of expertise in order to be tackled. Moderators have been chosen carefully based on their proven ability to talk to all the communities involved due to their broad and interdisciplinary work.

Moderator have opened the program by listing the questions collected in the previous weeks and by providing their personal take on the topic of the day. After the moderator's introduction, the morning program was organized around introductory talks. The scope of the introductory talks was to explain the technical jargon and to set a common starting point for the interactions of the different groups. Indeed, although the communities involved share the objects of study (i.e. black holes and neutron stars), their motivation to study them, their approaches and their very jargon are extremely different and sometimes almost unintelligible to the other community.

Furthermore, speakers were instructed to provide questions rather than answers, so as to engage the participants in a discussion. With the same goal, all participants were offered lunch vouchers for the whole workshop, so that the group would not disperse and the interactions could effectively continue over lunch time in a very informal and relaxed environment. The proposed structure turned out to be quite successful. Most participants were very eager to interact and learn, and were engaged in very active discussions. Ample time was allocated for discussions, both in the middle of the program and at the end of the day. All discussion sections have been attended by the entire group of participants and systematically lasted longer than expected. Despite the quite intense schedule, discussions essentially went on during the entire day, including coffee breaks, lunches and shifts from the Lorentz Center to the hotel. More specifically, critical issues at the interface between gravitational physics and astrophysics that are relevant for the workshop's themes were identified, namely:

- The relation between jets and compact object spin, which is not yet understood. Accurate measurements of spins by gravitational-wave detectors will help shed light on this issue.

- The mechanism converting energy from the Pointing fluxes produced by compact objects to observable electromagnetic radiation. This is a critical missing link in our understanding of jets, outflows, and feedback, and one on which possible detections of gravitational waves by advanced detectors in coincidence with gamma-ray bursts will probably provide breakthrough advancements before the end of the decade.
- VLBI observations of SgrA* and M87 were identified as the most promising way of testing gravity in strong field regimes with electromagnetic data in the next few years. In this respect, the critical issue was identified to be the uncertainty in our the knowledge of the accretion flows in the galactic center, whose impact needs to be carefully assessed.

Discussions on a shared roadmap for the future have resulted in a plan to have a follow-up workshop in 2-3 years from now, when advanced gravitational-wave detectors will be finally operational and very long baseline interferometers are expected to achieve enough resolution to resolve the region near the black hole horizon of SgrA* and M87. We hope that this workshop has paved the way for more fruitful collaborations between the different communities involved in these studies and we expect that several publications will emerge from the collaborations initiated at this workshop.

Enrico Barausse (Paris, France)
Tamara Bogdanovic (Georgia, USA)
Vitor Cardoso (Lisbon, Portugal)
Paolo Pani (Rome, Italy)
Elena Maria Rossi (Leiden, Netherlands)

Training Course: Data Integration in the Life Sciences

2 – 6 February 2015 @Snellius

This training course focussed on an important and novel challenge in the life sciences: the integration of diverse types of data in aiming at a better understanding of how biological systems function. For instance, to understand a living organisms it is essential to combine (i) genetic information and knowledge about gene activity with (ii) data sets that describe the presence and function of proteins and metabolites and (iii) spatial information from light and electron microscopy. The course addressed the question how to integrate such disparate and highly dynamic (time–dependent) data in predictive computational models, that give insight into the interrelated processes in cells, tissues and organs.

Aim of the five days course was to provide students with the following knowledge:

- Overview of different types of data sets and data integration approaches;
- Hands-on training in applying such approaches in selected case studies;
- Insight into how such approaches may affect their individual research project.

The course programme contained a limited number of introductory lectures and presentation of examples of ongoing research projects in different European countries. The main component was hands–on work, using data sets provided by the course organization. The course was attended by 21 young postdocs from eight countries.

The overall evaluation of the course, conducted 2 to 3 weeks after it ended, was 3,6 on a scale of 4. Both the topic and the course itself were timely and highly appreciated.

Roel van Driel (Amsterdam, Netherlands)
Jaap Molenaar (Wageningen, Netherlands)
Lodewyk Wessels (Amsterdam, Netherlands)
Hans Westerhoff (Amsterdam, Netherlands)

Artefacts in X-ray Tomography

9 – 13 February 2015 @Oort

Significant progress has been made in recent years in the ability to perform advanced 3D X–ray imaging for scientific, industrial and medical applications. The quality of such images is often limited by the presence of certain structured distortions, known as "artefacts". Artefacts can have a broad range of causes, related to the experimental setup, but also to the computations performed on the measured data. The main goal of this Lorentz Center Workshop was to initiate an in–depth discussion on the various artefacts that arise in X–ray tomography.

The workshop brought together around 55 participants from different communities (mathematical, computational, engineering, photonics, experimental) involved in tomography. From the first day and onwards, there was a strong urge among the participants to zoom into concrete problems and exchange experiences related to these problems.
Several discussion groups on selected topics were formed during the week:

- Region-of-Interest Tomography;
- X–ray micro–CT;
- Full system calibration;
- Fluid flow reconstruction in CT;
- Reconstruction from limited and noisy data;
- Correction for motion introduced during acquisition;
- Quality measures for tomography scans.

Before the workshop, Francesco de Carlo compiled a repository of experimental synchrotron datasets that served as a basis for many of the discussions.

A particular successful item in the program was the speed dating session, where participants were teamed up in pairs for 3–minute discussions. Although no one knew what to expect, it was highly valued by most participants as a good means of creating new contacts.

As a platform for shaping the newly formed collaborations, a web repository was set up for the different topics treated during the workshop, which can be found at:
https://confluence.aps.anl.gov/display/XSDLORENTZ2015/Artefacts+in+X–Ray+Tomography,+Lorentz+Center+2015+Home

This workshop was partially funded by the EU EXTREMA COST Action, a network grant for advanced tomography. The next challenge will be to transform the discussion results into concrete computational/experimental solutions for various types of artefacts. On 18–20 May 2015, there will be a follow–up workshop at the European Synchrotron (ESRF) in Grenoble. This will include simultaneous availability of three experimental beamlines, creating a unique experimental/computational event.

Overall, the workshop was received in a very positive way. Due to a major local outbreak of a flu-like virus, about half the participants suffered from sickness during the week. On one hand, this caused difficulties, but at the same time it created a special atmosphere where the group felt united in its struggle against the elements.

Joost Batenburg (Amsterdam, The Netherlands)
Francesco de Carlo (Argonne, United States)
Lucia Mancini (Basovizza, Italy)
Jan Sijbers (Wilrijk, Belgium)

Extracting Information from Weak Lensing: Small Scales = Big Problem

16 – 20 February 2015 @Oort

Our meeting was focused on arguably the most important question in physics today: what is dark energy? The observational evidence for dark energy, that is causing the expansion of the Universe to accelerate, indicates that either general relativity is incorrect on cosmic scales, that there is a fundamental misunderstanding of vacuum energy, that there is a new fundamental field, or that we live multiverse. One of the most promising approaches that have been proposed to measure dark energy properties from cosmological data is to use weak gravitational lensing. This is the effect that images of distant galaxies are distorted by the presence of mass along the line of sight. By measuring the distortion we can trace the growth of massive structures over the evolution of the Universe and the geometry of the Universe simultaneously.

Understanding the origin of dark energy will require the measurement of its impact on the growth of structures and the expansion history of the Universe. Weak Lensing has the ability to measure both these effects, but the majority of the information comes from small-scales where feedback effects between the dark matter distribution and the baryonic matter complicate our interpretation of the measurements. This workshop looked at simulations, theory and observations to address the issue of how to best analyze the information-rich, but poorly understood, small-scale matter distribution for cosmology.

The most tangible outcome of the meeting was the creation of several new collaborations that cross between theory, observations and simulations. An example was a "simulation task force" that was set up to begin comparing nobody simulation codes. Key moments in the meeting were in the transfer of knowledge between these disciplines, and the pedagogical presentations, and long discussion time meant that "simple" questions could be asked, and understanding gained. A particular highlight was the pedagogical lecture on simulations. One speaker reminded us of the parable of the blind men describing an elephant: each person describing one part of the whole, but no one appreciating the entirety of the problem.

There were several discussions and presentations on the theoretical side of analytically predicting the distribution of matter on small–scales. We heard some brand–new work on bringing particle physics like field theory analysis into a cosmological setting, and we were reassured that the LHC "is the other successful dirty physics experiment", and that small-scale-to-big-scale problems are everywhere in physics; the problem is that on small-scales velocity and momentum interact.

More questions than answers abounded. How many simulations do we need? How can we combine baryonic feedback and intrinsic alignments? How do we calibrate hydrodynamic simulations? Can we use strong lensing to help? Is the halo model adequate? Are scaling relations sufficient, or too simplistic? Can we use perturbation theory to bootstrap simulations? And many more.

There was some lively debate on the correct approach to modelling of small-scales for current data, the differing opinions being that we should either remove these small-scale by creating tailored statistics, or model the small–scales using a halo model ansatz. Both approaches were deemed to be useful. What became clear is that whilst the halo model approach is promising there are some fundamental assumptions (e.g. sphericity and randomness) that will need to be validated before we have the next generation of data. We were also reminded that if baryonic feedback is not hard enough, we also have to deal with the intrinsic alignment of galaxies. "Clipping" off the bad information in the data also was seen as a good approach.

The central problem was seen to be a lack of independent non–lensing data that can be used to calibrate the proposed simple models. Meanwhile the lensing data continues to accumulate. We were given state-of-the-art reports from KiDS, DES, and HSC surveys. All of which promise cosmology

results within the next year. There was no consensus on whether methods discussed were sufficiently accurate, precise or validated to work for these surveys.

The overall mood was one of an increasing appreciation for the magnitude of the task ahead in the community. That there are challenges in all aspects of the problem – simulations, theory, and observations – but that it was extremely useful to meet in the context of a weeklong meeting where these problems could be articulated. Our keynote speaker ended the workshop by setting us a challenge, saying that it was "unthinkable that we not use high [small-scale] information".

A problem shared is a problem halved, and the first step to recovery is admitting you have a problem. Both of these aphorisms were true of this workshop, and we now plan for many more workshops on the same topic, to meet the challenge in time for dark energy physics.

Katrin Heitmann (Chicago, USA)
Catherine Heymans (Edinburgh, United Kingdom)
Henk Hoekstra (Leiden, Netherlands)
Thomas Kitching (Edinburgh, United Kingdom)

Authorship in Transition

23 – 27 February 2015 @Snellius

What is a scientific author? What are the different practices for making-up this elusive figure, and how do these connect? Are current modes of enacting authorship still fit for purpose and how might we imagine and enact new forms?

What is understood as 'authorship' has varied over time and contexts yet is relevant across all fields of scholarship and science. This multiple figure is deeply interwoven with cognitive aspects of knowledge, such as creativity, originality, and invention, as well as with the institutional aspects of knowledge production, such as reward–systems, ownership and recognition. Authorship is also very much at the Centre of ethical considerations in science and scholarship. Questions such as what is an appropriate contribution that warrants authorship, or how are authorship practices affected by increasing competition are of both practical and political importance. Moreover, authorship is linked to communication technologies and social networks: writing a scholarly letter for a print journal differs in important ways from authoring a submission on a Wikipedia page.

These manifold dimensions of authorship have rarely been brought together or mobilized to better understand and rethink authorship practices. With this in mind, in February 2015 a five–day workshop named Authorship in Transition was held in the city of Leiden, the Netherlands. Commissioned by the prestigious NIAS–Lorentz Program and organized by Anne Beaulieu, Blaise Cronin, Frank Miedema, Sarah de Rijcke, and Paul Wouters, the event stimulated critical insights into authorship dynamics but also opened–up spaces for imagining new formations.
Many recent discussions about authorship have focused on two important issues: fraudulent authorship, and possible perverse effects of evaluative metrics. Without ignoring ethical and political matters, our workshop took a different starting point, considering the changing conditions and practices of authorship and the need to understand these in a grounded way. This requires posing some challenging questions, which touch the core of contemporary definitions of authorship and its practice. For example, to what extent does it still make sense to think about authors as autonomous individual subjects? Are more radical innovations in authorship practices thinkable and desirable? What are the implications for the reward and reputational system in science and scholarship? To what extent do we need new forms of quality control if scientific instruments are starting to play a more autonomous role in the creation of knowledge? What are the consequences for the organization of labour in research of highly distributed teams of authors (Beaulieu et al., 2012)? And what would the near future of scientific writing look like in a scenario analysis (Davidson & Goldberg, 2010)?
These are large, wide–ranging and challenging questions that justify a broad research program. Our workshop was intended as a first step in formulating such a program.
In appreciation of the richness and complexities of the topic, participants assembled from academia, but also other key players in the scholarly authorship process, such as editors, publishers, evaluators, representatives of university libraries, science policy advisors, research information system specialists, and non–academic authors (performance artists, media specialists).

During the week, each day discussions were loosely organized around a particular dimension, so that interdisciplinary exchange could take place in a concerted way. These dimensions were: authorship as diverse practice, authorship as labour, authorship and reward structures, technological and material aspects of authorship, and politics and ethics of authorship. Besides sharing their expertise on the topic of authorship, workshop participants were also triggered to reflect on their own writing practices.
Work forms during the workshop consisted of:

- Presentations by experts from different fields;
- Presentations by key players in the process of authorship (authors, but also editors, publishers, reviewers, evaluators);
- Explorations of the meaning of authorship through experimentation with different forms of authorship (in particular the Scalar workshop);
- Live performances, social media feeds, quizzes, surveys.

The highlights of each day were summarized daily, to make the most of the cumulative effect of these discussions in the final session of the final day, and in the follow–up to the workshop. A key material participant in this respect was the venue itself: whilst allowing for traditional academic exchanges, the Lorenz Center's creative interior design features afforded a perfect setting for stimulating bottom–up thought spaces ('think pod' work spaces, walls to be written on, ample rooms to split–off into group work).

The event made visible a number of developments and problems circulating academic authorship in the present time. We heard throughout how audit explosions in universities and the measures and tools used to facilitate evaluation processes have performative effects in the shaping of research (cf. Rushforth & De Rijcke, 2015). This raised important political questions regarding how authorship is counted, and by extension, what forms of authorship count? Scientometrics, for example, performs authorship through counting names that have been archived onto specific digital databases. Vincent Larivière (University of Montreal) reminded us how this field offers a powerful descriptive tool through which to monitor shifts in authorship practices across fields of inquiry and regions over time. However enacting authorship through these elaborate counting systems has performative effects in extending the reach and intensity of formal academic evaluation. The talk by sociologist David Pontille (Centre de Sociologie de l'innovation, Mines Paris Tech & CNRS) related how authorship emerges through technologies of attribution, including a number of artefacts for naming individual contributors and corporate entities as well (cf. Pontille, 2008). In contemporary big science biology and physics the complexity of tasks appears to be increasing and therefore so too the numbers of authors. The proliferation of so–called hyperauthorship in biomedicine (see the infamous 'fruit fly' paper recently reported by Nature), provokes uncertainties in the attribution of credit, priority and authority, not to mention ethical issues of responsibility. Also drawing on anthropology of writing, Tjitske Holtrop (University of Amsterdam) recounted the instabilities in infrastructure and expertise which emerged in administrative report writing in the turbulent political and geographical context of the Dutch military's involvement in Afghanistan during the 2000s. Returning to academia, Ruth Müller (TU Munich) reported how the premium placed on first (and last) authorship berths in the institutional and epistemic reward systems of the life sciences was transforming social relations in labs, putting particularly strain on those occupying post–doc positions (cf. Müller, 2014). Maarten Derksen (University of Groningen) told of how recent high profile exposes of fraud and plagiarism have tended to implicate authorship systems – and their excessively tight coupling with individual scientific careers and rewards – in their explanations. Various developments in knowledge making, and limitations they expose in modern authorship techniques, have led certain actors to attempt solutions. Examples of collective responses to crises of credit and trust include attempts to create innovative authorship modes like 'contributorship', first launched in the nineties in biomedical sciences, and more recently crowdsourcing, which seek to accommodate new frontiers whilst also preserving some established norms and routines. Such efforts appear to generate quite specific authorship functions that hitherto are barely reported on, let alone understood. How ways of counting authorship effect labour, class, and gender relations in different epistemic and institutional contexts are also key issues at stake.

Questions of which new authorship practices can emerge are intimately related to questions of how they will do so: imagining and cultivating new and emergent forms will depend upon the practices and politics of infrastructure building. One session introduced participants with Scalar, an open–web based platform, which explicitly seeks to transform authorship in the humanities and social sciences. The result of collaborations between academics, web designers, and university presses, Scalar provides a flexible means for open publishing that provides quite distinct set of features and affordances than physical and digital book formats. The platform was developed by the Alliance for Visual Networking Culture (ANVC), led by Tara McPherson (University of Southern California), with support from the Andrew W. Mellon Foundation. In the spirit of spontaneity the workshop sought to cultivate, Matt Burton gave an off–the–cuff presentation on Ipython Notebook, an interactive authoring platform for combining rich text, media, code, plots, and mathematics. As well as providing a practical demonstration of its interfaces, he brought into view path–dependencies surrounding scholarly infrastructure, such as the ubiquity of the PDF as a standard computer document through which 'authorship' gets circulated.

The format of the week placed great emphasis on group work, with participants each day splitting off into groups stimulating working on the production of new authorship interventions and platforms. These teams sought to imagine new ways in which authorship practices could be prised-open and done differently. For instance: one group produced the idea of The Authorshop, a web-based platform which makes available for free academic writing, thus circumventing academic journals and extortionate pay–walls. Initiatives like The Authorshop have potential to disrupt and improve the science system through ushering in better direction of public funds towards research, by calling on innovative quality control mechanisms to be developed, and by undermining the undue influence of indicators like the Journal Impact Factor in shaping scientific careers and evaluations.

The Authorship in Transition workshop enabled the authorship topic to trail off into multiple productive directions. The week has provided impetus for exploring further various branches of the discussions and findings, which we hope to translate into follow–up research projects, infrastructure–building initiatives and benchmarks for policy–makers and evaluators. One of the challenges will be to tease apart analytical dimensions of authorship, as it became clear throughout the week that the notion is so often entwined with reward, property, persona and voice – elements that matter deeply to scholars and researchers. The workshop provided a rich set of insights for further analyzing contemporary authorship practices and stimulating opportunities to pursue modest interventions to re–shape this elusive but vital object.

We would like to express our gratitude to the Lorentz Center for their generous funding of the workshop, and to the Netherlands Graduate Research School of Science, Technology and Modern Culture (WTMC), CWTS at Leiden University, the University Medical Centre in Utrecht, Open Access Publishing Services (OPuS), and the Rathenau Instituut for co-sponsoring the event.

Anne Beaulieu (Groningen, Netherlands)
Blaise Cronin (Indiana, USA)
Frank Miedema (Utrecht, Netherlands)
Sarah de Rijcke (Leiden, Netherlands)
Paul Wouters (Leiden, Netherlands)

Good Vibrations for Energy Management in Biomolecules

23 – 27 February 2015 @Oort

There is mounting scientific evidence that a dynamical interplay between electronic and vibrational dynamics takes place in the primary process of energy transfer and conversion in variety of photo–activated processes such as excitation transfer in photosynthetic light harvesting complexes, charge separation in photosynthetic reaction centers, and photo transduction in rhodopsin and bacteriorhodopsin. Moreover, specific vibrational motions have being hypothesized to assist hydrogen transfer in some enzyme–catalyzed reactions as well as to be an integral component in molecular recognition.

The above scientific findings suggest that a possible common fundamental operational principle for energy management in biomolecules is the direct involvement of specific, non–thermal equilibrium vibrational motion in the process of interest. The aim of this workshop was to explore this hypothesis by addressing the following three key questions:

- Which experimental techniques do we need to develop to probe correlated electronic vibrational dynamics in photo–activated molecules?
- What is the functional role of non–equilibrium vibrational motion for energy and charge transport as well as energy storage in biomolecules? How are these specific molecular motions "selected"?
- Do we have an appropriate theoretical framework to describe and understand these phenomena? Is the predictive power of the current theories enough to accurately predict dynamics and functionality?

The workshop was a success in all possible aspects. The meeting congregated scientists that have not all coincided in any conference together before. This promoted the beginning of new research collaborations, as it is the case for researchers of University of Barcelona and University of Ulm and for researchers of UCL and University of Cyprus.

The participants indicated that they were very happy with the significant amount of time that was left to discussion after every talk. Many of them mentioned this was the first time they attended a meeting like that and that it was the most beneficial part of the meeting. Also, the available shared office space promoted small group interactions that were highly appreciated by the participants.

The meeting had a good balance between experienced and junior researchers and between female and male scientists. The participants mentioned this was refreshing and enjoyable, and that it made the event more dynamic. The coffee room with the whiteboard allowed people to have discussions while enjoying their coffee and the white board was perfect for participants to write questions they had which then were discussed in the final round table.

The meeting concluded with subgroups discussions where each group was given the following task: if you were given all funding possible with no restrictions, what would be the research question you would address and why? These subgroups presented their ideas at a round table. Participants indicated that this was one of the activities they enjoyed the most. They dare to think of ideas that passionate them the most and also it gave junior researchers another opportunity to speak up their minds without feeling the pressure of a larger audience. A couple of subgroups coincided on the idea of pursuing research on "quantum photonics".

Rienk van Grondelle (Amsterdam, Netherlands)
Alexandra Olaya–Castro

Transition Disks and Planet Formation

2 – 6 March 2015 @Oort

Cornelis Dullemund (Heidelberg, Germany)
Nienke van der Marel (Leiden, Netherlands)
Richard Nelson (London, United Kingdom)
Paola Pinilla (Leiden, Nethetrlands)
Jonathan Williams (Honolulu, Hawaii)

Social Support TAT: Theory, Applications, and Technology

16 – 20 March 2015 @Oort

This workshop dealt with the theory of social support, how this relates to a healthier and happier life, and how technology can improve or damage that relationship. From our perspective, the workshop was an immense success: It contributed to our NIAS group's theoretical development, while it also contributed to the development of new hard– and software. The workshop was crucially important for both goals. More detail on each is provided below.
One of the main reasons for our success was because of its unique setup: The workshop mixed theory (via scientific talks) with hard– and software development. Specifically, hard– and software developers attended talks, but also left the room for talks to work on their own applications. During our workshop, a number of brainstorm sessions during which scientists gave suggestions to developers, and developers presented what opportunities lay ahead. This setup – which was a novel one to us and all participants – immensely contributed to the week, and we would retain the same setup were we to organize it again.

In order to guide our guests through the week and through these activities, we had specified a number of goals prior to the workshop. The first and most important goal was to discuss theoretical mechanisms crucial to social support from a diverse set of theoretical backgrounds, like biological psychology, clinical psychology, social psychology, developmental psychology, sociology, anthropology, and medicine. These talks ranged from fundamentally theoretical talks focusing on elementary understanding of how relationships economize effort to deal with the world or on which kinds of relationship models help us understand social support, to more specific talks that discussed which kinds of technologies are currently being implemented in medical care.
Hard– and software development

The hard– and software developers (which we coined our "Living Lab") showed our scientists how relatively easy it was to develop new applications. The presentation of their products ranged from affordable VR glasses, to easy to implement software, to wearables that measure heart rate, skin temperature, and blood glucose, to sensors that are implemented into one's skin. During the week, one scientist and one developer developed an app that helps them do an experiment to train empathy within a romantic relationship. After the workshop, another scientist teamed up with a couple of developers to create a small camera aimed to assess the crying of a participant (it is currently under development, see also here: http://www.pavlov.io/2015/07/01/detecting–crying–eyes/). Our own lab has continued developing hard– and software after the workshop, and the progress in developing this hard– and software would not have been possible without the Lorentz workshop (available here: http://www.pavlov.io/category/blog/). In approximately half a year, we will get in touch with the workshop's participants to monitor their progress (and to inform them of others' progress).
Theoretical progress

The NIAS theme group utilized the workshop to advance its theoretical development. This progression was significant, for a number of reasons. First, it helped the group realize what was and is possible in terms of technological applications, and, second, it helped the group in terms summarize pathways to social support that are not only crucial from a theoretical perspective, but are also the most crucial ones for those working in care communities. The workshop was thus essential in making our progress possible. The entire group feels strongly that we now have made a strong advancement in our understanding of technology and social relationships, and we feel that with our manuscript, we will make a strong theoretical breakthrough once we are finished.

Berry Aarnoudse & Jos van der Loo (Oisterwijk, Netherlands)
Hans Ijzerman (Tilburg, Netherlands)
Spike Lee (Toronto, USA)
Frederic Petrignani (Delft, Netherlands)
Fieke Wagemans (Tilburg, Netherlands)

JML: Advancing Specification Language Methodologies

23 – 27 March 2015 @Snellius

The Java programming language is by far the most popular object–oriented programming language, and the most popular programming language in teaching. The Java Modeling Language (JML) aims at providing uniform means to describe and establish formal correctness of Java programs. JML is being developed as a decentralized community project since around 1999. It is an annotation language based on the principle of design–by–contract, where classes are formally specified with invariants and single class methods are specified with pre– and post–conditions. Although design–by–contract is commonly associated with classical imperative approaches to formal verification based on Hoare logic and calculus, the verification techniques based on JML go considerably beyond this classical paradigm.

In the past years, JML has matured and is known to a broad audience of software engineering practitioners, researchers, university teachers and university students. There are several different methodologies for (more or less formal) verification. JML is now being applied in real–time, embedded, and concurrent systems; and for properties which go beyond functional correctness such as information flow security.

The research goals centered around JML are (i) to advance the art of specification and verification, (ii) to define and clarify the semantics of specifications in order to unify verification, and (iii) to make the JML based verification methods more practical. The practicality factor is especially important in university education, where the verification principles should be in focus. Following its title, "JML: Advancing Specification Language Methodologies", our Lorentz Center workshop was dedicated to:

- Further develop the design of JML and JML–like languages, in particular targeting the challenge of accommodating different specification and verification philosophies, as well as the different programming and execution platforms;
- Unify the corresponding research efforts scattered around the world;
- Share experiences and develop ideas for teaching formal specification and verification using JML and similar paradigms.

The workshop took roughly four and a half days with most participants staying the whole duration of the workshop. Generally, the program was divided 50/50 between scientific presentations (typically 30 minutes slots) and plenary discussions. Additionally, we had one short remote session with two participants from the United States (Daniel Zimmerman and Joseph Kiniry of Galois) who could not attend the workshop in person, but had very interesting insights about the use of JML in industrial context.

With respect to discussions, we initially planned on having discussions about: (a) teaching of JML and formal methods, (b) a book about JML, (c) tools, (d) design and standardization of JML, and (e) industrial context. Discussions on topic (a) and (b) took place more or less as planned, however, during the course of the workshop the discussions on topic (d) took over most of the time allocated for the remaining topics. This was for a good reason and cause, as shortly described below. On Friday afternoon, the workshop was concluded by a one hour quiz about Java and JML intricacies to finish the week in a relaxed yet focused fashion.

The most important part of the workshop outcome was setting up the task force (in the persons of James Hunt and Mattias Ulbrich) for organizing and cleaning up the JML standard. During the scientific presentations by the representatives of the different research groups it became apparent that there is a lot of disagreement and unclarities about the semantics of the JML language, and hence corresponding (very heated) discussions emerged. The different aspects of JML were discussed one by one over the course of the workshop and specific participants were appointed to write a summary, distribute it, and progressively put the discussed changes into effect.

During the discussions and work on the potential book on JML a preliminary list of contents for the book was established, and the editors for the book were initially appointed. Since the standardization

of the JML language is one of the prerequisites for the book, the book is one of the motivating factors for the work described above. A similar conclusion was developed in the sessions on JML in teaching. The participants emphasized the need for a more stable language and more stable tools supporting it. Many courses would benefit from a textbook.

Finally, it was decided that a follow–up meeting should take place in about a year time, the KIT research group preliminarily agreed to lead and organize such a meeting in Germany next year.

Daniel Bruns (Karlsruhe, Germany)
Marieke Huisman (Twente, Netherlands)
Gary Leavens (Florida, USA)
Wojciech Mostowski (Enschede, Netherlands)

Socio-Economic Complexity

23 – 27 March 2015 @Oort

The aim of the NIAS–Lorentz Workshop Socio–Economic Complexity was to stimulate national and international interdisciplinary research and cooperation between economists, physicists, social scientists, ecologists, mathematicians, computer scientists and biologists to develop complex systems based approaches aimed at understanding systemic instabilities and crises in socio–economic systems.

The workshop brought together leading experts in complexity from different fields. The aim of the workshop was to stimulate and intensify national and international cooperation and to start concrete joint research projects applying complexity tools to the socio–economic domain. Each day focused on one common theme. The leading question was: how can complexity tools be used to address socio–economic applications and problems and to manage the fragility and resilience of complex socio–economic systems? The five domains and themes were:

- Complexity & Contagion in Social Systems;
- Complex Networks, Systemic Risk & Financial Fragility;
- Agent–Based Models & Epidemiology;
- Critical Transitions & Early Warning Signals;
- Complexity & Policy.

The workshop was very successful with more than 50 participants, 30 senior researchers including 16 distinguished speakers, with keynotes by Martin Scheffer (Wageningen), Andy Haldane (Bank of England), Carlo Jaeger (Gobal Climate Forum) and Charlotte Hemelrijk (Groningen), senior participants from mathematics, physics, ecology, epidemiology, biology, computer science, social sciences, economics, finance, banking and climate change, and about 20 postdocs and PhD students from different countries.

The last day of the workshop was devoted to Complexity & Policy and the workshop ended with a Policy Panel Debate between academics and policy makers (e.g. from DNB and CBS). The best sign that the workshop was successful is perhaps the fact that the participants with very heterogeneous backgrounds seem to speak a common "complexity language". This also illustrates the success of the NWO Complexity program in the past five years, where many interdisciplinary meetings have been organized. The policy panel debate worked very well with stimulating discussion about complexity research and its relevance for policy.

Participants can submit their contributions to a special issue of the new journal Complexity Economics planned to appear in 2016. The organizers together with the keynote speakers are preparing an article on Complexity and Policy to be submitted to the Insights section of Science.

Stefano Battiston (Zürich, Netherlands)
Andreas Flache (Groningen, Netherlands)
Diego Garlaschelli (Leiden, Netherlands)
Hans Heesterbeek (Utrecht, Netherlands)
Cars Hommes (Amsterdam, Netherlands)

Brain Equations: Challenges and Next Generation Mathematical Models

13 – 17 April 2015 @Snellius

Neural mass models are most suitable in scale to relate to a variety of both clinical and experimental imaging modalities, such as EEG, MEG and fMRI. But since these models have a weak connection to known biology (for they do not include all relevant biological details), it is debatable how useful the results are that are obtained from these procedures. Although the performance of imaging techniques has vastly increased in the last two decades both in terms of spatial resolution and analysis techniques, neural mass models have barely advanced. In order to ensure that the mathematical neuroscience community will be able to keep providing theoretical support to the life sciences, it is critical to push the field forward.

The primary aim of the workshop was to identify the relevant challenges of neural mass models and define corresponding objectives for the community.

To prepare the discussion, three notes have been written:

- The theory of elliptic condition: do we know what we need to know? (Stiliyan Kalitzin);
- Inverse problems and data assimilation for brain equations – state and current challenges (Roland Potthast);
- Towards mean–field analysis of spiking neural networks (Hil Meijer and Sid Visser).

These discussion papers sparked of a lot of discussion. For instance about models and how to evaluate them. It is inevitable that models in neuroscience cover many scales: from the microscale at the single neuron activity, as measured by micro–electrodes, to mesoscale collective synaptic currents as measured by EEG. Neural fields provide the framework to describe neural activity at the mesoscale. Structural information from dMRI can directly be used to infer results on connectivity, one of the ingredients for the neural fields. Mathematically challenging inverse problems arise when coupling EEG data to neural field equations. The same can be said for other modalities, like MRI, fMRI or SPECT. While the latter modalities give information about function, and the neural fields are based on structure, the inverse problem couples structure to function.

A relevant discussion on the modelling was devoted to electro–neutrality. As it turned out, many of the models used for spreading depression, also relevant for epilepsy, have the aw that they don't respect this basic principle. New models will have to be made that deal with this issue. This has not been settled during the workshop, but the mere fact that this is yet agreed upon is already a breakthrough.

At present the math departments of the technical universities are preparing a large proposal to further develop mathematical methods to image the brain. The discussion at the Lorentz center on the relation between structure and function is part of this proposal.

To have the three notes available even before the start of the meeting was really helpful. It centered the discussion and showed the commitment of the authors to the workshop. There were relatively few talks and lots of time for discussion. This gave for instance ample time to discuss the electro–neutrality issue with some of the specialists present. As always, the staff of the Lorentz Center did a marvelous job to make everything very smooth.

Stephen Coombes (Nottingham, United Kingdom)
Stephan van Gils (Enschede, Netherlands)
Paul Tiesinga (Nijmegen, Netherlands)
Sid Visser (Nottingham, United Kindom)

Amyloid Aggregation: Single Molecule Approaches to a Many Molecule Problem,

13 – 17 April 2015 @Oort

The aggregation of proteins into amyloid nanostructures is relevant for both disease and for functional materials. Current efforts to study amyloid formation are based predominantly on bulk approaches that are not well suited to capture the dynamics and structural changes associated with individual (mis)folding transitions critical to a mechanistic understanding of the early aggregation process. This workshop focused on recent developments in experimental biophysics, including innovative single–molecule techniques, which have begun to yield unprecedented molecular and dynamic views on protein aggregation. Internationally this is an extremely timely, rapidly–developing, and relevant topic (c.f. KNAW Heineken prize 2014 to Dobson).

This workshop brought together key international players, including a mix of biophysicists, (bio)chemists, molecular modeling experts, and biologists, applying these approaches to study protein aggregation across length scales from molecules to cells and organisms. Our hope was that the workshop would:

- Enable an open exchange about the nuances of the latest experimental approaches, with a particular emphasis on single molecule spectroscopies, applied to protein aggregation;
- Establish key targets in the protein aggregation pathway that are amenable to study by these approaches;
- Create cross-disciplinary interactions amongst scientists from different communities and disciplines.

In addition, a number of senior investigators from the Dutch scientific community participated in the workshop (full list of participants available), augmented by a number of junior scientists from the Netherlands and abroad, who thoroughly enjoyed the opportunity to interact with each other.
Reflection on workshop: We held the workshop to discuss the properties of intrinsically disordered proteins and their aggregation behavior. To summarize, an analogy that came up at the last day of the workshop is particularly telling: the proteins we deal with normally resemble a mountain landscape with well–defined valleys separated by high mountain ridges. The energy landscape of intrinsically disordered proteins, on the other hand, resembles the landscape of The Netherlands. Experiment and theory is well established for the former class of landscape, the Dutch landscape–type proteins are more challenging.

The workshop atmosphere was described by all participants as unusually open with particular mention that discussions went into a depth that was well beyond what the participants would share at conferences. Interdisciplinary discussion sessions worked very well, and researchers from different backgrounds started talking to each other, which was widely appreciated by many participants. Scrutinizing biophysical results for their biomedical relevance was common and lead to new viewpoints.

At the level of the junior participants (graduate students and postdocs) the interest in their work and meeting the big–shots that they knew only from the publications was particularly valued. Most participants managed to stay throughout the workshop or at least a large portion thereof, thus providing ample opportunity to discuss questions in detail.
We found the interest in the break–out sessions remarkable and were very happy at the ample preparation that the session chairs showed.
Finally, several initiatives arose from the workshop, such as comparing experiments and theory to better describe the conformation of disordered proteins by theory and efforts to initiate new collaborations on the interface of biophysics and biochemistry/cell–biology experiments relevant to disease.

Acknowledgment of financial support: We are grateful to the Lorentz Center, the FOM program "A Single Molecule View on Protein Aggregation" (SMPA), the Leiden Institute of Physics (LION), and the KNAW Congressubsidiefonds for financial support of this workshop.

Now here we stand and feel derided, the curtain falls and nothing is decided. Freely translated from Bertolt Brecht, The Good Person of Szechwan. But actually scientists feel relieved, not derided, if there still exist many open questions.

The atmosphere of the Lorentz Workshop was very good. The participating scientists discussed openly and freely. Nobody was defensive about their methodology or favorite results and participants did not shy away from admitting ignorance in fields other than their own. According to my observations everybody, including the most established and renowned participants, learned a lot.

This observation on a friendly and open atmosphere does not mean that there were no controversies. We were good in agreeing to disagree, in many cases. In fact, the atmosphere was very critical. Even the most impressive results were questioned, at the very least concerning their relevance for understanding amyloid–related diseases. It was even questioned whether the topic of the workshop constitutes a (homogeneous) field of science: "An aggregate is not an aggregate is not an aggregate." Still I think, considering how well we could talk to each other, molecular cell biologists to physical chemists, computational chemists to biochemists, biophysicists to people using genetic approaches, a common field of research certainly does exist and it became clear that such a workshop was necessary for everybody to understand the complexity of the topic.

We learned that minute details (e.g. N–acetylation of the N–terminus of syncline influence structural preferences and that living cells tend to convert syncline to the form that they prefer, independently which form is supplied to them. We heard the hypothesis that one function (or the function?) of ·–syncline might be the detoxification of peroxidated lipid molecules. We learned that, yes, fibrillization may be a defense mechanism that prolongs cell life, but that cells will die nevertheless, only a bit later. We also learned that death is overestimated, at least in the sense that even living neurons may not function anymore if they are full of amyloid aggregates, but that their function can be restored. In ·–syncline structural propensity does not seem to change for residues more than two peptide bonds away from a mutation site, but for A·42, introduction of a single cysteine or spin label appears to cause a drastic shift in the ensemble of conformations visited by the monomer. We don't know yet, what is really toxic, it is probably more than one species. Cyclic D,L–peptides appear to be able to disassemble aggregates, but we don't know how. In A·, mutations that turn a certain charged residue from the inside to the outside in fibrils might be causing disease. We learned that in vitro models for membranes are rather poor mimics of biological membranes and that syncline happily interacts with the former, but is not seen by in–cell NMR to interact with the latter. Metal ions definitely play a role in amyloid–related disease, but are often neglected when possible mechanisms are discussed. Some conformers of amyloidogenic proteins appear to be hyper mechanically stable, in fact very surprisingly stable against full stretching, but it is not known what molecular basis such stability could have. Everybody appears to agree on one thing: A·1–40 and A·1–42 are two very different animals. In MD simulations of intrinsically disordered proteins, the choice of force field, of water model, and the specific treatment of water–protein interaction can cause quite significant differences in structural propensities and radii of gyration. If not enough care is taken, syncline is more compact in silico than in experiments. Very coarse grained models reproduce some features of fibrilization, but cannot yet connected back to more detailed models. Careful kinetic experiments provide an unequivocal determination of the rate–determining step in fibril formation in vitro. Fibrils catalyse oligomer formation, which might explain that mixtures of fibrils and monomers are more toxic than either of the components alone. Secondary nucleation appears to be the culprit and can be inhibited by a certain chaperone.

I would conclude that we were treated to a lot of sophisticated experimental and theoretical approaches and to fascinating insights into detailed problems. Each piece of the puzzle is colorful, beautiful, and painted with great care in great detail. How the pieces fit together we don't know. This

may suggest that a full picture will emerge only after many additional puzzle pieces will have been found.

Martina Huber (Leiden, Netherlands)
Vinod Subramaniam (Twente, Netherlands)

Python in Astronomy

20 – 24 April 2015 @Oort

The aim was to bring together Python developers, users, and educators in Astronomy to share information about state–of–the art Python Astronomy packages and resources, and some of the concrete goals we outlined when applying for the workshop were:

- Improving interoperability between astronomical Python packages;
- Providing training for new contributors;
- Developing a common set of educational materials for Python in Astronomy.

In total, 54 participants attended the meeting. The format of the meeting was designed to include presentations in the mornings, and free–form unconference sessions in the afternoons. The idea of the unconference time was to allow participants to propose and vote for sessions during the workshop itself. Individual unconference sessions were typically one hour long, and there were usually at least three parallel sessions. The main categories of unconference sessions were tutorials and demos, discussions about future plans for development of packages, discussions on educational resources, discussions on community aspects, and finally coding sprints/hacks.

During the workshop, we were able to make significant progress towards the above goals:

- From the point of view of interoperability, we had a number of discussion sessions and hands–on sessions to define common data structures that could be used across many projects. For example, we were able to agree on a roadmap for having all tools that deal with astronomical spectra share a common type of data object, and we also had an extensive discussion on how to represent regions on the sky, which is something that is needed by a number of different packages. Essentially, by agreeing on common data structures such as these that can be implemented in core packages, we were able to ensure that many tools will then automatically work together in future.
- In terms of training new contributors, we held a number of tutorials aimed at training people with existing programming experience on how to use version control systems, how to build packages, and how to publish them. Most participants who had never contributed to open–source software previously made contributions to real open–source packages for the first time during the week, and several participants were able to publish their own software for the first time.
- As far as developing a common set of educational materials, we laid the foundations for this by first collaboratively compiling a census of existing resources which can be found on the Astrobetter wiki. We also laid out plans for re–designing and re–launching the http://www.astropython.org website, which is intended to be a portal for all things related to Python in Astronomy, including educational resources, but was not actively maintained prior to the meeting. The Astropy project has a student funded by Google who will now work on creating this new website over the summer.

Talks and unconference sessions covered a number of other topics, including modeling tools, statistics, photometry, observation planning, and so on. Several hands–on/sprint sessions made concrete progress on various issues.
The talks given in the morning sessions have been collected in a Github repository (DOI: http://dx.doi.org/10.5281/zenodo.17666), and the videos are beeing posted to a Python in Astronomy Youtube channel. We are currently also writing a proceedings document that will be published online, and which contains detailed summaries of all the 'unconference' sessions.

The workshop has already had a significant impact beyond simply those present. The meeting was followed via social media by a number of people who were not able to attend. In total, over 2,500 tweets were sent by people at the workshop and other people in the community (using the hashtag #pyastro15). We also created a new "Python in Astronomy" community group on Facebook, where over 500 people signed up within a week of the end of the workshop. There was unanimous

agreement amongst participants that this type of meeting should be repeated on a yearly basis, and we are now in the process of planning the 2016 meeting!
We are extremely grateful to the Lorentz center for making this meeting possible, and we were also fortunate to have generous sponsors (GitHub, LCOGT, NumFOCUS, and the Python Software Foundation) who provided generous travel support. This allowed us to ensure that no one was prevented from attending the meeting for financial reasons.

Pauline Barmby (London, Canada)
Eric Jeschke (Hilo, Hawaii)
Sarah Kendrew (Oxford, United Kingdom)
Stuart Mumford (Sheffield, United Kingdom)
Magnus Persson (Leiden, The Netherlands)
Thomas Robitaille (Heidelberg, Germany)

Micro-flow and Survival - The Role of Slow Flows in Biological Physics

20 – 24 April 2015 @Snellius

Marco Cosentino Lagomarsino (Paris, France)
Christopher Lowe (Amsterdam, Netherlands)
Ignacio Pagonabarrage (Barcelona, Spain)

The Life and Death of Satellite Galaxies

28 April – 1 May 2015 @Oort

The aim of the workshop was to bring together observers and theorists who were working on all ranges of satellite galaxy evolution from nearby systems like the Milky Way and the Local Group, Virgo and Coma, all the way to the most distant clusters, groups, and protoclusters, to discuss a consistent framework of satellite galaxy evolution across the observable ranges in mass and redshift. Ultimately, the goal of the workshop was to identify common connections between the physics of satellite galaxy evolution of different scales and epochs.

In total, 40 participants attended the meeting. To make progress on these topics the workshop emphasized group–wide discussion sessions, review talks and targeted talks on specific recent progress. To begin the workshop, the organizers drew up a list of questions which would bring together the physics of satellite galaxies, and which could be relevant across all scales and redshifts. The workshop proceeded through each session, always followed by a discussion that focused on the insights gained on these main questions.

Despite the wide–range in scientific focus, the participants were engaged throughout. Several areas of common connection and future avenues were identified. In particular, the gas content of satellite galaxies from current and future radio telescopes, the resolved stellar populations from future large optical telescopes and low surface brightness imaging are all regions where a common technique can be applied to the Local Group and higher redshift. Several collaborations to exploit these opportunities were formed.

We are very grateful to the Lorentz center for making this meeting possible. The combination of focused sessions and the time and space for small group contemplation has surely added to our collective scientific knowledge.

Alis Deason (Santa Cruz, USA)
Sean McGee (Leiden, Netherlands)
Adam Muzzin (Leiden, Netherlands)
Stephanie Tonnesen (New Jersey, USA)
Andrew Wetzel (Pasadena, USA)

Energetic Processing of Large Interstellar Molecules

11 – 13 May 2015 @Snellius

The Lorentz workshop brought together an international and interdisciplinary community for research on Energetic Processing of Large Interstellar Molecules to overview the state of the art in experimental and theoretical studies on energetic processing of large molecules by ions and photons and address the key questions and strategies to advance our understanding of large molecules in space. Experts were drawn from working Group 2 of the XLIC COST action (CM1204) Energetic Processing of Large Interstellar Molecules and from Theme 3, Interstellar PAHs, of the Dutch Astrochemistry Network (DAN). These experts covered the fields of molecular physics, physical chemistry, and astronomy, including molecular physicists involved in laboratory or quantum chemical studies on the interaction of energetic ions or photons with large molecules and astronomers involved in studies of the origin and evolution of large molecules in space. The program consisted of invited reviews in this highly interdisciplinary field supplemented by contributed talks sketching the depth of on-going research. The program also included ample time for discussion. The workshop was attended by 26 scientists from 10 countries.

The workshop has very successful in defining the key questions for the field and advised strategies to address these (see below). Specifically, the close interaction between the participants facilitated the definition of a number of new joint experimental, theoretical, and observational studies with the aim of understanding energetic processing of large molecules of astrophysical relevance, including polycyclic aromatic hydrocarbons as well as carbon chains, and fullerenes.

Progress in these joint projects will be monitored at a successor meeting on Energetic Processing of Large Molecules (EPoLM-2, April 11-13, 2016). EPoLM-2 will be held in conjunction with the XLIC Stockholm meeting which runs from April 13-15.

Henrik Cederquist (Stockholm, Sweden)
Ronnie Hoekstra (Groningen, Netherlands)
Xander Tielens (Leiden, Netherlands)

Transformations in Optics

18 – 22 May 2015 @Oort

The topic of this workshop was the conjunction of three very active fields in the physics of light and imaging: Shaped wave fronts, Metamaterials to structure the illumination and Compressive sensing. These fields are of interest to researchers in academic and industrial settings.

The participants were a mix of four categories:
- Well known senior research leaders;
- Junior professors and young faculty;
- Ph.D. students and postdocs;
- Researchers in an industrial setting (e.g. TNO, ASML, Zeiss).

The workshop was fully booked, with most participants staying for the full length of the event (we noticed that only by Friday there was a decline in the number of participants present). Many participants were present at the social events and "breakout" discussion sessions. It was noted that the participants from industry played a very active role in the discussion sessions and in chairing and discussing.

The scientific program contained several different types of sessions:
- 10 Keynote lectures (40+5 min);
- 5 Tutorial lectures by keynote speakers (90 min);
- 8 Invited lectures (35+10 min);
- 3 Breakout discussion sessions (90 min);
- 1 Poster session.

The total of 23 lectures is about the maximum one should schedule in a one–week workshop. Almost all lectures were very well attended and raised significant discussion. Discussion time was planned between the lectures, with the speakers requested to keep to a 40+5 minute time slot. In practice, 5 minute discussion is barely enough and most speakers tend to slightly overrun their time slot, so that it may be more effective to schedule short breaks in between the talks.

Tutorial lectures were an experiment in this workshop which worked very well. While not every tutorial lecture was accessible to all the participants, a number of participants indicated they found the tutorials an extremely useful component of the workshop. The tutorials were spread through the week, this worked well, and is probably better than having all tutorials on one day.

The coffee and tea breaks were very effective means to stimulate discussion, especially since whiteboards and tables for discussion were nicely available and posters could stay up all week.
The breakout discussion sessions were organized to start with a "break–in" where several discussion leaders (from academia and industry) presented their possible topic. In these sessions especially the application oriented themes contributed by the industrial participants were intensively discussed. In breakout sessions some participants tend to leave the discussion. This is not a problem thanks to the offices at the Lorentz center floor.

What went well:
- The tutorial lectures were a success;
- The participation by industrial researchers was very active;
- There was intensive discussion in practically all breaks;
- The poster session on the first day was good, especially since participants could revisit posters during the week.

What could be improved:
- More small breaks to have more discussion time after talks;
- Discussion sessions: More, but shorter sessions could be more productive;
- Total number or time of talks could be reduced to make more time for discussion;

- More use could be made of the unique infrastructure of offices.

During the workshop a fire alarm went off. This led to some confusion as it was not immediately clear whether this was a test and by which route to leave the building. Thanks to the Lorentz center staff the building was evacuated quickly and in good order. However it would be good to avoid this initial confusion in case a true emergency happens.

In summary this workshop was generally regarded as a great success. Surprisingly (at least to the organizers) some of the most useful aspects named by the participants were the background material on structured illumination and compressive sensing that was brought forward in the tutorial lectures. The workshop has brought together researchers from several very different settings and stimulated contact between academia and industry. As importantly, the participants enjoyed the excellent atmosphere and ambience of the Lorentz Center and Leiden.






Carlo Beenakker (Leiden, Netherlands)
Allard Mosk (Utrecht, Netherlands)
John Pendry (Cambridge, United Kingdom)

Integrated Plasma Modelling of Solar Flares

18 – 22 May 2015 @Snellius

Hugo de Blank (Nieuwegein, Netherlands)
Philippa Browning (Manchester, United Kingdom)
Giovanni Lapenta (Heverlee, Belgium)
Vyacheslav Lukin (Washington, USA)
Valery Nakariakov (Coventry, United Kingdom)

Models and Numerics in Financial Mathematics

26 – 29 May 2015 @Oort

We selected 27 international top scientists from academics and industry in the research areas related to the workshop theme to present a lecture or to moderate a group discussion. In total 61 researchers registered and participated in the workshop, from 13 different countries. Of these researchers, 17 are member of the EU funded Initial Training Network (ITN) STRIKE, with 8 early stage researchers (ESRs).

This workshop had different purposes:

- Discussion of stochastic models involved in post–crisis financial products, and concepts to reduce the risk of losses due to unexpected market conditions;
- Bring together experts in different numerical techniques (Monte Carlo, PDEs, quadrature); inform each other about the latest advances and exchange in particular information about the cross-fertilization between these methods;
- Bring together academic researchers in financial mathematics with practitioners from renowned financial institutions;
- Members of the STRIKE project present their research results in computational finance.

All four purposes listed above were amply reached at the workshop. The group of participants formed a very good mix between junior and senior researchers and between academic and industrial researchers. The quality of all presentations was high. They were allocated in the program according to the workshop themes, and covered these very well. Each lecture was followed by 10 minutes of questions. The pleasant workshop atmosphere created much fruitful interactions, also beyond these formal moments, for instance during the coffee breaks and the lunches and dinners.

Ample attention was given to the communication of the research results obtained in the ITN STRIKE project to the other workshop participants. Prof. Matthias Ehrhardt presented an overview lecture with the state-of-the-art of the STRIKE project and dr. Christof Heuer gave a demonstration of the first version of the computational finance toolbox. All ESRs presented posters on their recent research results, which were on display the whole week of the event and attracted much interest by all participants. The poster display was preceded by a ash presentation on the first day of the workshop, where all poster contributors were given the opportunity to brief introduce themselves and their research.

On Wednesday afternoon a special session was held tailored to the industrial needs, with lectures by participants from Banco Santander (Spain), ING Bank (The Netherlands) and Math Finance (Germany), who presented financial models that are used nowadays and their effective implementation on modern computer platforms. The financial industry was well represented at the workshop, with researchers also from Rabobank (The Netherlands), KBC Bank (Belgium), Bank of America (USA) and Calypso (France).

On Thursday and Friday afternoon two group discussions among the workshop participants were organized. These were centered around two contemporary topics in finance:

- PDEs, Quadrature, Monte Carlo methods. Which formulation to use for modern financial problems?
- Models and products after the credit crisis.

These one-and-a-half hour discussion sessions were excellently moderated by two experts, prof. Peter Forsyth and dr. Mie Staunton, and led to much interaction and new insight and ideas.

On Thursday evening a very pleasant boat excursion with Indonesian dinner was held on the lakes and rivers near Leiden. The sunny weather, beautiful scenery and fine food inspired more discussions and networking among the participants.

As a particular outcome of the workshop, a special issue of the renowned Journal of Computational Finance will be devoted to it.
All the goals of our workshop have been accomplished, and we therefore consider it to be a highly successful event.

Karel in 't Hout (Antwerp, Bergium)
Cornelis Oosterlee (Amsterdam, Netherlands)

Geometric Invariants and Quantum Spectral Curves

1 – 5 June 2015 @Oort

The workshop was devoted to the core problems of the theory of topological recursion and quantum spectral curves and its interaction with combinatorics, geometry of moduli spaces, and integrable systems. The key topics were: Givental and Frobenius structures; quantum spectral curves and topological recursion; discretizations of moduli spaces; Hurwitz numbers and related generating functions; quantum Riemann surfaces and knot invariants.

The workshop attracted a big amount of experts specializing in the theory of topological recursion as well as prominent scholars working in the area of interaction of geometry of the moduli spaces of curves and integrable hierarchies. We also had a huge number of PhD students.

Though there is no obvious breakthroughs or "aha" moments that we can report so far, the discussions were really very fruitful. It is sufficient to mentions, for instance, the discussions that we had on global spectral curves in singularity theory, where two different groups have not only completely different approaches but also literally completely different curves as an outcome.

The format of the workshop was absolutely standard, which is the best for scientific discussions (a few lectures in the morning and the afternoon, with an ample time for discussions in small groups). A special focus was on the introduction and discussions with PhD students, we had special sessions for that, and they were very well received. Also the morning lectures were requested to be more focus on general exposition, and this was really a great benefit even for senior participants, since we managed to gather people with completely different points of view on the subject.

Though a very small time has passed since the workshop, there is already a number of papers where the authors acknowledge it, for instance:

- Relations in the tautological ring, a PhD thesis by Felix Janda, http://webusers.imj–prg.fr/ felix.janda/thesis.pdf
- Lectures on the topological recursion for Higgs bundles and quantum curves, by M. Mulase and O. Dimitrescu, arXiv 1509.09007v1
- Edge-contraction on dual ribbon graphs, 2D TQFT, and the mirror of orbifold Hurwitz numbers, by M. Mulase and O. Dimitrescu, arXiv 1508.0592

Leonid Chekhov (Moscow, Russia)
Bertrand Eynard (Gif–sur–Yvette, France)
Sergey Shadrin (Amsterdam, Netherlands)

Future Perspectives in Computational Pan–Genomics

8 – 12 June 2015 @Oort

Aims and Description: Pan–genomics studies, which are concerned with research on large, coherent collections of genomes have particularly profited from the drastic increase in throughput and the drastic cost reduction of sequencing experiments. In fact, the era of pan–genomics has just begun. Sequencing data from genome collections is massive ('big'), noisy and poses complex computational questions. The corresponding issues affect several communities, such as population, cancer and pathogen biologists. The driving idea underlying this workshop was to systematically create maximum synergy among the communities in this exciting fresh new area of research. The goal was to survey existing and anticipate future computational challenges, and to identify both common denominators and discipline–specific challenges.

Tangible Outcome: As an incentive for active participation, we have been writing a white paper that documents and summarizes the ideas raised during the workshop. Writing this white paper proceeded (extremely!) favorably – nearly everyone made major efforts to contribute. Participants are still actively editing this paper and at this point, nearly 50 valuable pages have been written. The goal is that this white paper will serve as a 'roadmap' for the forming community of 'computational pan–genomics' for the coming 2–3 years. We are aiming at publishing this paper in a high–impact journal.

Scientific Breakthroughs: Pan–genomics need novel data structures, indices and compression schemes, as well as the corresponding algorithms that allow for arranging (sometimes exhaustive) collections of genomes efficiently. Many ideas were raised during the workshop. Once implemented, scientific breakthroughs in several areas of biological research, often concerned with health–related questions, will be "unavoidable". Computational pan–genomics is interdisciplinary research. While new inspiration is to be expected also for computer science, real breakthroughs, in terms of scientific relevance, are to be expected in particular in biomedical research, which depends on underlying "data infrastructure".

"Aha" Moments: We realized already before the workshop that the interest would be enormous. Several "big shots" (e.g. Evan Eichler, Jan Korbel, two leading genomicists of our times) agreed on participating. During the workshop, the "Aha" effect consisted in watching the great momentum during the discussions. It was obvious that the majority of participants was "burning" to contribute. We believe that, as a topic selected, "computational pan–genomics" was just perfectly right, both in terms of topic and point in time. By mere coincidence, another workshop concerned with similar topics, also taking place in Leiden, organized by the "Global Alliance for Genomics and Health" (run by globally leading institutions such as the Sanger Institute, Cambridge), was running in parallel. Several participants (from renowned institutions) of this workshop got aware of our workshop and joined ours (and not the other way round), actively participating by giving spontaneous short talks, and (still) actively contributing to the white paper.

In summary, the "Aha" moment was to observe the huge interest and the currently enormous momentum of the newly forming field of "computational pan–genomics". The workshop seemed to happen perfectly right in time.

Format of the workshop: The "Lorentz format" was just absolutely perfect for this workshop, there could not have been a better platform for this. Ample room for discussions and work/writing sessions, also in combination with lots of free time to reflect and interact with others on a more private basis were key to success for this workshop!

Victor Guryev (Groningen, Netherlands)
Tobias Marschall (Saarbrücken, Germany)
Alexander Schönhuth (Amsterdam, Netherlands)
Fabio Vandin (Odense, Denmark)
Kai Ye (Saint Louis, USA)

Dynamics and Geometry

15 – 19 June 2015 @Snellius

The main objectives of the workshop were:

- Communicate Recent Advances in Geometric Methods for Dynamical Systems
- Extend Methods for Low–Dimensional Systems to High–Dimensional Systems
- Applications to High–Dimensional Systems from Celestial Mechanics, Molecular Dynamics and Other.

The workshop was a great success and very well perceived by the participants. Almost all of the invited speakers came to the workshop and gave talks along the lines of the main objectives. In total there were 51 participants which included 26 speakers and 13 PhD students. In addition to the throughout high quality talks there were lively discussions after each of the talks and during the free time in between the talks. Basically all participants contributed to the discussions which were experienced as very fruitful and stimulating. PhD students had the opportunity to present their work on posters. Six (plus one senior participant) have made use of this opportunity. There was a strong interest in the posters resulting in many small group discussions in front of the posters during the breaks. This very much stimulated the interaction between PhD students and senior workshop participants.

A major result of the workshop is a conference proceedings which will be published as a special issue of the journal Indagationes Mathematicae. The special issue will have the same title as the workshop. To this date a substantial number of participants have already submitted their manuscripts for the proceedings.

These manuscripts are presently going through a proper refereeing process. The special issue will be published in 2016. Accepted papers will moreover be published online on the website of the journal immediately after their acceptance.

Heinz Hanßmann (Utrecht, Netherlands)
Igor Hoveijn (Groningen, Netherlands)
Sebastian van Strien (London, United Kingdom)
Gert Vegter (Groningen, Netherlands)
Holger Waalkens (Groningen, Netherlands)

Clusters, Games and Axioms

22 – 26 June 2015 @Oort

The workshop concerned the study of cluster analysis using techniques developed in machine learning, game theory and social choice theory.

The primary goal was to create a forum for discussing common research objectives and to unravel and study in depth these striking, not well–known, parallels in these research areas. Examples include axiomatic approach and iterative methods.

The workshop was attended by about 33 participants. It provided a multi–disciplinary forum during which issues and achievements in research on clustering, social choice theory and game theory were discussed.

The presentations together with the discussions in groups led to the identification of interesting issues, analogies and related concepts and problems across the three topics of the workshop.

In our view this structure of the program, with few lectures and much time left for discussion, strengthened synergy among researchers from these different disciplines. In particular researchers working in game theory, social choice theory and machine learning identified related research questions and issues concerned with the study of cluster analysis.

In summary, this workshop will hopefully lead to new research directions and to new advances in all three fields.

Krzysztof Apt (Amsterdam, Netherlands)
Jerome Lang (Paris, France)
Elena Marchiori (Nijmegen, Netherlands)
Marcello Pelillo (Venezia, Italy)

The Impact of Massive Binaries throughout the Universe

29 June – 3 July 2015 @Oort

Massive stars are instrumental to many areas of astrophysics, both in the local universe and at high redshift. The last decade had seen growing evidence of extreme multiplicity rates and a propension for a large fraction of massive stars to interact with a binary companion before their final explosion. Such interaction has drastic consequences for the further evolution and final fate of both components. However, the exploration of these effects on entire stellar populations, nearby and at high redshift, and on their observational diagnostics, is still in its infancy. With this Lorentz Workshop, we have bridged the gap between the massive stars and extragalactic communities and explored how binarity affects the role of massive stars as Cosmic Engines and as Cosmic Probes in modern astrophysics. We have reviewed the latest observational and theoretical advances and identified future research directions.

A Lorentz workshop was the ideal format to address this topic given its interdisciplinary nature and the cross–fertilization of fields needed to progress in our understanding of the impact of massive binaries throughout the Universe. The workshop program was designed to leave at least 2h of work / breakout sessions in the afternoon allowing to create parallel sessions and/or work in small groups. This build–in freedom turned out to be very fruitful, yielding many animated discussions between scientists within and across their field boundaries.

The highlight sessions, extremely short, 5–min discussion starter talks followed by 10 min discussion with the audience, was another novelty that we introduced during this workshop and that contributed to create a special very interactive atmosphere. The format allowed the speaker to focus on the essential message, resulting in extremely sharp discussions in the core ideas of our field.

All in all, allowing for over three quarters of the workshop program to be dedicated to Q&A, discussions, interaction sessions and free time was the key for creating a very interactive atmosphere and extremely fruitful scientific discussions that have been pursued for beyond the week spend at the Lorentz center.

Selma de Mink (pasadena, USA)
Hugues Sana (Baltimore, USA)

Liquid Fragmentation in Nature and Industry

29 June – July 3 2015 @Snellius

Hanneke Gelderblom (Enschede, Netherlands)
Emmanuel Villermaux (Marseille, France)

Human Circadian Rhythms: Developing a Multi–Oscillator Framework

6 – 10 July 2015 @Oort

Human function is a result of a carefully orchestrated, hierarchical, multi–oscillator system that interacts with environmental cues. Traditionally, main stream human circadian rhythm research has focused on a reductionist approach, seeking to identify and model 'the' circadian clock. However, it is increasingly recognized that circadian rhythmicity is a result of many interacting clocks resulting in daily (circadian) rhythms in transcription and translation, physiological and behavioral cycles including, core body temperature, melatonin secretion, blood pressure the sleep/wake cycle and cycles of feeding and fasting.

The aim of this workshop was to bring experimentalists and modelers together from different communities, all interested in modelling human circadian rhythms but from different perspectives. The motivation was to consolidate existing knowledge and start to consider the architecture of the full, hierarchical, multi–oscillator system.

The workshop was attended by 50 participants from the US, Brazil, Japan and Europe. The first day set the scene with some general talks and discussion on the concept of considering human circadian organization as a multi-oscillator system. This was followed on subsequent days by considering what is known already at each different level, from the transcription-translation feedback loops that generate rhythms at the cellular level, to oscillations in the endocrine system, neuronal oscillators, oscillations of the periphery, sleep-wake cycles, the role of light as a zeitgeber, and circadian rhythmicity in the real world. The final session considered the consequences of circadian disruption for health. Each session included talks from biologist(s), mathematician(s) and a discussion. This format gave a coherent structure within which the diverse interests and expertise of the participants could be explored.

The week provided a rare opportunity for participants to spend time with people outside their normal research circles and reflect on the current status of the field from new perspectives. There were many inspirational talks; many people shared un–published data, enabling an open and frank discussion to take place on current knowledge and where further research is needed in order to develop a deep understanding of real world behavior of the human circadian system.
In order to further foster interaction between mathematicians and biologists, we assigned office space to make sure that in every office there was at least one biologist and one mathematician with overlapping interests.

Overall, the workshop has initiated a dialogue between biologists and mathematicians on the complexity of human circadian architecture. At this stage, it is hard to evaluate the legacy of such a meeting, but the meeting has sparked off new cross–disciplinary discussions and we hope this dialogue will develop and deepen over the next decade. There was considerable enthusiasm for a follow–on meeting in 2-3 years' time.

Derk–Jan Dijk (Surrey, United Kingdom)
Daniel Forger (Michigan, USA)
Anne Skeldon (Surrey, United Kingdom)

Paving the Way to Simultaneous Multi-wavelength Astronomy

13 – 17 July 2015 @Oort

The aims of the workshop were to establish means to facilitate multi–wavelength observing of sources which varied on relatively short (< day) timescales and emitted across orders of magnitude in wavelength. The lack of such observational strategies prevents an understanding of coupled emission for example in the jets in black hole binary systems. The meeting brought together high level mission scientists and instrument PIs (with representation from ESO, NuSTAR, Chandra, XMM–Newton, Swift, FERMI, ASTROSAT, Astro–H, eROSITA, JWST, Gaia, MWA, LoFAR, LSST, CTA, NRAO, Spitzer, SALT and other ground based telescopes), senior scientists working in the field and theorists, and was consequently unique in its format and scope.

In order to make progress on such an important and complicated topic, the workshop took the form of a series of short (~30 mins) invited talks with associated question and discussion time. The talks followed the logical progression of 'sources under discussion', 'present instrumentation', 'techniques' and 'forthcoming instruments'. Three strategy sessions provided opportunity for whole–workshop discussion and to address the issues central to the meeting. The details of the motivation, the obstacles and potential solutions will be presented in a forthcoming community white paper where all of the attendees will be co–authors. The key issues for the white paper were reinforced via sub–group discussions.

The format of the workshop was relatively unique given the breadth of discussion necessary to make progress. We found that the combination of the talks, discussion and pivotally, the range and experience of the attendees, lead to a successful and fruitful meeting. In particular, the contributions from NASA and ESA mission directors was invaluable and has informed our future goals of multi–lateral observing; notably, the possibility of discovering and triggering observations of new transients found in proprietary data was discussed and is also expected to be implemented within the observational framework of ESA's next generation mission, Athena.

Central to the workshop discussions was the issue of communication and how this could often be extremely difficult when attempting to coordinate observations between instruments. Whilst networks for studies of supernovae and gamma–ray bursts exist, none yet exist for coordinating many instruments for compact object accretion or general transients. We have formally created a network (named SMARTNet: http://www.isdc.unige.ch/SMARTNet) to better facilitate such observing and hope to build on this solid foundation.

Piergiorgio Casella (Roma, Italy)
Poshak Gandhi (Durham, United Kindom)
Matthew Middleton (Cambridge, United Kingdom)

Superconductivity on the Verge

27 – 31 July 2015 @Oort

The recent technological developments in the synthesis and characterization of superconducting materials in low dimensions has revealed intriguing similarities between strongly disordered films of materials like NbN, InOx or TiN, superconducting LaAlO3–SrTiO3 engineered hetero–structures, and artificial superconducting nanostructures. The open questions raised by the experimental and theoretical progresses made in the last 5 years in all these fields are often very similar: Is the survival of SC properties at strong disorder or low carriers a signature of localization of bosonic pairs? What controls the typical length scales over which local and global superconductivity is established? However, despite these analogies, the scientific communities involved in these apparently different classes of material remain substantially separated.

The main goal of this workshop was to bring together researchers working in the fields of strongly disordered superconductors, hetero–structures and artificial nanostructures with the twofold aim to establish the analogies and differences between these areas and to promote a cross–fertilization of ideas that can bring new perspectives on the research agenda for the future.

The balance after the five days' workshop is extremely positive. We can report that the workshop has been very successful in shaping and moving forward this emerging research field. We based this assessment on the following indicators:

- The workshop structure was based on a topic session followed by a discussion session on the questions raised during the talks, to stimulate cross–fertilization among researchers with different backgrounds. This structure was definitively very efficient, since all talks and discussions were well attended. Multitude of questions and lively exchanges among participants, even between researchers with relatively different backgrounds, were a constant across the workshop.
- Each talk was blogged by a participant, not necessarily in the same field as the speaker. Even though it is a relatively time consuming task, we found all participants willing to blog a colleague. We were pleasantly surprised by the high quality of the blogs and the interesting questions posed by some of the bloggers. The blogs are linked to the workshop webpage.
- According to informal discussions, the workshop helped to establish multiple collaborations and to open new research lines for many of the participants.

Some of the results presented in the workshop attracted an unusual level of interest and discussion:

- The observation of a "strange" metallic phase, characterized by a plateau in the resistivity, observed in the low temperature limit of superconducting STO/LAO hetero-structures. Is this phase universal? What is its physical origin?
- The observation of high Tc (Tc >100K) superconductivity in one–layer FeSe on STO. What is the mechanism of superconductivity? Is it possible to find this novel form of engineered high Tc superconductivity in other materials? Is it a Kosterlitz–Thouless transition?
- The conditions for the observation of the Higgs mode in disordered superconductors. Is the recent claimed experimental observation conclusive?
- The observation of novel quantum phase transitions in disordered STO/LAO hetero-structures. Are these phase transitions universal and therefore observable in other materials? Is it necessary further experimental and theoretical progress for a quantitative description of these transitions?
- There was consensus among participants that advances in these problems would set the agenda of this emerging field in the coming years.

As a final remark, we can say that all participants gave us spontaneously a very positive feedback on the choice of this workshop structure, and many of them found this "one of the most interesting and lively workshop" they had attended in the last years. On this respect, the selection of participants was crucial to create the right conditions for exchanging ideas. In addition, our decision to have 30% of female speakers (i.e. a factor of 3 larger than what happens usually in these communities) was

positively appreciated by all participants. We would like also to report to Lorentz Center organization the suggestion made by some participants concerning the possibility for the workshop attendees to access to some childcare facilities during their stay. Having a larger percentage of female participants and helping them to reconcile these activities with the child–care constitute to us two important steps forward to create better conditions for the presence of female researchers in hard sciences.

Lara Benfatto (Rome, Italy)
Andrea Caviglia (Delft, Netherlands)
Antonio M. García–García (Cambridge, United Kingdom)
Jerome Lesueur (Paris, France)
Pratap Raychaudhuri (Mumbai, India)

The Zoo of Accreting Compact Objects

3 – 7 August 2015 @Snellius

Cees Bassa (Dwingeloo, Netherlands)
Caroline D'Angelo (Leiden, Netherlands)
Jason Hessels (Amsterdam, Netherlands)
Alessandro Patruno (Leiden, Netherlands)

To be Announced!' Synthesis of Epistemic Protocols

17 – 21 August 2015 @Oort

In protocols (or planning), various aspects can be called epistemic: the condition for executing a action in a protocol may be knowledge or ignorance, such an action may consist of imparting information (so, again, knowledge), actions may be partially observable (so that the agent does not know what really happened), and the goals of plans may be epistemic (the spy may not get to know the secret). Five workshop themes agency, concurrency, uncertainty, communication, strategy were investigated in discussion groups. There were 11 invited keynotes, who admirably focused on epistemic planning.

No tangible outcome of the workshop was planned, but over the week some became clear. The discussion groups promoted collaborations between workshop participants. A special issue of a journal is planned and was announced at the closing of the workshop. The AI Journal or JAIR will be approached with a special issue proposal. The explicit goal of the workshop was to bring the `dynamic epistemic logic' and the `artificial intelligence' communities within epistemic planning closer. The main outcome of the workshop is that this goal has been realized. In particular it was stimulating to see junior participants making new contacts across the two communities. Chitta Baral, Thomas Bolander, Hans van Ditmarsch, and Sheila McIlraith will be the organizers of a to be proposed follow–up Dagstuhl workshop. An epistemic planning webpage will be launched by Thomas Bolander.

Organization/Format: Much encouraged by repeated interaction with the Lorentz Center staff, the organizers scheduled a large amount of time for discussion groups. Apart from the invited talks, two rump sessions of each 90 minutes (18 presentations in total) were also scheduled on Monday and Tuesday, for which participants could sign up on the first day of the workshop. The originally planned five discussion groups were on Monday made into three, after first asking the participants to sign up for interest. The `planning' discussion group (formerly `strategy') produced a taxonomy of epistemic planning methods. This investigation may be continued into a survey for the journal special issue. The `concurrency' discussion group delivered a detailed comparison table, identifying (technically) the commonalities and differences in the approaches, thus offering specific directions for filling gaps and providing formal ways of comparison. The discussion group 'agency' was changed mid-week into a discussion group `gossip', given participants' interests. Such flexibility in reshaping the program during the week was very effective to capture the participants' attention. The participants wanted time on Friday afternoon for one–on–one discussions with collaborators. This was enabled by an impromptu decision to shift the Friday afternoon session to the end of Friday morning.

The boat trip was the high point of the week. The guided tour of the Boerhaave Museum and the subsequent Public Lecture also went down well. A very welcome and helpful gesture of the Lorentz Center staff was to encourage us to organize an evening of epistemic games (for which epistemic planning is important) in the Lorentz Center on Tuesday afternoon (`encouragement' means: free beer, drinks, and nibbles).

Thomas Bolander (Lyngby, Denmark)
Hans van Ditmarsch (Vandoeuvre-lès-Nancy, France)
Jan van Eijck (Amsterdam, Netherlands)
Ramaswamy Ramanujam (Chennai, India)

Enumeration Algorithms Using Structre

24 – 28 August 2015 @Oort

Enumeration is at the heart of Computer Science. Traditional enumeration algorithms use an output–sensitive time analysis. Recently exact exponential time enumeration algorithms using an input–sensitive analysis have been emerging. The main goal of the workshop was to bring the two communities together. Another goal was to discus and study the use of structural input properties when constructing enumeration algorithms.

The major and longtime open problem in algorithmic enumeration is the question whether the minimal transversals of a hypergraph can be enumerated by an output–polynomial algorithm.
Recently it was shown that this question is equivalent to the question whether the minimal dominating sets of a graph can be enumerated by an output–polynomial algorithms. The later problem has been studied for many graph classes. More such results are to be expected.
A major question in input–sensitive enumeration mentioned various times at Leiden was solved recently: the number of minimal connected dominating sets of a graph on n vertices is smaller than 2^n.

While the methods used by the two communities turned out to be very different, input–sensitive and output–sensitive enumeration algorithms can be combined sometimes such as to obtain a kind of optimal enumeration algorithm.

The format of the workshop was perfect for our purposes. The many invited talks and the tutorials allowed to share the knowledge of the two communities. There are more researchers with publications on both types of enumeration algorithms now. The French enumeration community has now an ANR project (ANR = French Research Agency) concentrating on enumeration on graphs and hypergraphs which started in October 2015. One of the ideas of the project is to organize another enumeration workshop at Leiden.

We were happy with the Lorentz Center and the help in organization, administration etc. we obtained. We compiled a technical report of open problems at the University of Utrecht.

Hans Bodlaender (Utrecht, Netherlands)
Endre Boros (New Jersey, USA)
Pinar Heggernes (Bergen, Norway)
Dieter Kratsch (Metz Cedex, France)

The Future of Multi-Scale Soft Matter Modeling

31 August – 4 September 2015 @Snellius

A key challenge in the study of soft structured materials, which includes living matter, is that the emergent properties are a consequence of mechanisms at a variety of length/time scales, often down to the smallest scales, and it is the strong correlation between these processes that renders them inseparable. New multi–scale & multi–resolution computational approaches deal with these issues, but the key challenges remain disputed and the most promising route ahead remains unclear. Among computational scientists, there is a strong need for discussing the various prospects/ limitations of these new modelling paradigms and for setting up collaborative frameworks that contribute to validation and integration of these modern techniques in a lab environment. Moreover, how can we improve the position of this emerging field on the research agenda in terms of funding, against the growing tendency to fund only towards application?

Based on the discussions during the week, a list of priorities concerning multi–scale simulation of heterogeneous soft matter was drawn and a number of individual collaborations were started on diverse topics. A small group of participants – Kawakatsu, Milano, Schmid and Sevink – are currently working on materializing this outcome in a review on multi–scale modelling, to be submitted to npj Computational Materials. The position of multi–scale modelling community on the (local and international) research agenda has been strengthened by an initiative of participants Asinari, Paillusson and Sevink after the meeting. In April 2016, Asinari (member of the European Materials Modelling Council/ EMMC) and Sevink will present prospects of multi–scale modelling in a network meeting on Nanosafety in Brussels, one day prior to their participation to the Roadmap meeting of the EMMC. An additional outcome is that the same organizers submitted a new Lorentz workshop proposal on structured soft interfaces (January 15, 2016).

The setup – inviting scientists with multi–scale modelling as common denominator but otherwise diverse expertise – was geared toward shaping minds rather than facilitating the detailed discussion needed for a scientific breakthrough on special topics (although this was not ruled out). In this sense, the workshop was a great success. The technical and conceptual discussions, as well as the diverse overview of efforts in this field, were a good starting point for out of the box thinking, cross–fertilization and discussion of future collaborations.

The discussion focusing on 'common' issues, e.g. systematic versus thermodynamic driven coarsening schemes, benefitted from the presence of many experts in sub–topics, and touched upon issues that are usually considered too technical or where no proper solution exists. It provided a profound understanding of the actual challenges and improved insight in commonalities between different disciplines. A few unexpected topics arose, e.g. the need and opportunities to better quantify the precision of simulation methodologies. The discussion of identifying funding opportunities – proactive versus program–driven – was an eye-opener for many.

We replaced our proposed format – few talks, many outbreak discussion sessions in groups, case studies – by a more conventional one during the preparation stage, after consultation with the Lorentz Center. Given both the broad topic and diverse background of the participants, we felt that the workshop would be better served by keeping the discussion central and enabling all participants to define their field via short plenary talks. Since the number of participants was small (25 on average), such a setup works very well. One of the key restrictions associated with other formats is that they are better suited for small(er) communities, which usually have closer ties and enhanced commitment during the preparation stage. Unfortunately, in practice, most researchers (in particular high–profile) are used to start preparing only after on–site arrival.

Lorentz workshops provide a unique platform for discussion amongst peers. Compared to the many highly–focused workshops that are organized in small communities, they possess a unique value in providing a platform for stimulating and timely discussions of important topics/insights in a new setting, bringing together less familiar faces, expertise and disciplines. As such, the workshops

are attractive to all scientists, but this attraction does not stem from keeping participants confined (several participants complained about the remote location of the hotel) or forcing participation all week. They should be naturally attractive, provide a home for the scientists by the opportunities that they offer. The support of the Lorentz Center in the practical part – program and planning – is therefore extremely valuable. That some scientist, in particular those of greater fame, cannot commit themselves for a whole week is understandable and does not reflect any statement on the intrinsic value of the workshop (their participation does!). With such a dynamic audience, the total number of invitees can easily be more than 25, to ensure critical mass at all times.

Ignacio Pagonabarraga (Barcelona, Spain)
Agur Sevink (Leiden, Netherlands)
Ryoichi Yamamoto (Kyoto, Japan)
Andrei Zvelindovsky (Lincolnshire, United kingdom)

Logic and Random Graphs

31 August – 4 September 2015 @Oort

Random graphs are mathematical models of networks that have been studied intensively for over half a century, beginning with the seminal work of Erdős and Rényi.
Given the central position of logic within graph theory and theoretical computer science, it comes as no surprise that researchers have studied random graphs from a logical perspective for nearly as long as random graph theory has existed. Despite its established role within random graph theory, there is a strong, renewed impetus for research activity on random graphs from a logical perspective. This is partly because recent advances in our understanding of various random graph models, including random graphs with a given degree distribution and random graphs embeddable on surfaces, make it possible to attack questions that were out of reach until very recently.
Another reason for the renewed impetus is related to graph limits. After the introduction of graph limits around 2006, many in the field realized that there is a close connection between graph limits and some of the phenomena and in particular the limit objects produced in the theory of logical limit laws of random graphs.

In this five–day workshop, we gathered together some of the most active and influential researchers in the field, with roughly equal proportions of participant working mostly on random graphs, logic or theoretical computer science, and visiting from several parts of North America and Europe.
There were twenty talks spread over five days, which left ample time for (informal) discussions. This appears to have been appreciated by the participants. On Monday there was an open problem session. Several of the participants are now working on the problems posed by others, and one of the open problems was even solved during the workshop. Another nice, concrete result of the workshop was that one of the keynote speakers, Prof. Luczak, managed to solve an old research problem while preparing his presentation.

The workshop provided a useful platform to view future directions for research in the area. Given the even mix of younger and more established scientists, and of different fields, it was an excellent opportunity for many parties to gain new perspectives.

Ross Kang (Nijmegen, The Netherlands
Tobias Müller (Utrecht, The Netherlands)
Jaap van Oosten (Utrecht, The Netherlands)
Oleg Pikhurko (Coventry, United Kingdom)
Anusch Taraz (Hamburg, Germany)

Novel Quantum Materials and Systems

7 – 11 September 2015 @Oort

This workshop has been inspired by a recent surge of new results in the realm of quantum materials. Such materials can serve as physical media for the storage and transfer of quantum information, therefore one of the strongest forces driving research in this area comes from the challenges facing experimental quantum information science. Several conceptual approaches to the outstanding challenges that exist at present are pursued by different physics communities. In this workshop we have succeeded in bringing together leading experts representing such communities in order to promote exchange of knowledge and know–how. Researchers working in the areas of solid–state topological materials, ultra–cold atomic gases, photonics, even classical non–autonomous ensembles have had an opportunity to exchange their ideas, views and outstanding problems. A good balance between experiment and theory was maintained.

On the theory side, an excellent overview for the role of topological invariants in magneto–electricity of quantum materials was given by J. Moore. Hybrid structures with topologically–protected Majorana modes were described in a talk by C. Beenakker. An inspiring discussion of the theory of frustrated quantum systems was presented by S. Eggert. All workshop guests have been impressed by V. Vitelli's talk on the topological theory of constrained mechanical systems revealing a rather surprising connection between topological quantum systems and mechanical machinery. An exciting idea of a fractional Chern insulator was proposed in the presentation by E. Bergholtz's. On the experimental side, L. Kouwenhoven has given a thorough account of his group's search for the Majorana mode – one of the most promising candidate for the topologically protected qubit. Prof. J. Smet reported on the investigation of the fractional quantum Hall states in bilayer graphene – a new and largely unexplored quantum Hall system. Finally H. Hilgenkamp discussed recently discovered examples of criticality emerging in rather unusual settings.

Apart from recognized experts, younger researchers were given an opportunity to present their work at a poster session. Training sessions were also organized to introduce both the younger participants and non–experts into key developments in one of the specialized areas. An excellent introduction into topological phases in cold atomic gases was given by C. Morais Smith. A nice theoretical review of the applications of conformal field theory and tensor category to non–abelian topological states was presented by K. Schoutens.

The workshop stimulated new interactions between participants that will definitely result in interesting advances in the field with possible scientific breakthrough.

The workshop unraveled in a friendly and stimulating atmosphere. The schedule of the presentations as well as the compact and convenient sitting and accommodation of the participants allowed for plenty of time for informal discussions.

Vadim Cheianov (Leiden, The Netherlands)
Mikhail Katsnelson (Nijmegen, The Netherlands)
Mikhail Titov (Nijmegen, The Netherlands)

Reappraising the Role of Linear Structure in Language

14 – 18 September 2015 @Snellius

In spite of growing support for the controversial view that sequential (as opposed to hierarchical) structure may be fundamental to language, there is no coherent research programme for investigating how language arises from sequential structure processing. The workshop aimed at creating a research community that addresses this question. The specific goals were to establish novel collaborations (in particular between researchers from different disciplines) and to develop concrete proposals for research projects, experiments, and models.

Workshop outcomes:

- The intended bridging across disciplines was highly successful. In particular, some of the participating neuroscientists and linguists noted that they originally considered the other field to be of little relevance, whereas by the end of the workshop they understood each other's questions, methods, and problems, and respected each other's empirical findings even if not buying into the accompanying theoretical commitments. More generally, the cross–disciplinary discussions were very fruitful and miscommunications were rare indeed.
- Several ideas for novel collaborative studies were developed. We intend to put together a special issue of Philosophical Transactions of the Royal Society B to publish the results of these studies as well as other contributions (e.g., review papers) from workshop participants.

We adopted a format focused around four small discussion groups, each focusing on a single theme. Participants were assigned to the groups based on their preferences but also making sure that all scientific disciplines (linguistics, psychology, neuroscience, computer science) were represented in each group and that all groups included both junior and senior researchers. Participants stayed in the same group for the entire week but because only two groups met at any one time, it was possible to join another discussion when one's own group was not in session.

We began on Monday morning with four opening talks by researchers from each of the four represented disciplines. These talks were not research presentations but focused on cross–disciplinary collaboration from each discipline's perspective: What are the specific assumptions, methods, and jargons from each field? What are common misunderstandings about my field and what is hard for us to understand about other fields? These opening talks successfully pre-empted potential miscommunications during the group discussions and we can recommend this approach to other organizers of cross–disciplinary workshops.

On Monday afternoon, all four groups met to specify the questions to discuss and the group's agenda for the coming three days. Tuesday to Thursday were reserved for the group discussions. At the end of the day, each group presented their progress in a plenary session. On Friday, there were two plenary sessions to discuss what we had learned during the workshop. There were also discussions about possible collaborative research projects to work on in the near future.

All participants were generally positive about the workshop format and the discussion sessions turned out to work quite well. In retrospect, it would have been better to include a plenary session on Monday late afternoon, so that each group could present its questions and agenda for the week. This would have made it easier for participants to decide which other group meetings to join and would have forced the groups to actually come up with questions and an agenda, thereby making the upcoming discussion sessions more focused.

Rens Bod (Amsterdam, Netherlands)
Morten Christiansen (New York, USA)
Karl Magnus Petersson (Nijmegen, Netherlands)
Stefan Frank (Leiden, Netherland)

Verification of Concurrent and Distributed Software: Towards Industrial Use

14 – 18 September 2015 @Oort

This workshop was a follow–up of the May 2014 meeting "Reliability of Concurrent and Distributed Software", which focused on finding ways of overcoming the existing fragmentation in the development and application of techniques and tools in the field. During the previous workshop, we realized that an important next step for our research field is to bridge the gap with industrial practice, because the current formal analysis techniques are still not easily applicable in an industrial setting. Therefore, during the workshop we focused on the technology transfer from academia to industry, and bringing academic tools to industrial usability standards. In particular, we discussed: current industrial practices, maturity of the techniques, user interfaces and tool feedback, learning curves, tool integration, and the incorporation of verification tools into the software development and quality assurance process. We aimed at having a balanced mix of participants with an academic and an industrial background. We invited several of the participants to give a presentation on these topics, based on their own perspective and experiences.

Most participants with an industrial background were not able to participate the full week. Therefore, the fourth day of the workshop was a special industry day, with several industrial representatives invited for the day. During the day, several of the industrial representatives presented their view on what academia could bring to industry, and the day ended with a panel discussion about this topic. In addition to the presentations and the industry panel, during the week we had several plenary and group discussions. In particular, we discussed what a roadmap of actions to achieve the technology transfer from academia to industry could look like. From the discussions, four areas were identified where action should be taken:

- Education;
- Identifying industrial needs w.r.t. validation and verification;
- Identifying possibilities and scientific challenges for technology transfer, and organizational activities.

The presentations and panel discussion during the industry helped to develop a better idea on what industry needs. For the other topics, group discussions were held that led to concrete ideas for further actions.

During the final day of the workshop, a structure for a roadmap document has been sketched. After the workshop, all discussion summaries have been collected and several of the workshop participants have agreed to work out a more detailed action plan, which should eventually lead to one or more publications on how to bridge the gap between academia and industry in the area of formal methods.

Dilian Gurov (Stockholm, Sweden)
Marieke Huisman (Twente, Netherlands)
James J. Hunt (Karlsruhe, Germany)
Arnd Poetzsch–Heffter (Kaiserslautern, Germany)

Active Liquids

21 – 25 September 2015 @Oort

Active liquids are composed of large assemblies of active "particles", the defining feature of which is that energy being injected at the level of the individual particle promotes self–propulsion and other non–equilibrium features. The recent upsurge of studies has led to a rather confusing situation where many competing theories, incompatible as often as not, try to explain experimental or numerical results. The goal of the meeting was to confront all the fruitful approaches and try to identify major issues on which the Active Matter community should focus in the future.

To achieve this goal, we had organized the workshop around review Duet–Lectures, and "Questalks" selected on the basis on "Questract", to load the focus–topic discussions. The questalks and related questracts was a complete new format: participants had to present and discuss questions of interest to them rather than results. The participants also had the opportunity to present their work with posters. The last day of the meeting was left open to a special synthesis and perspective session.

Overall the workshop was a complete success as could be inferred from the very positive feedback we had from the participants. Many of them went back to their home institution, with new perspectives in mind.

The new comers to the field could learn very efficiently during the morning review duet–talks, a fact that could be appreciated during the questions and focus discussion sessions. This new format was challenging for the speakers, who all made the effort to provide integrated performance. (We had carefully taken care of strongly encouraging them not to do two separate talks)

The new Questalk format appeared to be extremely efficient in launching the discussions sessions All were extremely animated and vivid. The debates lasted far beyond the anticipated schedule. An entire new topic, un–anticipated at the time of the preparation of the workshop and which had emerged a few months before the workshop was intensively debated during the whole week. Two participants spontaneously prepared a review talk during the week to be presented on the Friday morning.

The "wikipedia night" during which we started editing the wikipedia page on Active Matter was also a success: both in terms of outcome and as a new form of scientific proceeding.

All in all this workshop was very successful, both thanks to the scientific quality of the audience and the great format allowed by the Lorentz Center.

Olivier Dauchot (Paris, France)
Marjolein Dijkstra (Utrecht, Netherlands)
Julien Tailleur (Paris, France)
John Toner (Oregon, USA)
Sriram Ramaswamy (Hyderabad, India)

An Emerging Technological and Societal Transition: Preparing for the Post-Industrial World

5 – 9 October 2015 @Oort

We asked the fundamental question: Is technology in the process of fundamentally transforming our society into something we have difficulties imagining? To address this question the workshop brought together scientists, business leaders and storytellers from a very broad spectrum of fields to identify and explore what these changes are and how we could prepare for them. Thus, the aim of the workshop was to define a new interdisciplinary research agenda about the postindustrial societal transformation.

The workshop was a success with many tangible outcomes: Two living documents are still under development by a subset of the workshop participants, one on a scientific identification, documentation and characterization of the emerging societal transition, and another document summarizing these findings for engaged citizens, the press and policymakers. A number of new cross–disciplinary scientific collaborations were started during the workshop (e.g. between computer scientists, economists, physicists and historians). Further, a number of research proposals have already either been submitted or are under development seeking to address the open questions identified and clarified at the workshop. These include an internal grant at Oxford University and two European Commission grants. Finally, follow–on workshops are in the planning including a new Lorentz Center workshop and a Santa Fe Institute workshop.

Because this international workshop was one of the first of its kind it was also the first forum where critical and in depth discussions could occur across traditional disciplinary boundaries. Surprisingly quickly the workshop participants reached consensus about the existence and the character of an ongoing technology driven societal transition. Thus, for the workshop participants, there is an experience of "before" and "after" the workshop. We now know the transition is real.
We believe everybody had several "Aha" moments during the week, mainly because of the diverse perspectives on the same broad set of issues. In that respect the workshop was also successful as everybody acquired new potential collaborators and vocabularies with which to approach and describe the current transition.

The workshop schedule was divided between daily (i) 10-minute plenum presentations, (ii) group work activities focusing on (pre–selected) broad crosscutting issues, (iii) plenum discussions, (vi) public lectures and discussions as well as (v) a policy discussion session with a parliament member. None of the participants, including the organizers, had previous experiences from bringing together so many different competencies that within a week should address such broad and complex issues. However, all but (ii) worked well and as the organizers had hoped for. The group discussions and writing did not work as anticipated. The organizers should have been more specific about what was expected from these groups. We had created a password protected online wiki with background information and guidelines, were people could share references and develop documentation that would allow us to do further writing after the workshop. This has only happened in a limited manner. Perhaps this goal was too ambitious in such a diverse group.

It was a great pleasure working with the Lorentz Center both before and during the workshop. However, we have one important suggestion for process improvement: If a Lorentz workshop proposal is rejected and is given the option to resubmit (as we did), it should be clarified what that means. We were under the impression that a rejection of our workshop proposal was also a likely outcome after a resubmission. With this uncertainty we could of course neither confirm financial support for the workshop participants nor engage in a serious dialog with external sponsors. When the workshop was finally approved many high level key invitees had predictably made other commitments and the timeline for obtaining external sponsorship was too short. This meant that the workshop didn't have sufficient representation from several key areas including synthetic biology, cognitive science/psychology and big history/anthropology.

Lene Rachel Andersen (Copenhagen, Denmark)
Christopher Coenen (Karlsruhe, Germany)
Norman Packard (San Francisco, USA)
Steen Rasmussen (Odense, Denmark)
Dirk Stemerding (The Hague, Netherlands)

Shape Constrained Inference: Open Problems and New Directions

5 – 10 October 2015 @Snellius

Dragi Anevski (Lund, Sweden)
Geurt Jongbloed (Delft, Netherlands)
Wolfgang Polonik (California, USA)

Proteins and Beyond

12 – 16 October 2015 @Oort

The aim of the workshop was to discuss the future of protein research. The central questions to be addressed were: Has the reductionist approach to study isolated proteins with advanced biophysical methods been exhausted and should the future aim be to study the protein only in its native environment, such as the living cell? What are the next challenges in this field?

We had indicated in the application that this workshop would be considered a success if a) a number of new challenges in protein research for the coming decade had come into sight and b) technique–oriented researchers would have contemplated their methods in light of these new research challenges. A set of challenges and questions would be formulated as the outcome of the discussions. We brought together scientists from a wide range of areas, both technique and research question oriented and from industry as well as academia. The speakers had tuned their presentations remarkably well to the broad background of the audience and as a result the participants were informed about the latest developments in a range of areas. The term 'reductionism' was central in many discussions. The general consensus was that in–cell protein research is becoming very powerful in visualization of proteins and thus in the study of their function in the cellular context, yet in–vitro studies at the atomic level remain essential for a) structural understanding at the atomic level and b) hypothesis formulation for cellular studies. The first atomic level studies of proteins in the cell are appearing, yet they are very far from what can be achieved using isolated proteins.
The workshop ended with a public session, attended by about 150 people, with three helicopter view presentations on the developments in amyloid research, DNA repair and molecular simulations of biochemical structures and processes. In the introduction by the chair and the following panel discussion conclusions from the workshop were presented to the public.

The organization of the workshop was excellent. The atmosphere was very informal from the start and everything ran very smoothly. The ample time for discussion avoided pressure on the program and was used flexibly to enable certain conversations to continue longer than planned and to allow participants who were not scheduled as speakers to make additional points.
Each session led to the formulation of research questions or directions of research. The final set is listed below. It does not pretend to be a comprehensive agenda of protein research. It should be considered as food for thought for people in the field and it also helps to identify areas of interest for young researchers starting in protein research.

Promising techniques:

- CryoEM is rapidly developing and will be combined more with (super–resolution) fluorescence, leading to structures of ever larger supramolecular complexes being determined;
- Cellular protein research is using the microscope as an analytical tool, producing very large data sets (e.g. fluorescent cell movies). For extraction of useful quantitative data closer collaboration with bioinformaticians is required;
- Crosslinking entire cell lysates to identify new contacts between proteins followed by MS analysis presents a new, promising way for interactomics;
- Dynamics of proteins can be studied at timescale of ps –seconds by combining biophysical methods, enabling much better descriptions of protein's energy landscapes;
- Organoids offer much better context to study proteins in situ, in particular with CRISPR/Cas tools for genetic modification.

Required for the future progress:

- Better fluorescent probes (more stable, genetically introduced, switchable, smaller) required;
- Protein purification methods need to be faster, more robust and automated. We also need methods to stabilize proteins for medicinal use;
- We need course grained systems for modelling of cellular processes;
- Bioinformatics should better integrate existing omics datasets (datamining);

- Alternatives for radioactive labelling (e.g. pulse chase) are required. Can isotope labelling / unnatural aa help, together with MS?
- Parameters need to be identified that link in–vitro and in–cell properties of proteins.

Biological Questions (from larger to smaller scale):

- How do cells divide?
- What are the molecular mechanisms of aging?
- What are the molecular mechanisms of cancer development?
- Can we predict how drugs affect cellular stress response networks?
- Can we understand stochastic properties of molecular biology and their ramifications?
- How do proteins fold in the cell? Which roles do chaperones play?
- How do glycans influence folding and function of proteins?
- How do membranes affect protein folding and function and how do proteins affect membranes?
- How do IDPs (intrinsically disordered proteins) behave and function in cells and what are their roles in disease?
- Can we comprehend the versatility of post–translational modifications (in time)?
- What are the energy landscapes of proteins and what is the functional reason that they are so complex? Which of the states and motions are relevant for the function?

Thijs Aartsma (Leiden, Netherlands)
Gianfranco Gilardi (Torino, Italy)
Las Jeuken (Leeds, Unitied Kindom)
Marcellus Ubbink (Leiden, Netherlands)

Capturing Phylogenetic Algorithms for Linguistics

26 – 30 October 2015 @Oort

The past decade has seen an explosion in the availability of large datasets of both structural and lexical linguistic data that can now be exploited computationally to explore linguistic history and linguistic universals. The workshop aimed to bring together bio-informaticians, mathematicians and linguists to present work on how to modeling of linguistic data quantitatively, algorithms for inferences on linguistic data, case studies of specific families/regions and synergies between linguistic and non–linguistic data.

There will be a proceedings and a state–of–the–art survey paper by the organizing team. Some members of the organizing team were able to meet and a get an impression on the scientific capabilities of potential candidates for jobs. Several possibilities for joint project applications were discussed. Many interesting problems were discussed and several sub–problems were solved but a breakthrough is a too strong word.

Many participants reported revelations after John Huelsenbeck's very accessible tutorial on methods that involve advanced mathematical knowledge (also continued in a more interactive manner during the discussion sessions). Jotun Hein was very active in the discussion sessions and explained the progress on algorithms for string comparison developed in Bioinformatics, which turns out to be extremely similar problem(s) on word (form) comparison in linguistics. Eva Boon presented the state–of–the–art of data resources and infrastructure in Bioinformatics. The world of Bioinformatics databases and Linguistics databases turn out to be almost completely parallel, except that the Bioinformatics world is far larger.

The attendants consumed the (full) program lasting five days surprisingly well, no doubt due the generally high level of presentations and participation. We attempted discussion sessions in the form of state–of–the–art sessions with mixed results, and one session of joint discussion which especially the junior participants found very rewarding. Many potential attendants outside the main core of participants were interesting in coming ad–hoc for a day or two. The Lorentz Center were helpful in accommodating this, and, in retrospect, we should have been clearer (towards these potential attendants) on the possibilities to do so.

The long turn–around with reviews, our response to reviews, the final approval from the Lorentz Center significantly delayed us. Ideally, the process should have started earlier or be slimmed down to be quicker. Many of the comments from the reviewers were difficult to address, i.e., those that called for more detailed information than the two pages allotted admit and those that were general (rather than addressing the relation between the aims of the workshop and the stated plan of achieving them). Possibly the reviewers can be given some more direction at reviewing the relation between the goals and the plan. The reviews also contained some very good suggestions for improvement.
The webpage capabilities seem unnecessarily restrictive since they did not allow more than two bullet points and could not list the invited speakers without a click to open a pdf containing only this list.

Devdatt Dubhashi (Gothenburg, Sweden)
Russell Gray (Auckland, USA)
Harald Hammarström (Nijmegen, Netherlands)
Gerhard Jäger (Tübingen, Germany)
Marian Klamer (Leiden, Netherlands)
Andrew Meade (Reading, United Kingdom)

Capillarity of Soft Interfaces

2 – 6 November 2015 @Oort

This workshop took place from 2–6 Nov 2015 and centered on understanding the role of capillarity in soft materials. This is an exciting new field that has recently been driven forward by a wide variety of experimental and theoretical work showing a host of novel physical phenomena caused by capillarity having strong effects on the behavior of soft materials. Key aims of the workshop were to explore the wide variety of potential applications, identify new directions for important research, and bring together diverse scientists from a spectrum of scientific disciplines and industry to pool expertise. We also wanted to develop a common view on interfacial forces in soft materials, as there have recently been opposing viewpoints published in the literature.
Throughout the workshop, we collected a list of the most important questions and applications needed to drive this field forwards. We have received permission from the Editor of Soft Matter to write these up as an opinion piece for that journal. This will be authored by four of the participants (who were charged with collecting the key questions) and the organizers.

A key aim of the workshop was to establish a common view on interfacial forces in soft materials. A large part of the discussion time was given to debating the differences between opposing viewpoints of interfacial forces in solids. Importantly, we believe that we have managed to resolve these differences and establish an understanding of the links between microscopic and macroscopic views of how surface stresses appear.

There were several Aha! moments where we realized that work had been done in other fields that was highly relevant to soft capillarity. One example came from Simeon Stoyanov who pointed out that surface elasticity could play a much more important role in soft solids than was previously appreciated (illustrated with examples of surfactants on liquid droplets). This drove home the need for detailed measurements of this effect. Herbert Hui pointed out the links between fracture mechanics and contact lines, and how the techniques of fracture mechanics can be usefully applied in this field. Finally, we had a very useful session on capillarity in biology, which brought up a range of interesting new connections between biology and soft capillarity which pose a rich variety of questions for future work.
We tried a new type of discussion session as the last session of the week. In this, we split into 5 groups to discuss for an hour the 5 key areas that we had identified as important topics throughout the week. At the end of the session the groups came back together and reported their results. Feedback from younger participants was that this had given them a chance to become more involved in the conversation. We think that it would have been good to try something like this earlier in the program to break the ice and build up the confidence of the younger participants so that they felt like they could share their opinions.
We felt that we put in a few too many hours of scheduled programming as we all agreed that we would have liked more time to interact with the other participants — especially earlier in the week. Having a free session on Thursday was useful but did not give much time for resulting collaborations to develop throughout the week. As a result we thought we would have preferred a free discussion on Wednesday instead.

Overall, I think the majority of participants came away thinking that it was an incredibly useful and productive week. The Lorentz Center did a great job of doing the bulk of the organization which made it much easier to just focus on the scientific aspects of the week (we would particularly like to thank Aimée for her hard work). So we don't really have any major criticisms/suggestions – thank you very much!

Bruno Andreotti (Paris, France)
Karen Daniels (Raleigh, USA)
Eric Dufresne (New Haven, USA)
Jacco Snoeijer (Enschede, Netherlands)
Robert Style (Oxford, United Kingdom)

Moduli Spaces and Arithmetic Geometry

9 – 13 November 2015 @Oort

The workshop Moduli spaces and arithmetic geometry was organized on the occasion of the 80th birthday of Frans Oort. It was agreed from the very start that the meeting should not be a gathering of old friends of Oort, but that instead we should aim for the highest possible scientific level. The organizers felt that this is the best way to do justice to the mathematical career of Oort.
The interest in the workshop was overwhelming. Even though it was held in the middle of the semester, many of the leading experts whom we invited agreed to attend and give a lecture. Also, the number of interested people went well above the capacity of the Lorentz Center, and we had to install a waiting list. In the end, the workshop was attended by 56 registered participants, but many lectures were attended by more people. One of the highlights of the week was the lecture by Jean–Pierre Serre, arguably the most famous living mathematician; on that occasion the lecture room was packed to maximum capacity, with several people standing at the back of the room or sitting in the window sills.

It would be an understatement to say the week was a success. Even though the expectations were high, we could not have hoped for such a wonderful week. As organizers we feel we have rarely ever been part of such a lively and inspiring event, and many participants have expressed similar feelings. The scientific level of the talks was exceptionally high, and we have heard about several recent developments that constitute breakthroughs in the field. Also the overall quality of the talks was very high. Most of all, however, we received many positive comments about the exceptionally lively atmosphere. There were hilarious jokes during the lectures, inspiring discussions between old and new friends, ideas for future collaborations, and so on.

We had chosen to organize two mini-series about special topics, and to leave the remaining talks open for other topics. This worked out well. The two mini–series got enough time for the speakers to go in depth, but they did not dominate the workshop too much. The other talks were about a variety of different topics. As people in our research field tend to have broad interests, we feel that these lectures were also very inspiring to the audience.

During the first three days, we organized Question & Answer sessions for PhD students and postdocs. These again were a great success, as witnessed not only by the high number of young people attending but also but their eagerness to ask questions and have discussions with leading experts.
On Thursday we had a special afternoon with two talks aimed at a broader audience of mathematicians, and concluded by a reception. This afternoon was attended by more than 120 people. It was remarkable to note that many people who came especially for this afternoon commented on the wonderful atmosphere; the enthusiasm of the workshop participants apparently showed that something special was going on.

Also on behalf of the participants, we should like to express our gratitude to the staff of the Lorentz Center, for facilitating this workshop, taking so much work out of our hands, and for their friendly support. This has enabled us to smoothly run a workshop that will be remembered by many as an exceptional event.

Ben Moonen (Nijmegen, Netherlands)
Ching-Li Chai (Pennsylvania, USA)
Jaap Top (Groningen, Netherlands)

Life Sciences with Industry

16 – 20 November 2015 @Oort

The aim of the Life Sciences with Industry workshops is exposing young researchers in the life sciences to real–life research challenges in industry. Vice versa they immerse investigators from industry into the world of academic research. This aim connects to Dutch and European research policies that stress linking academic research to industrial R&D. The 2015 workshop was attended by 30 PhD students and postdocs.

During the workshop 6 groups, each of 4 to 6 participants, focussed for 5 days on the following 6 scientific challenges that have been formulated by 6 Dutch companies (3 big industries and 3 SMEs) and are listed below.

- New possibilities for developing disease–resistant plants *(Bejo Zaden);*
- Technologies to modulate galactosylation and fucosylation in human antibodies production in clonal cell lines *(Bioceros);*
- Isolation of phospholipids from fresh cow milk *(Nutricia Danone);*
- Applications of a novel low–cost/disposable high resolution and sensitive detector in health and biotechnology *(NXP Semiconductors);*
- Quantifying the quality of light for human–centric lighting solutions: how to objectively measure (visual) comfort and well–being *(Philips);*
- Automated 3D imaging and analysis systems to measure plant volume and other critical parameters of seed germination and seedling establishment *(Syngenta);*

The format of the workshop followed that of the successful Life Sciences with Industry workshops in the Lorentz Center in 2013 and 2014. In short, after an introduction by the 6 industries the participants worked in groups and were in close contact with a representative from the company that had formulated the challenge. Mid–term (Wednesday) and final (Friday) plenary presentations by the groups provoked the necessary discussions among participants and representatives from industry, further sharpening ideas and results. Most of the time was spend by the groups on the analysis of the problems they addressed and on developing and formulating potential solutions. Some of the proposals will be follow-up R&D activities of the companies.

Based on the criterion 'overall rating workshop' the judgement of the participants scored an average of 3.5 on a scale of 4 (2014: score 3.2). This result encouraged us to apply for a fourth workshop Life Sciences with Industry in 2016.

Roel van Driel (Amsterdam, Netherlands)
Ellen Feddes-de Haan (Utrecht, Netherlands)
Lydia Meesters (Leiden, Netherlands)

Physics with Industry 2015

23 – 27 November 2015 @Oort

Michel van den Hout (Utrecht, Netherlands)
Jeroen van Houwelingen (Utrecht, Netherlands)
Victor Land (Utrecht, Netherlands)
Melvin Kasanrokijat (Utrecht, Netherlands)

Mathematical Pharmacology

30 November – 4 December 2015 @Snellius

High rates of attrition in drug development are limiting the development of novel drug treatments. Quantitative models have already shown their use in rationalizing drug development and optimizing drug treatment in patients. However, major challenges remain in the effective development and application of these mathematical models in drug development and specifically pharmacology. Mathematical model development and analysis could further address the challenges in this area.

This Lorentz workshop aimed to assess if and how a stronger involvement of mathematicians in the area of pharmacology, i.e. mathematical pharmacology, can move forward the effective application of mathematical approaches in this area. A mix of early career and established mathematicians and pharmacologists from both academia and industry was brought together, and through a combination of lectures with case examples and group discussions the key challenges and opportunities were explored. Specifically the workshop focused on three major challenges:

- Theme 1: Multiple scales and the integration between those scales. Talks focused on i) time delays in cell maturation, ii) individual cell behavior in tissues, and iii) spatio–temporal models to describe drug concentration gradients in organs such as the liver. The talks were followed by group discussions which underlined the potential for multi–scale models and identified the challenges in and need for making such models useful for a pharmacological context.
- Theme 2: Integration of modelling approaches outside differential equation–based models. Talks about the use of agent–based models and network–based Boolean logic models provided input on the use of model formalisms other than the commonly used differential equation based methods. The group discussions clarified the complimentary character of those approaches and the need to combine and integrate them better.
- Theme 3: Bridging between highly mechanistic models that are too complex to apply in drug development. One major challenge for pharmacologists is how to integrate and apply large systems biology models towards key questions in drug development. The talks on various model reduction techniques received strong interest and the group discussions concluded that those techniques have a huge potential for further collaboration between disciplines.

Until now, there has been only very limited interaction between pharmacologists and mathematicians. However, at the end of this meeting a clear consensus was reached that further interactions between (quantitative) pharmacologists and mathematicians will be valuable, and the development of a novel specific sub–field of mathematical pharmacology should be stimulated. In order to achieve this, raising further awareness of a field of mathematical pharmacology in both pharmacologist and mathematics audiences is of importance. To this aim, a session on the theme of mathematical pharmacology are proposed at three major conferences: the American Conference on Pharmacometrics (ACOP), the European Conference on Mathematical and Theoretical Biology (ECMBT), and the Conference on Complex Systems (CSS). The ECMTB and CCS proposals are accepted. Furthermore, a website is created (www.mathematical–pharmacology.org). Finally, we are preparing the submission of a Perspective to CPT: Pharmacometrics & Systems Pharmacology to summarize the specific outcomes of this Lorentz workshop and raise further interest.
Future plans are a European Study Group on Mathematical Pharmacology and a follow–up meeting on a specific pharmacological problem to explore contrasting and integrating the various approaches.

The first day was an introductory day, followed by 3 days with the different themes, ending Friday with a wrap–up/conclusions day. The division of mornings with talks and most of the afternoon with group discussions (distributed into 3 groups) worked well.

It turned out to be a major challenge for industrialists to commit a full week at a workshop. Unfortunately a few industrial participants had to cancel their participation at short notice because of urgent project commitments at their company and a few others could attend a few days only.

Although the Lorentz Center prefers participants to attend all days, a greater industrial input might have been achieved if we had been more flexible about participation for a few days only.
One of the participants was invited to give a presentation at the Leiden University series "This Week's Discoveries" during lunch on Tuesday. This was an exciting opportunity to promote our activities. A slight point of improvement could have been the communication with organisers of this series so it would have been less disrupting and confusing for our program.
The support of the Lorentz Center has been crucial for the success of our meeting, Many thanks for this!

Gianne Derks (Guildford, United Kingdom)
Pinky Dua (Cambridge, United Kingdom)
Piet Hein van der Graaf (Leiden, Netherlands)
Coen van Hasselt (Leiden, Netherlands)
Vivi Rottschäfer (Leiden, Netherlands)

Fibrodysplasia Ossificans Progressive

30 November – 4 December 2015@Oort

The aim of the Lorentz Center workshop on Fibrodysplasia Ossificans Progressive (FOP) was to bring together experts from different backgrounds involved or interested in FOP to initiate an in–depth discussion on the prospects of research in FOP. The ultimate goal was to identify the most important research questions to elucidate the complex causes of FOP, to determine new treatment options and the best way to study this. FOP is a progressive disease characterized by heterotopic ossifications following flare ups. The course of the FOP disease is devastating and many unknown factors still need to be resolved.

A group of 44 experts from all over the world participated in the Lorentz Oort workshop, who were mostly involved in FOP research from many different perspectives.. Each day was dedicated to one topic which started with a keynote lecture including the latest knowledge presented by experts. Each afternoon the morning expert presentations were followed by lively discussions. The days were closed formulating the most important evolved research questions and the desired breakthroughs. On the last day (5^{th}) a plenary discussion was held together with all involved pharmaceutical companies to share each prospective, to share new insights and to enable new collaborations and future developments. These topics included Muscle biology; In vitro and computer models; Targets for therapy and New perspectives as angiogenesis, new discoveries as Activin A antibodies and new statistical challenges.

Outcomes: Extremely enervating and fruitful in-depth discussions led to many new important questions. An article providing a roadmap in FOP research by summarizing the most important research questions in FOP will be submitted for publication by all participants.
The Lorentz organization and their workshop design were really perfect to enable in-depth discussions that were even ongoing during the social events till late. The contribution of the different experts in relation to FOP was an breakthrough leading to new insights for all participants.
New integrative and collaborative approaches were discussed and future plans initiated.

Breakthroughs were for instance new insights in muscle biology in relation to FOP leading to new research questions, the importance and collaborative contribution of different in vitro models, the development of a new collaborative study in modeling. The new development of Activin A antibodies which may enable surgery in the near future. The different existing in vitro and computer models all add important additional information in FOP research and combined they may add important contributions in the search for more treatment options in FOP in the future.

The format of the workshop was perfect, every participant was enthusiastic about the design and all are looking forward to a follow–up in the next years. The Lorentz organization, all their financial and logistic help and facilities made the workshop successful. We would advise every research groups lacking so many answers in difficult issues or diseases to collaborate with the Lorentz Center to organize a workshop.

Nathalie Bravenboer (Amsterdam, The Netherlands)
Marelise Eekhoff (Amsterdam, The Netherlands)
Gerard Pals (Amsterdam, The Netherlands)
Petra Knaus (Berlin, Germany)
Roberto Ravazzolo (Genova, Italy)

ICT with Industry

7 – 11 December 2015 @Oort

Since 2013, NWO and STW are collaborating with the research schools ASCI, IPA and SIKS in the organization of the ICT with Industry workshop. The main aim of the workshop is to stimulate contacts and future collaborations between researchers and professionals from industry and public organizations. At the 2015–edition the steering committee received overall very positive feedback from the participants. The most common remarks were, first of all, that the participants gained a broader view, and learned about new fields and the techniques that they use, which may possibly also be useful in their research work or within their organizations. Second, participants enjoyed meeting new people in a creative setting, yielding useful professional contacts for future collaborations. The workshop also allowed them to showcase their knowledge and skills, and thus gain more visibility. Third, participants appreciated gaining a better understanding of industry needs, and how their research may be useful for practical applications. The format of the workshop also gave people the opportunity to work on problems that they otherwise would not have the time for. Finally, several participants appreciated the additional guidance from the steering committee in solving their specific cases.
Experience of the existing workshops, such as Physics with Industry, Life Sciences with Industry, Mathematics with Industry and the previous editions of ICT with Industry, was used as points of considerations for this third edition.

The industrial partners presented their case study and objectives on the first day. Immediately afterwards, groups of participants began to brainstorm, to program and to look for possible solutions. Each team was guided by an academic team leader and the case owners. The case studies of 2015 were as follows:

- Alten PTS and Deltares: Towards computational early warning systems for cyanobacteria blooms in fresh–water swimming waters and drinking water reservoirs

The challenge was to construct an initial predictive, computational model of toxic scum formation of the fresh water cyanobacterium Microcystis aeruginosa, prepare it for the assimilation of satellite data and for integration into existing predictive models for surface water quality. During the workshop the team formulated research questions based on the existing information. Unfortunately the case owners could not attend the entire workshop, which was not very much stimulating for the team members. The team delivered a workshop report for Deltares and Alten PTS.

- Vicarvision and Noldus Information Technology: Tiny Motion Detection

During the workshop, the team worked on the following challenges:

  - Validation of the technology in scientific articles;
  - Extend the technology to include camera motion compensation, and validation of results;
  - Extend the technology to process crowds rather than a single subject;
  - If time permits: based on measured data: develop models, scientific analysis to interpret human.

The team was very dedicated to their case study and showed at the end of the workshop the possible solutions. At the moment the researchers are preparing a project proposal to be submitted for funding. The team delivered a workshop report for Vicarvision and Noldus Information Technology.

- IND and Belastingdienst: Towards a Method for a Formal Analysis of Law

Service providing organizations, either private or public, are increasingly working within a cross organizational setting. As a result they are confronted with more and more rules. These rules include external rules, coming from partner organizations. Much work has been done in recent years on agile ways of defining rules in IT–systems ('Rule–based or knowledge–based working', 'rule management', 'Knowledge as a Service' (KaaS)). However, no method exists as yet for guaranteed compliancy to the sources of law and other norm frameworks these rules are based on. During the week the team worked on identifying research questions and formulating possible recommendations. At the end of the week there were concrete plans for follow ups, among other internal workshop within IND and Belastingdienst, writing scientific publication and preparing a Lorentz workshop proposal. The team delivered a workshop report for IND and Belastingdienst.

- Greenclouds: Towards a MicroServices Architecture for Clouds

The case focused on the main research questions as follows:

  - How portable are applications to microservices? How well do state of the art methods lend themselves to this problem?
  - How can the performance of microservices be evaluated? Are standardized benchmark suites reusable in this context? How can the performance evaluation methodology be extended to include business impact metrics?

During the workshop the team came up with solutions and recommendations. At the moment the team is looking for funding possibilities for research projects. A possible spin–off may derive from this workshop. The team delivered a workshop report for Greenclouds.
In short, the workshop resulted in new collaborations and research ideas, which all have the potential to be further developed into research proposals. Funding possibilities were offered by NWO and STW.

The workshop results were communicated through the following channels:

- NWO EW newsletter: http://www.nwo.nl/actueel/nieuws/2015/ew/onder–druk–presteren.html
- NWO website: http://www.nwo.nl/over–nwo/organisatie/nwo–onderdelen/ew/bijeenkomsten/ict+with+industry+workshop/case+studies

On 22 March 2016 there will be a session dedicated to ICT with Industry 2015 at the ICT.OPEN2016, which is the main ICT research conference in the Netherlands. www.ictopen.nl

NWO and STW in collaboration with the research schools, ASCI, IPA and SIKS are currently planning the fourth edition Workshop ICT with Industry to be organized in 2016/2017. A Call for Case Studies has been published at: http://www.nwo.nl/over–nwo/organisatie/nwo–onderdelen/ew/bijeenkomsten/ict+with+industry+workshop

Jan Hidders (Delft, Netherlands)
Alexandru Iosup (Delft, Netherlands)
Arend Rensink (Twente, Netherlands)
Joaquin Vanschoren (Eindhoven, Netherlands)
Ana Lucia Varbanescu (Amsterdam, Netherlands)
Remco Veltkamp (Utrecht, Netherlands)

Quantum Random Walks and Quantum Algorithms

7 – 11 December 2015 @Snellius

Networks form the backbone of modern society. To deal with the uncertainty, variation, unpredictability, size and complexity inherent in these networks, we need to develop radically new ways of thinking. Progress is expected to come from a combination of stochastics and algorithmics.

Classical random walks have been used successfully to model a variety of phenomena in physics, chemistry and biology. Over the past century a vast body of knowledge has accumulated, leading to a better understanding of the basic processes underlying these phenomena. Classical random walks also play an important role in the development of classical algorithms, for instance, to explore the architecture of large networks or to find fast ways to optimize their performance. Much less is known in the quantum setting, for which there are many open questions and many key challenges. The main goal of the workshop was to bring together the classical and the quantum community, discuss these questions and challenges, and look for common ground.

Invited lectures were given by:
Andris Ambainis (Riga)
Alexander Belov (Riga)
Richard Cleve (Waterloo)
Yimin Ge (Munchen)
David Gosset (Waterloo)
Sabine Jansen (Bochum)
Stacey Jeffery (Boston)
Roman Kotecky (Prague & Warwick)
Robin Kothari (Waterloo)
Hans Maassen (Nijmegen & Amsterdam)
Fred Magniez (Paris)
Piotr Milos (Warsaw)
Ashley Montanaro (Bristol)
Maris Ozols (Cambridge)
Frank Redig (Delft)
Jeremy Roland (Brussel)
Mario Szegedy (New Brunswick)
Balint Toth (Budapest & Bristol)
Daniel Ueltschi (Warwick)
Reinhard Werner (Hannover)

There were 15 additional participants. People came from different backgrounds: probability theory, statistical physics, quantum physics, combinatorics, logic, algorithmic theory.

At the opening of the workshop the organizers explained the main goals of the meeting: identify key problems for quantum random walks, investigate their role for developing quantum algorithms, discuss recent developments, and explore the links with classical random walks and classical algorithms.

The workshop had a strategic nature. Each day was devoted to a core topic on the agenda, with a plenary discussion at the end. The meeting was closed with a plenary discussion to reflect on what had been achieved during the week, and to look towards the future.

Harry Buhrman (Amsterdam, Netherlands)
Frank den Hollander (Leiden, Netherlands)

Computational Cosmology

14 – 18 December 2015 @Oort

Over 70 people participated in what turned out to be a very successful meeting at the Lorentz Center.

The workshop, which was in part motivated by the visiting Oort professorship that was awarded to Prof. Carlos Frenk, brought together a substantial fraction of the leading researchers in the field of large–scale computer simulations of the growth of structure in the universe.

Progress in this field has been breathtaking in recent years. In the last two years, multiple simulations have been performed in which galaxies form that look remarkably like the observed ones. During the workshop we discussed both the successes and the limitations of such simulations. A lot of time was spent discussing new applications of the latest simulations, which led to the initiation of several new projects. The work that will be required to model the physics of the interstellar medium of galaxies in a cosmological context also received a lot of attention. Besides simulations of galaxies, other focal points were simulations of clusters of galaxies, of the epoch of reionization, and of the effects of different types of dark matter. Finally, code development featured in many talks and discussions.

The first and last days of the meeting were devoted entirely to work in small groups, while the middle three days consisted of a mixture of plenary sessions and time to work in groups. The majority of people were present all five days, but there was also a sizeable group of specialists who attended only particular days. This division was productive, since it enabled interaction with people with specific expertise for whom attending the entire week was either impossible or not sensible.

In total there were 45 plenary talks which each lasted 15 minutes including questions, as well as three plenary discussion sessions. The vast majority of the talks were given by PhD students and postdocs. The Tuesday ended with a wine & cheese party and the workshop dinner took place on Wednesday in "Het Prentenkabinet".

Altogether the workshop was very successful. People were brought up to date, existing collaborations were expanded and new ones were formed. The mix of different backgrounds enabled the participants to get to know different communities working on related aspects of the same problems. The large amount of time scheduled for "self–organized work" was very much appreciated. It allowed people to sit down together for in depth discussions and brain storms.

The diverse and excellent facilities of the Lorentz Center, as well as the efficient and friendly help from Tara Seeger and the other staff members, greatly contributed to the success of this workshop.

Carlos Fenk (Durham, United Kingdom)
Joop Schaye (Leiden, Netherlands)
Volker Springel (Heidelberg, Germany)
Peter Thomas (Brighton, United Kingdom)
Simon White (Garching, Germany)

Endophenotypes of Social Anxiety Disorder: Can we Detect Them and Are They Useful in Clinical Practice

14 – 18 December 2015 @Snellius

24 national and international experts in genetics, brain imaging, psychiatry and clinical and developmental psychology came together in Leiden to discuss possible endophenotypes of social anxiety disorder. Social anxiety disorder is characterized by a strong fear of being evaluated by others in a social situation. Previous research has shown that social anxiety runs in families. Although this suggests that genes are involved, there is no single social anxiety gene. The disorder seems to result from the interplay of many different genes, together with life experiences. Because genes are difficult to relate to symptoms, scientists are currently focusing at an intermediate step on their way to unravel the causes of the disorder: the endophenotype. An endophenotype is a heritable characteristic related to the disease, more strongly present in patients' relatives than in non–relatives and stronger in relatives that are more affected by the disorder.

This Lorentz workshop aimed to gain more insight into candidate endophenotypes of SAD and their potential relevance for clinical practice. We discussed the definition of endophenotypes, and debated on, for example, the question whether a characteristic may be responsive to treatment or has to be present throughout a person's life to qualify as an endophenotype. The fact that participants from various scientific backgrounds shared their views on this topic has led to interesting and inspiring discussions throughout the week.

After discussing endophenotypes and the reasons for suspecting their presence in social anxiety disorder on Monday, the workshop continued by examining candidate endophenotypes proposed in different fields for the next three days. These fields included the functioning of various brain regions and circuits, as measured by MRI, patterns of electrical activity of the brain (EEG, registered by placing electrodes on the head), hormones involved in the regulation of social behavior, and biases in information processing. On Thursday, the workshop addressed development, while family factors that contribute to social anxiety were also discussed. The final day of the workshop focused on treatment of social anxiety disorder. The program ended with a public keynote lecture by prof. Marcus Munafò, who discussed the utility of endophenotypes and offered recommendations to further improve the reproducibility of endophenotype research.

The output of the workshop–days will be published as a position paper that sets out the research agenda for the field of endophenotypes for social anxiety disorder. A synopsis for this paper, with the eye–catching title "*Taking Social Anxiety Disorder Seriously: Out of the shadows and into the spotlight*" has been written and is currently under review by a prestigious scientific journal.

We highly appreciated the multidisciplinary and interactive nature of the workshop. Compared with large-scale conferences, there was more time to hear about the details of each other's work and to receive feedback from experts. The time reserved for discussion offered ample opportunity to exchange ideas, set–up new collaborations and start working on a joint paper. Furthermore, the workshop was an excellent opportunity to build an international network of social anxiety researchers that may be successful at raising awareness of the disorder and obtaining funding for further research. Social anxiety disorder is highly prevalent, difficult to treat and often precedes mood and substance abuse disorders. It is detrimental to the quality of life of individuals and costly to society. Yet, the results presented during the workshop stem hopeful: they suggest several possible targets for intervention. It would be a missed opportunity not to invest in research exploring these possibilities.

Janna Marie Bas–Hoogendam (Leiden, Netherlands)
Jennifer Lau (London, United Kingdom)
Nic van der Wee (Leiden, Netherlands)
Michiel Westenberg (Leiden, Netherlands)

Funding Sources of the Lorentz Center

Basic Funding of the Lorentz Center

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

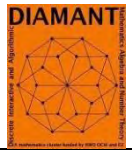
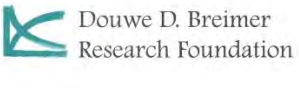
Leiden University Faculty of Science		Facilities and staff
FOM Foundation for Fundamental Research on Matter		Physics workshops
NWO Netherlands Organization for Scientific Research	Netherlands Organisation for Scientific Research	Workshops in Astronomy, Computational Science, Informatics, Life Sciences, Mathematics, and NIAS–Lorentz workshops
OCW Ministry of Education, Culture and Science	Ministerie van Onderwijs, Cultuur en Wetenschap	Lorentz Center@Snellius venue: renovation and interior Workshops Outreach
NIAS Netherlands Institute for Advanced Study in the Humanities and Social Sciences		NIAS–Lorentz workshops
Lorentz Fonds	Lorentz fonds	Physics workshops

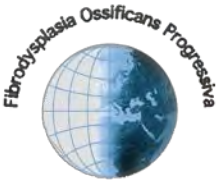
Additional funding for specific Lorentz Center meetings

Funding granted to the scientific organizers of the meetings
2015 Additional Funding for Specific Lorentz Center Meetings

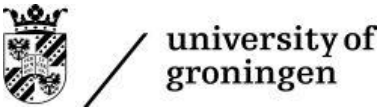
Sponsor		Workshop
3TU. Centre for Ethics and Technology	3TU.Centre for Ethics and Technology	>Capillarity of Soft Interfaces
3TU. Applied Mathematics Institute	4TU.AMI	>Brain Equations: Challenges and Next Generation Mathematical Models
aicas	aicas realtime	JML: Advancing Specification Language Methodologies
Alten PTS	ALTEN PTS	> ICT with Industry
ANR	Agence Nationale de la Recherche ANR	> Active Liquids
ASML		> Liquid Fragmentation in Nature and Industry
Bejo Zaden bv	bejo zaden bv	> Life Sciences with Industry 2015

Bioceros bv		> Life Sciences with Industry 2015
BioSolar Cells		> The Future of Multi–Scale Soft Matter Modeling
Bina Technologies		> Future Perspectives in Computational Pan–Genomics
Company of Biologists		> Human Circadian Rhythms: Developing a Multi–Oscillator Framework
COST		> Energetic Processing of Large Interstellar Molecules > Integrative Cell Models: Bridging Microbial Physiology and Systems Biology
CWI		> Quantative Biology of Auxin Transport
Delta		> Transformations in Optics
Deltares		> ICT with Industry

DIAMANT Cluster		> Moduli Spaces and Arithmetic Geometry
Donders Institute		> ICT with Industry
Douwe D. Breimer Research Foundation		> Mathematical Pharmacology
DTCA		ICT with Industry
Dutch Astrochemistry Network		> Energetic Processing of Large Interstellar Molecules
ERASys*APP*		> Training Course: Data Integration in the Life Sciences
ERIBA		> Future Perspectives in Computational Pan–Genomics
ESF		> Quantative Biology of Auxin Transport

ESPCI		> Superconductivity on the Verge
European Research Counsil		> Capillarity of Soft Interfaces > Compact Objects as Astrophysical and Gravitational Probes > Extracting Information from Weak Lensing: Small Scales = Big Problem? > To be Announced! Synthesis of Epistemic Protocols > Transition Disks and Planet Formation
European Union		> Compact Objects as Astrophysical and Gravitational Probes
FOM		> Amyloid Aggregation: Single Molecule Approaches to a Many Molecule Problem > Liquid Fragmentation in Nature and Industry
Fonds George Charpak		> Active Liquids
FOP		> Fibrodysplasia Ossificans Progressiva
Foundation Compositio Mathematica		> Dynamics and Geometry> Geometric Invariants and Quantum Spectral Curves > Moduli Spaces and Arithmetic Geometry
Fundação para a Ciênca e a Tecnologia		> Compact Objects as Astrophysical and Gravitational Probes

FWO–WOG	FWO VLAANDEREN FWO-WOG Stochastische modellering met toepassingen in financiële markten	> Models and Numerics in Financial Mathematics
Genalice	GENALICE TECHNOLOGY FOR PEOPLE & SCIENCE	> Future Perspectives in Computational Pan–Genomics
Github	GitHub	> Python in Astronomy
GQT	GQT	> Dynamics and Geometry > Geometric Invariants and Quantum Spectral Curves > Moduli Spaces and Arithmetic Geometry
Greenclouds	GREENCLOUDS running the cloud together	> ICT with Industry
High School of Economics	HIGHER SCHOOL OF ECONOMICS	> Geometric Invariants and Quantum Spectral Curves
i3B	i3B	> ICT with Industry
IBM	IBM	> ICT with Industry

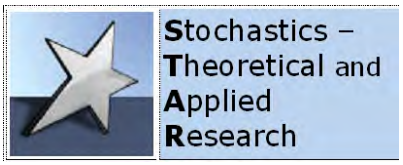
ILLC		> Reappraising the Role of Linear Structure in Language> To be Announced! Synthesis of Epistemic Protocols
ING		> Models and Numerics in Financial Mathematics
Institute of Biology Leiden		> Quantative Biology of Auxin Transport
International Society of Photosynthesis Research		> Good Vibrations for Energy Management in Biomolecules
ISSP		> An Emerging Technological and Societal Transition: Preparing for the Post–Industrial World
Johann Bernoulli Institute		> Dynamics and Geometry
KBC Bank Brussel		> Models and Numerics in Financial Mathematics
KNAW		> Amyloid Aggregation: Single Molecule Approaches to a Many Molecule Problem > Clusters, Games and Axioms > Dynamics and Geometry > Future Perspectives in Computational Pan–Genomics > Good Vibrations for Energy Management in Biomolecules > Logic and Random Graphs > Proteins and Beyond > Social Support TAT: Theory, Applications and Technology

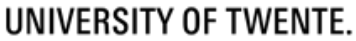
		> Superconductivity on the Verge
Language in Interaction	LANGUAGE in INTERACTION	> Reappraising the Role of Linear Structure in Language
Las Cumbres ObservatoryGlobal Telescope Network	LCOGT.net	> Python in Astronomy
Leiden University FWN 200 jaar	We are SCIENCE SINCE 1815	> Proteins and Beyond
Leiden University Leids Universiteits Fonds	Leids Universiteits Fonds	> Proteins and Beyond
LION	LION Leiden Institute of Physics	> Amyloid Aggregation: Single Molecule Approaches to a Many Molecule Problem
Marie Curie Actions	GREAT-ITN MARIECURIE ACTIONS MARIE CURIE ACTIONS	> Compact Objects as Astrophysical and Gravitational Probes > Reappraising the Role of Linear Structure in Language
Mathematisch Instituut Leiden	Mathematisch Instituut Universiteit Leiden	> Quantative Biology of Auxin Transport
Max Planck Institute for Demographic Research	MAX-PLANCK-INSTITUT FÜR DEMOGRAFISCHE FORSCHUNG MAX PLANCK INSTITUTE FOR DEMOGRAPHIC RESEARCH	> Capturing Phylogenetic Algorithms for Linguistics

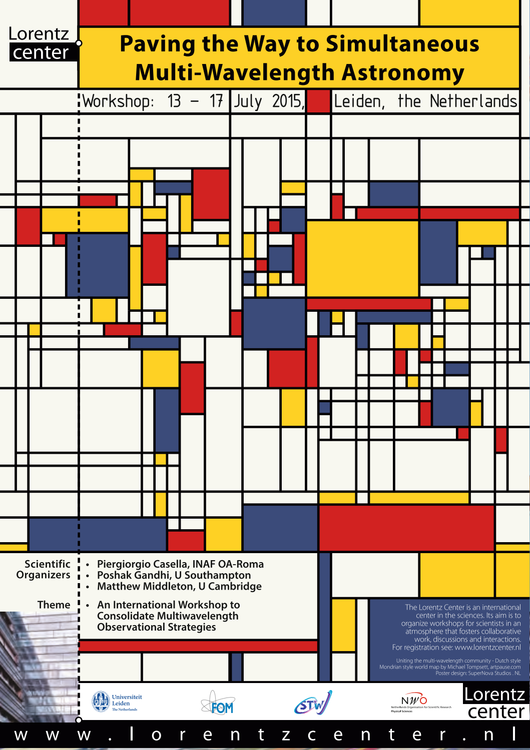
Ministerie van Veligheid en Justitie Immigratie– en Naturalisatiedienst		> ICT with Industry
MSC		> Active Liquids
NanoFront		> Proteins and Beyond > Transformations in Optics
National Science Foundation		> Moduli Spaces and Artihmetic Geometry> Shape Constrained Inference: Open Problems and New Directions
NDNS+ Cluster		> Brain Equations: Challenges and Next Generation Mathematical Models > Dynamics and Geometry > Quantitative Biology of Auxin Transport
Netherlands Foundation for Pharmacological Sciences		> Mathematical Pharmacology
Netherlands Institute for System Biology		> Training Course: Data Integration in the Life Sciences
Networks		> Quantum Random Walks and Quantum Algorithms

NIAS		> Reappraising the Role of Linear Structure in Language > Social Support TAT: Theory, Application and Technology > Socio–Economic Complexity
Nissan		> HART – Human–Agent–Robot Teamwork: Tools and Methods for Designers
NLeScience Center		> An Emerging Technological and Societal Transition: Preparing for the Post–Industrial World
Noldus		> ICT with Industry
Norden		> An Emerging Technological and Societal Transition: Preparing for the Post–Industrial World
NOVA		> Energetic Processing of Large Interstellar Molecules > Shock Acceleration: from the Solar System to Cosmology > The Impact of Massive Binaries Throughout the Universe > The Life and Death of Satellite Galaxies > Transition Disks and Planet Formation
NumFOCUS		> Python in Astronomy
Nutricia Research		> Life Sciences with Industry 2015

NWO		> Clusters, Games and Axioms > Dynamics and Geometry > Future Perspectives in Computational Pan–Genomics > Logic and Random Graphs > Moduli Spaces and Arithmetic Geometry > Quantitative Biology of Auxin Transport
NXP		> Life Sciences with Industry 2015
PacBio		> Future Perspectives in Computational Pan–Genomics
Pfizer		> Mathematical Pharmacology
Philips		> Life Sciences with Industry 2015
Platform Wiskunde Nederland		> Mathematical Pharmacology
Python		> Python in Astronomy
Centre for Quantum Geometry of Moduli Spaces		> Geometric Invariants and Quantum Spectral Curves

Rabobank		> Models and Numerics in Financial Mathematics
Roche		> Mathematical Pharmacology
SAESPCI		> Active Liquids
Springer		> To be Announced! Synthesis of Epistemic Protocols
Star Stochastics		> Logic and Random Graphs > Shape Constrained Inference: Open Problems and New Directions
Syngenta		> Life Sciences with Industry 2015
Truce		> An Emerging Technological and Societal Transition: Preparing for the Post–Industrial World
University of Amsterdam		> Socio–Economic Complexity

University of Nottingham		> Brain Equations: Challenges and Next Generation Mathematical Models
University of Surrey		> Human Circadian Rhythms: Developing a Multi–Oscillator Framework
University of Twente		> Brain Equations: Challenges and Next Generation Mathematical Models
Vicarvision		>ICT with Industry
VUmc		> Fibrodysplasia Ossificans Progressiva
Wonder		> Geometric Invariants and Quantum Spectral Curves


Lorentz center
Paving the Way to Simultaneous Multi-Wavelength Astronomy
Workshop: 13 – 17 July 2015, Leiden, the Netherlands
Scientific Organizers
Piergiorgio Casella, INAF OA-Roma
Poshak Gandhi, U Southampton
Matthew Middleton, U Cambridge
Theme
An International Workshop to Consolidate Multiwavelength Observational Strategies
The Lorentz Center is an international center in the sciences. Its aim is to organize workshops for scientists in an atmosphere that fosters collaborative work, discussions and interactions.
For registration see: www.lorentzcenter.nl
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Enumeration Algorithms Using Structure
Workshop: 24 – 28 August 2015, Leiden, the Netherlands
Scientific Organizers
Hans Bodlaender, Utrecht U
Endre Boros, Rutgers U
Pinar Heggernes, U Bergen
Dieter Kratsch, U Lorraine
Invited Speakers
Bruno Courcelle, U Bordeaux
Arnauld Durand, Paris-Diderot U
Khaled Elbassioni, Masdar Institute
Vladimir Gurvich, Rutgers U
Mamadou Kanté, Blaise Pascal U
Takeaki Uno, NII Tokyo
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Lorentz center
The Future of Multi-Scale Soft Matter Modeling
Workshop: 31 Aug. – 4 Sept. 2015, Leiden, the Netherlands
Scientific Organizers
Ignacio Pagonabarraga, U Barcelona
Agur Sevink, Leiden U
Ryoichi Yamamoto, Kyoto U
Andrei Zvelindovsky, U Lincoln
Invited Speakers
Peter Bolhuis, U Amsterdam
Eric Clement, UPMC Paris
Gijsje Koenderink, Amolf Amsterdam
Marcus Müller, U Göttingen
Anjali Pandit, Leiden U
Friederike Schmid, JGU Mainz
Gregory Voth, U Chicago
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Geometric Invariants and Quantum Spectral Curves
Workshop: 1 – 5 June 2015, Leiden, the Netherlands
Scientific Organizers
Leonid Chekhov, Steklov Moscow
Bertrand Eynard, IPhT Gif-sur-Yvette
Sergey Shadrin, U Amsterdam
Invited Speakers
Joergen Andersen, QGM / Aarhus U
Gaetan Borot, MPIM Bonn
Vincent Bouchard, U Alberta
Olivia Dumitrescu, U Hannover
Maxim Kazarian, HSE Moscow
Johan van de Leur, U Utrecht
Todor Milanov, Kavli IPMU
Motohico Mulase, UC Davis
Paul Norbury, U Melbourne
Nicolas Orantin, EPFL Lausanne
Alexandr Orlov, HSE Moscow
Peter Zograf, PDMI St. Petersburg
Dimitri Zvonkine, JMI Paris
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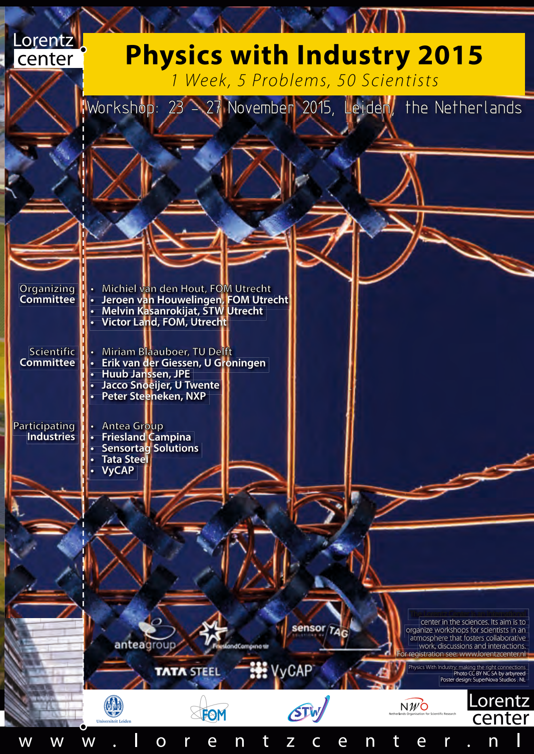
Lorentz center
Physics with Industry 2015
1 Week, 5 Problems, 50 Scientists
Workshop: 23 – 27 November 2015, Leiden, the Netherlands
Organizing Committee
Michiel van den Hout, FOM Utrecht
Jeroen van Houwelingen, FOM Utrecht
Melvin Kasanrokijat, STW Utrecht
Victor Land, FOM, Utrecht
Scientific Committee
Miriam Blaauboer, TU Delft
Erik van der Giessen, U Groningen
Huub Janssen, JPE
Jacco Snoeijer, U Twente
Peter Steeneken, NXP
Participating Industries
Antea Group
Friesland Campina
Sensortag Solutions
Tata Steel
VyCAP
anteagroup
TATA STEEL
VyCAP
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Lorentz center
Socio-Economic Complexity
NIAS
Workshop: 23-27 March 2015, Leiden, the Netherlands
Scientific Organizers
Cars Hommes, NIAS / U Amsterdam
Distinguished Lorentz Fellow
Stefano Battiston, U Zürich
Andreas Flache, U Groningen
Diego Garlaschelli, Leiden U
Hans Heesterbeek, Utrecht U
Keynote Speakers
Doyne Farmer, INET Oxford
Andrew Haldane, Bank of England
Carlo Jaeger, Global Climate Forum
Marten Scheffer, Wageningen U
Invited Speakers
Cees Diks, U Amsterdam
Frank van Harmelen, VU Amsterdam
Charlotte Hemelrijk, U Groningen
Lex Hoogduin, U Groningen
Giulia Iori, City University London
Marco van der Leij, U Amsterdam
Michael Mäs, ETH, Zurich
Tiziana di Matteo, King's College London
Suzy Moat, U Warwick
Isabelle Salle, U Amsterdam
Peter Vervest, Erasmus U
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Lorentz center
Models and Numerics in Financial Mathematics
Workshop: 26 – 29 May 2015, Leiden, the Netherlands
Scientific Organizers
Karel in 't Hout, U Antwerp
Kees Oosterlee, CWI Amsterdam
Invited Speakers
Kristian Debrabant, SDU Odense
Matthias Ehrhardt, U Wuppertal
Fabien Le Floc'h, Calypso
Peter Forsyth, U Waterloo
Sven Foulon, Banco Santander
Emmanuel Gobet, TU Palaiseau
Lech Grzelak, Rabobank
Margaret Insley, U Waterloo
Andrey Itkin, New York U
Alex Lipton, Bank of America
Luis Ortiz-Gracia, CRM Barcelona
Andrea Pascucci, U Bologna
Christoph Reisinger, U Oxford
Mike Staunton, London Business School
Jari Toivanen, Stanford U
Carlos Vazquez-Cendon, U of A Coruña
Uwe Wystup, MathFinance
... plus many prominent researchers from Belgium and the Netherlands
KBC
ING
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Lorentz center
Capillarity of Soft Interfaces
Workshop: 2 – 6 November 2015, Leiden, the Netherlands
Scientific Organizers
Bruno Andreotti, ESPCI Paris
Karen Daniels, NCSU
Eric Dufresne, Yale U
Jacco Snoeijer, U Twente / TU Eindhoven
Robert Style, Oxford U
Invited Speakers
Françoise Brochard-Wyart, Curie Paris
Hans-Jürgen Butt, MPIP Mainz
Elisabeth Charlaix, LIPhy
Chung-Yuen (Herbert) Hui, Cornell U
Anand Jagota, Lehigh U
Elie Raphael, ESPCI Paris
Benoit Roman, ESPCI Paris
Martin Shanahan, U Bordeaux
Howard Stone, Princeton U
Simeon Stoyanov, Wageningen UR
Byung Mook Weon, Sungkyunkwan U
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Lorentz center
Life Sciences with Industry 2015
1 week, 40 scientists, 6 challenges
Workshop: 16 – 20 November 2015, Leiden, the Netherlands
Organizers
Roel van Driel, U Amsterdam
Gökhan Ertaylan, MaCSBio Maastricht
Ellen Feddes, STW Utrecht
Jurgen Haanstra, VU Amsterdam
Participating Industries
Bejo Zaden B.V.
Bioceros B.V.
Nutricia Research
NXP N.V.
Philips Research
Syngenta
Bejo
NXP
DANONE NUTRICIA RESEARCH
PHILIPS
syngenta
Lorentz center
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