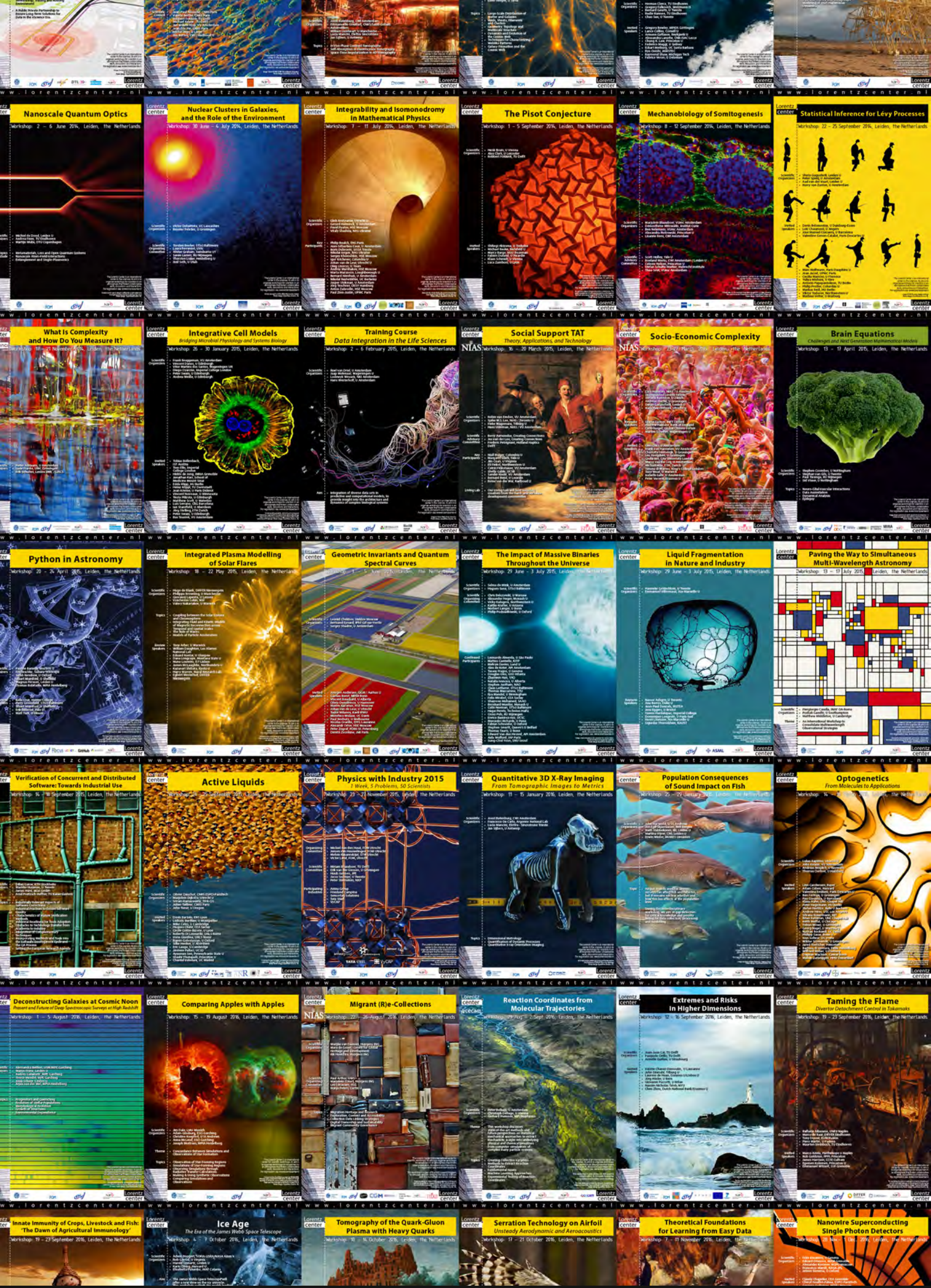
Lorentz center

Lorentz Center
Self-Assessment 2014-2018


Nanoscale Quantum Optics
Nuclear Clusters in Galaxies, and the Role of the Environment
Integrability and Isomonodromy in Mathematical Physics
The Pisot Conjecture
Mechanobiology of Somitogenesis
Statistical Inference for Lévy Processes
What Is Complexity and How Do You Measure It?
Integrative Cell Models
Bridging Microbial Physiology and Systems Biology
Training Course
Data Integration in the Life Sciences
Social Support TAT
Theory, Applications, and Technology
Socio-Economic Complexity
Brain Equations
Challenges and Next Generation Mathematical Models
Python in Astronomy
Integrated Plasma Modelling of Solar Flares
Geometric Invariants and Quantum Spectral Curves
The Impact of Massive Binaries Throughout the Universe
Liquid Fragmentation in Nature and Industry
Paving the Way to Simultaneous Multi-Wavelength Astronomy
Verification of Concurrent and Distributed Software: Towards Industrial Use
Active Liquids
Physics with Industry 2015
1 Week, 5 Problems, 50 Scientists
Quantitative 3D X-Ray Imaging
From Tomographic Images to Metrics
Population Consequences of Sound Impact on Fish
Optogenetics
From Molecules to Applications
Deconstructing Galaxies at Cosmic Noon
Present and Future of Deep Spectroscopic Surveys at High Redshift
Comparing Apples with Apples
Migrant (R)e-Collections
Reaction Coordinates from Molecular Trajectories
Extremes and Risks in Higher Dimensions
Taming the Flame
Divertor Detachment Control in Tokamaks
Innate Immunity of Crops, Livestock and Fish: 'The Dawn of Agricultural Immunology'
Ice Age
The Era of the James Webb Space Telescope
Tomography of the Quark-Gluon Plasma with Heavy Quarks
Serration Technology on Airfoil
Unsteady Aerodynamic and Aeroacoustics
Theoretical Foundations for Learning from Easy Data
Nanowire Superconducting Single Photon Detectors

Lorentz Center

Self-Assessment 2014-2018

CONTENTS

1.

MISSION, ORGANIZATION AND CORE VALUES

The Lorentz Center is a national center for international workshops in all scientific disciplines. Our guiding philosophy is that innovative research thrives on interactions between creative researchers: Lorentz Center workshops focus on initiating and stimulating interactions and new collaborations between (groups of) researchers.

1.1 Lorentz Center workshops

The driving force of the Lorentz Center is to advance science by initiating and stimulating new scientific collaborations and interactions. The core values and tools on which we base our contribution to scientific progress, and thus the organization of our workshops, are:

- High scientific quality
- Time for interaction and reflection
- Building bridges between individuals and/or communities
- Diversity in all aspects
- Support in developing ideas into successful workshops
- Open to initiatives from within as well as from outside the academic world
- Space for daring and unusual initiatives
- Welcoming and inclusive environment
- Care for all practical matters: *'You do the research, we do the rest'*

Lorentz Center workshops can be proposed and organized by any researcher in any field of research, at any professional level, and from any geographical location. Our workshops focus on collaborations and interactions within highly diverse groups of researchers – with different scientific viewpoints, as well as (geographical) origin, (academic) seniority, gender, and culture. The Lorentz Center welcomes multidisciplinary[1] initiatives – we consider the successful multidisciplinary part of our program one of our unique qualities. However, we believe that multidisciplinary progress must be based on (mono)disciplinary strength, hence monodisciplinary workshops form another cornerstone of our program.

Our workshops have clearly defined aims, but do not necessarily require tangible outcomes (for instance in the form of publications). The program of a Lorentz Center workshop is usually interactive and ample time is allocated for discussions among individuals or in groups. Our workshops typically have a duration of 5 days and the number of participants is limited: it is essential to a Lorentz Center workshop that all participants get to know one another throughout the meeting. This way, we optimize the potential long term impact of our meetings. Organizers are encouraged to stimulate diversity and to boost the active participation of all participants, including the junior researchers. The financial and organizational support provided by the Lorentz Center allows participants as well as organizers to focus on their research. Moreover, we also welcome different meeting formats or combinations of formats, like study groups, consortia meetings and industrial teams.

The two Lorentz Center venues are set up to optimally facilitate our mission and core values. The venue Lorentz Center@Oort can accommodate groups of up to 55 participants, while the Lorentz Center@Snellius is especially designed for smaller groups of up to 25 participants. The lecture rooms and the casual common rooms are centrally located at each venue and designed to stimulate interaction and discussion among the participants. In addition, both venues have several break-out locations for groups of varying sizes, provide personal working spaces for all participants, and are furnished to facilitate in-depth discussions throughout the venue.

1. For simplicity, we do not distinguish between multi-, inter- and transdisciplinary (etc.) in this report.

1.2 Management and staff

In the period 2014-2018, our staff grew from 7.2 to 12.5 FTE[2] (Figure 1). Since the Lorentz Center@Snellius was opened in the fall of 2012, this growth reflects the development of a center with only one venue and about 40-45 workshops per year to the present size of about 80-85 workshops per year at two venues. Moreover, starting in the summer of 2015, the program of the Lorentz Center in the social sciences and humanities (SSH) was significantly expanded and strengthened.

The management of the Lorentz Center comprises of the director, institute manager and scientific manager, together they run the Center and shape its course and strategy. The director, prof. dr. Arjen Doelman, is the Lorentz Center's figurehead for the scientific community – from active scientists through funding agencies and policy makers. The director has the ultimate responsibility for all Lorentz Center activities and staff; his major direct activities concern the scientific program, strategy, external contacts and fundraising. The institute manager, or executive director, Dr. Anna Tudos, is responsible for the daily management of the Lorentz Center, its operational management and for the practical organization of the Lorentz Center meetings. The institute manager is in charge of all practical aspects of the Lorentz Center. The scientific manager, dr. Henriette Jensenius, is responsible for the scientific program, the application process and the (contacts with the) scientific advisory boards, as well as for further developing the workshop format and the scientific procedures.

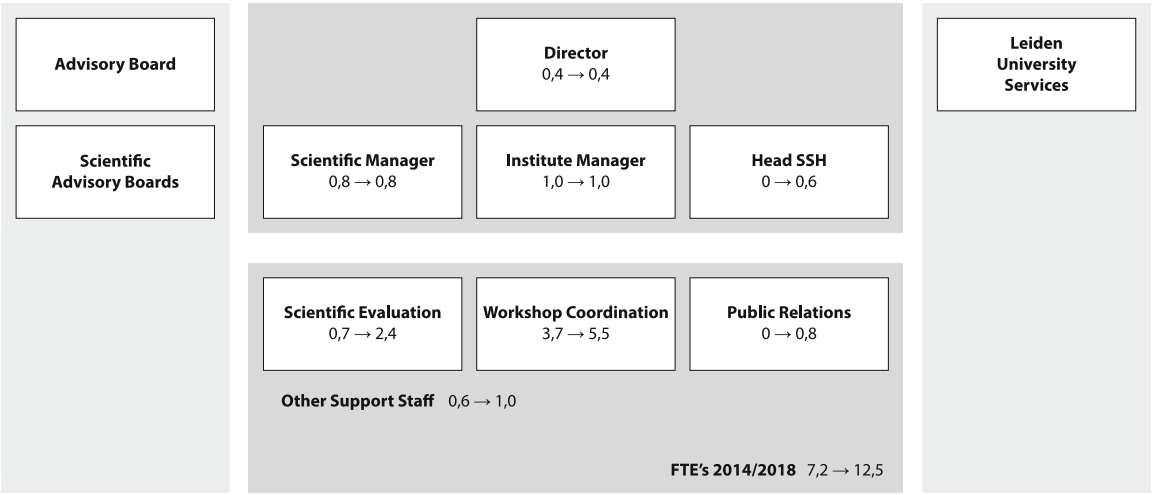


Figure 1. Organizational chart of the Lorentz Center depicting the different roles and the growth in FTEs between 2014 and 2018.

In 2015, the position of 'Head SSH' was created. Taken up by dr. Mieke Schutte, this 'quarter making' role was aimed at boosting and broadening the Lorentz Center program in the SSH domain. The activities of the Head SSH ranged from initiating workshops by actively attracting potential organizers and setting up a Scientific Advisory Board to raising and securing funding for the activities of the Lorentz Center within the SSH. The 'quarter making' activities were successful on all fronts and by 2018 SSH workshops amounted to about one third of our total program with about 25-30 SSH workshops per year (see Table 3).

2. FTE = full-time equivalent

The staff of the Lorentz Center is one of our key strengths. Together, they constitute a dedicated and flexible team that takes care of all aspects of 'running' the Lorentz Center: our team enables the atmosphere of 'You do the science, we do the rest' that is so crucial to the success of the Lorentz Center. The organizational chart shows the integral growth of the Lorentz Center and thus of its team, both in scientific evaluation – supporting the scientific programming and the application process – as well as in workshop coordination – taking care of all practical aspects of workshop organization. Moreover, a new role has been created for public relations, to support external communication, joint initiatives with special calls (e.g. our collaborations with NIAS, the CECAM[3] , see Section 2.5), and our public outreach activities (see Section 5.3) and to coordinate the production of our workshop posters.

1.3 Advisory Boards

The Lorentz Center is supported by eight Scientific Advisory Boards. Most boards center around a scientific discipline, others are explicitly interdisciplinary[4]. Together our boards are composed of around 100 members, (mostly) active researchers that are chosen based on their scientific merit as well as on their interest in research beyond their own direct specialty. Moreover, we seek a balance in scientific expertise, representation of Dutch universities and research institutes, as well as gender and (academic) seniority. We hold that only peers can evaluate scientific quality, therefore, the opinion of the boards is decisive in issues involving scientific content and is leading in developing our scientific policies.
The activities of the boards include:

- Evaluate workshop applications
- Inform the Lorentz Center about significant scientific developments and emerging topics
- Provide advice and feedback on the course and strategies of the Lorentz Center
- Act as ambassadors and stimulate researchers to apply for a Lorentz Center workshop

The Scientific Advisory Boards are essential to the success of the Lorentz Center: we thrive on direct contact with active scientists and scholars, (the members of) our Boards are our most important links to this community, also by being our most important ambassadors connecting us to their colleagues. The chairs of the Scientific Advisory Boards play a special role: we discuss all important decisions and scientific choices with our chairs. A similar role is played by the Advisory Board, a board installed at the request of the Faculty of Science of Leiden University to match the advisory board structure of the institutes within the Faculty. The role of this board is to signal and share societal trends relevant for the Lorentz Center and act as advisors and ambassadors, also beyond the academic world.

---

3. NIAS = Netherlands Institute for Advanced Study in the Humanities and Social Sciences, https://nias.knaw.nl CECAM = Centre Européen de Calcul Atomique et Moléculaire, www.cecam.org. See Appendix 6.1 for a list of all used abbreviations.

4. The 8 Advisory Boards: Astronomy, Chemistry, Computational Science, Informatics, Life and Medical Sciences, Mathematics, Physics and NIAS-Lorentz (SSH). See Appendix 6.2 for the present composition of the boards.

1.4 Finances

The funding of the Lorentz Center is comprised of two major sources of comparable magnitudes: Leiden University and the Dutch Research Council (NWO). A third significant source is the external funding obtained by our organizers – see Table 1.

Within Leiden University, the relatively constant funding by the Faculty of Science (FNW) of about 300 k€/year was strengthened from 2015 by the Executive Board (CvB) (with 300 k€/year) and three SSH faculties[5] (in total 200 k€/year). These investments aimed (successfully) at boosting our program within the SSH, more specifically at expanding our NIAS-Lorentz program – that focuses on multidisciplinary activities that bridge the sciences and the SSH domain – to a fully developed general program within the SSH.

In 2016, the first year of the present NWO funding period (2016-2020), the origin and distribution of the NWO funding had a somewhat complex structure, based on the seven NWO 'divisions' – totaling 515 k€/year – in addition to 250 k€/year direct support by the General Board. After the restructuring of NWO in 2017, the main support of the Lorentz Center comes through the Domain of Science (390 k€/year) together with the Executive Board (250 k€/year), with relatively minor support by the Domain Social Sciences and Humanities (65k€) and the Domain Applied and Engineering Sciences (TTW, 60 k€/year). The Lorentz Center does not receive support from the fourth NWO domain, the Domain for Health Research and Development (ZonMw).

The third major funding source is the external funding successfully acquired by our organizers and allocated to support their workshop. In 2014 this added up to 285 k€. The external funding has grown in the period 2016-2018 to just under 500 k€. Finally, other organizations have been providing steady support to specific workshops, e.g. the Lorentz Fonds, CECAM and the Netherlands eScience Center.

Table 1. Overview of Lorentz Center funding in the period 2014-18 (in k€).

Funding source	Funding per year (k€)				
	2014	**2015**	**2016**	**2017**	**2018**
Leiden U FNW	285	289	323	329	317
Leiden U (for SSH)	0	40	471	500	500
NWO (total)	798	776	809	765	765
External funding of workshops	228	238	494	495	494
Others	122	137	120	51	51

In Table 2, the expenditures are shown along two dimensions: on staff and material as well as on workshops; since the organized workshops largely determine our expenditures, the number of workshops/year is added as reference. The total workshop costs are comprised of FTE costs, material costs and external funding. In 2015, the final year of the previous funding cycle, the limited NWO funding hampered the integral growth observed in other years, hence, fewer workshops could be organized. The steady funding in 2016 through 2018 allowed the increase

5. Faculty of Humanities, Faculty of Social and Behavioural Sciences and Leiden Law School.

of the number of workshops to around 80. The broadening of scientific scope, and especially the growth of our SSH program, did not jeopardize our 'classical' core of 50-60 science-oriented workshops – as agreed with all parties involved at the onset of our expansion of into the SSH.

Table 2. Overview of Lorentz Center expenditures in the period 2014-18 (in k€).

	Expenditures per year (k€)				
	2014	**2015**	**2016**	**2017**	**2018**
FTE costs	513	596	804	858	785
Material costs	181	138	182	158	243
Workshop costs total	1324	1122	1729	1735	1681
of which external funding	377	426	495	495	486
Number of workshops	64	56	76	81	80

1.5 Comparison with sister institutes

Internationally, a multitude of centers has features in common with the Lorentz Center. We consider two aspects of the Lorentz Center as decisive: the organization of 1-week workshops and the range of the scientific spectrum. Here, we compare the Lorentz Center to other institutes from the point of view of these two aspects.

Similar to the Lorentz Center, a number of centers worldwide focus on the organization of 1-week workshops. Some of the most established are the *Mathematisches Forschungsinstitut Oberwolfach* (MFO) and *Schloss Dagstuhl*, both in Germany, that organize workshops (almost) every week of the year. Both institutes are highly regarded in their fields, respectively mathematics and computer science, and their scientific program strongly centers on their core disciplines. Especially within mathematics, this format has been successfully implemented at various sister institutes all over the world, for example *Banff International Research Station for Mathematical Innovation and Discovery* in Canada. The *NII Shonan Meetings* in Japan provide a recent example in computer science.

The organization of 1-week workshops has a strong tradition in astronomy, computer science, mathematics and physics, the original focus areas of the Lorentz Center. In the majority of comparable centers in these fields, 1-week workshops are often one feature of larger programs that last about 3-6 months. During these programs, the centers also have long term visitors. Often, they also have a postdoc program. Some of the most famous institutes are *Aspen Center for Physics* and *KITP Institute for Theoretical Physics* in the US and the *Isaac Newton Institute for Mathematical Sciences* in the UK.

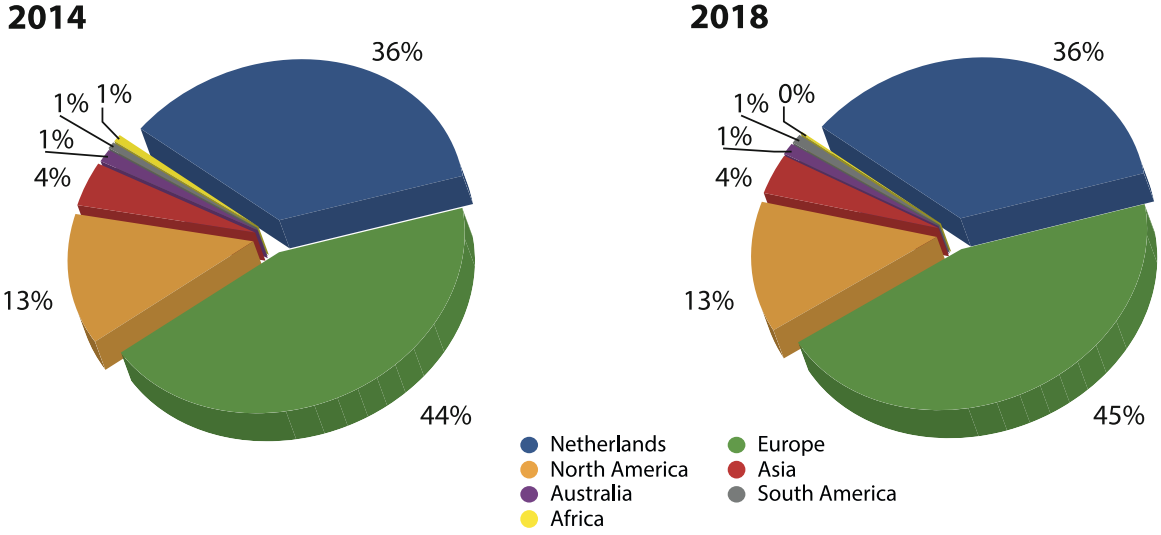
Regarding the breadth of the scientific spectrum, especially *Institutes for Advanced Study* – such as the IAS at Princeton (US), the NIAS in the Netherlands, het FRIAS in Freiburg (Germany) and STIAS in Stellenbosch (South Africa) – are, by their nature, open to a large variety of scientific and scholarly fields. The focus of their activities is on long term visitors, sometimes also on faculty. These visitors may organize workshops, or symposia, but this is not the core business of the institute. Some of these institutes are dedicated to multidisciplinary science – for instance the *Ernst Strüngmann Forum* associated to the FIAS in Frankfurt (Germany) – but in general, the set-up is based on individual scientists/scholars who come to the IAS to do multidisciplinary research, sometimes in interaction with a limited number of close collaborators.

The *Tohoku Forum for Creativity* (TFC) in Japan was set up inspired by the format and the success of the Lorentz Center. The Lorentz Center even has an official *Agreement on Academic Collaboration* with TFC. There are a number of similarities: the TFC is open to proposals from all scientific and scholarly fields and has a strong multidisciplinary focus. The main distinction is that also the TFC runs longer, larger, thematic programs that include long term visitors and 'embedded' workshops.

Thus, although various centers focus on the organization of 1-week workshops, the Lorentz Center is unique in successfully 'exporting' this concept beyond the fields of astronomy, computer science, mathematics and physics, as proven by the viability of our program in the social sciences and humanities. Moreover, unlike any other center in the world, the Lorentz Center has realized – and demonstrated – that the concept of stimulating active collaborations in the setting of a 1-week workshop is pre-eminently suitable for establishing viable multidisciplinary connections and communities.

1.6 Diversity

The Lorentz Center aims at increasing diversity among the workshop participants and to create an inclusive environment for all our visitors. Figure 2 indicates no significant change of the geographical distribution of the participants of our workshops between 2014 and 2018. The diversity in (academic) seniority shows a similarly 'stable' level: the active stimulation of our organizers to invite junior participants clearly has been recognized by the community. Moreover, the Lorentz Center recognizes that the organization of a Lorentz Center workshop may be especially beneficial for early/mid-career researchers, especially those who wish to explore and open new fields of research. Therefore, we actively stimulate potential organizers in this stage of their career – with the invaluable help of our Advisory Boards.



	Nether-lands	Europe	North America	Asia	Australia	South America	Africa
2014	957	1165	358	115	33	17	19
2018	1107	1380	412	121	34	28	6

Figure 2. Geographical distribution of participants

The gender distribution (Figure 3) shows a slight increase of female participants towards 30%[6], however this increase is related to the broadening associated with the introduction of SSH workshops. After extensive deliberation with all our Scientific Advisory Boards, we decided not to work with 'hard quota' to improve the gender balance of our workshops within the sciences, but continue to actively challenge the (potential) organizers to increase the percentage of female participants. For every discipline, we have determined the average percentage of female participants in Lorentz Center workshops, and urge organizers to aim for a higher percentage in their workshop. The feedback and suggestions from our Boards are instrumental, especially in the iterative application process (see Section 2.1), moreover, we use our direct contacts with (potential) organizers at every stage of the process.

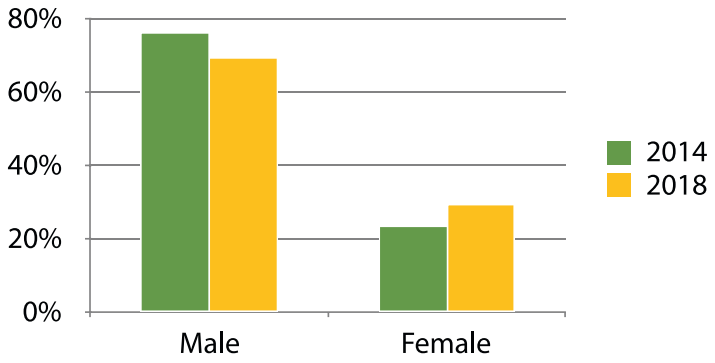


Figure 3. A small shift in gender distribution between 2014 and 2018.

To further stimulate diversity among participants we created a diversity fund in 2018. The fund is available to all researchers attending a Lorentz Center workshop. Participants are eligible if their situation meets one of the criteria, e.g. if they require childcare or extra care in case of an impairment. The diversity fund may also provide financial support for underrepresented groups based on geographical location or socio-economic status. In 2018, 10 participants received support through this fund to enable them to attend a workshop. Most participants were junior scientists, from underrepresented geographical areas (India, Ghana, South Africa), or in need of support for extra costs for family room accommodations.

Other diversity initiatives of the LC were aimed at the accessibility of our venues, as well as the hotel and other partners (e.g. restaurant). Regarding diversity in the staff, in our recruitments we sought professional advice on gender-neutral posting of vacancies, best practices for the interviews, and tested 'anonymous candidate selection' by removing the personal data from CVs and motivation letters.

1.7 Code of Conduct, Privacy and Sustainability

The Lorentz Center has a code of conduct that applies to all staff and visitors. It explicitly subscribes to the overarching Code of Conduct on Integrity of Leiden University. Firstly, it clarifies what is meant by integrity and acting with integrity. Secondly, it aims to protect the staff and visitors of the university by distinguishing potential risks. Thirdly, the Code of Conduct provides guidelines on what is allowed and not in frequently occurring situations. If staff members or

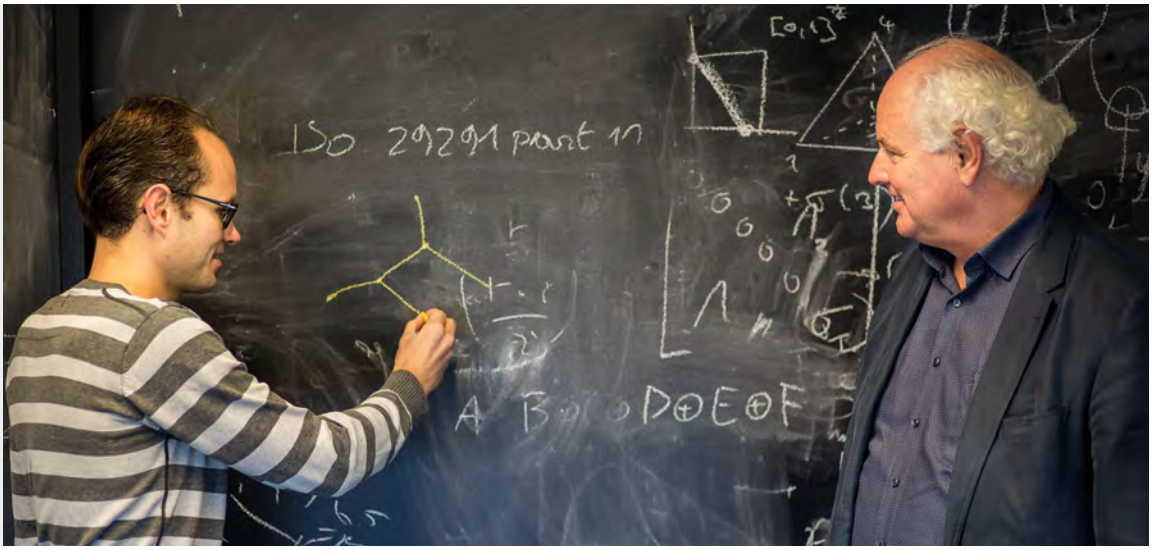
6. Coincidentally, the target of Leiden University is 30% women in top roles; according to Unesco 30% of scientists is female.

visitors have been subject to unacceptable behavior and need personal support or advice, they can contact our confidential counselors.

The Lorentz Center complies with the General Data Protection Regulation (GDPR). We are supported by the Privacy Officer of Leiden University, who is in charge of GDPR compliance. The Lorentz Center strives to be a sustainable organization: we continuously take steps to reduce our ecological footprint and consider sustainability when selecting our partners (e.g. hotel, catering, and transportation).

2.

PROCEDURES AND PROGRAM



Undoubtedly, the main output of the Lorentz Center is our workshop program, although we also organize other activities such as study groups and (summer) schools. In this section, we first present the procedures describing how the workshops are evaluated, selected and subsequently organized. Next, we discuss the composition and evolution of our program in the period 2014-2018, including several of its special aspects (such as study groups, partnerships and 'alternative use').

2.1 Iterative application process

The Lorentz Center considers the development from the first idea for a potential workshop through the organization of a workshop as one integrated process. Two (intertwined) major steps naturally stand out. The application phase includes support of the applicants in developing their idea and their proposal and the subsequent evaluation process. After the proposal is approved

by the Scientific Advisory Board(s) follows the organization phase, including support in all aspects of the practical organization of the workshop – see Section 2.2. The result is workshops tailored to the specific scientific goals and wishes of the workshop organizers, while making optimal use of the possibilities and experience of the Lorentz Center.

Any researcher with a clearly defined scientific goal can apply to organize a Lorentz Center workshop. The Lorentz Center encourages potential organizers to contact us early in the application process so that we can support the development of their ideas into a successful application. At this phase, also the relevance of the interactive Lorentz Center format to the goals of the applicants and the diversity among the organizers and proposed participants is addressed.

In three annual applications submission rounds (deadlines 30 January, 30 May and 30 September), proposals are evaluated for workshops intended to take place 8-16 months after the application deadline. Though contact with the Lorentz Center before submission normally results in better evaluation outcomes, it is naturally also possible to submit a proposal without previous consultation. Each workshop application is evaluated by at least five board members, together covering the scientific areas of the topic of the proposal. Multidisciplinary proposals are typically evaluated by multiple boards, in which case this number is often higher. If there is not sufficient expertise among the board members, external reviewers are approached. The boards and reviewers assess the submitted proposals on:

- Scientific quality and novelty
- Aims of the workshop
- Participants and diversity: Are they well chosen to achieve the aims?
- Program format: Does it support the aims of the workshop?

Independent of each other, the chair(s) of the relevant Scientific Advisory Board(s) determine the outcome of the evaluation of a proposal, as well as its ranking[7]. Their evaluation and ranking is based on the input of their board members, and is finalized in discussion with the Lorentz Center. The final outcome of the evaluation process follows, by considering and merging the conclusions of all boards. To support and encourage multidisciplinarity, we established the principle that the advice of the most enthusiastic board is leading. Nevertheless, in the outcome letter sent to the applicants we include feedback on the proposal from all boards.

This outcome letter provides a first feedback moment to our applicants (after the submission of their proposal). Only a small percentage of the proposals is accepted `as is', most applicants are asked to respond to selected points of the board's advice – if there is a reasonable chance that the application will be approved. The advice aims at improving the workshop, but applicants may choose to follow a different course. Thus, our iterative application process includes two feedback loops. A workshop can be conditionally approved and one or two rounds of revisions and/or responses may be requested. Alternatively, a resubmission is encouraged, so that a proposal may reenter the application loop (see the two feedback loops in Flowchart A[8], Appendix III. It rarely happens that a submitted proposal is rejected without an invitation to resubmit (an invitation that will include significant feedback and advice from our boards). Typically, a proposal improves substantially in each step of the application procedure.

7. This ranking is also used to decide whether a workshop can be organized in the week preferred by the organizers.

8. The flowcharts shown in Appendix 6.3 illustrate the application process and the practical workshop organization.

2.2 From approved proposal to workshop

When a proposal has been approved, a workshop coordinator is assigned to the workshop. The workshop coordinator takes care of all the practical aspects of the organization (Flowchart B , Appendix III). The organization start with an 'intake meeting' at the Lorentz Center with one or more of the organizers, where the goals of the week together with the program and the boards' feedback are discussed. Given the goals and the desired outcomes, we support the organizers to come to the best possible set-up of their workshop. At this point, the program has become more concrete and is considered in further detail. Moreover, practical details are discussed about participants, invitations, social events, workshop web page, etc. After the intake meeting, the aims and the program of the workshop are published on the workshop webpage and invitations are sent to all (potential) participants. The workshop coordinator handles all further practical aspects: the registration, hotel booking, travel arrangements and financial administration. Both the organizers and the participants can contact the workshop coordinator for support (e.g. program changes, travel reimbursement) before, during and after the workshop.

After the workshop, the workshop coordinator also takes care of the financial closure, communication of the outcomes of the survey results to the organizers and sets up a meeting to evaluate the workshop – if this is required. The organizers provide a scientific report.

Lorentz Center workshops have no registration fees. Coffee/tea, cookies and fruit throughout the day are free, as well as the welcome reception on the first day and a midweek workshop dinner – both are also open to partners at no extra charge. The Lorentz Center further provides a (limited) budget for the organizers to cover (part of) the travel expenses and/or lodging of selected participants. Moreover, included with each workshop is their own Lorentz Center poster. Our posters are our key PR 'tools', they provide visibility for the, often, new communities that are formed at our workshops.

2.3 Workshop program 2014 - 2018

In the period 2014-2018 our (workshop) program has strongly expanded, both in the number of workshops as well as in the coverage of the scientific spectrum. An overview of the total programming in the period 2014 through 2018, i.e. all workshops organized in that period, including the respective scientific fields, is provided at our website[9].

Table 3 shows the evolution of the Lorentz Center program in numbers. The total number of workshops per year increased from 64 in 2014, through a dip of 56 in 2015, to 80 in 2018. At present, the Lorentz Center organizes 80-85 workshops per year and in principle our workshop program covers the entire scientific spectrum. The number of submitted proposals has increased in a rate comparable to the number of organized workshops: the quantitative growth of our program did not have a negative impact on the quality.

9. See Lorentz Center Organized Workshops 2014-2018 www.lorentzcenter.nl/Overviewworkshops2014_2018.pdf

Table 3. Overview of the workshops in numbers between 2014-2018.

	2014	2015	2016	2017	2018
Submitted proposals	89	82	105	84	106
Organized workshops	64	56	76	81	80
Organized science workshops	59	47	60	56	52
Organized SSH workshops	5	9	16	25	28
Participants	2489	2454	2803	2935	3072

The growth in the number of workshops organized per year is largely due to our expansion in the SSH domain. In fact, the total number of 'classical' workshops, i.e. workshops with topics in the sciences, has staged constant at approximately 55 per year[10]. Also before the investment of 2015 in SSH, the Lorentz Center featured a limited number of workshops with aspects in the SSH, in the context of our – successful – NIAS-Lorentz program: NIAS-Lorentz workshops must bridge sciences and SSH (see below). Since 2016, we also organize workshops 'purely' within the SSH [11]. Nevertheless, only about a quarter of the SSH workshops organized are of this type: the majority of the SSH workshops crosses the boundaries between the sciences and the SSH – a trademark of Lorentz Center workshops. Also within SSH, more often than not, the workshops are interdisciplinary.

The evolution of the number of workshops and their spread over the various disciplines in the period 2014-2018 is shown in Figure 4 and Figure 5. The numbers in these figures are the number of workshops approved per Scientific Advisory Board. Consequently, multidisciplinary workshops, which are typically approved by several boards, are counted multiple times. Figure 4 and Figure 5 confirm that the activities in our original disciplines – astronomy (A), mathematics (M) and physics (P) – had already matured to a (relative) stable level by 2014, indicating that our workshops in these disciplines probably represent the needs of the corresponding communities within the Netherlands. Our fourth original discipline, informatics (I), has proven more challenging. We are happy to conclude that our efforts to stimulate this field have been successful and that the number of workshops in this field has increased in the period 2014-2018 to what we believe is a mature level (see also Section 2.4).

The largest growth has been in the area of SSH (from 5 to 28 workshops). We consider this a real achievement, however, SSH remains an area of special attention: we have made significant headway, but many subfields of SSH are not yet sufficiently aware of the Lorentz Center. Another growth area is Computational Sciences, an intrinsically multidisciplinary field with a completely natural embedding in the Lorentz Center. Further, we still cover only minor parts of the vast scientific fields of chemical, life and medical sciences. These are clearly areas of opportunity for the Lorentz Center. However, to increase our impact, we need to better understand the needs of these disciplines, and – most likely – need to adapt to these needs.

10. Due to the multidisciplinarity of our program, it is not possible to make a completely exact distinction between 'science workshops' and 'SSH workshops'.

11. Our first 2 'pure' SSH workshops *Children Seen and Heard Across the Globe* and *Egypt Incorporated: Economic, Political and Cultural Developments from Late Antiquity to Islam* immediately provide an indication of the breadth of our scientific spectrum within the SSH.

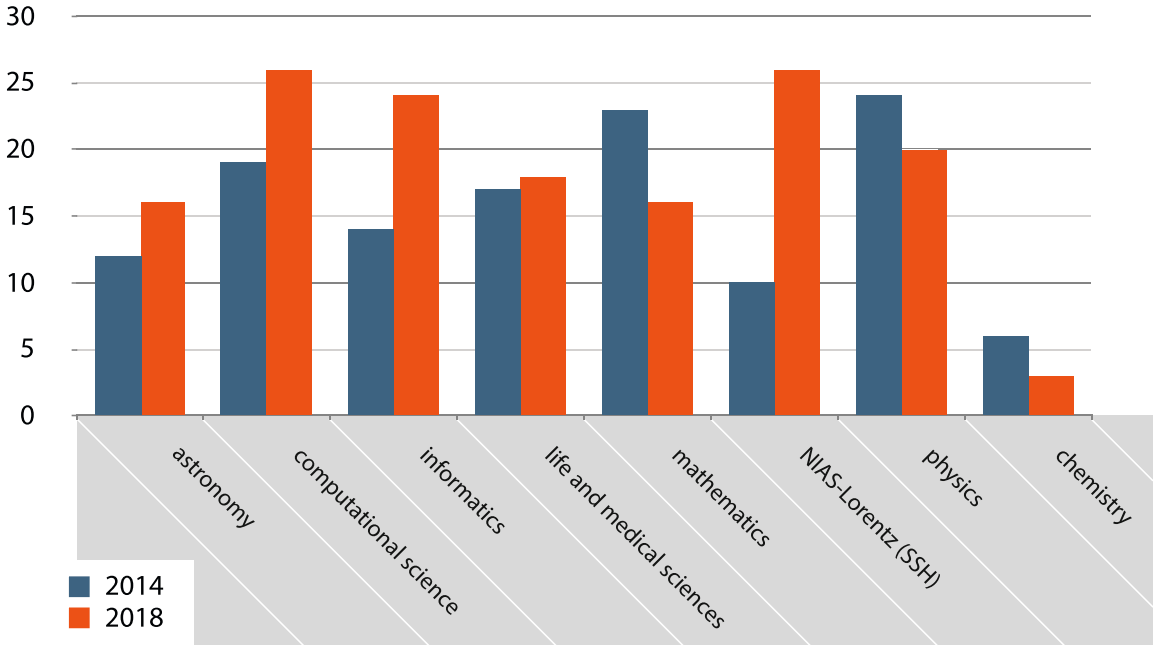


Figure 4. Number of workshops per scientific area in 2014 and in 2018. Multidisciplinary workshops are counted multiple times

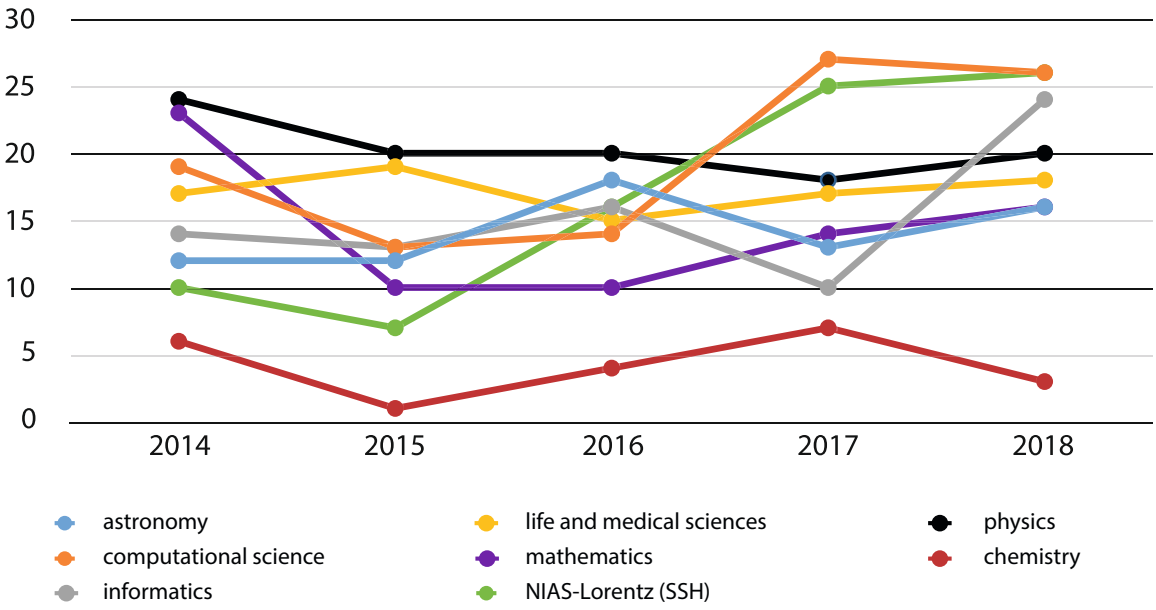


Figure 5. The evolution of the number of workshops in the period 2014-2018 per discipline

2.4 Mono- and multidisciplinarity of Lorentz Center workshops

The Lorentz Center is well-known for the organization of high quality multidisciplinary workshops. The figures shown in Appendix IV indicate the levels of mono- or multidisciplinary of workshops organized in 2014 and 2018. As definition of disciplines involved in a workshop we have used the involvement of our Scientific Advisory Boards (as in Figure 4 and Figure 5). The figures shown in Appendix IV lead us to the perhaps somewhat surprising conclusion that, on average, the ratio between mono- and multidisciplinary workshops has remained relatively stable. A slight but most likely non-structural shift towards monodisciplinary workshops may

be seen in the areas of mathematics and physics; a similar light, non-structural shift towards multidisciplinary workshops may be observed in astronomy and life and medical sciences.

We do distinguish two more structural developments. The growth in our informatics program is mostly in multidisciplinary workshops: the number of multidisciplinary informatics workshops increased from 5 in 2014 to 13 in 2018. As expected, the most significant shift can be seen in SSH, where in 2014 we only organized multidisciplinary workshops. Due to the broadening in scope after 2014, around one quarter of the workshops were 'purely' within SSH area (approved by only the NIAS-Lorentz board) in 2018. Furthermore, both in the computational sciences and in chemistry exclusively multidisciplinary workshops were organized. For the computational sciences this is built-in, but it is a further strong indication that the Lorentz Center program clearly has not penetrated the chemistry community yet.

2.5 Collaborations and Special Programs

The Lorentz Center actively engages in setting up partnerships and awards and/or prizes associated with these partnerships. Such partnerships enable us to reach specific (new) target groups, the dedicated calls for awards and prizes are efficient 'tools' to increase our visibility. Moreover, the quality of prize winning workshops is in general excellent. Our partnerships include the celebrated NIAS-Lorentz program, featuring competitions for the Distinguished Lorentz Fellowships (DLF) and the NIAS-Lorentz Theme Groups (NLTG), the Study Groups with Industry and joint annual calls with CECAM and the Netherlands eScience Center. See Appendix V for a list of awarded fellowships and prizes.

i. *The NIAS-Lorentz collaboration*

The collaboration between NIAS and the Lorentz Center was set up in 2006, with the (ambitious) goal to bring perspectives from the humanities and social sciences together with the natural and technological sciences. We consider the NIAS-Lorentz program as one of our showpieces: it has been instrumental in stimulating the multidisciplinarity of our workshop program and it successfully introduced us into the SSH community – especially through the introduction of the prestigious Distinguished Lorentz Fellowships. Importantly, the program served also as a firm foundation for our further expansion into the SSH domain, now embedded within the NIAS-Lorentz collaboration.

The NIAS-Lorentz Advisory Board oversees all the activities of the collaboration. Besides the selection of workshops taking place at the Lorentz Center, within the overarching program as well as within the SSH, it includes selecting the NIAS Lorentz Theme Groups (NLTG) as well as the Distinguished Lorentz Fellows (DLF) residing at NIAS. The Distinguished Lorentz Fellowship is awarded annually to a leading researcher to work on cutting-edge research at the interface between the humanities or social sciences and the natural or technological sciences. Prominent figures from within the Dutch academic community nominate Distinguished Lorentz Fellow candidates and the fellowship carries a personal cash prize (to be spent on research). A NIAS-Lorentz Theme Group (NLTG) is an international group of either three or five – typically mid-career – researchers (including the coordinator). All NLTG members hold fellowships at NIAS, providing them the opportunity to work as a team and engage in an intensive multidisciplinary research collaboration that bridges the divide between the humanities and/or social sciences and the natural and/or technological sciences. In addition to their residential fellowship at NIAS, the NLTG and DLF are awarded to organize a workshop at the Lorentz Center – in fact, it is a prerequisite associated to the fellowship.

ii. *The CECAM and eScience collaborations*

Our partnerships with CECAM and the Netherlands eScience Center brought about workshops at the frontiers of the computational sciences. Both partnerships involve the yearly organization of a prize winning workshop. These prizes are selected and awarded in a two-step process. A broad, yearly call invites applicants to submit a one-page pre-proposal[12]. Of these, a small number – typically 2-3 out of 10-20 – are selected by the (sub)board especially set up for this competition (that usually consists of about 6 members, half of these associated to one of our Scientific Advisory Boards). The selected pre-proposals are worked out into full proposals along the lines of 'standard' Lorentz Center proposals. The winner is then selected by the same (sub)board. The yearly CECAM-Lorentz competition embeds the Lorentz Center strongly into the European computational science community. Workshops within the Lorentz-eScience competition must be co-organized with non-academic partners: through the Lorentz-eScience collaboration, we gain visibility and a stronger foothold in the non-academic research community. Both collaborations have yielded more than 'only' the winning workshops: yearly several contestants are encouraged to submit an 'ordinary' workshop proposal, which often leads to high quality workshops. The collaborations with CECAM and the Netherlands eScience Center thus also play a role in the continuous growth of our computational science program.

iii. *The Huibregtsen prize*

Since 2016, the Lorentz Center has been involved in the *Avond van Wetenschap en Maatschappij* (Evening of Science and Society). This annual event is organized on behalf of the Ministries of Economic Affairs and of Education, Culture and Science to put science in the Netherlands in the limelight. It takes place in the *Ridderzaal* in the Hague[13] and welcomes prominent figures from science, culture, business, politics, media and sports. On this *Avond*, the Huibregtsen prize[14] is awarded to a researcher who performs highly innovative research with social relevance. In addition to a cash prize and a bronze sculpture, the winner is awarded a Lorentz Center workshop. As a national scientific workshop center, the presence of the Lorentz Center at this evening contributes to establishing new contacts and maintaining existing relationships, both with researchers and policy makers.

iv. *Study groups with Industry*

Together with the NWO Domains of Science and of Applied and Engineering Science (TTW), we organize *Study Groups with Industry* that specifically focus on seeking solutions to real industrial problems – i.e. submitted from industry – by junior researchers. These weeks serve two purposes: the junior researchers can broaden their horizon beyond academia, allowing them to taste the world of applied R&D, the industrial partners have the benefit of in-depth scientific discussions on their technical problems with oftentimes applicable solutions emerging. This program has grown into an annually returning event at the Lorentz Center with 3 study groups per year centering on problems in, respectively, physics, life sciences, and informatics[15].

---

12. See www.lorentzcenter.nl/cecamcall.php for the most recent example: the CECAM-Lorentz call 2020.

13. The *Ridderzaal* is part of the *Binnenhof*, the central residence of the Dutch government.

14. See www.avondwenm.nl/huibregtsenprijs/over-de-prijs for more information (in Dutch).

15. The concept of *Study Groups with Industry* originates from the *Study Groups Mathematics with Industry* originally organized in the UK and introduced into the Netherlands about 20 years ago. Together with NWO, the Lorentz Center expanded this concept to physics, life sciences, and informatics.

2.6 Summer schools and `Alternative use'

Next to the 80-85 workshops we organize each year, there is space within our venues for groups who intend to use our facilities for e.g. summer schools – which we always encourage – or other activities we refer to as 'alternative use'. Examples of the latter are a meeting on university education and harmonization of curricula by the Dutch informatics community, a network meeting of 'Women in Mathematics', a meeting of chemists on the image of chemistry in our society, one-day workshops around the National Science Agenda (NWA) and various 'brainstorm sessions' by groups of scientists who plan to write a proposal for a joint grant or a workshop.

Apart from creating goodwill with the scientific community – which we also consider to be highly relevant – these 'alternative use' activities also provide us a platform for experimentation. The organization of 1-week workshops is the main 'tool' by which we initiate and stimulate creative scientific research, but it may not be the most suitable way to reach for example medical and/or industrial researchers. By monitoring and setting up `alternative use' activities, we may come into contact with specific target groups and can learn how to cater for their needs – see Section 5.6.

3.

QUALITY AND PERFORMANCE

One of the recommendations of the assessment of the Lorentz Center over the period 2008-2013 was to measure the quality of the Lorentz Center and assess the relevance of (the output of) its workshops. Especially the latter aspect is challenging, for instance, only in very special cases there is a direct link between a publication and a workshop[16]. Typically, a Lorentz Center workshop is a step – often a crucial one –in a longer process that leads to the publication of a paper.

16. An example in which there clearly is such a direct link is the paper *Complexity theory and financial regulation* (*Science* **351**(6275), 818-819 (2016)) that appeared as 'output' of the Lorentz Center workshop *Socio-Economic Complexity* in 2015.

The Lorentz Center has thoroughly discussed this issue with the Centre for Science and Technology Studies (CWTS)[17], an internationally recognized center for 'measuring' the impact of science. This resulted in the surveys discussed in the upcoming section and a report by the CWTS[18].

Since March 2017 a survey is sent to all organizers and participants of a workshop, in the week following the workshops to obtain feedback from organizers and participants. The second, long term, survey was sent in March 2019 to organizers of workshops organized in the period 2012-2017. Apart from quantitative insights, discussed in Section 3.2, this survey also yielded more qualitative input (see Section 3.3 and Appendix VII).

3.1 Outcome weekly surveys

In this (sub)section the cumulative survey results of 2 years are presented (March 2017 - January 2019), based on 2069 completed responses of 4538 participants and organizers of 119 workshops (response rate 45.6%). The overwhelming majority of the respondents is affiliated with academia, 5.7% in total has affiliations in a public, private or non-profit organization.

More than 94% of the participants assessed the scientific level of the workshops as high or very high, whereas more than 80% of the respondents indicated that the workshop inspired them to new research lines (Figure 6). The overall concept, with ample time for discussion, an open and interactive atmosphere and support before and during the workshop is what makes the Lorentz Center a place where researchers can excel together – as is clearly confirmed by the outcome of our survey. Moreover, more than 97% of the respondents confirmed that the 'atmosphere' set up by the Lorentz Center highly 'contributed to open and interactive discussions' and the overwhelming majority agreed that the right amount of time was dedicated to discussions. In addition, more than 75% found the workshop coordinator (very) important and around 85% indicated that the duration was (very) important as well. The total weighed average score amounted to 8.9 on a scale of 10.

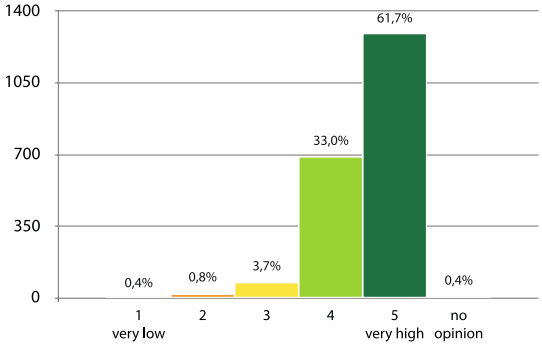
In addition to the general questions to all participants, further questions were put forward to the organizers to gauge the evaluation procedure and the support to the organizers (Figure 7). The instructions on our website as well as the support provided during the application period were found (very) useful by 79.1% and 89.5% of the organizers, respectively. The feedback provided on the final proposal was assessed as (very) useful by 86.8% of the organizers. Almost all organizers (96.4%) found the support provided by the workshop coordinator (very) useful. The intake was also highly appreciated (often one or two organizers represent the others at the intake, this may explain why a significant part of the organizers chose 'no opinion' here). The total weighed average score amounted to 9.1 on a scale of 10.

The pie chart indicates that a remarkable 52% of the organizers is new to the Lorentz Center – which indicates the continued relevance and viability of our program. Others are returning for the first time (21%), whereas 5% had participated in our workshops more than 5 times before.

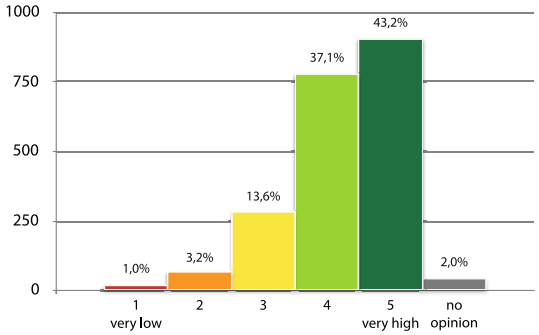
17. See www.cwts.nl.

18. See S. de Rijcke, T. Holtrop, CWTS report 2019.

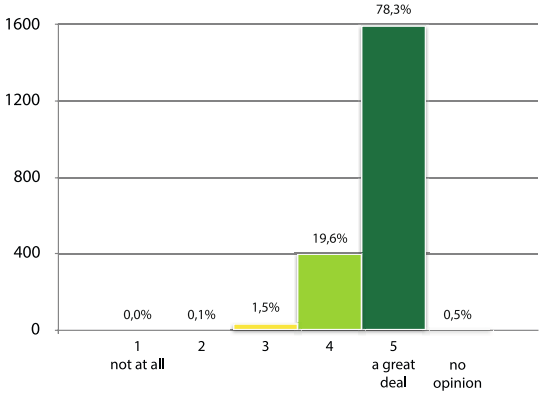
What do you think of the scientific level of the workshop?



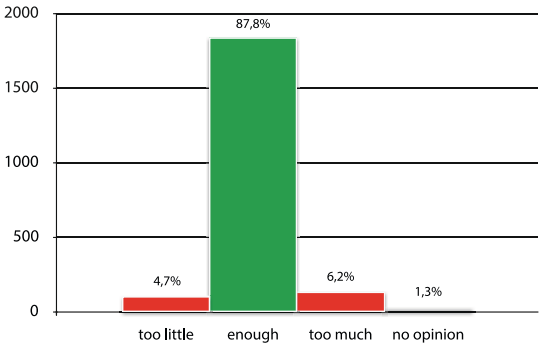
To what extent do you expect this workshop will inspire you to new research lines?



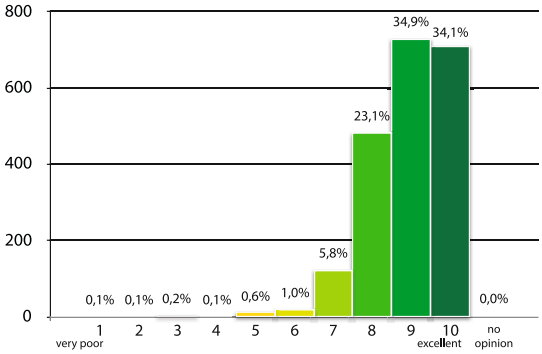
How much do you think the atmosphere of the Lorentz Center contributes to open and interactive discussions?



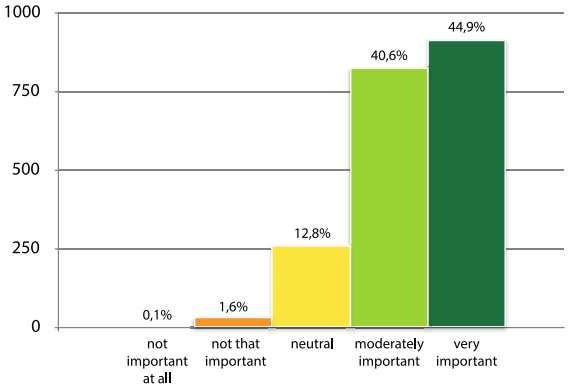
What do you think about the amount of time dedicated to discussions during the workshop?



Total score for this workshop at the Lorentz Center



How important was the duration of the workshop?



How important was your Lorentz Center workshop coordinator?

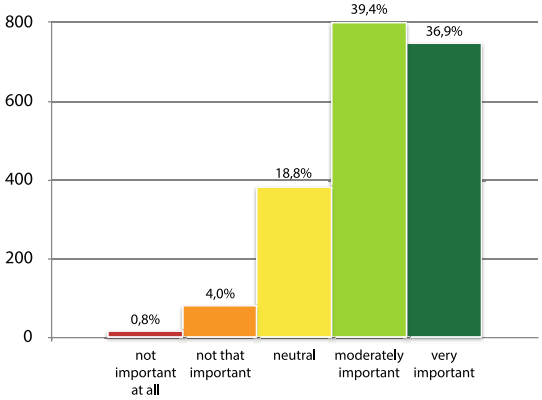
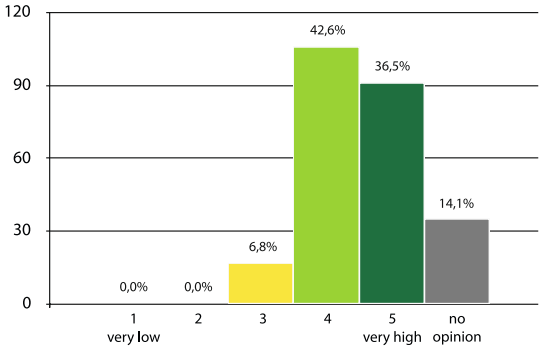
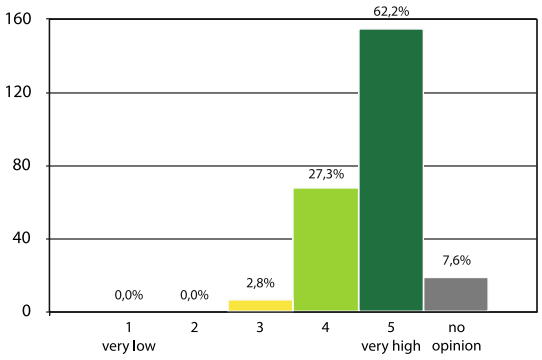


Figure 6. Survey results of workshop participants (2069 completed responses of 119 workshops, response rate 45.6%).

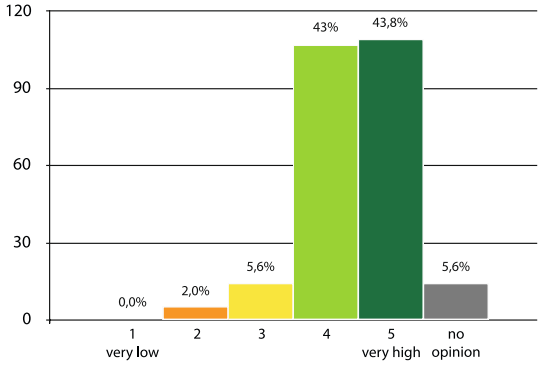
How useful/helpful did you find the instructions on the application procedure on the website?



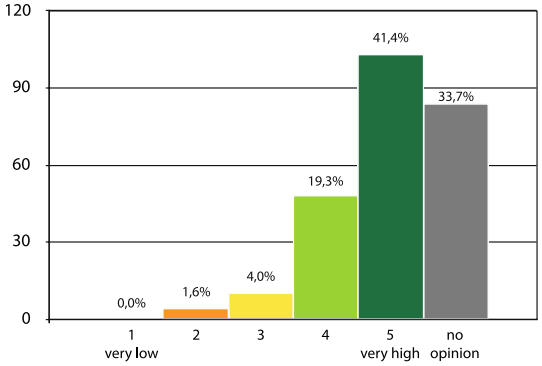
How useful/helpful did you find the support of the Lorentz Center during the application procedure?



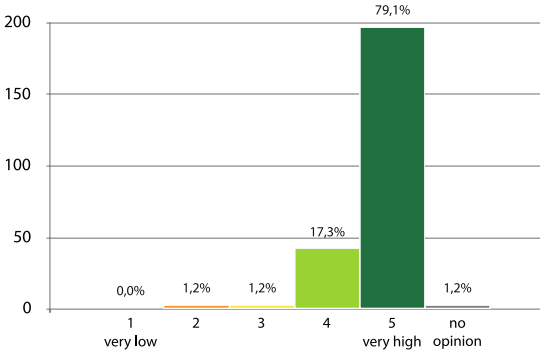
How useful/helpful did you find the feedback on your final proposal?



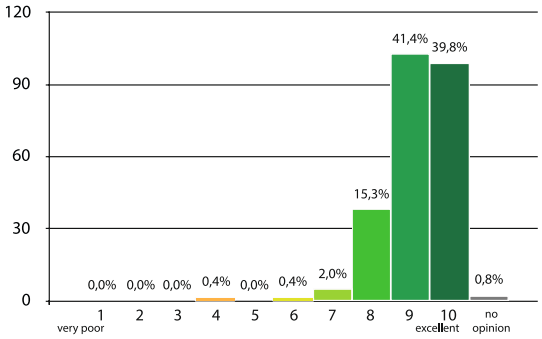
How useful/helpful did you find the intake meeting?



How useful/helpful did you find the support of the Lorentz Center workshop coordinator?



Overall score for the procedure and support for organizing a workshop



Have you participated in a Lorentz Center workshop before organizing this workshop?

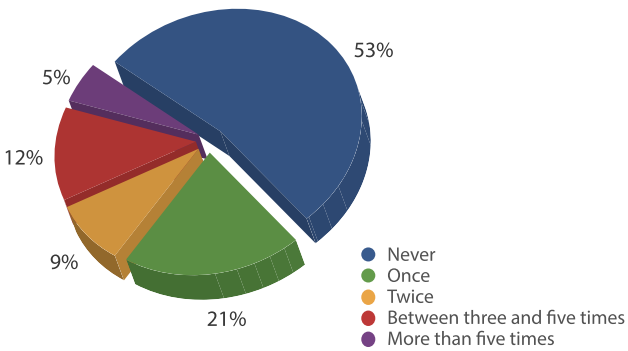


Figure 7. Survey results of workshop organizers.

In conclusion, we may say that the survey results are quite positive in general. In fact, the results of the weekly survey are shared with the organizers of the respective workshop and, in case required, they are discussed in a meeting. In addition, the cumulative outcomes are regularly shared in the Scientific Advisory Board meetings. The suggestions and learnings are used for improvement. Thus, apart from providing a quantitative description of the quality of our work, the weekly surveys also are of great value to us for improving the quality of our services.

3.2 The long term survey: quantitative aspects

In the spring of 2019, a questionnaire was sent to almost 1400[19] organizers of workshops which took place between 2012 and 2017. The outcomes of the quantitative results (Figure 8) corroborate the outcomes of the previous survey: the objectives have been largely met, new collaborations are in place and new research ideas have been generated. Furthermore, around 20% of the respondents indicated that they had more than 10 publications inspired by the workshop, although many commented that it is impossible to make a reliable assessment – a statement we strongly agree with.

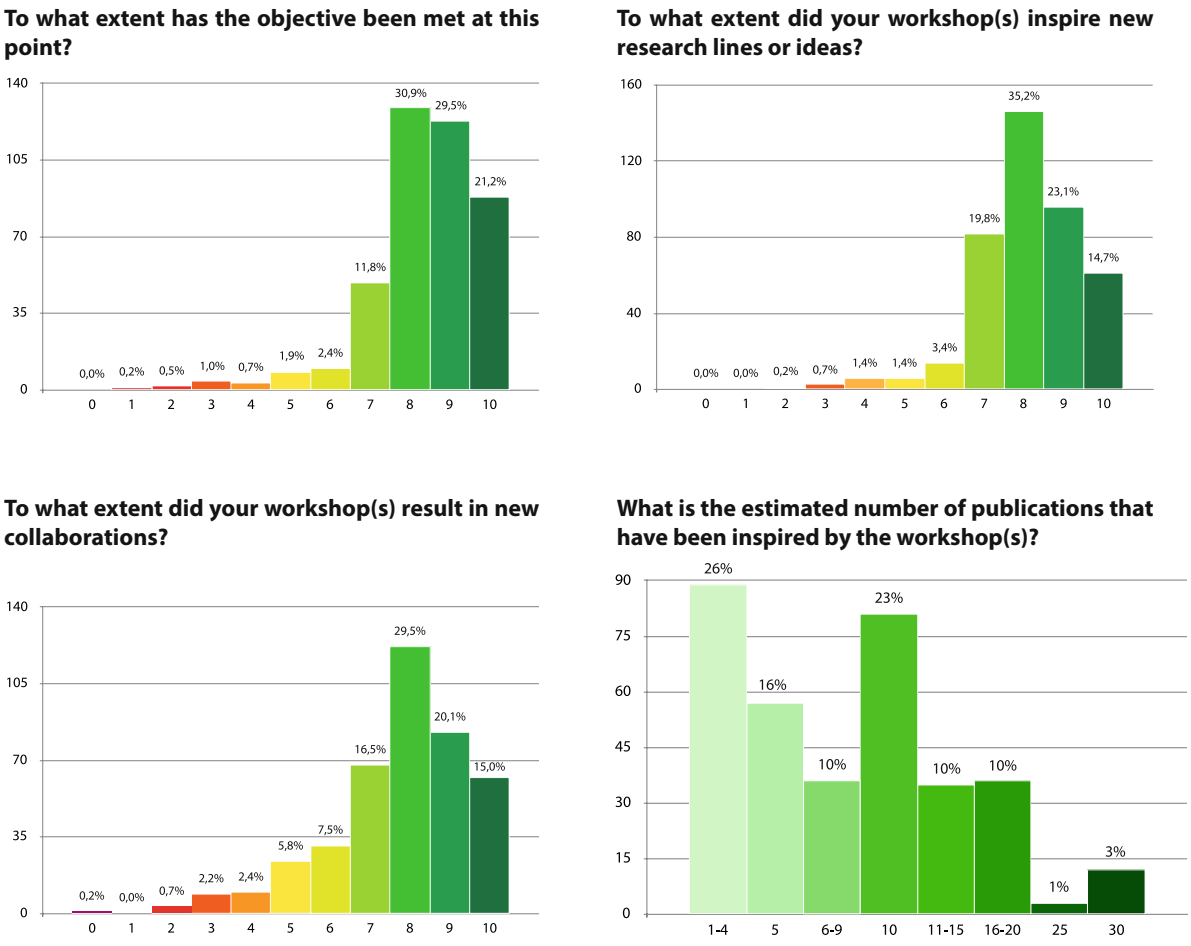


Figure 8. Long term outcomes of workshops held between 2012 and 2017.

19. 435 of the 1395 invited organizers responded.

3.3 Qualitative aspects

The long term survey also included open questions to the organizers. The responses corroborated the direct feedback we received from our organizers after the organization of their workshops (independent of the survey): there are many examples, ranging over the entire scientific spectrum, of publications and collaborations that have been directly initiated by the workshop – we refer to a non-exhaustive list of (literal) quotes from the survey in Appendix VII.

In their feedback, the organizers indicate that their objectives for the organization of their workshops were:

- (New) collaborations/interactions/networking/discussions
- Setting new research agenda/brainstorm about new ideas and future trends
- Working towards specific output: proposal/consortium, white paper, book
- Data interpretation/working on a model, share vision about the state-of-the-art
- Cross-pollination/start dialogue/bring together different fields and build a new community
- Educational goals e.g. developing curriculum

In addition to the scientific output in the form of publications and collaborations, many respondents acknowledge the support and services provided by our staff and praise the venue, the office space provided and the high standards/competency of the organization – see again the (often very inspiring) quotes in Appendix VII. Moreover, positive feedback was given on the atmosphere, the (interactive) format, and how our staff co-shaped the ideas to yield an inspiring productive workshop with lasting impact. Moreover, almost all organizers mention how they receive highly appreciative comments from participants long after the workshop. Repeatedly, respondents claim this has been 'the best workshop ever attended' and 'great value for money'.

Among the points proposing improvement: some respondents mention that the quality of the lunches could be better ('everything is perfect except the food'). A few organizers have issues with the location (Leiden) and the distance to the hotel. Some (jokingly) propose to cut all internet connections. Finally, a few advise to raise workshop budgets as 'travel and hotel expenses quickly rise'.

4.

SWOT ANALYSIS

4.1 Strengths

i. **Scientific program scope & quality**
The scientific program of the Lorentz Center provides a unique platform for both mono- and multidisciplinary workshops of the highest scientific quality in all scientific and scholarly fields.

ii. **Connect through active interaction**
Our workshop format aims – and succeeds – at connecting participants and their ideas through intensive interaction. We focus on workshop programs with ample time for discussion and active participation of all participants.

iii. **Embedding in the scientific community**
We work together with our more than 100 board members – active researchers, mostly working in the Netherlands, who also act as Lorentz Center ambassadors. As a result, the Lorentz Center is thoroughly embedded in the (inter)national

scientific community. We can immediately pick up important scientific developments.

iv. **Coaching of applicants**
From the first idea for a workshop, the scientific team of the Lorentz Center actively supports potential applicants. They receive feedback and advice to work towards the best possible proposal and finally towards a high-quality workshop tailored to achieving their goals.

v. **Stimulating innovative workshops**
The Lorentz Center encourages workshops that are unconventional in their subject, approach and/or participants. One of our core strengths is enabling daring and unusual collaborations, often spanning uncommon combinations of topics, fields and/or actors. We are prepared to think outside of the existing frameworks and to give room to novel ideas.

vi. **You do the research, we do the rest**
The Lorentz Center team ensures that all participants – especially the organizers – can focus on their research. All practical organization is taken care of by the workshop coordinator. With our welcoming and dedicated staff and the informal settings of the two venues, we provide an environment in which researchers feel comfortable to interact freely.

vii. **Financial support**
The Lorentz Center is funded by NWO and by Leiden University, both for about 40%; the remaining 20% comes mainly from external sources independently secured by our scientific organizers and dedicated to their workshop. This is a robust structure in which, both NWO and Leiden University get optimal value for their money.

4.2 Weaknesses

i. **Uneven representation within disciplines**
The Lorentz Center is open to workshops within all scientific and scholarly fields. However, a number of disciplines – in particular chemistry, the life and medical sciences, as well as significant parts of the social sciences and humanities – are still under-represented within our program. As a consequence, the Lorentz Center as yet lacks 'critical mass' in these fields to be sufficiently visible within the associated scientific communities.

ii. **Diversity**
The diversity of our participants is limited. Especially within the natural sciences, it remains challenging to attract a sufficiently diverse group of participants to our workshops. Throughout the application procedure, we stimulate the inclusion of underrepresented groups. We have taken a number of measures to stimulate diversity including a diversity fund, support for child care and ensuring that our venues are wheelchair accessible.

iii. **Inhomogeneous structure of the Scientific Advisory Boards**
All SSH-disciplines are represented in one board, the NIAS-Lorentz board, while the monodisciplinary nature of the boards in the natural sciences remained intact. An exception is the multidisciplinary board on Computational Sciences. At present, this organically developed board structure works very well in practice. Nevertheless, it may be confusing to applicants, especially with regard to the visibility of the SSH domain. It may also influence our success in reaching certain communities.

iv. **Limited budget per workshop**
At about 80-85 workshops per year, there is a limited budget per workshop. Only a relatively small number of participants receives a reimbursement for (part of) their travel expenses and the Lorentz Center cannot take care of the accommodation expenses of all participants. Typically, organizers obtain additional funding for their workshops, however, the impact of our limited budget per workshop is unbalanced: it varies over scientific fields and is influenced by the track record of the applicant.

v. **Location**
Although the Lorentz Center is easily accessible from Schiphol Airport, workshop participants perceive the current location at the Bio Science Park as remote. The distances to the train station, hotel and city center are too far to walk for the majority of our visitors. The lunch facilities are inadequate – especially by international standards.

4.3 Opportunities

i. **Multidisciplinary approach**
Scientific breakthroughs occur more and more at the intersections of various disciplines: multidisciplinary approach is the driving force behind the science of tomorrow. The Lorentz Center is unique in its ability to bring together communities, to create bridges with lasting impact between different research areas and between science and society: an indispensable ingredient of modern scientific practice.

ii. **Societal relevance**
The scientific quality of a proposal is our main selection criterion, nevertheless, we also have freedom to actively stimulate fields or topics. The Lorentz Center increases its societal impact by selecting workshops on urgent challenges imposed on our global society – such as climate change, health care, etc. – that without exception ask for novel scientific insights ranging over many fields.

iii. **Our workshops**
The open, interactive and stimulating nature of Lorentz Center workshops is well-recognized in the natural sciences and their renown is steadily increasing within the social sciences and humanities: the participants truly appreciate our workshops. Lorentz Center workshops provide significant added value to all active scientists and scholars and there is a fertile ground for further expansion of the activities and scope.

iv. **Novel concepts**
Lorentz Center workshops are a means to our ultimate goal of actively stimulating creative scientific research. We are in the process of developing new formats beyond the standard 5-day set-up and we experiment with new facilitation methods. We expect to open up fields in which we are presently less well-represented, such as the medical sciences and industrial R&D.

v. **Networks and partnerships**
The Lorentz Center has a very strong network of active and former board members. We have set up partnerships with a range of organizations such as NIAS, CECAM, the Netherlands eScience Center and the Tohoku Forum for Creativity (Sendai, Japan), but also museums as Rijksmuseum Boerhaave that support the visibility of research to a broader public. Although the Lorentz Center thrives on this network, we are aware that we can make even better use of it.

vi. **New venue**
The Lorentz Center will be moving to a new location within a few years. A new place, preferably in one building, offers many opportunities: a flexible interior for different sessions and varying group sizes, improved catering options, all staff at one place, a more inclusive location, and – especially – potential growth of the Center.

4.4 Threats

i. **Multidisciplinary vs. monodisciplinary**
The trademark of the Lorentz Center, its multidisciplinary workshops may threaten to overpower the monodisciplinary workshops, particularly in the perception of potential organizers of those workshops. Fundamental monodisciplinary workshops are crucial foundations of science, and thus of the Lorentz Center. Thus far, active stimulation of researchers especially by our board members resulted in a constant inflow of such workshops.

ii. **Funding**
About 20% of our workshop funding is secured by our organizers, but the sources through which they can obtain external support have been decreasing. The lack of indexation of our own funding tightens our budget, since all costs rise with inflation. Another increasing difficulty is the earmarking of potential funding, which limits our flexibility.

iii. **Researcher's work pressure**
Researchers are under an increasing pressure: more is expected, with less resources. Will they still have the time to commit a whole week to a visit to the Lorentz Center? To invest in organizing a workshop? To support us as board member? We must continue to emphasize the value of the focused 'mini-sabbatical' that is a Lorentz Center workshop.

iv. **Professionalism and flexibility**
Along with its growth, the Lorentz Center also has become more professional as organization. However, increased size and professionalism do not automatically go well with flexibility and being open to new initiatives.

v. **Team**
The Lorentz Center has a small and therefore relatively vulnerable team, spread out over two venues. The career opportunities within the Lorentz Center are limited, which results in a relatively high turnover of the staff.

vi. **New venue**
Apart from opportunities, moving to a new location also introduces uncertainties. Can we create and keep the Lorentz Center atmosphere treasured by our participants and organizers? Will the new location be sufficiently recognizable as an academic environment: what may be the impact of leaving the university research buildings? What are the financial implications of moving?

vii. **Ecological footprint**
The concept of the Lorentz Center is to physically bring people together from all over the world – direct interaction between scientists forms the core of our activities. However, many of our participants travel by plane and they may – naturally – decide to fly less in order to reduce their ecological footprint.

5.

VIABILITY, EMBEDDING AND FUTURE

5.1 Viability

The Lorentz Center is the only center in the world that focusses on the organization of 1-week workshops encompassing the entire scientific spectrum. We stimulate high quality creative scientific interactions by challenging our organizers from the very first moment they come to us with an idea for a potential workshop and by creating an atmosphere during our workshops within which all participants feel completely free to actively engage in discussions, independent of seniority, gender or culture. This approach is not at all common – especially not outside the sciences – but the highly positive feedback of the entire scientific community, especially our organizers and participants, demonstrates its success.

Scientific progress is driven by open and direct interaction between scientists and/or scholars. In present day science, with its persistent pressure on the 'free time' of a scientist/scholar to do research, the 'oasis' of a Lorentz Center workshop has become indispensable. Moreover, the

scientific problems of the present days more and more ask for multidisciplinary approaches: it is essential to build bridges between scientific communities. In the face of these internationally recognized challenges, the Lorentz Center has successfully shown that it has the unique ability to contribute to the building of these bridges and that it thus plays a pivotal role within the scientific community. A role that will only become more relevant in the coming years.

5.2 National and international embedding

The Lorentz Center is part of the Faculty of Science of Leiden University. At the same time it is a national center, it serves the entire Dutch scientific community. The Lorentz Center has shown that there is no contradiction, or friction, between these two roles, in fact, that these two roles may even strengthen each other.

Of course, Leiden University – and certainly not only the Faculty of Science – has a direct benefit from the Lorentz Center: our participants come to Leiden, 'locals' can easily drop by during a workshop or invite our participants to come over to their group/lab/institute. Nevertheless, the Netherlands is small, the Lorentz Center can easily be reached from other locations in the Netherlands and our visitors often visit colleagues at neighboring universities. More importantly, we have succeeded in convincing the Dutch scientific community that the Lorentz Center is open to everybody, that we are indeed part of the national infrastructure. In fact, in our classical fields – astronomy, informatics, mathematics and physics – the Lorentz Center is active for more than 20 years. As a consequence, we are known to the entire community and reach (about) all potential organizers within the Netherlands – with the help of our national Scientific Advisory Boards. We are optimistic that we will be able to reach a similar level in all scientific and scholarly fields – although we do realize that we still need to make significant progress, especially in the SSH and the medical sciences.

Within the Netherlands, the Lorentz Center continues to search for setting up collaborations like those with NIAS and the Netherlands eScience Center, from the point of view that we are not only part of the national infrastructure, but that we also may act as a driving force strengthening this infrastructure. Moreover, we have learned from our present partnerships that these collaborations have a direct impact on our program: we attract new high quality workshops, increase our visibility and we can enter new communities. Especially in the context of outreach, we are working to expand our connections with museums (see Section 5.3). By the international nature of scientific research, the Lorentz Center is also an integral part of the international scientific community. We are always open to setting up novel collaborations. At present, we are working together with CECAM and – at a more ad hoc level – the Tohoku Forum for Creativity, see Section 1.5.

We believe that the need for visiting centers such as ours will only keep on increasing in the upcoming years – given the multidisciplinary complexity of present day scientific challenges in combination with the increasing pressure on (the research time of) active scientists. Apart from establishing the viability of the Lorentz Center itself, this also encourages us to support plans for (possibly) setting up new sister institutes. Thus, we have for instance expressed our commitment to collaborate with the *Mathematics Horizons Institute* and thus supported the proposal submitted to the NSF by colleagues at the University of Wisconsin. Moreover, together with the TFC, we are in contact with colleagues at the National University of Science and Technology (MISIS) in Moscow, who are developing plans to set up a visiting center in the spirit of the Lorentz Center and the TFC.

5.3 Societal relevance and Outreach

Although the scientific quality of a (proposed) workshop is the leading criterion, the Lorentz Center has the opportunity and the flexibility to guide our program towards activities that increase its societal relevance – of course in close consultation with our Scientific Advisory Boards.

This attitude has led to initiating our *Study Groups with Industry* program – a program we plan to expand together with NWO beyond the present (yearly) activities in informatics, life sciences and physics (see Section 2.5). Moreover, it is the driving force behind the Lorentz-eScience competition and our involvement with the Huibregtsen prize (Section 2.5). Strengthening our opportunities to reach out beyond the direct realm of academia into industrial R&D and society will be a central aspect of the new collaborations and/or partnerships we may set up in the future.

Apart from collaborations and special programs, the Lorentz Center is keen on enabling – and thus organizing – workshops at the interface between science and society. Obvious examples are our workshops on citizen science such as *Citizen Science Lab: Air Pollution* (January 2018) and *Citizen Science Lab: Sampling Language and Culture* (April 2018). Other examples include *Modelling Social Reality: Emergence of the Glass Ceiling* (January 2014), *Uncertainty Guidances in Science and Public Policy* (November 2017) and the *Distinguishing Science and Metaphysics in Evolution and Religion workshop* of August 2018 that led to the *Leiden Declaration on Evolution and Religion*[20]. A special mention should be made of *Jointly designing a data FAIRPORT* (January 2014), a workshop that lay the foundation of the *FAIR principles* 'to provide guidelines to improve the findability, accessibility, interoperability, and reuse of digital assets' that have by now been implemented worldwide[21]. These examples are certainly not exhaustive – see *Lorentz Center Organized Workshops 2014-2018.*

The Lorentz Center brings many scientists and scholars to the Netherlands. Of course, the main goal of their visit is to actively participate in a Lorentz Center workshop, but among these visitors there are also many talented science communicators who are absolutely willing to reach out to a broader public. To enable this, the Lorentz Center has established partnerships with academic institutions and stakeholders outside the academic environment, such as the Faculty of Science of Leiden University, Leiden University Medical Center, the study association De Leidsche Flesch, Studium Generales throughout the Netherlands, and Rijksmuseum Boerhaave[22]. We share our programming with our academic partners and regularly, participants of our workshops are invited to give a talk at their venue. Further, each semester the Dean of the Faculty of Science of Leiden University chooses a few workshops for lectures at the weekly science presentations of the Faculty in the series ´This Week's Discoveries' – the so-called Lorentz Center highlights, see Appendix VI.

Our partnership with the science museum Rijksmuseum Boerhaave dates from 2013 and aims at communicating the latest scientific activities of the international research community to the general public[23]. Like all our collaborations – see Section 2.5 – this partnership has a win-win structure: the Lorentz Center is embedded in the network of the Rijksmuseum Boerhaave, specialists in outreach to the public, and Rijksmuseum Boerhaave has access to our workshop

20. See www.wur.nl/en/Research-Results/Chair-groups/Plant-Sciences/Laboratory-of-Genetics/Leiden-Declaration-on-Evolution-and-Religion.htm

21. See www.go-fair.org/fair-principles.

22. A science museum in Leiden, see www.rijksmuseumboerhaave.nl/engels.

23. See www.rijksmuseumboerhaave.nl/te-zien-te-doen/Synchronizing-fireflies for a recent example.

program and our top quality speakers. Even though the building of Rijksmuseum Boerhaave was closed due to a major reconstruction during the years of this report, we organized yearly about 4-5 public events – see the list in Appendix VI. Associated to our evolution towards the SSH, we are also in the process of setting up partnerships similar to that with Rijksmuseum Boerhaave with non-science museums and other cultural institutions, such as Museum Volkenkunde[24] and Kijkhuis[25].

5.4 Future: the Lorentz Center 3.0

The Lorentz Center started in 1997 as a national center for the organization of international 1- or 2-week workshops in astronomy, computer science, mathematics and physics. With the expansion of its scientific spectrum towards the life sciences, social sciences and humanities, the Center entered a second phase – Lorentz Center 2.0 – in 2006. This expansion also had our highly successful program of multidisciplinary workshops as natural and consciously planned consequence. The opening of the Lorentz Center@Snellius in 2012 extended the options of possible group sizes from 50-55 @Oort with 25-30 @Snellius. In the following years, the activities of the center have evolved into the present program: the Lorentz Center organizes 80-85 workshops per year and is open to workshop proposals from all scientific and scholarly fields.

Nevertheless, the visibility of the Lorentz Center within the national and international scientific community is still limited, especially to those working within the life and medical sciences, the earth sciences but certainly also within significant (sub)areas of the social sciences and humanities. Despite the success of the Study Groups with Industry, scientists/researchers working outside academia are strongly underrepresented in our program, both as organizers and as participants. Given the enthusiastic response of the overwhelming majority of participants and organizers of Lorentz Center workshops, given the necessity of direct interactions between scientists for the advancement of present day science, and given our dedication to and success in connecting people and communities, we conclude that there is a continuously growing demand for the activities of the Lorentz Center. However, the Lorentz Center also will have to continue its evolution, we will have to adapt to the changing circumstances and to the requirements associated to the varying (sub)fields within its scientific spectrum. Therefore, we aim for a next stage Lorentz Center: the Lorentz Center 3.0.

5.5 Core values of the Lorentz Center 3.0

The core values of the Lorentz Center will not change: the Lorentz Center 3.0 is a national center embedded within Leiden University. Its driving force is advancing science by initiating and stimulating high quality creative scientific collaborations and interactions – in the broadest possible sense and in a fully international setting. It is dedicated to building bridges among individual researchers, among scientific disciplines, between academic and industrial research, and between science and society. The Lorentz Center 3.0 is a welcoming, flexible, informal 'oasis' that by the supportive as well as professional attitude of its staff and by the informal set-up of its venues optimally inspires and stimulates its visitors.

---

24. The (Dutch) national museum of ethnology (in Leiden), see www.volkenkunde.nl/en.

25. www.bioscopenleiden.nl

The scientific quality and relevance of the activities of the Lorentz Center are guaranteed by the crucial input of its Scientific Advisory Boards – our 'bottom up' lifeline to the scientific community. The Boards are also instrumental in guiding the scientific course and strategy of the Lorentz Center – a course set out in open interaction with Leiden University at the local and NWO at the national level.

5.6 Activities of the Lorentz Center 3.0

At present, the activities of the Lorentz Center are primarily focused on our 'core business': the organization of 1-week workshops. However, our workshops are 'only' a 'tool' towards stimulating creative collaborations and interactions, not an end by themselves. In fact, this success might even inhibit our opportunities to go beyond the 1-week workshop format, despite a possibly growing need for such activities.

Organizing 1-week workshops will remain the major activity within the Lorentz Center 3.0. The number of participants per workshop may vary, although we expect the upper limit to stay around 55 participants: larger group sizes do not work well with forging connections between participants of different backgrounds, seniority, etc. The Lorentz Center 3.0 is open to all scientific and scholarly fields and organizes both mono- and multidisciplinary workshops. The majority of our workshops will have the successful 'classical' set-up in which we guide and support our organizers in the phase of the organization preceding the actual workshop. In addition, the Lorentz Center 3.0 will also offer active support during some of our workshops (only at the request of the organizers).

The Lorentz Center 3.0 will also develop new activities: it will offer researchers – in the broadest sense of the word – a home and support to interact and collaborate in settings that go beyond that of its classical workshops, such as 1-day brainstorm sessions or intensive team gatherings with well-defined end goals with lengths that may vary from a couple of days to several weeks. Together with organizers and boards, the Lorentz 3.0 will actively develop novel formats, with our mission of stimulating creative interactions as fundamental principle.

Based on the success in increasing our impact within the social sciences and humanities, the Lorentz Center 3.0 will also actively invest in stimulating fields that are underrepresented within our present program, such as the medical sciences and industrial R&D. This will most likely involve the above novel formats. Finally, the Lorentz Center will always remain open to developing completely new and original formats and collaborations within the framework of our mission and core values.

5.7 The venue

The Faculty of Science of Leiden University will move out of the Oort and Snellius buildings in the course of 2022-2026: the Lorentz Center 3.0 will move to a new venue. It is not yet clear where this new venue will be, however, unlike the present set-up, the Lorentz Center 3.0 will seek housing for all its activities in one single location.

The Lorentz Center is collaborating in a very constructive way with all relevant stakeholders (the Faculty of Science, Leiden University Real Estate, NWO, etc.) to find the best possible solution. These stakeholders understand and acknowledge the conditions that the new venue must

satisfy in order to guarantee the (continuation of) the success of both the existing and the newly envisioned activities. These conditions include:

- The Lorentz Center 3.0 will host up to 100-120 visitors per week, which amounts to more than 5000 guests per year. Optimally, all visitors will use the same hotel, located close to the venue.
- The new venue will be at an appealing and central location within Leiden in (the vicinity of) University buildings.
- The layout satisfies the requirements of the Lorentz Center; most importantly, providing a welcoming atmosphere that inspires and stimulates our visitors.
- The set-up of the new venue must be flexible: it will be possible to either host 2 to 3 groups as 'classical' workshops or several smaller groups at the same time. These groups will have the opportunity to independently use different parts of the new venue.

APPENDICES

I. List of abbreviations

CECAM	Centre Européen de Calcul Atomique et Moléculaire
CvB	Executive Board of Leiden University
DLF	Distinguished Lorentz Fellowship
MFO	Mathematisches Forschungsinstitut Oberwolfach
NIAS	Netherlands Institute for Advanced Study in the Humanities and Social Sciences
NLTG	NIAS-Lorentz Theme Group
NWA	Dutch National Science Agenda
NWO	The Dutch Research Council
R&D	Research and Development
SSH	Social Sciences and Humanities
TFC	Tohoku Forum for Creativity
TTW	NWO Domain of Applied and Engineering Science
ZonMw	Netherlands Organisation for Health Research and Development

II. Advisory Boards

The Advisory Board

A board installed at the request of the Faculty of Science of Leiden University to match the advisory board structure of the institutes within the Faculty. The role of this board is to signal and share societal trends relevant for the Lorentz Center and act as advisors and ambassadors, also beyond the academic world.

Detlef Lohse (chair)	University of Twente
Eppo Bruins	Tweede Kamer der Staten-Generaal
Eveline Crone	Leiden University
Frank den Hollander	Leiden University
Jakob de Vlieg	Eindhoven University of Technology
Marja Zonnevylle	Shell

The Scientific Advisory Boards

The Lorentz Center is supported by eight Scientific Advisory Boards. Most boards center around a scientific discipline, others are explicitly interdisciplinary. The board members evaluate workshop applications and inform the Lorentz Center about significant scientific developments and emerging topics. They also act as ambassadors and stimulate researchers to apply for a Lorentz Center workshop.

Astronomy

Pratika Dayal (chair)	Groningen University
Jayne Birkby	University of Amsterdam
Elisa Costantini	SRON
Elizabeth Humphreys	ESO
Gemma Janssen	ASTRON
Onno Pols	Radboud University Nijmegen
Phil Uttley	University of Amsterdam
Reinout van Weeren	Leiden University

Chemistry

Floris Rutjes (chair)	Radboud University Nijmegen
Marc Koper (co-chair)	Leiden University
Marc Baldus	Utrecht University
Harry Bitter	Wageningen University
Shirin Faraji	University of Groningen
Tati Fernández Ibáñez	University of Amsterdam
Jurriaan Huskens	University of Twente
Beatriz Noheda	University of Groningen
Ernst Sudholter	Delft University of Technology
Luuk Visscher	VU Amsterdam

Computational science

Franciska de Jong (chair)	University of Utrecht
Joost Batenburg	CWI Amsterdam
Peter Bolhuis	University of Amsterdam
Claudia Filippi	University of Twente
Claudia Hauff	Delft University of Technology
Charles van den Heuvel	University of Amsterdam
Alfons Hoekstra	University of Amsterdam
Wander Jager	University of Groningen
Elena Marchiori	Radboud University Nijmegen
Eric Postma	Tilburg University
Federico Toschi	Eindhoven University of Technology
Frans Wiering	Utrecht University
Mariëtte Wolthers	Utrecht University

Informatics

Marieke Huisman (chair)	University of Twente
Marco Aiello	University of Groningen
Lejla Batina	Radboud University Nijmegen
Hendrik Blockeel	University of Leuven
Hans Bodlaender	Utrecht University
Kevin Buchin	Eindhoven University of Technology
Alexandru Iosup	VU Amsterdam
Patricia Lago	VU Amsterdam
Pieter Spronck	Tilburg University
Fons Verbeek	Leiden University
Ronald de Wolf	CWI Amsterdam

Life and medical sciences

Roberta Croce (chair)	VU Amsterdam
Maikel Peppelenbosch (co-chair)	Erasmus University Medical Center
Clara Belzer	Wageningen University
Paul Coffer	University Medical Center Utrecht
Janneke Grutters	Radboud University Medical Center
Jef Huisman	University of Amsterdam
Wout Krijgsman	University Utrecht
Boudewijn Lelieveldt	Leiden University Medical Center
Ody Sibon	University of Groningen
Bas Zwaan	Wageningen University

Mathematics

Jan van Neerven (chair)	Delft University of Technology
Karma Dajani	Utrecht University
Marcel de Jeu	Leiden University
Kees Oosterlee	CWI Amsterdam
Bob Rink	VU Amsterdam
Jasper Stokman	University of Amsterdam
Jaap Top	University of Groningen
Maria Vlasiou	Eindhoven University of Technology
Hans Zwart	University of Twente

NIAS-Lorentz

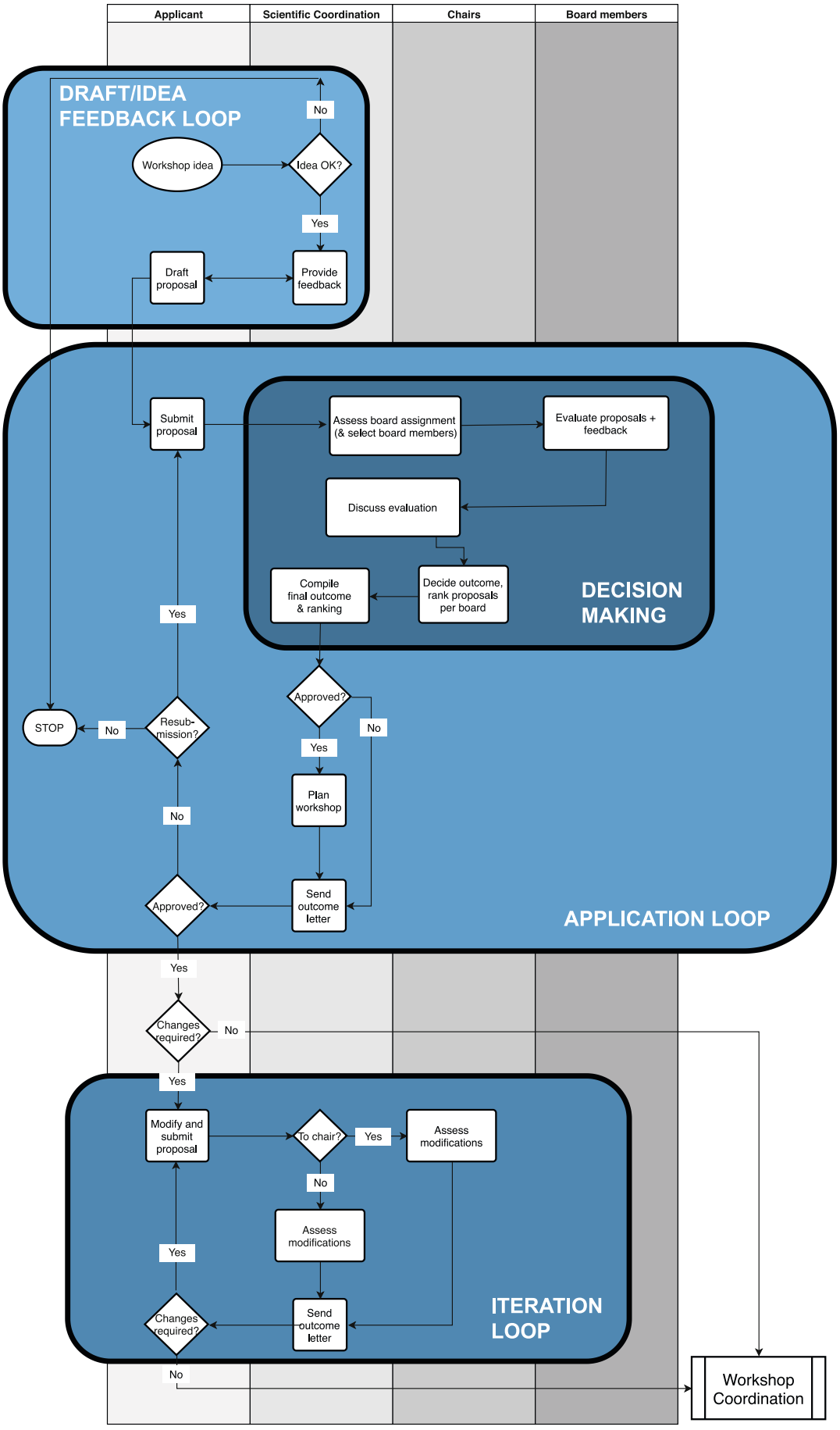
Louise Gunning-Schepers (chair)	University of Amsterdam
Anne Beaulieu	University of Groningen
Milene Bonte	Maastricht University
Sven Dupré	Utrecht University
Martha Frederiks	Utrecht University
Sui Lin Goei	VU Amsterdam
Esther Jansma	Cultural Heritage Agency
Julia Kursell	University of Amsterdam
Amade M'Charek	University of Amsterdam
Bernike Pasveer	Maastricht University
Brenda Penninx	VU Medical Center
Jan Willem Romeijn	University of Groningen
Leonard Rutgers	University of Utrecht
Sonja Smets	University of Amsterdam
Eliza Steinbock	Leiden University
Behnam Taebi	Delft University of Technology
Claes de Vreese	University of Amsterdam
Franjo Weissing	University of Groningen

Physics

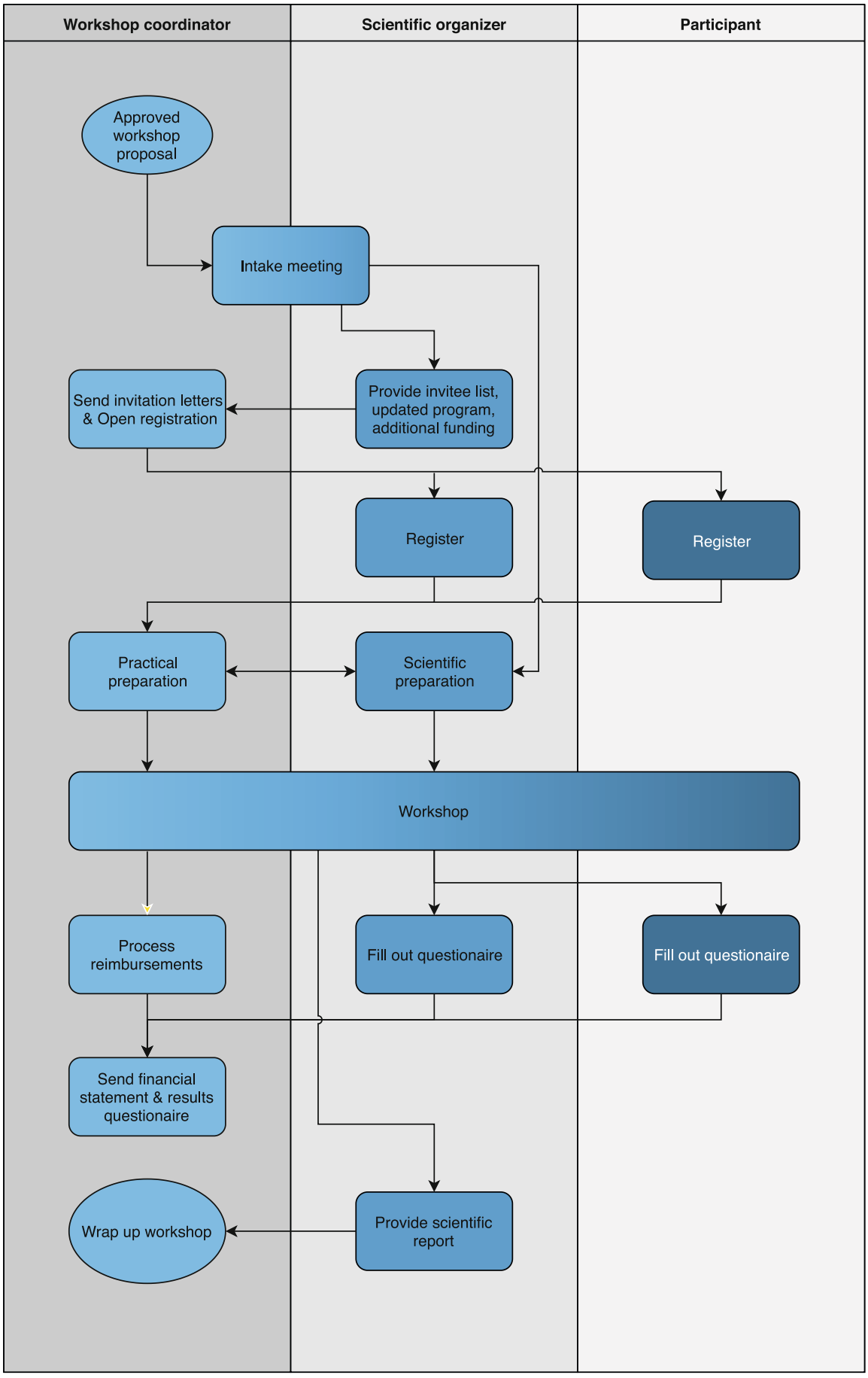
Jacco Snoeijer (chair)	University of Twente/Eindhoven University of Technology
Wim Beenakker	Radboud University Nijmegen
Daniël Boer	University of Groningen
Jan de Boer	University of Amsterdam
Ageeth Bol	Eindhoven University of Technology
Kjeld Eikema	VU Amsterdam
Gijsje Koenderink	Institute AMOLF
Kobus Kuipers	Delft University of Technology
Pieternel Levelt	Delft University of Technology
Sander Nijdam	Eindhoven University of Technology
Christian Poelma	Delft University of Technology
Anouk Rijs	Radboud University Nijmegen
Peter Schall	University of Amsterdam
Daniel Vanmaekelbergh	Utrecht University
Thijs Vlugt	Delft University of Technology

III. Schematic flowcharts

These two flowcharts illustrate the application process and the practical workshop organization.



Flowchart A: Schematic flowchart of the iterative application procedure

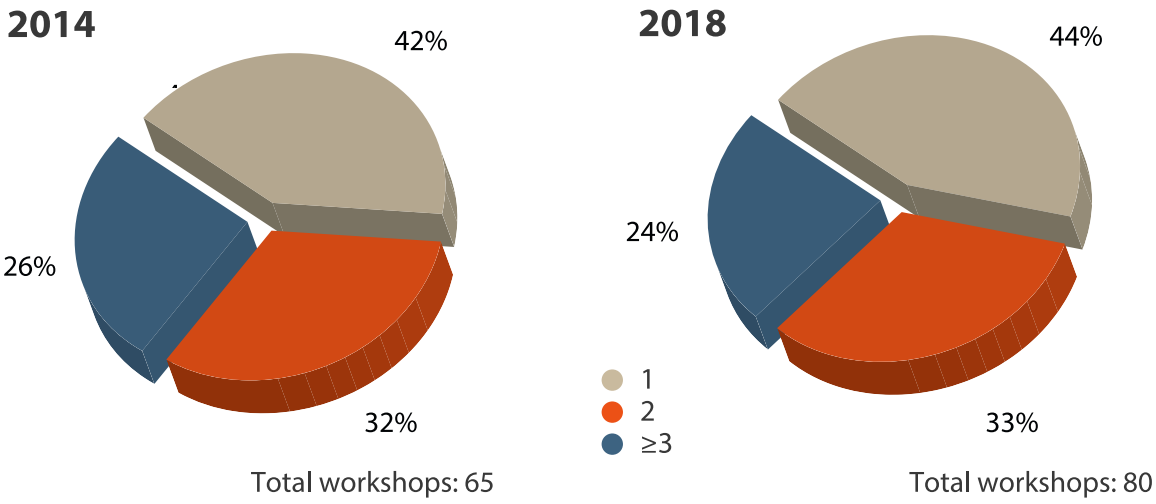


Flowchart B: Schematic flowchart of the organization of a workshop

IV. Mono-/multidisciplinarity of workshops in 2014 and 2018

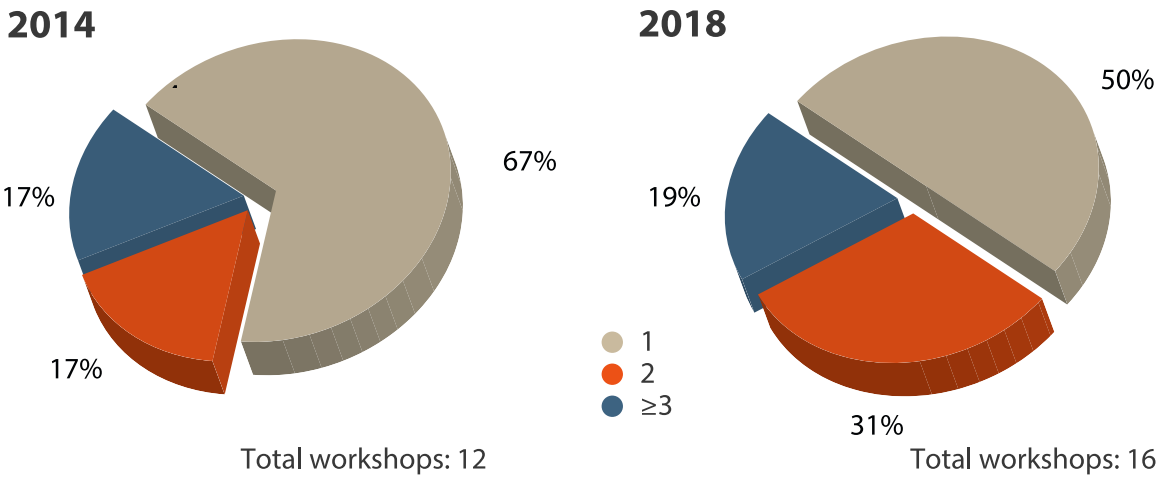
The figures in this appendix indicate the levels of mono- or multidisciplinary workshops organized in 2014 and 2018 – see Section 2.4 for a discussion.

Number of boards per workshop



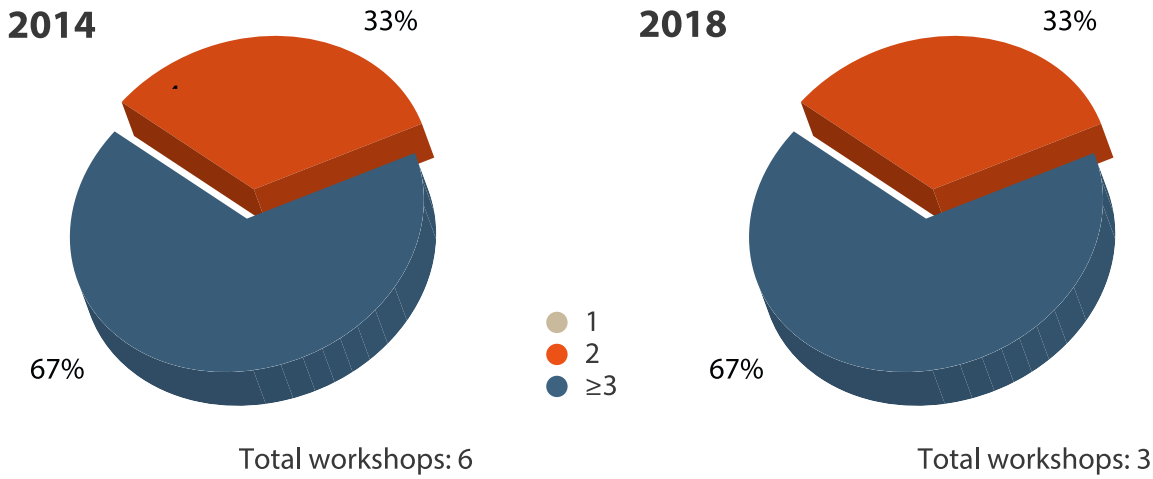
Total workshops: 65 Total workshops: 80

Number of boards per Astronomy workshop

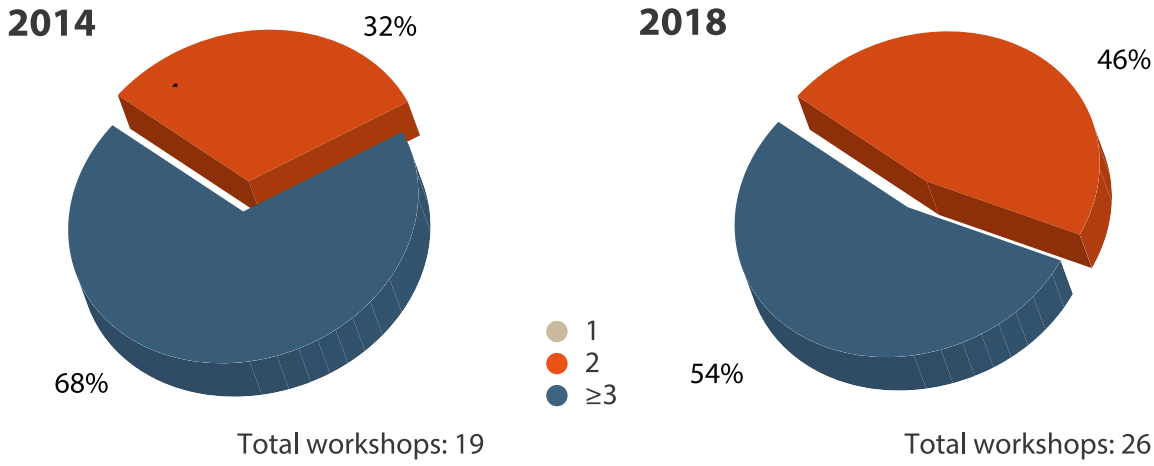


Total workshops: 12 Total workshops: 16

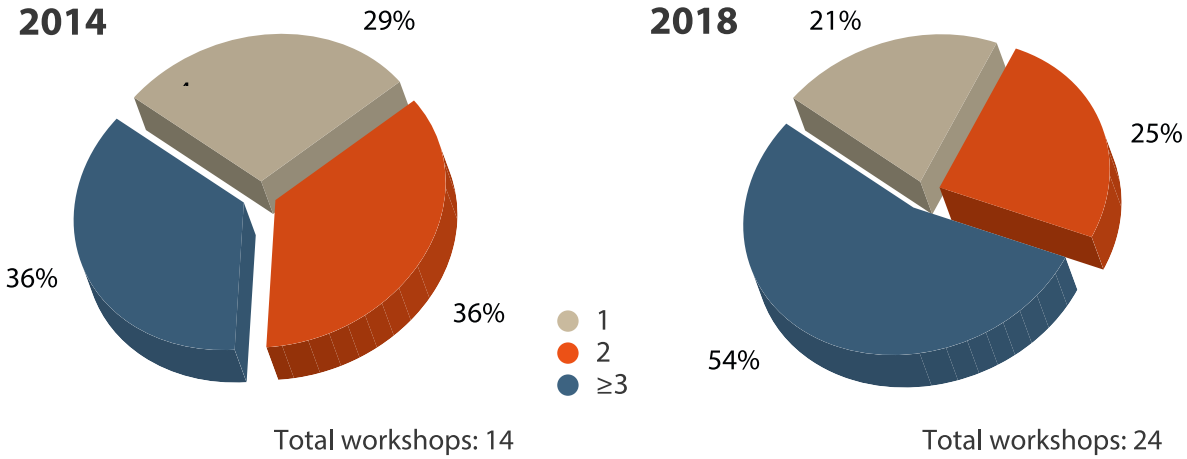
Number of boards per Chemistry workshop



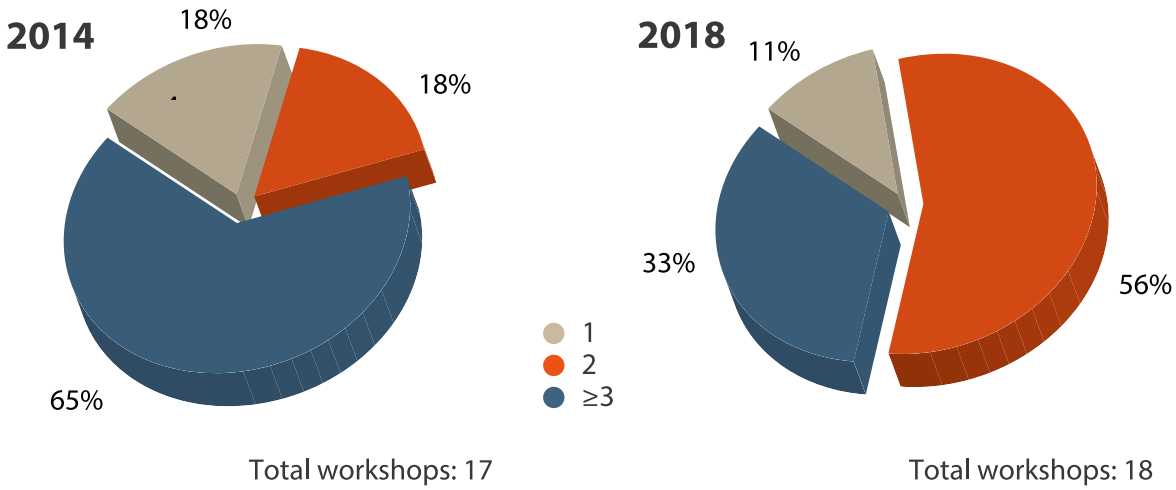
Number of boards per Computational Sciences workshop



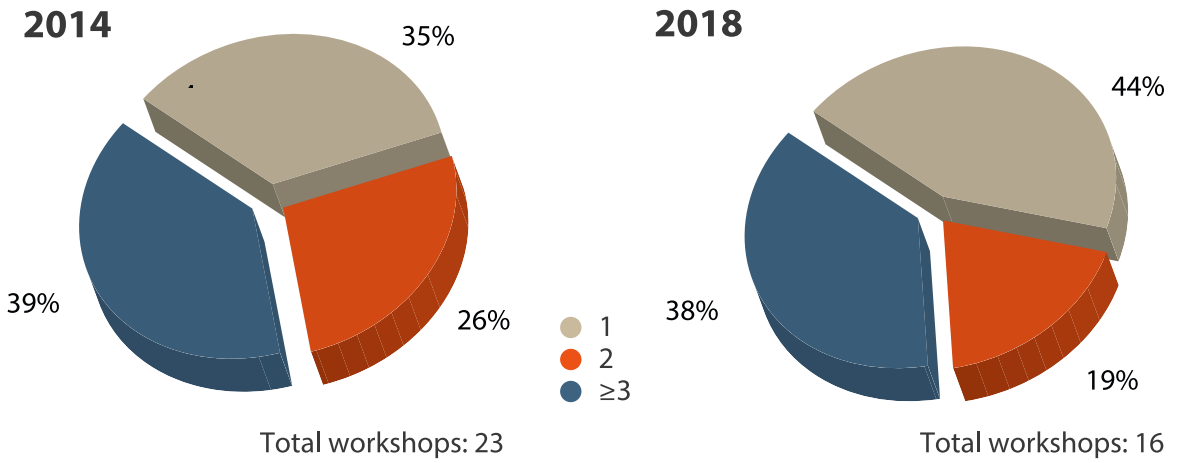
Number of boards per Informatics workshop



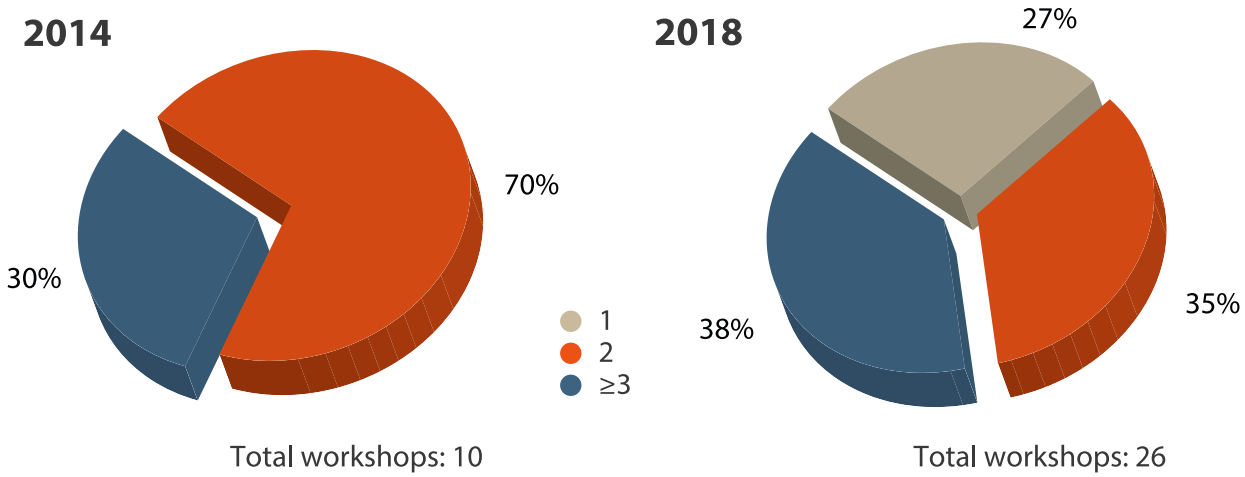
Number of boards per Life Sciences workshop



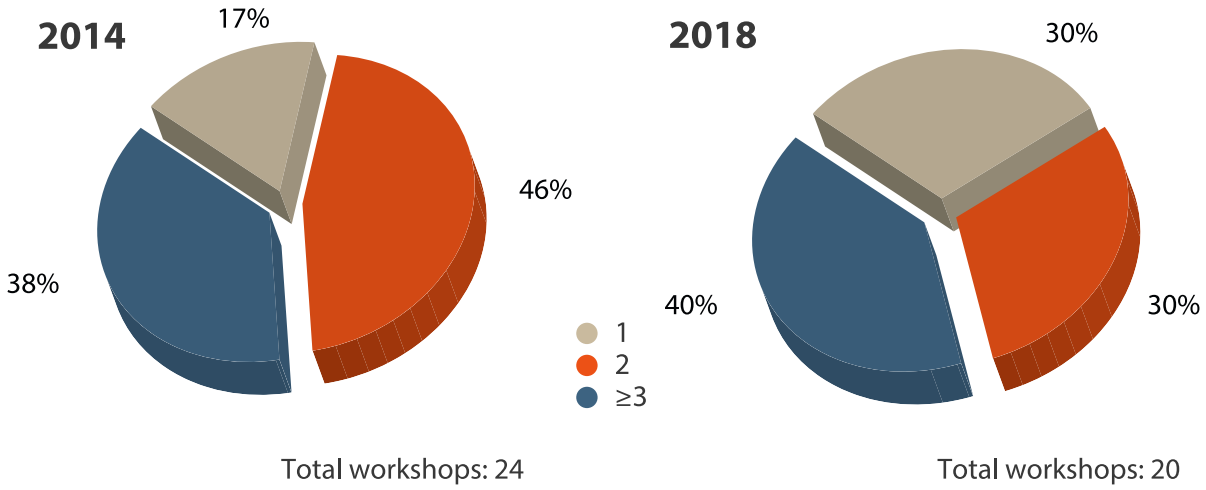
Number of boards per Mathematics workshop



Number of boards per NIAS workshop



Number of boards per Physics workshop



Total workshops: 24

Total workshops: 20

V. Overview winners of calls and special programs

Our partnerships include several calls and competitions. Below an overview of the winners of the Distinguished Lorentz Fellowships (DLF), the NIAS-Lorentz Theme Group (NLTG), the CECAM-Lorentz call and Lorentz-eScience Competition.

DLF	Workshop title	Fellow
2014	Socio-Economic Complexity	Cars Hommes (University of Amsterdam)
2015	Bridging Technological and Social Innovation for a Biobased Economy	Patricia Ossenweijer (Delft University of Technology)
2016	Privacy by Design Beyond the Screen: (How) Is it Possible?	Bert Jaap Koops (Tilburg University)
2017	Probing the Foundations of Cultural Evolution	Franjo Weissing (University of Groningen)
2018	Intersecting Worlds: The Interplay of Cultures and Technology	Corinne Hofman (Leiden University)

NLTG	Workshop title	Fellowship group
2014	Social Support TAT: Theory, Applications, and Technology	Jim Coan (University of Virginia); Julianne Holt-Lunstad (Brigham Young University); Spike Lee (University of Toronto); Harry Reis (University of Rochester); Hans Ijzerman (Tilburg University)
2015	Capturing Phylogenetic Algorithms for Linguistics	Devdatt Dubhashi (Chalmers University); Harald Hammarström (Max Planck Institute for Psycholinguistics); Gerhard Jäger (University of Tübingen); Marian Klamer (Leiden University); Andrew Meade (University of Reading)
2016	The Comparative Biology of Language Learning	Carel ten Cate (Leiden University); Judit Gervain (CNRS, Paris); Claartje Levelt (Leiden University); Chris Petkov (Newcastle University); Willem Zuidema (University of Amsterdam)
2017	Diaspora, Migration and the Sciences: A New Integrated Perspective	Leonard Rutgers (Utrecht University); Harry Ostrer (Albert Einstein College of Medicine); Tracy Prowse (McMaster University)
2018	What is Translation? Exploring the Missing Link Between Neuroscience and Psychiatry	Leon de Bruin (Radboud University Nijmegen); Francesca Ervas (University of Cagliari); Jeroen Geurts (Amsterdam UMC); Gerrit Glas (VU Amsterdam); Annemarie Kalis (Utrecht University)

CECAM	Workshop title	Organizers
2014	Virus as a Whole: Meso- and Macroscopic Structure and Dynamics at All Atom Resolutions	Dimitry Nerukh (Aston University); Sergey Karabsov (Queen Mary University of London)
2015	Reaction Coordinates from Molecular Trajectories	Peter Bolhuis (University of Amsterdam); Gerhard Hummer (Max Planck Institute of Biophysics); Christoph Dellago (University of Vienna)
2016	Multiscale-modelling of nucleosomes and their positioning on DNA	John H. Maddocks (Swiss Federal Institute of Technology Lausanne); Helmut Schiessel (Instituut-Lorentz for Theoretical Physics)
2017	Integrating Molecular Simulation with Machine Learning/Artificial Intelligence for Advance Material Design	Frank Noe (Free University of Berlin); Siewert-Jan Marrink (University of Groningen); Shirin Faraji (University of Groningen); Niels Taatgen (University of Groningen)
2018	Computing Complex Mechanical Systems	Martin van Hecke (Leiden University); Pedro Reis (EPFL); Miguel Bessa (Delft University of Technology); Mark Pauly (EPFL)

eScience	Workshop title	Organizers
2016	eWUDAPT: Bringing eScience to Urban Climate Mapping and Modelling	Alexander Baklanov (WMO Geneva); Bert Holtslag (Wageningen UR); Gerald Mills (UCD Dublin); Gert-Jan Steeneveld (Wageningen UR); Natalie Theeuwes (University of Reading)
2017	Crowdsourcing for Medical Image Analysis	Lora Aroyo (VU Amsterdam); Alessandro Bozzon (Delft University of Technology); Veronika Cheplygina (Eindhoven University of Technology); Danna Gurari (UT Austin); Zoltán Szlávik (IBM Amsterdam)
2018	Artificial Intelligence in Cybersecurity	Vincent Lengkeek (Joint Sigint Cyber Unit); Roy Lindelauf (NLDA The Hague); Arnout van de Rijt (Utrecht University); Paulo Shakarian (ASU Phoenix); V.S. Subrahmanian (Dartmouth College)

VI. Public events and 'This Week's Discoveries' presentations

To increase the visibility of research to a broader public, we organize events to communicate the latest scientific activities to the general public. This list provides an overview of the public events organized in collaboration with Rijksmuseum Boerhaave. Also listed below are the lectures given by workshop participants in the series ´This Week's Discoveries' at the Faculty of Science of Leiden University.

PUBLIC EVENTS

2014

16 January	Jointly Designing a Data FAIRPORT	Barend Mons, Leiden University
14 May	Expecting the World	Andy Clark, the University of Edinburgh
19 September	Computing in Secondary Education	Jan Karel Lenstra, CWI Amsterdam
12 November	Logics for Social Behaviour	Alessandra Palmigiano, Delft University of Technology

2015

27 February	Authorship in Transition: Towards a Common Research Agenda	Paul Wouters, Leiden University
19 March	Relaties, Technologie en Gezondheid	Berry Aarnoudse, CreatingConnections Oisterwijk; Margaret Clark, Yale University
20 August	One Hundred Prisoners and a Light Bulb	Barteld Kooi, University of Groningen, Hans van Ditmarsch, CNRS Vandoeuvre-lès-Nancy
8 October	BINC: Societal Impact of New Technology	Lene Andersen, Next Scandinavia; Steen Rasmussen, University of Southern Denmark
16 October	The Future of Protein Research	Thijs Aartsma, Leiden University; Marcellus Ubbink, Leiden University

12 November	Moduli Spaces and Arithmetic Geometry Celebrating FO80	Aise Johan De Jong, Columbia University; Don Zagier, MPI Bonn
14 December	NleSC-Lorentz eHumanities Day	Mieke Schutte, Lorentz Center; Tobias Blanke, King's College London; Sally Wyatt, KNAW Amsterdam

2016

10 January	Perspectives on Diversity, The Cultural Life of Absence	Douwe Draaisma, University of Groningen; Jascha Blume, Bologna, Vincent Bijlo, Nieuwegein
18 February	Catchy Categories for the Celestial Emporium of Beneficial Knowledge	Michael Moortgat, Utrecht University; Nachoem Wijnberg, University of Amsterdam
26 May	The Good, the Bad, and the Calculable: the Pro- and Cons of Terrorism Risk Analysis	Quirine Eijkman, Leiden University; Detlof von Winterfeldt, University of Southern California

2017

10 January	Ladder of Lies and Integrity Risks	Jan Henk Van der Velden, Wyn Stael Advocaten Utrecht
13 June	Conservation Facsimiles in Luxor	Carlos Bayod Lucini, Factum Arte Madrid
14 September	Laughing Dogs and Jealous Cats	Pim Martens, Maastricht University
19 December	Fairness and Accountability of Sociotechnical Algorithmic Systems	Danah Boyd, Microsoft Research New York

2018

18 January	The richness of multilingualism	Gerrit Jan Kootstra, Radboud University Nijmegen; Pieter Muysken, Radboud University Nijmegen
7 June	Brains, Robots and Dance	Stephen Batts, Echo Echo Dance Theatre Company Derry
2 August	Contextuality: At the Borders of Paradox	Samson Abramsky, University of Oxford
16 August	Exploring the Ghostly Side of Galaxies with Dragonfly	Roberto Abraham, University of Toronto
22 November	Weighing Stars	Fabian Schneider, Heidelberg University

Lorentz Center Highlights at the Faculty of Science in the series 'This Week's Discoveries'

2014

11 February	Superresolution Reconstruction in Tomographic Imaging	Jan Sijbers, University of Antwerp
11 March	Geometric Semiconductors with Graphene-plus Properties	Daniël Vanmaekelbergh, Utrecht University
18 March	Supercooled Clouds: Ece Crystal Power Laws and Orbits	Raymond Shaw , Michigan Technological University
1 April	Searching for the Building Blocks of Galaxies	Natalie Webb, XMM-Newton Survey Science Centre Toulouse
6 May	Challenges in the Verification of Concurrent Software	Marieke Huisman, University of Twente
13 May	The Predictive Mind	Jakob Hohwy, Monash University
20 May	At War with Animals	Jessica Pierce, University of Colorado Denver
7 October	Making the Cut: Kirigami Topology	Randall Kamien, University of Pennsylvania
21 October	Reconstructing the Mass Assembly of Galaxy Disks Over the Last 12 Billion Years with ALMA, HST and Spitzer	Kartik Sheth, North America ALMA Science Center
18 November	Facticity, Creativity and Complexity	Pieter Adriaans, University of Amsterdam

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, Jena
30 November	Modelling and Simulation in Drug Discovery and Development	Pinky Dua, Pfizer BioTherapeutics, Cambridge
15 December	Powerful Outflows from Supermassive Black Holes in the Early Universe	Debora Sijacki, University of Cambridge

2016

2 February	Black Holes, on the Black Background of Space - So How are You Meant to See Them?	Chris Done, Durham University
16 February	Logics for Social Behaviour	Alessandra Palmigiano, Delft University of Technology
1 March	Breaking the Billion Variable Barrier in Real-World Optimization	Kalyanmoy Deb, Michigan State University
5 April	What is the Dark Matter?	Carlos Frenk, Durham University
10 May	Groups as Moral Anchors	Naomi Ellemers, Utrecht University
20 September	Self-Organized Helical Fusion Plasmas: When Kinking Matters	Piero Martin, University of Padova
1 November	The Sandpile Model – A Simple Model for Cascades	Wioletta Ruszel, Delft University of Technology
8 November	Massivizing Computer Systems = Making Modern Computer Systems Scalable, Reliable, High-Performance, yet Efficient and Easy-to-Use	Alexandru Iosup, Delft University of Technology

2017

21 February	Io, the Most Volcanically Active Body in our Solar System	Imke de Pater, University of California
7 March	The Role of Massive Galactic Outflows in Galaxy Evolution	Roberto Maiolino, University of Cambridge
18 April	Data Science with Human in the Loop: Harnessing User Semantics at Scale	Lora Aroyo, VU Amsterdam
9 May	Unravelling the Long-Term Evolution of Black Holes with Machine Learning	Daniela Huppenkothen, New York University
10 October	OpenML - An Online Platform for Collaborative and Open Machine Learning	Heidi Seibold, University of Zurich

24 October	Galaxies 800 Million Years after the Big Bang Seen with the Atacama Large Millimetre Array	Renske Smit, University of Cambridge
14 November	Why the Weather Forecasts of the Future Forecast will Not Forecast the Future?	Leonard Smith, London School of Economics and Political Science
5 December	What the Structure of the Cortex Tells Us About Its Particular Function	Almut Schüz, Max-Planck-Institute for Biological Cybernetics

2018

16 January	Unravelling the Mistery of Dark Matter	Gianfranco Bertone, University of Amsterdam
6 March	How do microbes adapt to changing conditions?	Bob Planqué, VU Amsterdam
20 March	Symmetric Cryptanalysis: the Foundation of Trust	Maria Naya plasencia, INRIA Paris
29 May	Natural Thermal Convection: Scaling Relations and Boundary Layers	Olga Shishkina, Georg-August-Universität Göttingenn
30 October	Making Habitable Worlds and the Chemistry of Planet Formation	Karin Oberg, Harvard University
13 November	Ultimate Rayleigh-Bénard and Taylor-Couette turbulence	Detlef Lohse, University of Twente
11 December	Quasicrystals: Minimal recipes to make them and tools to catalog them	Priya Subramanian, University of Leeds

VII. Quotes from the long term survey

In the spring of 2019, a questionnaire was sent to 1400 organizers of workshops that took place between 2012 and 2017. Besides rating scale questions, the survey also included open-ended questions. We received numerous responses, from which we selected some quotes.

Publications/outcomes

1. "After the Lorenz workshop, about 10 Netherlands-Japan and vice versa visits have been undertaken by the participating scientists. A special issue in Frontiers in Nutrition on 'New Horizons in Food Science via Agricultural Immunity' has been initiated. This special issue currently has 12 articles and over 22.000 views."
2. "I was involved in two publications that were a direct result from the meeting on Socio-Economic Complexity (2015) and were a collaboration by the leading experts at the meeting. The initiative came from the main organiser Cars Hommes, and me, who together wrote the paper using contributions of all authors. The result was published as a Policy Forum contribution in Science in February 2016 (with a follow-up slightly later), with authors in alphabetical order to underline the joint initiative and necessity of all fields represented. The paper has generated a lot of media attention (papers, radio, internet) and has so far (March 2019 Google Scholar) been cited almost 200 times. A set-up like the Lorentz centre (facilities, philosophy, funding, management, scientific embedding) was essential in realising the objectives we had."
3. "We managed to bring together working in different fields of transient research. What we did not realize in the beginning is how popular the idea would be, and that due to space limitations we had to turn down a number of interested people (therefore the 9 to question 2). The workshop was a huge success, with very interesting talks and highly motivating discussions. There were three new/emerging topics discussed at the workshop: searching for electromagnetic counterparts to gravitational wave sources, tidal disruption events (stars torn apart by tidal forces of supermassive black holes), and fast radio burst (FRB). The dominance/interest in the FRB topic was a complete surprise to the organizers: a milestone paper announcing the detection of four new FRBs just appeared around the time, and was presented at our workshop. These new topics represent a completely new line of research with the EVN today. There were high-profile EVN/multi-messenger papers published as well, directly or indirectly related to this workshop: two in Nature and two in Science."
4. "We have received approval to publish a special issue in Mathematical Biosciences and Engineering with about 10 contributions expected to be submitted by workshop participants to this issue by July 31, 2019 on research related to the workshop focus or inspired by workshop discussions."
5. "The Chatterjee et al. 2017 paper presents the first-ever localization of a fast radio burst, a true breakthrough in the field (200 citations in 2 years). The EVN provided the highest precision localization of the transient - this was separately published by Marcote, Paragi, Hessels et al. (2017, ApJ 834, L8) - probably the first ever EVN paper to reach >100 citation

within a year (currently has 130 citations). The Ghirlanda et al. (2018) paper presents the highest angular resolution VLBI imaging of the first electromagnetic counterpart to a binary neutron star merger, that produced the gravitational wave event GW170817. In this case VLBI provides the only way to constrain the nature of the ejecta (jetted vs. symmetric outflow). The Lorentz Center organization was very professional. The environment was very stimulating for discussions, and we fully made use of that. This workshop had a long-time imprint in our field."

6. "The workshop was probably the best I have ever attended. The environment was excellent for working on real problems and actually making progress. We published a whole series of articles after the workshop in a special edition of Nature Astronomy, several new collaborations were instigated and new research programmes were started."
7. "I would like to add that without this workshop "ICE AGE", a 31 hr observing early science release program at the JWST, worth some 4.5 MEuro of observing time, would not have been realized. The workshop provided the setting to get this initiative started. The scientists that met at the LC workshop is still largely active in the consortium preparing for interpreting the JWST data, once the telescope has been launched. NASA has been offering funding to this consortium, of the order of 250 k$. Papers have not been directly realized yet; however, a large number of preparations, partially resulting in published work, have been already realized."

New collaborations

1. "The workshop inspired the possibility to provide the state-of-the-art in the field of dual Active Galactic Nuclei in a review paper, that we are currently writing for a submission, hopefully within a couple of months. This is the result of efforts made by about 30 people who attended the workshop. The Lorentz Center represents a great opportunity for meetings, in a very nice location and beautiful city and, as such, it would be important to keep it 'alive' in the future. Moreover, especially for young scientists, it is a wonderful occasion to show results in a friendly context."
2. "The Lorentz Center workshop was one of the best workshops I have been involved in. The infrastructure really optimises and enforces discussions and collaborations. During the workshop, I have set up collaborations that are still ongoing (6 years later!)."
3. "I believe that the Lorentz Center represents an excellent venue for small to medium size workshops! As an organizer, I always liked the support and excellent infrastructure. As a participant, I always liked the relaxed atmosphere. My experience is that new collaborations always depend very much on the participants (and on the organizers) as people who already collaborate tend to gather and discuss of ongoing projects. Therefore, preference should be given to invitations extended outside the collaboration network of the organizers."
4. "The facilities and administrative support were excellent. The offices provided for participants were helpful in stimulating discussions that triggered new collaborations."
5. "The ideas developed at the workshop are consistently propagating. Most notably, they have led to the SUNRISE initiative, a Large Scale Research Initiative (a.k.a. Flagship) on solar energy conversion with academia and industry, for which a first seeding grant has been awarded by the Commission of the EU. The community present at the workshop is having a leading role here."
6. "There are very few opportunities like the workshops offered by the Lorentz Center. Grants often target interdisciplinary work of a few PIs over a longer time frame. But it is very hard to find funding and infrastructure to bring together interdisciplinary groups of a larger number of researchers for short, but intense interactions. It allows for synthesis like no other forum or form of interaction."

7. "A successful application for a European ITN network emerged later from the group brought together during the workshop."
8. "The Lorentz Center is friendlier towards collaboration between business and academic institutions than other conferencing centers."

You do the Research

1. "The workshop was probably the best I have ever attended. The environment was excellent for working on real problems and actually making progress. We published a whole series of articles after the workshop in a special edition of Nature Astronomy, several new collaborations were instigated and new research programmes were started."
2. "Absolutely wonderful experience! The available facilities and format really made the meeting a big success - several people said it was the best meeting they had ever participated in. With my three co-organizers we have had a review based on the workshop accepted for publication in the high impact journal The Lancet Infectious Diseases. My network has also been significantly expanded and I've established a new collaboration."
3. "Excellent format and setting and great service in setting up the meeting. Takes away all the work on logistics that, as a scientist, you would rather not spend your time on, while allowing almost complete freedom regarding the scientific program."
4. "I had the opportunity to participate to other workshops at the Lorentz center and it was always inspiring. The location and organization has always been smooth facilitating the focus on scientific aspects. I think this is not so common to most of the venues in which I participated or organized workshops."
5. "The Lorentz Center is one of the few institutions in the world that will let junior scientists organize a meeting, leaving them in complete control over the scientific content. This was the main reason why we chose the Lorentz Center, since the two main organizers of this meeting (Allison Man and I) were junior postdocs. I believe that our workshop was particularly successful, and this is partly due to the relatively young ages of the SOC and the attendees, which led to a very lively and open discussion."
6. "I found the Lorentz Center infrastructures extremely comfortable under any aspect related to the organization. In addition, the presence of an excellent administrative staff helped us enormously in any practical issue, leaving to the scientific organizers only the duties related to the scientific aspects of the workshop."

Venues

1. "The location was particularly suitable for the open workshop with daily discussions. I have been to similar workshops at AIM and MSRI in California, but somehow the atmosphere was more suitable at the Lorentz Center."
2. "Organizing this workshop has been an exceptionally good experience, where organizers could focus on the scientific aspects and the Lorentz Center carefully organized the practical things. But they also gave advice on where to place breaks and how long, and altogether it created an atmosphere where many ideas were exchanged, it was busy at the posters during al breaks (and not just at the scheduled poster event). As an organizer I got many compliments from respected colleagues, and I should pass them on to the Lorentz Center. The Center has now a very good reputation also internationally, there is prestige in participating in their small pressure-cooker high-quality events, and it puts Leiden and the Netherlands on the map as an academic hub. It is really hard to estimate the number of papers that result from an event. Organizing the workshop has contributed to my scientific network and five years later it still helps me."
3. "The Lorentz Center enables incredibly effective workshops. Our own format - focused

mainly on hands-on group sessions rather than traditional presentations - was extremely fruitful and inspiring. The participants found the physical setup of the Lorentz Center - plenty of breakout rooms with entire walls to write on - ideal. We would love to be awarded another workshop!"

4. "I find it extremely useful to have a place that very much looks like my ordinary working environment, but where the "faculty" is not a random assembly of professors (as is the case at my department), but a carefully selected group of people, with which I can work and socialize intensively for a week. And the overall service provided by the Lorentz Center is truly excellent."
5. "The Snellius venue of the LC is wonderfully suited for running small workshops with a lot of informal interaction. The service of the helpful staff of the LC is flawless. I don't know of any better venue."
6. "The venue is amazing. It was for us especially the fact that we were away from our own working spaces in a place where all we needed was available that contributed to the success: we were totally in a bubble (and that was a good thing!). The blackboard walls and the sheets to write on do indeed invite to put things down in writing and so move from discussion to concrete plans, lay-outs of arguments and new projects. The support is valuable during the conference but causes some extra work in the preparation phase exactly because of the location, but the very well worked out blueprint makes up for that."

Colophon:

Contact

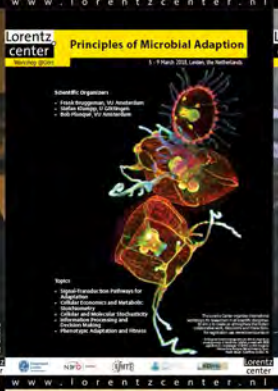
Lorentz Center@Oort
Niels Bohrweg 2
2333 CA Leiden
+31 71 527 5400

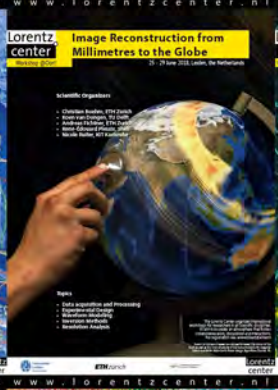
Lorentz Center@Snellius
Niels Bohrweg 1
2333 CA Leiden
+31 71 527 5401

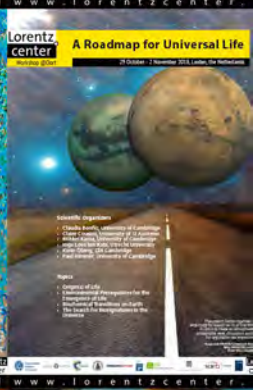
info@lorentzcenter.nl
www.lorentzcenter.nl

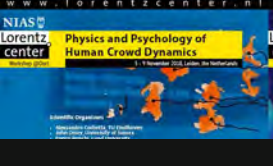
Design
SuperNova Studios, Amsterdam

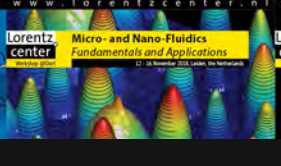
Photography
Hucopix, Amsterdam











Lorentz center

The Lorentz Center organizes international workshops in all scientific disciplines. We believe that research thrives by open interaction. We promote innovative research, at the scientific frontiers as well as on complex societal challenges. Our strength is to foster collaboration between research communities, reaching also beyond academia. Our workshops are characterized by ample time for active discussions and informal interactions.

'You do the research, we do the rest'

Universiteit Leiden
The Netherlands

NWO

NIAS

cecam
Centre Européen de Calcul Atomique et Moléculaire

netherlands eScience center

rijksmuseum boerhaave