



May 2021

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Upcoming

Next Jour Fixe

May 7: Angkana Rüland and Hans Knüpfer

More information on the STRUCTURES web page.

Special Talks

June 11: Alan Yuille

CP 7 Lunch Seminar

May 5, contact Anja Randerdecker

General Assembly

July 23

Introducing the Newsletter

With this newsletter, we would like to add to the flow of information in and around the STRUCTURES community. It will keep you up to date about the latest developments in the cluster and provide insights into our current research within the comprehensive and exploratory projects. In particular, we introduce members and their research, to help you in getting to know colleagues and finding common topics of interest. If you are not (yet) part

of STRUCTURES, we hope to motivate you to establish contact, exchange ideas and collaborate, and maybe eventually join our community.

The newsletter will appear bimonthly both in print and online. Its scope will develop over time, and we are looking forward to your suggestions and input!

Manfred Salmhofer, Anna Wienhard and Ralf Klessen

RESEARCH AWARDS

Anna Wienhard Wins ERC Advanced Grant

The European Research Council (ERC) has awarded Anna Wienhard, principal investigator and co-speaker of our cluster, an ERC Advanced Grant. In her new ERC project "Positivity in Lie Groups and Representation Varieties" (PosLieRep), she will use positivity structures on Lie groups that she has recently discovered to obtain new results in higher Teichmüller theory.

Congratulations, Anna, for this very prestigious award!



Foto: HITS/Gülay Keskin

Anna Wienhard is Professor at the Mathematical Institute on Differential Geometry and leads the research group Groups and Geometry at the Heidelberg Institute for Theoretical Studies.

STRUCTURES COMMUNITY

New Members and Fellows

Since 2019, the STRUCTURES community has grown larger and more diverse. Today, STRUCTURES builds on the commitment of 54 senior and 130 junior members, combining the disciplines of physics, math and computer science.

STRUCTURES Professors

Three new STRUCTURES professors have joined us since last summer and strengthened our scientific portfolio:

**Lauriane Chomaz**

Physikalisches Institut
Quantum Fluids

**Razvan Gurau**

Inst. f. Theoretische Physik
Mathematical Physics

**Beatrice Pozetti**

Mathematisches Institut
Geometric Group Theory

STRUCTURES Fellows

Two STRUCTURES fellows have been elected by the General Assembly in March:

**Matthias Bartelmann**

Inst. f. Theoretische Physik
Cosmological Structure Formation

**Jan Pawlowski**

Inst. f. Theoretische Physik
Strongly Correlated Systems

Matthias Bartelmann dedicates his fellowship to further connecting kinetic field theory for cosmic structures with approaches established in quantum field theory.

Jan Pawlowski uses his fellowship to further the understanding of the underlying stochastic (quantum field theoretical) structure of the spiking (and non-spiking) neuromorphic hardware and the influence of (colored) noise.

STRUCTURES Members

The General Assembly has elected four new members:

**Jan Johannes**

Inst. f. Angewandte Mathematik
Statistics of Inverse Problems

**Philipp Preiß**

Physikalisches Institut
Atomic Quantum Matter

**Johannes Schemmel**

Kirchhoff-Institut für Physik
Electronic Vision(s)

**Fabian Schneider**

Heidelberg Institute for
Theoretical Studies
Stellar Evolution Theory

STRUCTURES welcomes all its new professors, fellows and members and wishes them a good start!

YOUNG RESEARCHER'S CONVENT

YRC Report by Christophe Pixius and Valentina Disarlo

In 2020, the YRC has grown and adapted to the changing situation constantly. To financially support the younger members of the cluster during Covid times as well, the previously popular travel funds were largely replaced by funding for online equipment. This ranges from microphones and webcams to writing pads that allow for more efficient communication of ideas for online teaching and conferences.

Additionally, we were lucky to be able to hold the YRC-sponsored Schöntal Workshop, as well as contribute to the Graduate Days and launch a new talk series

where PhD students can practice their defense.

In May 2021, we will close our open call for funding, containing an even larger variety of funding opportunities than before, including books and online courses.

The YRC is also currently gathering proposals for speakers at the 47th HGSFP Graduate Days and will be responsible for two of the talk series presented there.

In the General Assembly in February, Dr. Valentina Disarlo became the new deputy speaker, replacing Christophe Pixius who was elected as speaker, stepping into the footsteps of Celia Viermann. On this oc-

casional, we would like to express our gratitude to Celia for her vital contribution to the YRC.

JOIN THE YRC

Did you know that every student and Postdoc in your group can apply for a YRC membership, even without a STRUCTURES contract? Let them know about the YRC! All members of the YRC have access to talks, workshops and special funding.

STRUCTURES PROJECTS

The Exploratory Projects of STRUCTURES

In addition to the comprehensive projects (CP), which define the main research lines of the cluster, the exploratory projects (EP) play an important role for the functioning and the development of the cluster. The format of EPs is completely flexible. Their scope ranges from focused projects that pursue ideas not (yet) represented in the CPs, collaborations that establish new links between researchers in different fields, joint workshop and group activities to explore and develop new interdisciplinary topics, to projects that link the cluster to other parts of academia.

Twice a year, we call for EP proposals to be submitted to the steering board of the cluster. Up to now, we have selected 23 EPs, which have been initiating a lot of activity in the cluster, providing innovative ideas and freshening our research. Seven new EPs have started following the last call:

- ▶ The semi-random method in the continuous world
- ▶ Machine Learning and the Renormalisation Group
- ▶ Opinion Dynamics and Kinetic Field Theory
- ▶ Small-denominator problems and self-

reinforcing singularities

- ▶ Magnetic Field Structures from Dust Polarization - On the Alignment Dynamics of Interstellar Dust
- ▶ Multilevel Monte Carlo for Lattice Field Theory
- ▶ Autocatalytic Reactions

The next call for EPs will be issued in May, 2021. We are looking forward to your proposals.

Below we briefly present the EP Opinion Dynamics and Kinetic Fields Theory by Carsten Littek and Matthias Bartelmann as an example. The full list of all EPs can be found on the [STRUCTURES web page](#).

Exploratory Project: Opinion Dynamics and Kinetic Field Theory

INVITED SUMMARY BY CARSTEN LITTEK

In this Exploratory Project, we aim at applying methods from Kinetic Field Theory to systems in a linguistic context. Specifically, we are interested in decision making processes in communicative ensembles, i.e. how decisions are made and/or opinions are formed. Our collaboration with Dr. Katharina Jacob of the Linguistics Department is funded by the Heidelberg Academy of Sciences and Humanities within the 7th sub-programme on „Collective Decision Making“ of the WIN-College. With her PhD student Jöran Landschoff, she investigates the manifestation and change of opinions using streamed data from Twitter.

In this project, we consider systems of many individuals, which carry a vector representing their opinion on several topics, i.e. each dimension is another topic. These degrees of freedom may take dis-

crete values (such as an Ising spin) or continuous values, which represent the individual's bias towards or against a statement. Each individual might change their opinion stochastically or by interaction with other individuals. Another important aspect of the dynamics is the way individuals are connected, e.g. they could be arranged in a static network representing a social space or they could move through space like (active) particles.

In a network, neighbouring individuals will interact but far-away individuals can only interact via mediation through (possibly many) other individuals. Of course, (active) particles moving through space have more degrees of freedom; they can move stochastically through space, and in addition to a change in opinion, it is possible that individuals of different



Carsten Littek (STRUCTURES Post-Doc) received his PhD in 2018 based on his work on "Kinetic Field Theory, Momentum-Density Correlations and Fuzzy Dark Matter" with Matthias Bartelmann, before starting this interdisciplinary project.

opinions are repelled by each other. Such systems are typically investigated using agent-based models, and those models show transitions towards consensus, polarisation and fragmentation.

The main scientific aim of this project is a translation of existing agent-based models to a statistical field theoretic framework. This will allow investigations into the conditions of transitions towards consensus, i.e. an ordered state or polarisation may occur.

STRUCTURES OFFICE

Behind the Scenes: this is your STRUCTURES Office

Have you ever wondered what the STRUCTURES Office is doing? We take care of everything behind the scenes so that all researchers can invest their time in the scientific questions of STRUCTURES.



May-Britt Becker: Managing Director. She is responsible for scientific management within STRUCTURES and thus ensures dependability in research funding, recruitment activities and the organisation of new space for the cluster. May-Britt Becker is experienced in research (PhD at MPI bpc in Göttingen, Postdoc in Zurich and Konstanz), in research funding (DFG) and as Managing Director of the cluster of excellence CellNetworks 2007 – 2020.



Aletta Berger: Assistant in the office. She is a trained European secretary and has been pursuing English Studies since 2020. She is responsible for research data handling, scientific events, and the implementation of construction requests at our new sites.



Christine Hermann: Project Management and STRUCTURES College. We are looking forward to her return from maternity leave in 2022.

Nina Kastner: Assistant in the office. She has been studying Geography since 2019. Campaigning experience from her jobs at the "Generationen Stiftung" will be of help for her activities in STEPS.



Sara Konrad: Managing Scientist with a PhD in Physics. She joined the STRUCTURES office in January 2021, while also working on cosmic structure formation. She takes care of the website development, supports the YRC networking and College programs.

Cindy Schwäger: Financial Processing and Human Resources. She is a trained office administrator and has worked in projects such as the cluster of excellence CellNetworks and the internal audit department of Heidelberg University.



Sebastian Stapelberg: Assistant for digital design and style. He holds an MSc in physics and joined STRUCTURES in 2021, while also working in the field of cosmology at ZAH. Aside from his scientific background, he is trained and experienced in media and communication design, with a particular interest in science communication.



Nadja Weigel: Human Resources and STRUCTURES College. She is your first contact in the office and has taken on the task of staff recruitment as well as internal project handling (EP, Fellows). She has joined STRUCTURES in 2021 while also working as a freelance conference interpreter.



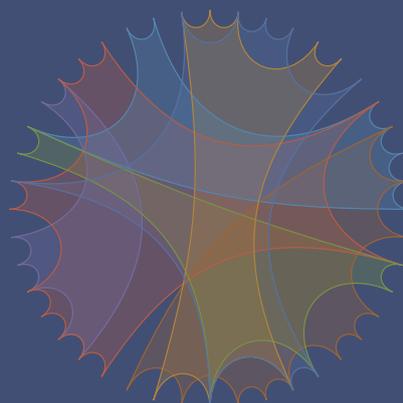
We also want to thank our former assistant **Helen Koch**, who has greatly supported the STRUCTURES office for over two years. In April, she has started a position in Kyrgyzstan for the German Corporation for International Cooperation. We wish her all the best!

STRUCTURES ON THE WEB

<https://structures.uni-heidelberg.de>

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Each person depicted in the images has provided consent to the use of their pictures.



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