OUT OF EQUILIBRIUM

Granada, 1-5 September 2025

Detailed program

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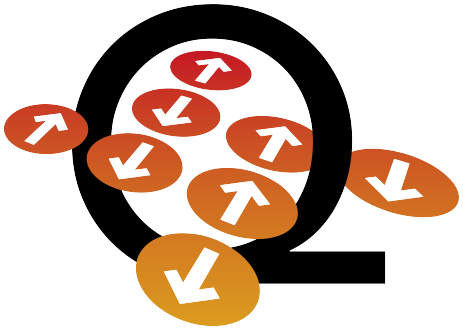

LONG-RANGE INTERACTING
QUANTUM SPIN SYSTEMS
OUT OF EQUILIBRIUM
EXPERIMENT, THEORY AND MATHEMATICS

Funded by the European Union

European Research Council
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DFG Deutsche Forschungsgemeinschaft
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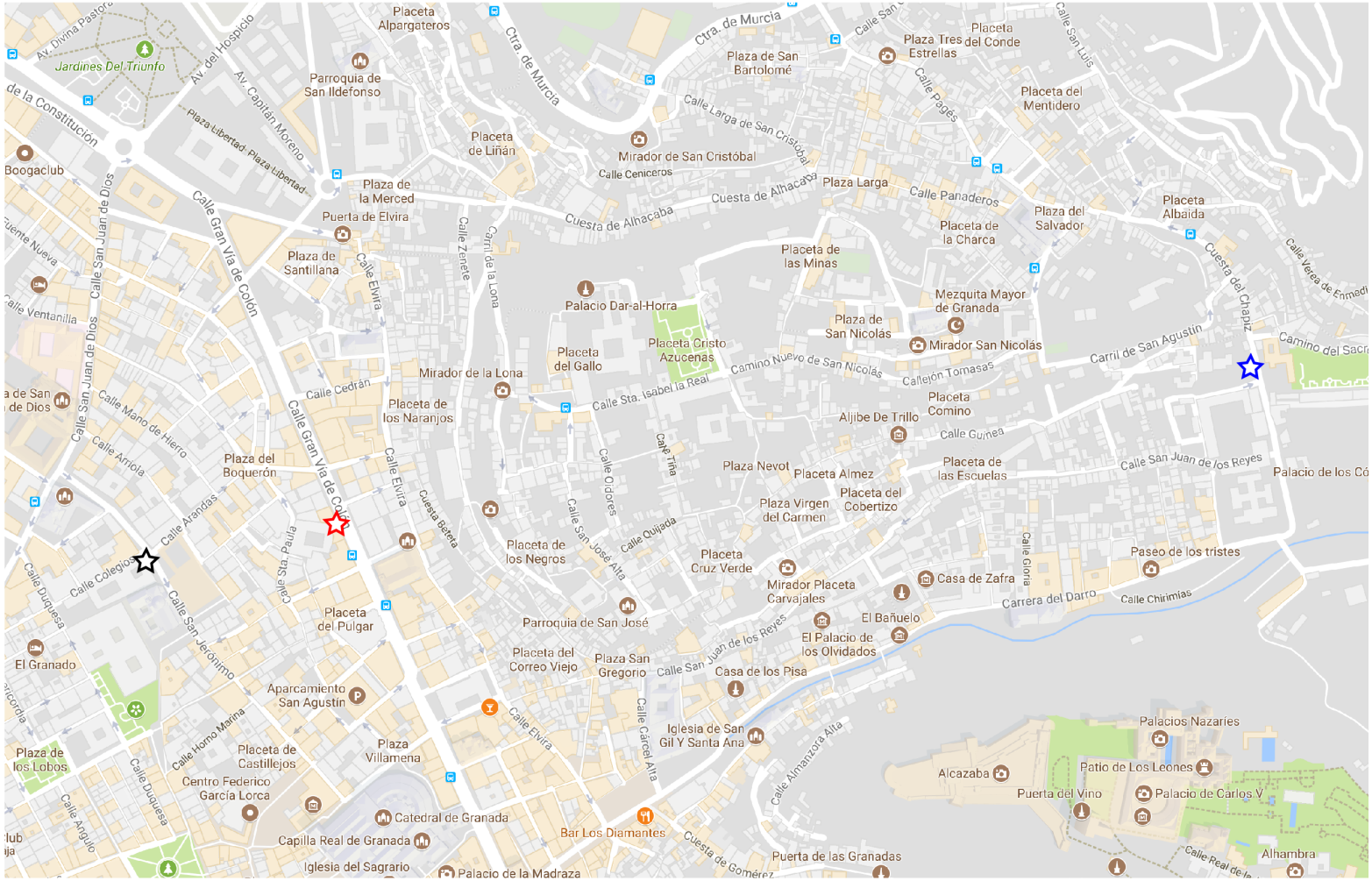
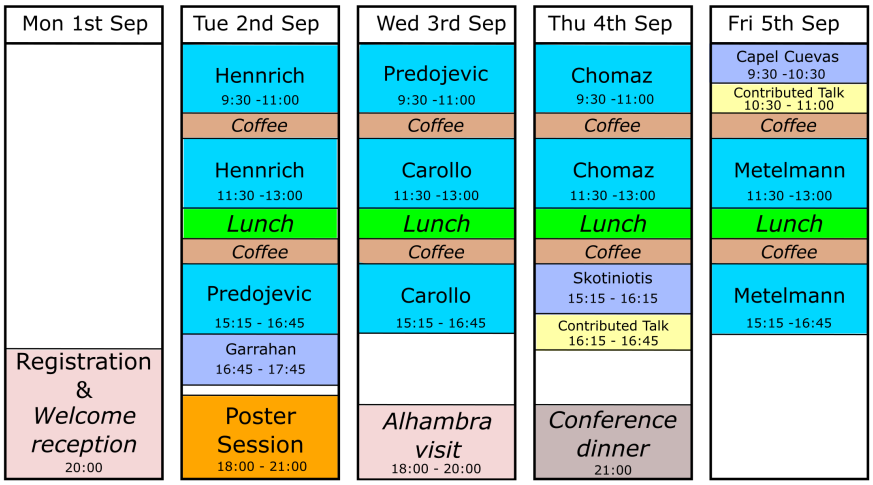


☆ Colegio Mayor Bartolome y Santiago (student accommodation)

☆ Hotel AC Santa Paula (conference dinner)

☆ Carmen de la Victoria (lectures, lunch, poster session)

Program



Lectures' Topics

- Federico Carollo (Coventry University). *Mean-field and quantum fluctuations dynamics in long-range interacting open quantum systems.*
- Lauriane Chomaz (University of Heidelberg). *Experiments with ultracold quantum gases of (magnetic) atoms.*
- Markus Hennrich (University of Stockholm). *Trapped ions and Rydberg excitation: From precision qubits to strong interaction.*
- Anja Metelmann (Karlsruhe Institute of Technology/University of Strasbourg). *Open Quantum Systems: from Operations to Measurements.*
- Ana Predojevic (University of Stockholm). *Quantum light form quantum emitters.*

Guest Speakers

- Angela Capel Cuevas (University of Cambridge). *Efficient and simple Gibbs state preparation of the 2D toric code via duality to classical Ising chains.*
- Juan P. Garrahan (University of Nottingham). *Circuits is all you need (for hydrodynamics).*
- Michalis Skotiniotis (University of Granada). *Quantum Statistical Inference: Theory and Applications.*

Contributed talks

Squeezed Lasing via Cavity-Assisted Raman Transitions

Speaker: Rodrigo Grande de Diego – Instituto de Física Fundamental IFF-CSIC
A squeezed laser is a system in which a squeezed cavity mode acquires a macroscopic photonic occupation through stimulated emission. Above the lasing threshold, the emitted light maintains both the spectral purity of a conventional laser and the quadrature-squeezing characteristics of correlated photons. Here, we propose an implementation of such a device in the optical regime by leveraging cavity-assisted Raman transitions in between the hyperfine levels of Rubidium 87. Crucially, we demonstrate that the intricate interplay between dissipation and high-energy virtual states involved in Raman processes leads to a driven-dissipative phase transition in which we can identify a squeezed lasing regime. These findings establish this system as a compelling platform for exploring the fundamental physics of dissipative phase transitions, quantum simulation in non-equilibrium environments, and potential applications in quantum metrology.

Quantum Time-Crystal Clocks (and their Performance)

Speaker: Ludmila Viotti – ICTP Trieste
Understanding different aspects of time lies at the core of many areas in theoretical physics. Recent investigations focused on thermodynamic aspects of time-keeping in a quantitative way, by simultaneously studying the operation and performance of quantum clocks. In condensed matter physics, time-crystals are a recently found quantum phase of matter that spontaneously breaks time-translation invariance. Beyond their intrinsic fundamental interest, time crystals may also hold promise for quantum technological applications. This naturally raises the question: can time crystals serve as quantum clocks, and how do they perform from a thermodynamic perspective? In this talk, I will address this question.

Poster Contributions

Poster: 1

Graph coloring problem via quantum optimization on a Rydberg-qudit atom array

Author: Toonyawat Angkhanawin, Aydin Deger, Jonathan D. Pritchard, C. Stuart Adams – Durham University

Poster: 2

Dynamics of long-range interacting dipole-dipole systems

Author: Arianna Bertoluzza – University of Tübingen

Poster: 3

Calculating the capacity of quantum neural networks

Author: Lukas Bödeker, Markus Müller – RWTH Aachen University

Poster: 4

Probing universal relaxation speed in a Bose-Einstein condensate far from equilibrium

Author: Simon Böhly, Niklas Rasch, Thomas Gasenzer – University of Heidelberg

Poster: 5

Dynamical control of transport in a one-dimensional periodically driven system

Authors: Vincenzo Bruno, Ameneh Sheikhan, Roberta Citro and Corinna Kollath – Unviersity of Salerno

Poster: 6

Revealing emergent many-body phenomena by analyzing large-scale space-time records of monitored quantum systems

Authors: Marcel Cech, Cecilia De Fazio, María Cea, Mari Carmen Bañuls, Igor Lesanovsky, and Federico Carollo – University of Tübingen

Poster: 7

Electronic Transport in Quantum Chaotic Mesoscopic System

Authors: Fartash Chalangari – Tampere University

Poster: 8

Multi-qubit gates between distant atoms in Rydberg quantum computers

Authors: Antonis Delakouras – University of Crete and Foundation for Research and Technology Hellas

Poster: 9

Self-Induced Superradiant Masing

Authors: Wenzel Kersten, Nikolaus de Zordo, Oliver Diekmann, Elena S. Redchenko, Andrew N. Kanagin, Andreas Angerer, William J. Munro, Kae Nemoto, Igor E. Mazets, Thomas Pohl, Stefan Rotter, Jörg Schmiedmayer – TU Wien

Poster: 10

Adiabatic Control of Photon Transport in Ring Geometries

Authors: Milena Djatchkova, Igor Lesanovsky, Beatriz Olmos Sánchez – University of Tübingen

Poster: 11

Quantum gates between distant atoms mediated by a Rydberg excitation antiferromagnet

Authors: Georgios Doultsinos, David Petrosyan – University of Crete and Foundation for Research and Technology Hellas

Poster: 12

Construction of an enhancement cavity for qubit state isolation in a strontium quantum processor

Authors: Samed Erseymen – University of Tübingen

Poster: 13

Optimizing quantum transport via the Doob Transform

Authors: Dolores Esteve, R. Gutiérrez, C. Pérez-Espigares, D. Manzano – University of Granada

Poster: 14

Rydberg atom arrays as quantum simulators for molecular dynamics

Authors: Simon Euchner, Wilson S. Martins, Igor Lesanovsky – University of Tübingen

Poster: 15

Dynamical high-temperature expansion for frustrated spin systems

Authors: Jan Erik Fitzner, Björn Sbierski – University of Tübingen

Poster: 16

Generation of squeezed lasing in cavity QED system

Authors: Rodrigo Grande de Diego, Carlos Sánchez Muñoz – Instituto de Física Fundamental IFF-CSIC

Poster: 17

False vacuum decay in ferromagnetic superfluids

Authors: Giacomo Guarda – University of Trento

Poster: 18

Non-equilibrium dynamics of long-range interacting quantum systems Authors

Authors: Arianna Bertoluzza, Paul Hampp, Moriz Härle, David Petrosyan, Daniel Braun, Andreas Günther, József Fortágh – University of Tübingen

Poster: 19

Quantum Ising Networks and Eigenstate Entanglement

Authors: Yoshiaki Horiike, Yuki Kawaguchi – Nagoya University

Poster: 20

Towards x-ray quantum optics using periodically structured cavities

Authors: Robert Horn – Max Planck Institute for Nuclear Physics

Poster: 21

A new setup for Rydberg experiments

Authors: Florian Jelonnek – University of Tübingen

Poster: 22

Critical quantum dynamics of observables at eigenstate transitions

Authors: Simon Jiricek, Miroslav Hopjan, Patrycja Łydżba, Fabian Heidrich-Meisner, Lev Vidmar – Józef Stefan Institute / University of Ljubljana

Poster: 23

Analogue Hawking Radiation in Dipolar Superfluids and Supersolids

Authors: Felix Kaufmes, Wyatt Kirkby, Thomas Gasenzer, Lauriane Chomaz – University of Heidelberg

Poster: 24

Floquet-Lindblad description of periodically driven open quantum systems

Authors: Andriani Keliri, M. Schirò – Collège de France, CNRS

Poster: 25

Fading ergodicity in the ensembles of random Hamiltonians

Authors: Maksymilian Kliczkowski, Rafał Świetek, Miroslav Hopjan, Patrycja Łydżba, Lev Vidmar – Wroclaw University of Science and Technology

Poster: 26

Metastability in a Z2-symmetric dissipative quantum Ising model with application to quantum machine learning

Authors: Simon Kochsiek – University of Tübingen

Poster: 27

Evolution of multi-qubit correlations in the correlation tensor picture

Authors: Aleksandra Kwiatkowska, Waldemar Kłobus – University of Gdańsk

Poster: 28

Symmetries, Conservation Laws and Entanglement in Non-Hermitian Fermionic Lattices

Authors: R. D. Soares, Youenn Le Gal , C. Y. Leung , D. Meidan, A. Romito, M. Schirò – Collège de France, CNRS

Poster: 29

Spin-wave theory for quantum trajectories

Authors: Zejian Li, Anna Delmonte, Xhek Turkeshi, and Rosario Fazio – ICTP Trieste

Poster: 30

Site-resolved imaging of ultracold Sr-84 in large optical lattices

Authors: Arnab Maity, Sanghyeop Lee, Félix Faisant, Romaric Journet, Marc Cheneau – Université Paris Saclay (Institut d'Optique Graduate School)

Poster: 31

Driven-dissipative fermionised topological phases of strongly interacting bosons

Authors: Arkajyoti Maity, Bimalendu Deb, Jan-Michael Rost – MPI-PKS Dresden

Poster: 32

Observation of the dispersion relation of exciton-polaritons using ellipsoidal microlenses

Authors: Nina Mitroczuk, Magdalena Furman, Przemysław Oliwa, Marcin Muszyński, Maciej Nytko, Aleksander Bogucki, Łukasz Zinkiewicz, Jacek Szczytko, Wojciech Pacuski, Barbara Pietka – University of Warsaw

Poster: 33

Pushing the Boundaries: Interferometric Mass Photometry at the Quantum Limit of Sensitivity

Authors: Fabian Müller, Emre Köse, Alfred J. Meixner, Erik Schäffer, Daniel Braun – University of Tübingen

Poster: 34

Ergotropy transport in a one-dimensional spin chain

Authors: Dara Murphy, Anthony Kiely, Irene D'Amico, Steve Campbell – University College Dublin

Poster: 35

Resonant stroboscopic Rydberg dressing: electron-motion coupling and multi-body interactions

Authors: Chris Nill, Sylvain de Leseleuc, Christian Groß, and Igor Lesanovsky – University of Tübingen

Poster: 36

Quantum Transport with Non-Markovian Quantum Trajectories

Authors: Teddy Ong – University of Oxford

Poster: 37

Chaos in Quantum spin-1/2 disordered Fermi-Hubbard systems

Authors: Louis Renck, Peter Schlagheck, Juan Diego Urbina, Thomas Michel – University of Liège

Poster: 38

Setting up a Cryogenic Ion Trap for experiments with Rydberg Ions

Authors: Vinay Shankar, Marion Mallweger, Natalia Kuk, Simon Schey, Ivo Straka, Robin Thomm, Markus Hennrich – University of Stockholm

Poster: 39

Non-Linear Hall Effect: from theory to experiment

Authors: Helena Silva, Eduardo V. Castro, André M. Pereira – University of Porto

Poster: 40

Topological quantum thermometry

Authors: Anubhav Kumar Srivastava, Utso Bhattacharya, Maciej Lewenstein, Marcin Płodzień – ICFO

Poster: 41

Adiabatic generation of a one-dimensional gas of fermionized photons in an optical waveguide

Authors: Alberto Tabarelli de Fatis, Stephanie Matern, Gianluca Rastelli, Iacopo Carusotto – University of Trento

Poster: 42

Thermodynamics consistency of driven dissipative systems

Authors: Luisa Toledo Tude, Gonzalo Manzano, Gian Luca Giorgi, and Roberta Zambrini – IFISC - UIB

Poster: 43

Stabilization of spin mixtures and two-body contact dynamics in dipolar Bose gases

Authors: Maxime Lecomte, Alexandre Journeaux, Julie Veschambre, Ethan Uzan, Félix Werner, Dmitry S. Petrov, Jean Dalibard, Raphael Lopes – Collège de France, CNRS

Poster: 44

Kondo-Zeno crossover in the dynamics of a monitored quantum dot

Authors: Matthieu Vanhoecke – *Collège de France, CNRS*

Poster: 45

Novel tensor network based time integration algorithms for simulating long-range open quantum many-body dynamics

Authors: Charlotte Verhoeven – *University of Tübingen*

Poster: 46

Quantum Time-Crystal Clock and its Performance

Authors: Ludmila Viotti, Marcus Huber, Rosario Fazio, and Gonzalo Manzano – *ICTP Trieste*