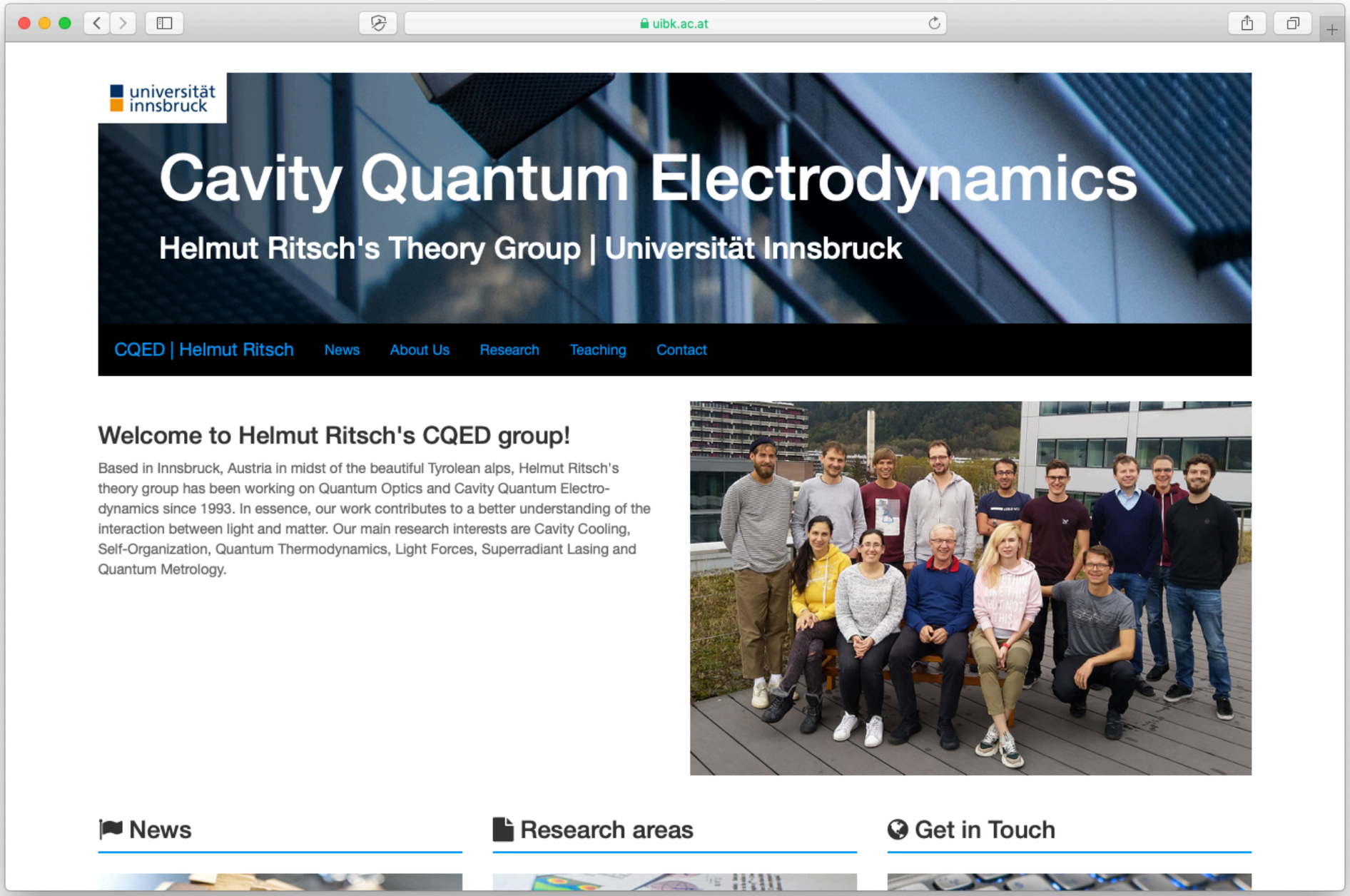
Quantenoptik und Ultrakalte Quantengase

Helmut Ritsch



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Cavity Quantum Electrodynamics

Helmut Ritsch's Theory Group | Universität Innsbruck

Research

This page details our research efforts and interests. Below you will find a selection of topics we are currently working on. For a list of publications please see the links.

Cavity cooling | Self-organization | Quantum engines | Light forces | Superradiant lasing | Metrology | QuantumOptics.jl

General research statement

Our research covers the fields of theoretical quantum optics and ultra cold gas physics with strong connections to quantum information theory, foundations of quantum physics and quantum theory of condensed matter systems. We focus on full quantum descriptions of matter and light waves, which are strongly coupled by momentum exchange. Our aim is an effective theoretical description of real physical systems in a close connection with experiments, where genuine quantum phenomena as quantum phase transitions, entanglement and macroscopic super positions can be studied in a well-controlled and understood environment.

Publications

For an (almost) complete list of publications that have emerged from our research, please visit

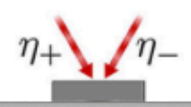
- catalog in the arXiv
- theses collection

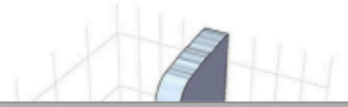
or contact

Light forces in high-Q cavities

Cavity cooling

Freezing particles in very small regions in space is the prerequisite for any investigation (like





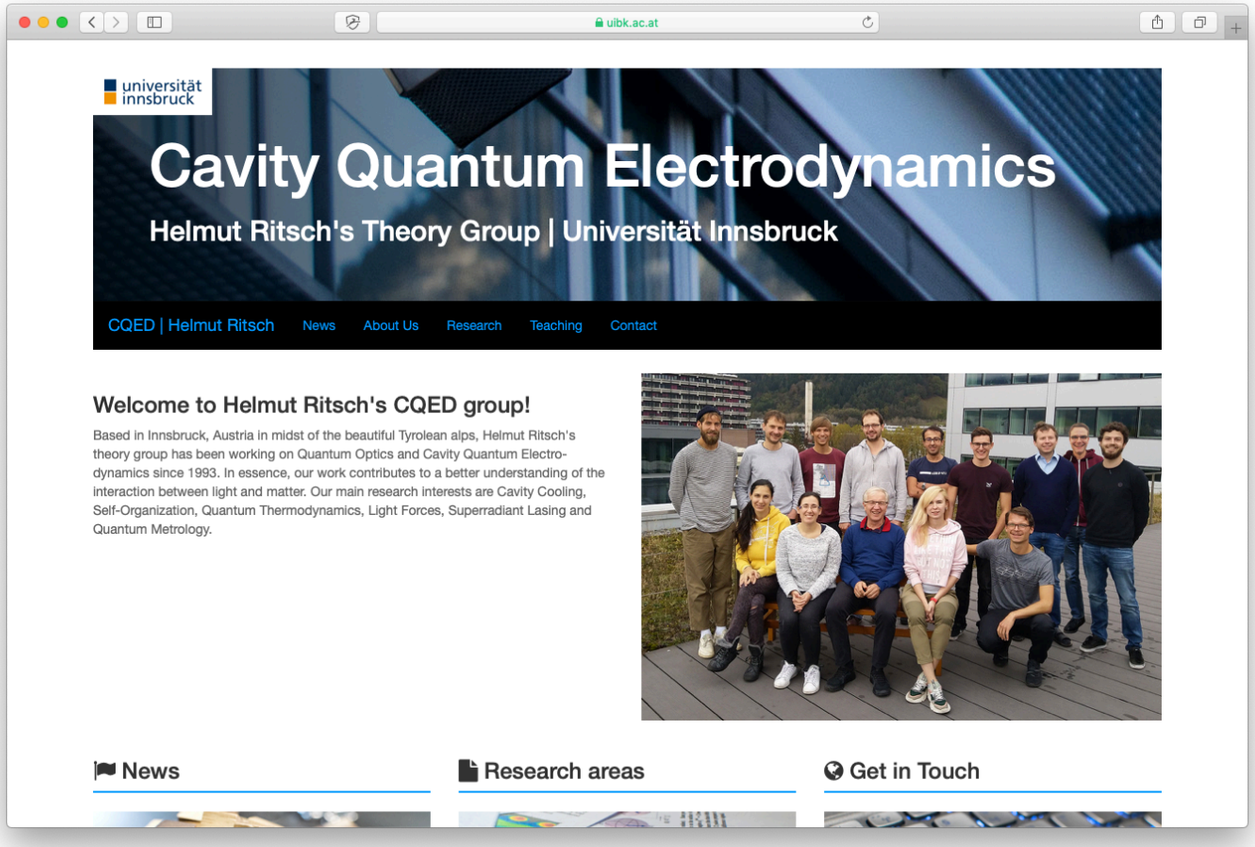
- *Collective Dynamics and Spectroscopy of Coupled Quantum Emitters*, D. Plankensteiner (Download PDF)
- *Light-Induced Emergent Quantum Phenomena in Ultracold Atomic Gases*, S. Ostermann (Download PDF)
- *Self-organization in Multi-mode Cavities and Dipole-dipole Interaction in Large Spin Systems*, S. Krämer (Download PDF)
- *Collective Radiation of Coupled Atomic Dipoles and the Precise Measurement of Time*, L. Ostermann (Download PDF)
- *Quantum simulation of nonlinear atom-photon dynamics in optical resonators*, R. Sandner (Download PDF)
- *Collective Dynamics of Polarizable Particles and Electromagnetic Radiation*, T. Grießer (Download PDF)
- *Self-consistent Optomechanical Dynamics and Radiation Forces in Thermal Light Fields*, M. Sonnleitner (Download PDF)
- *Cavity quantum electrodynamics with ultracold atoms and superconducting resonators*, K. Sandner (Download PDF)
- *Microscopic description and simulation of ultracold atoms in optical resonators*, W. Niedenzu (Download PDF)
- *Ultracold Atoms in Resonator-Generated Optical Lattices*, C. Maschler (Download PDF)
- *Interaction between optically trapped particles due to optomechanical coupling*, J. Asboth (Download PDF)
- *Cold atoms in optical resonators*, M. Gangl (Download PDF)

Diploma/Master theses

- *Dipole-Coupled Nano-Ring(s) of Quantum Emitters*, J. Cremer (Download PDF)
- *Superradiance in Atomic Arrays with a V-Type Level Structure*, R. Holzinger (Download PDF)
- *Superradiant Cooling, Trapping and Lasing of Dipole-Interacting Clock Atoms*, C. Hotter (Download PDF)
- *Tomography of time-bin entangled photons from a quantum dot*, P. Aumann (Download PDF)
- *Adaptive Dynamics of Scatterers in Multi-Frequency Light Fields in Optical Resonators*, V. Torggler (Download PDF)
- *Exploiting Collective Effects in a System of Interacting Quantum Emitters*, D. Plankensteiner (Download PDF)
- *Self-Ordering and Collective Dynamics of transversely illuminated Point-Scatterers in a 1D Trap*, D. Holzmann (Download PDF)
- *Nonlinear Optomechanical Dynamics of a Quantum Particle in a Single-Mode Cavity*, D. Winterauer (Download PDF)
- *Superradiant clock laser on an optical lattice*, T. Maier (Download PDF)
- *Scattering approach to multicolour light forces and self-ordering of polarizable particles*, S. Ostermann (Download PDF)
- *Simulating open quantum systems with high photon numbers in coherent bases*, S. Krämer (Download PDF)
- *Two interacting atoms in a quantum optical potentia*, K. Renz (Download PDF)
- *Cavity induced atom cooling and trapping*, G. Hechenblaikner (Download PDF)

Bachelor theses

- *A Superradiant Laser*, (Download PDF)
- *Cavity QED with Cold Particles*, B. Gstrein (Download PDF)
- *2D Solitons in QuantumOptics.jl*, B. Ertel (Download PDF)
- *Prime Factorization using a System of Spins with Controlled Coupling*, V. Zeni (Download PDF)
- *Spontaneous Emission and Superradiance*, A. Kruckenhauser (Download PDF)



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