

Exploiting Levitated Particles in the Quantum Regime

794. WE-Heraeus-Seminar

04 – 08 September 2023

at the Physikzentrum Bad Honnef/Germany

**WILHELM UND ELSE
HERAEUS-STIFTUNG**



Program (CEST)

Sunday, 03 September 2023

17:00 – 21:00 ARRIVAL and REGISTRATION

18:00 *BUFFET SUPPER*

Monday, 04 September 2023

08:00 *BREAKFAST*

08:50 – 09:00 Organizers **Introduction**

09:00 – 09:45 Markus Aspelmeyer **Levitated Solids in the Quantum Regime - from Ground state Cooling to Quantum Sources of Gravity**

09:45 – 10:30 Martin B. Plenio **Aspects of Low Energy Tests of Quantum Gravity**

10:30 – 11:00 *COFFEE BREAK*

11:00 – 11:45 Andrew Geraci **Precision Sensing and Searches for New Physics with Optically-levitated Dielectric Particles**

11:45 – 12:30 Tongcang Li **Rotational Optomechanics with Levitated Nanoparticles in Optical Tweezers and Ion Traps**

12:30 – 12:45 **Conference Photo (outside at the main entrance)**

12:45 – 14:00 *LUNCH BREAK*

14:00 – 14:45 Francesco Marin **Quantum Spectral Signatures of a Two-dimensional Optomechanical System**

14:45 – 15:30 James Millen **Levitated Electromechanics**

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15:30 – 16:00	<i>COFFEE BREAK</i>	
16:00 – 16:45	Klemens Hammerer	Predicting the Future, Remembering the Past: Stationary Entanglement in Optomechanics
16:45 – 17:30	Pavel Zemánek	Multidimensional Effects with Levitated Objects
17:30 – 18:00	Poster Flash Presentations	
18:00 – 19:30	<i>DINNER</i>	
from 19:30	Poster Session 1	

Program (CEST)

Tuesday, 05 September 2023

08:00	<i>BREAKFAST</i>	
09:00 – 09:45	Oriol Romero-Isart	Macroscopic Quantum Superpositions via Dynamics in Wide Nonharmonic Potentials
09:45 – 10:30	Romain Quidant	Controlled Dynamics of a Levitated Nanoparticle in a Hybrid Optical / RF Integrated Platform
10:30 – 11:00	<i>COFFEE BREAK</i>	
11:00 – 11:45	Klaus Hornberger	Probing Quantum Mechanics with Nanoparticles
11:45 – 12:30	Yiwen Chu	Schrödinger Cat States of an Acoustic Resonator
12:30 – 14:00	<i>LUNCH BREAK</i>	
14:00 – 14:45	Hendrik Ulbricht	Testing Fundamental Physics with Levitated Mechanics
14:45 – 15:30	Flaminia Giacomini	Quantum Systems as Gravitational Sources: Which Quantum Aspects of Gravity Can We Test?
15:30 – 16:00	<i>COFFEE BREAK</i>	
16:00 – 16:30	Murad Abuzarli	Non-Hermitian Dynamics in Arrays of Optically Coupled Levitated Particles
16:30 – 17:00	Henning Rudolph	Quantum Theory of Non-Hermitian Optical Binding Between Nanoparticles
17:00 – 17:30	Peiran Yin	Challenging Theories of Dark Energy with Levitated Force Sensor
17:30 – 18:00	Nikolai Kiesel	Fast Quantum Interference of a Nanoparticle via Optical Potential Control
18:00	<i>DINNER</i>	

Program (CEST)

Wednesday, 06 September 2023

08:00	<i>BREAKFAST</i>	
09:00 – 09:45	Christiane Koch	Quantum Control of Molecular Rotation
09:45 – 10:30	Martin Frimmer	Probing the Physics of Nanoscale Rotations with Levitated Nanoparticles
10:30 – 11:00	<i>COFFEE BREAK</i>	
11:00 – 11:45	Peter Barker	Characterisation and Control of Single Levitated Nanoparticles
11:45 – 12:30	Poster Flash Presentations	
12:30 – 14:00	<i>LUNCH BREAK</i>	
14:00	Excursion	
18:00	<i>HERAEUS BARBECUE at the Physikzentrum (with complimentary drinks)</i>	
from 19:30	Poster Session 2	

Program (CEST)

Thursday, 07 September 2023

08:00	<i>BREAKFAST</i>	
09:00 – 09:45	Gabriel Hétet	Spin-mechanics with Trapped Diamonds
09:45 – 10:30	David Moore	Levitated Optomechanical Sensors for Nuclear and Particle Physics
10:30 – 11:00	<i>COFFEE BREAK</i>	
11:00 – 11:45	Tracy Northup	Co-trapping an Ion and a Nanoparticle in a Two-frequency Paul Trap
11:45 – 12:30	Peter Rabl	Phase Transitions and Universal Scaling in Bosonic Transport
12:30 – 14:00	<i>LUNCH BREAK</i>	
14:00 – 14:45	Vanessa Wachter	Coupled Spin Mechanics in Levitated Nanoscale Particles
14:45 – 15:30	Carlos Gonzalez-Ballester	Quantum Light-matter Interaction with a Dielectric Sphere: Toward 3D Ground-state Cooling
15:30 – 16:00	<i>COFFEE BREAK</i>	
16:00 – 16:30	Mitsuyoshi Kamba	Nanoscale Feedback Control of Six Degrees of Freedom of a Near-sphere
16:30 – 17:00	Thomas Agrenius	Interaction between an Optically Levitated Nanoparticle and Its Thermal Image: Internal Thermometry via Displacement Sensing
17:00 – 17:30	Jakob Hüpfel	Multi-Particle Active Feedback Cooling Using Shaped Wave-Fronts
17:30 – 18:00	Antonio Pontin	Simultaneous Cooling of All Six Degrees of Freedom of an Optically Levitated Nanoparticle by Elliptic Coherent Scattering
18:00 – 18:15	Stefan Jorda	About the Wilhelm and Else Heraeus Foundation

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18:15 – 19:30 *DINNER*

19:30 – 20:15 Markus Arndt **Universal Matter-wave Interferometry
Across Mass and Complexity Scales**

20:15 **Poster Awards**

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Friday, 08 September 2023

08:00	<i>BREAKFAST</i>	
09:00 – 09:45	Helmut Ritsch	Controlling Interaction Forces Towards General Quantum Simulations with Trapped Particles
09:45 – 10:30	Philipp Kunkel	Engineering Spatial Entanglement and Graph States of Atomic Ensembles via Photon-Mediated Interactions
10:30 – 11:00	<i>COFFEE BREAK</i>	
11:00 – 11:45	Jayadev Vijayan	Cavity Quantum Optomechanics with Levitated Nanoparticles
11:45 – 12:00	Organizers	Closing Remarks
12:00	<i>LUNCH</i>	

End of Seminar / Departure