

# **Ultracold Quantum Matter: Basic Research and Applications**

**777. WE-Heraeus-Seminar**

**12 Dec - 16 Dec 2022  
at the Physikzentrum Bad Honnef/Germany**

The WE-Heraeus Foundation supports research and education in science, especially in physics.  
The Foundation is Germany's most important private institution funding physics.

**WILHELM UND ELSE  
HERAEUS-STIFTUNG**



# Program

## Sunday, 11 December 2022

17:00 – 21:00     Registration

From 18:30     *BUFFETT SUPPER / Informal get together*

## Monday, 12 December 2022

07:30 – 08:40     *BREAKFAST*

08:40 – 09:00     Carlos Sá de Melo     **Opening and Welcome**

### Session 1: Ultracold Atoms in Space

09:00 – 09:45     Nathan Lundblad     **Studying ultracold bubbles in orbital microgravity with the NASA Cold Atom Laboratory**

### Session 2: Fermi Gases

09:45 – 10:30     Nir Navon     **Fermions in an optical box**

10:30 – 11:00     *COFFEE BREAK*

11:00 – 11:45     Chris Vale     **Higgs mode in strongly interacting Fermi gases**

11:45 – 12:30     Yvan Castin     **Collective (Higgs) excitation branch in the broken pair continuum of pair-condensed spin 1/2 Fermi gases**

12:30 – 14:00     *LUNCH*

# Program

**Monday, 12 December 2022**

## **Session 3: Contributed Talks I**

|               |                                           |                                                                  |
|---------------|-------------------------------------------|------------------------------------------------------------------|
| 14:00 – 14:30 | Hauke Biss                                | Excitation spectrum and superfluid gap of an ultracold Fermi gas |
| 14:30 – 15:00 | Anne-Maria Visuri                         | Superfluid transport through a dissipative quantum point contact |
| 15:00 – 15:30 | Kali Wilson                               | Using vortices as probes of quantum many-body systems            |
| 15:30 – 16:00 | <i>COFFEE BREAK</i>                       |                                                                  |
| 16:00 – 18:30 | <b>Plenary Poster Flash Presentations</b> |                                                                  |
| 18:30 – 20:00 | <i>DINNER</i>                             |                                                                  |
| 20:00 – 22:00 | <b>Poster Session I</b>                   |                                                                  |

# Program

**Tuesday, 13 December 2022**

08:00 – 09:00    *BREAKFAST*

## **Session 4: Spin Physics**

|               |                         |                                     |
|---------------|-------------------------|-------------------------------------|
| 09:00 – 09:45 | Dieter Jaksch           | Quantum physics in connected worlds |
| 09:45 – 10:30 | Tilman Enss             | Polaron interaction in superfluids  |
| 10:30 – 10:35 | <b>Conference Photo</b> |                                     |
| 10:35 – 11:00 | <i>COFFEE BREAK</i>     |                                     |

## **Session 5: Open Quantum Systems**

|               |              |                                                                              |
|---------------|--------------|------------------------------------------------------------------------------|
| 11:00 – 11:45 | Herwig Ott   | Ultracold Bose gases in driven-dissipative environments                      |
| 11:45 – 12:30 | Achim Rosch  | Dicke transition in open many-body systems determined by fluctuation effects |
| 12:30 – 14:00 | <i>LUNCH</i> |                                                                              |

## **Session 6: Indistinguishability**

|               |                                                                                                  |                                                                         |
|---------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 14:00 – 14:45 | Niels Kjaergaard                                                                                 | Effects of quantum mechanical identity in scattering of atoms and light |
| 14:45 – 15:30 | Kazimierz Rzążewski                                                                              | The Fock states sampling method                                         |
| 15:30 – 15:45 | Stefan Jorda                                                                                     | About the Wilhelm and Else Heraeus Foundation                           |
| 15:45 – 16:15 | <i>COFFEE BREAK</i>                                                                              |                                                                         |
| 16:15 – 18:45 | <b>Poster Session II</b>                                                                         |                                                                         |
| 18:45 – 20:00 | <i>HERAEUS DINNER at the Physikzentrum<br/>(cold and warm buffet, with complimentary drinks)</i> |                                                                         |
| 20:00 – 22:00 | <b>2022 FIFA World Cup: Semifinal I</b>                                                          |                                                                         |

# Program

**Wednesday, 14 December 2022**

08:00 – 09:00    *BREAKFAST*

**Session 7: Quantum Droplets and Supersolidity**

09:00 – 09:45    Lauriane Chomaz            **Many-body physics with quantum gases of magnetic lanthanide atoms: advances and new trends**

09:45 – 10:30    Tim Langen                    **Supersolidity in dipolar Bose-Einstein condensates**

10:30 – 11:00    *COFFEE BREAK*

11:00 – 11:45    Blair Blakie                **Crystallisation transition of a dipolar Bose gas in an infinite tube**

11:45 – 12:30    Leticia Tarruell            **Unconventional superfluids in quantum gases with competing interactions**

12:30 – 14:00    *LUNCH*

14:00 – 16:30    **Excursion  
Walk**

16:30 – 18:00    **Wine Tasting at Vinery Broel**

18:30 – 20:00    *DINNER*

20:00 – 22:00    **2022 FIFA World Cup: Semifinal II**

# Program

**Thursday, 15 December 2022**

08:00 – 09:00    *BREAKFAST*

## **Session 8: Quantum Dynamics**

09:00 – 09:45    Tanja Mehlstäubler    **Non-equilibrium dynamics and nanofriction in ion Coulomb crystals**

09:45 – 10:30    Michael Knap    **Characterizing sine-Gordon dynamics with quantum gas microscopes**

10:30 – 11:00    *COFFEE BREAK*

11:00 – 11:45    Ian Spielman    **Topology in time-evolving quantum systems**

11:45 – 12:30    Cheng Chin    **Many-body chemistry - reactions of quantum degenerate molecules**

12:30 – 14:00    *LUNCH*

## **Session 9: Lattice Systems**

14:00 – 14:45    Ana Maria Rey    **Quantum simulation with spin-orbit-coupled fermions in optical lattices**

14:45 – 15:30    Fabrice Gerbier    **Anomalous loss of coherence of strongly interacting bosons in optical lattices**

15:30 – 16:15    Walter Hofstetter    **Correlated topological quantum states in ultracold atoms**

16:15 – 17:00    *COFFEE BREAK*

# Program

Thursday, 15 December 2022

## Session 10: Contributed Talks II

|               |                        |                                                                                                                                       |
|---------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 17:00 – 17:30 | David Clément          | Full counting statistics of interacting lattice gases after an expansion: role of the condensate depletion on the many-body coherence |
| 17:30 – 18:00 | Jan Arlt               | Microcanonical Fluctuations in a Bose-Einstein Condensate and its thermal cloud                                                       |
| 18:00 – 18:30 | Manfred Mark           | Supersolidity, Bloch oscillations and vortices in dipolar quantum gases                                                               |
| 18:30 – 20:00 | <i>DINNER</i>          |                                                                                                                                       |
| 20:00 – 22:00 | <b>Free Discussion</b> |                                                                                                                                       |

# Program

**Friday, 16 December 2022**

08:00 – 09:00    *BREAKFAST*

**Session 11: Quantum Matter**

09:00 – 09:45    Marzena Szymanska    **Novel non-equilibrium phenomena in quantum fluids of light**

09:45 – 10:30    Anna Minguzzi    **Kardar-Parisi-Zhang universality in a one-dimensional polariton condensate**

10:30 – 11:00    *COFFEE BREAK*

11:00 – 11:45    Sebastian Hofferberth    **Waveguide QED with Rydberg superatoms**

**Session 12: Polaron Physics**

11:45 – 12:30    Richard Schmidt    **From a polaron into a cluster: The fate of an impurity in a Bose Einstein condensate**

12:30 – 12:40    Axel Pelster    **Concluding Remarks and Poster awards**

12:40 – 14:00    *LUNCH*

***End of seminar and departure***