

The Vienna Doctoral Programme on Complex Quantum Systems  
invites you to a

## Seminar Talk

by

**Carlo Sias**

*LENS and INRIM, Florence*

### ***“Quantum Mixtures of Atoms and Ions: Results and Perspectives”***

Ultracold atoms and trapped ions are among the most formidable sources of coherent matter available in a laboratory. On the one hand, ultracold atoms form very large ensembles of particles that behave coherently, but it is extremely challenging to manipulate them at the single-particle level. On the other hand, trapped ions form much smaller clouds that can be much more easily controlled at the single particle level since Coulomb repulsion ensures a relatively large spacing between particles. Notably, trapped ions and cold atoms are among the most promising hardware for quantum technologies.

In a hybrid quantum system of atoms and ions, ultracold atoms and trapped ions are combined in a single experimental apparatus, thus realizing an innovative platform to experimentally investigate open problems of quantum physics from a new standpoint. An atom-ion hybrid system not only brings together the advantages of each single physical system, but moreover gives rise to atom-ion interactions, which are two orders of magnitude more long-ranged than atom-atom interactions. Atoms and ions can be independently manipulated through magnetic, optical and electric fields, thus making it possible to control very accurately many physical properties of the quantum mixture.

In my talk I will provide an overview of the field of atom-ion physics and its most notable results so far, in particular with regard to low-energy atom-ion collisional physics and its applications, e.g. atom-ion sympathetic cooling, controlled chemical reactions and the statistical distribution of the mixture's energy. Moreover, I will discuss the current limitations of the field, which have prevented so far the observation of long-living coherence in atom-ion mixtures. Lastly, I will describe our strategy to surpass these limitations in a new-generation hybrid quantum experiment currently under construction at the European Laboratory for Nonlinear Spectroscopy (LENS).

**Monday, 13 May 2019,  
16:30 get-together with coffee and snacks!**

Main Lecture Hall at TU Wien, Atominstitut, Stadionallee 2, 1020 Vienna

The seminar talk will be preceded by a CoQuS Student talk at 17:00h  
by

**Benedikt Limbacher**

*TU Wien*

***“Strong Light-Matter Interaction in Triple Barrier Resonant Tunneling Diodes”***

Hosted by: Thorsten Schumm