



Project CoRI 2024 (Physical Sciences) - Incoming Mobility

4-5-6 June 2025

at Dipartimento di Scienze della Terra e del Mare
Via Archirafi 36, Aula D06

Prof. Dr. Eugene Demler

***Institute for Theoretical Physics, Swiss Federal Institute
of Technology (ETH), Zurich, Switzerland***

will give a course on

Many-body physics with ultracold atoms

The course will run as follows

Wednesday 4 June 2025, 15:00-18:00

Quantum many-body systems of ultracold atoms

Using optical lattices and Feshbach resonances to control band structures and interaction strength of bosonic and fermionic systems. Quantum gas microscopes and snapshots of many-body states. Equilibrium phase transitions and dynamical experiments. Noise correlations, full distribution functions of quantum observables, RF and Raman spectroscopies, modulation spectroscopy, higher dimensional spectroscopy.

Thursday 5 June 2025, 15:00-18:00

Quantum magnetism in systems of ultracold atoms

Super-exchange interactions and antiferromagnetism; order/disorder transition in a bilayer system. Collective excitations (spin waves, amplitude mode), Stoner instability, Nagaoka ferromagnetism, kinetic magnetism in triangular lattices.

Friday 6 June 2025, 15:00-17:00

Exploring Polarons with ultracold atoms

Exploring Polarons with ultracold atoms. Bose and Fermi polarons, magnetic polarons in the Fermi Hubbard model in square and triangular lattices, mixed dimensional systems.

INFO

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As a part of the **CoRI 2024** project, **Prof. Dr. Eugene Demler** from the *Institute for Theoretical Physics, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland* will give a course entitled “**Many-body physics with ultracold atoms**”.

The course will review recent progress in realizing strongly correlated many-body systems with ultracold atoms. Both theory and experiments will be discussed with an emphasis on the connection between the physics of ultracold atoms and correlated electron systems. The course will explore unique features of ultracold atoms such as dynamical control of Hamiltonians and imaging with single atom resolution. The course, designed for **PhD students in Physical and Chemical Sciences**, will be taught at a level that can also be followed by **Master's degree students in Physics**.

Nell'ambito del progetto **CoRI 2024**, il **Prof. Dr. Eugene Demler** dell'*Institute for Theoretical Physics, Swiss Federal Institute of Technology (ETH), Zurich, Svizzera* terrà un corso dal titolo “**Many-body physics with ultracold atoms**”.

Il corso presenterà i recenti progressi nella realizzazione di sistemi a molti corpi fortemente correlati con atomi ultra-freddi. Saranno discussi sia la teoria che gli esperimenti, con particolare attenzione alla connessione tra la fisica degli atomi ultra-freddi e i sistemi elettronici correlati. Saranno inoltre esplorate le caratteristiche uniche degli atomi ultra-freddi, come il controllo dinamico delle hamiltoniane e l'imaging con risoluzione a singolo atomo. Il corso, pensato per studenti del **Dottorato in Scienze Fisiche e Chimiche**, sarà impartito a un livello tale da poter essere seguito anche dagli studenti della **Laurea Magistrale in Fisica**.

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