Harvard University Department of Physics Colloquium

Monday, February 3, 2020

4:30PM ~ Jefferson Lab 250

Colloquium Tea

3:45PM ~ Jefferson Lab 450

Engineered Ultracold Quantum Matter - From Quantum Simulations to Novel Quantum Light-Atom Interfaces

Immanuel Bloch - Max Planck Institute

More than 30 years ago, Richard Feynman outlined his vision of a quantum simulator for carrying out complex calculations on physical problems. Today, his dream is a reality in laboratories around the world using a variety of different physical implementations. Ultracold atoms are one of the most powerful systems in this regard, allowing us to explore large systems with single atom resolution and control. In my talk, I will present recent experiments based on our fermionic quantum gas microscope, in which we can detect both charge and spin degrees of freedom simultaneously, thereby gaining maximum information on the intricate interplay between the two in the paradigmatic Hubbard model. For the first time, we thereby have access to directly probe non-local 'hidden' correlation properties of quantum matter and to explore its real space resolved dynamical features far from equilibrium. I will also discuss our most recent experiments on realising bi-layer Fermi Hubbard system with tunable couplings and how such a setting can be used to realise a novel universal two-dimensional spin and charge resolved detection for quantum gas microscopy experiments. Finally, I will report on our experiment employing subradiant subwavelength ordered atomic arrays to realise novel and efficient atom-light interfaces at optical wavelengths. I will show, how a spatially structured single mono-layer of a few hundreds of atoms can act as an efficient and switchable subradiant optical mirror..

The Physics Monday Colloquium is supported by the Morris Loeb Lectureship Fund

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