

# Physics Colloquium

**Professor Vito Scarola**

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**“Quantum Analog Simulation with Ultracold Atoms in  
Optical Lattices: Opportunities and Challenges”**

**Friday, September 11, 2020**

**2:30pm—3:30pm**

**Virtual Meeting**

**Zoom link: <https://viriniatech.zoom.us/j/96084996911>**

Quantum analog simulation offers promise in effectively solving intractable quantum many-body problems. One class of problems in particular, disordered Hubbard models, provide simple reduced models of strongly correlated materials, such as copper oxide-based compounds or disordered superconductors. Yet unbiased numerical studies have not settled debates regarding the essential physics captured by Hubbard models. Progress in another seemingly unrelated area can help with this mathematical problem. Cooling neutral atoms to quantum degeneracy has enabled the precise construction and manipulation of large multi-particle quantum states. Lasers defining optical lattices constrain the atoms so that their motion is very accurately captured by Hubbard models. As a result, these experiments are being used to effectively perform quantum analog simulation of Hubbard models. Work in my theory group seeks to guide experimental setups in these simulations. I will review experimental setups and discuss recent progress in using optical lattices as quantum analog simulators of Hubbard models.