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## Understanding quantum materials using many-body computational tools

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**Abstract:**
Functional quantum materials, including Mott insulators and high-temperature superconductors, are at the forefront of condensed matter research. Understanding the fundamental mechanisms behind the exotic phases of matter emerging in quantum materials is a grand challenge, which must be overcome to maximize technological advancement. Due to the complexity of the many-electron problem numerical treatment is often required.

Over the past decades, numerical analysis has become a very powerful tool for studying strongly correlated electron systems, both clean and materials with defects. The focus of our group is to numerically model electron localization using the quantum many-body techniques for strongly correlated and disordered electron systems. Electron localization (driven by electron interactions or disorder) is a key feature of numerous quantum materials. Various exotic phases of matter with dramatic changes in electronic, magnetic, transport properties find their roots at electron localized states. Hence, its understanding is critical for further control and optimization of quantum materials and their applications. In this talk, I will first present our results on electron localization in the Hubbard model and beyond using the Dynamical Mean Field Theory and its cluster extension DCA. I will also share our recent results on treating electron localization in disordered electron systems using the typical medium approach in models and real materials.

**Speaker's Bio:**

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