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MMQ04: Quantum Embedding Lens on Strongly Correlated Electrons

Organizers: Benjamin Lenz (IMPMC), Cyril Martins (LCPQ), Carlos Mejuto Zaera (LPT)

Invited Speakers: Maria Chatzieftheriou (CPHT), Matthieu Saubanère (LOMA)

Strong electronic correlations underlie some of the most intriguing and promising phases of matter in quantum materials. Often hallmarked by the presence of 3d or 4f transition metal atoms, these materials have opened up the road towards the design of a wide palette of states of technological interest, such as unconventional superconductors, exotic magnetic orders, remarkable catalysts and potentially large-gap topological insulators. This richness results from the delicate competition between the energy scales that underlie the electron dynamics of strongly correlated solids. While this makes for a highly interesting theoretical problem, at the same time it poses a formidable challenge for any model seeking to accurately capture strong correlations.

Over the last few decades, quantum embedding has come to the forefront as a reliable strategy, as it allows the description of several energy scales on equal footing. This is achieved by treating only a small number of (usually local) degrees of freedom at a high-level of accuracy, while the rest of the system is modeled as a frequency dependent bath. The advent of first principles embedding methodologies has made the accurate prediction of opto-electronic properties in strongly correlated systems an invaluable tool to interpret, and eventually guide, experiment.

This mini-colloque proposes to focus on recent developments in quantum embedding theory for strongly correlated solids. It will cover the following topics of interest:

- State-of-the-art development of embedding frameworks: Dynamical mean-field theory, density matrix embedding theory, slave particle approaches, (ghost) Gutzwiller Ansätze,...
- Ab initio application to materials: Cuprates, iron pnictides, nickelates, ...
- Non-local generalizations
- Symmetry-broken solutions: magnetism, superconductivity, ...

With this colloquium, we aim at bringing together different communities both of strongly correlated material science and solid state chemistry interested in the development and application of embedding techniques. We welcome contributions from the above fields and specifically encourage young scientists including postdoc and graduate students to apply.