Strong Coupling Expansions for Models of Ultra Cold Atoms in Optical Lattice Emulators

H R Krishnamurthy
Centre for Condensed Matter Theory,
Department of Physics, Indian Institute of Science,
Bangalore 560012

Recent amazing advances in laser-cooling and trapping of atoms and ions using their interaction with electromagnetic fields, especially optical lattices, are bringing Feynman's vision of a ``quantum analogue simulator'', with one "designer" quantum system emulating the Hamiltonian of another physical system, close to realization. A crucial component in the development of such ``optical lattice emulators'' of quantum condensed matter is their benchmarking and validation using systems with strong correlations whose properties, including the effects of the trap, can nevertheless be well understood theoretically. In this talk I will review some of the challenges involved and the role that strong coupling expansions can play in such contexts, focusing especially on our recent work on the Bose-Hubbard model.