

**Session 3:** Fermionic and bosonic models

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**Title:** Entanglement and criticality in the Long-range Bose-Hubbard model.

**Abstract:** We investigate the stationary phases of two-dimensional extended Bose-Hubbard model with infinite long-range interactions. This model describes ultracold bosonic atoms confined by a two-dimensional optical lattice and coupled to a cavity mode with the same wavelength as the lattice. The competition between tunneling, onsite interactions, and the long-range interactions mediated by the cavity photons gives rise to a rich ground-state phase diagram, which exhibits Mott-insulator, superfluid, lattice super solid, and charge-density wave phases. We perform a mean-field analysis with slave-boson approach and probe the behavior of entanglement-entropy in different phases and at the transition between these phases. These results can be explained by careful investigation of the physical spectrum and corresponding entanglement spectrum. Using this approach we also probe the scaling of entanglement entropy in different phases.

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