Exploring Electronic Physics with Fermionic Atoms inside Optical Cavities

Abstract: Experimental progress in strongly coupling quantum gases into quantized electromagnetic fields of quantum cavities has opened a new avenue in many-body physics --- referred to commonly as many-body cavity quantum electrodynamics (QED) --- where the dynamics of both quantum matter and electromagnetic fields play equally essential roles. In this talk, after a short review of state of the art in many-body cavity QED I will present some of our recent theoretical works on many-body fermionic cavity QED. In particular, I will talk about superradiant topological Peierls insulators, Hofstadter butterfly in a cavity-induced dynamic synthetic magnetic field, and antiferromagnetic self-ordering of a Fermi gas in a ring cavity.