Non-equilibrium quantum many-body systems can display fascinating phenomena relevant for various fields in science ranging from physics, to chemistry, and ultimately, for the broadest possible scope, life itself. The challenge with these systems, however, is that the powerful formalism of statistical physics, which have allowed a classification of quantum phases of matter at equilibrium does not apply. Precisely engineered ultracold gases are emerging as a powerful tool to shed light on the organizing principles and universal behaviors of dynamical quantum matter. One emerging paradigm where ultracold atomic systems have shown to be a powerful resource is the case of dynamical phase transitions (DPTs). DPTs share many aspects of standard equilibrium phase transitions but differ in many fundamental ways with them. They also allow for the generation of metrologically useful steady states. I will discuss the observation of DPTs in different but complementary systems: trapped quantum degenerate Fermi gases, trapped bosonic gases and long lived arrays of atoms in an optical cavity. I will show how these systems can be used to simulate iconic models of quantum magnetism with tunable parameters and to probe the dependence of their associated dynamical phases on a broad parameter space. Besides advancing quantum simulation, our studies pave the ground for the generation of metrologically useful entangled states which can enable real metrological gains via quantum enhancement.

Host: Dr. Peter Engels

Meet the speaker at 3:10 pm, join us in welcoming the speaker and for an informal chat!