

Title: Heavy fermion physics in non-Kramers doublet materials

Abstract: While heavy fermion physics has long focused on Kramers doublet materials, based on ions with an odd number of f-electrons like Ce and Yb, non-Kramers doublet materials, based on ions with an even number of f-electrons like Pr have an even richer range of possible physics. In this talk, I will address the key question of what the heavy Fermi liquid looks like in non-Kramers doublet materials. This question is particularly important to understand the phase diagrams and quantum criticality of the superconducting Pr “1-2-20” compounds, such as PrV₂Al₂₀ and PrIr₂Zn₂₀. The non-Kramers ground state doublet ensures that the heavy Fermi liquid must be an exotic ‘hastatic’ order that breaks symmetries. I will elucidate the essential features of this phase within a realistic cubic model, argue that it solves the problem of the heavy Fermi liquid found at finite fields in these materials, and make experimental predictions.