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### *Charge Delocalization and Quantum Criticality in Strongly Correlated Electron Systems*

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Virtual option: [Zoom Link](#)

Host: Prof. Yong Chen

The nature of charge degrees-of-freedom distinguishes scenarios for interpreting the character of a second order magnetic transition at zero temperature, that is, a magnetic quantum critical point (QCP). Heavy-fermion systems are prototypes of this paradigm, and in those, the relevant question is where, relative to a magnetic QCP, does the Kondo effect delocalize their f-electron degrees-of-freedom. In this presentation, we report the discovery of an energy scale  $E_{loc}$  that signals a local-to-itinerant crossover of 4f degrees-of-freedom at an antiferromagnetic quantum-critical point (AFM QCP), a fundamental hallmark of Kondo-breakdown quantum criticality. Replacing 4.4% of the In atoms by Sn in  $CeRhIn_5$ , however, shifts  $E_{loc}(P)$  such that it extrapolates inside the magnetically ordered phase, decoupling it from the pressure-induced magnetic quantum-critical point that becomes a ‘conventional’ spin-density-wave (SDW) QCP involving only quantum-critical magnetic fluctuations. The qualitative change from Kondo-breakdown criticality in pure  $CeRhIn_5$  to SDW criticality with slight Sn doping signals an essential difference in the nature of fluctuations leading to Cooper pairing, i.e., from quantum-critical fluctuations of only a magnetic order parameter in the Sn-doped case to quantum-critical magnetic and charge fluctuations in pure  $CeRhIn_5$ .