**Title:** “Ultra-High Resolution Studies of Ferromagnetic Quantum Matter”

Abstract: Strongly correlated metals near magnetic quantum phase transitions (QPTs) are prime examples for quantum matter. For clean ferromagnetic metals, Belitz-Kirkpatrick-Vojta (BKV) theory [1] shows in excellent agreement with experiment that ferromagnetic QPTs are generally first-order due to the coupling of the magnetization to electronic soft modes, in contrast to the classical analogue that is an archetypical second-order phase transition. Our recent extensive magnetization study on the disordered ferromagnetic metal UCo1-xFeGe demonstrate that BKV theory even correctly accounts for the effects of disorder near ferromagnetic QPTs [2]. Despite this significant progress in understanding ferromagnetic metals, to date, little information is available on the underlying low-energy spin fluctuations that drive exotic behavior such as partial magnetic order, and topological non-Fermi liquid behavior [3], and unconventional spin-triplet superconductivity that is frequently observed in the vicinity of ferromagnetic QPTs. For the very recently discovered novel spin-triplet superconductor UTe2 that is situated on the paramagnet side of a ferromagnetic QPT [4], it has further been shown that in high magnetic fields ferromagnetic quantum matter may host topological chiral superconductivity that is considered as possible route to implement decoherence free quantum computing [5]. The outstanding challenge in understanding these fascinating quantum matter states is that their underlying characteristic energy scales are tiny compared to typical electronic energy scales in solids, and are, in turn, notoriously difficult to measure. Here we discuss some of our recent results to showcase how current advances in the resolution of neutron spectroscopy using the novel Modulated IntEnsity by Zero Effort (MIEZE) technique implemented at the neutron spectrometer RESEDA in Munich, allow to achieve ultra-high energy resolution of better than 1 µeV. Using MIEZE, we reveal that the spin fluctuations in UGe2 exhibit a dual nature arising from the interplay of localized and itinerant electronic degrees of freedom that is consistent with spin-triplet superconductivity [6].