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Quantum oscillation studies of quantum criticality in PrOs₄Sb₁₂

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PrOs₄Sb₁₂ is a cubic metal with an exotic superconducting ground state below 1.8 K. The crystal fields around the Pr site are such that it has a singlet ground state and a magnetic triplet just 8K above the ground state. Under an applied magnetic field, the triplet splits, and the $S_z = +1$ state crosses the singlet state at easily accessible magnetic fields. In the region of the level crossing the ground state reconstructs, creating a so-called “antiferroquadrupolar” (AFQ) phase that exists at temperatures below 1 K and magnetic fields between about 4.5 and 12 tesla. This state offers a rare opportunity to observe the behaviour of quantum oscillations upon crossing a phase transition.

In a recent paper [1] we argued that the lower boundary of the AFQ phase should have exotic behaviour as $T \rightarrow 0$ K due to mixing of hyperfine states with the AFQ order. We will describe our attempts to observe this behaviour via magnetic susceptibility and quantum oscillation measurements.

[1] A. McCollam, B. Andraka and S. R. Julian, Physical Review B 88 (2013) 075102.

Primary author: Dr JULIAN, Stephen (University of Toronto)

Co-authors: Mr SUTTON, Aaron (University of Toronto); Dr MCCOLLAM, Alix (Radboud University, Nijmegen); Dr ANDRAKA, Bohdan (University of Florida)

Presenter: Dr JULIAN, Stephen (University of Toronto)

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