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Muon Spin Rotation/Relaxation as a Probe of Unconventional Superconductivity

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There has been a resurgence of interest in superconductivity since the discovery of high temperature superconductivity in the cuprates. As a result, a variety of new superconductors with high transition temperatures and other interesting properties have been discovered. The muon spin rotation/relaxation (μ SR) technique is an extremely sensitive probe of magnetic fields in materials and has been used to determine electronic/magnetic phase diagrams and measure the London penetration depth.

Measurements in zero magnetic field ZF- μ SR allowed us to identify a broken time reversal symmetry superconducting state in Sr_2RuO_4 . The most likely superconducting state in this system is the chiral p-wave state which could potentially be employed for quantum computation. I will describe our transverse field TF- μ SR measurements of the vortex lattice in Sr_2RuO_4 determining the magnetic field penetration depth to further characterize its superconducting state. I will also describe some of our recent measurements of other novel superconductors including iron pnictides, the non-centrosymmetric CaIrSi_3 and the strong spin-orbit coupled $\text{Pt}_{0.05}\text{Ir}_{0.95}\text{Te}_2$.

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