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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 (μSR) 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-μSR 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-μSR 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 $Pt_{0.05}Ir_{0.95}Te_2$.

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