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London Penetration Depth Measurements in Iron-Based Superconductors Utilizing a Tunnel Diode Resonator Circuit

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Newly discovered iron-based superconductors may be the key to understanding how the general mechanism of high-temperature superconductivity is possible. One way to gain insight into how this phenomenon works is to experimentally probe the superconducting gap structure in these materials, which is closely tied to the electronic interactions that give rise to this state. The experimental probe that has been used in this study to look at the superconducting gap structure is the London penetration depth, which characterizes the rate at which externally applied magnetic fields are screened from the interior of a superconductor. The London penetration depth in various members of the iron-based superconductors has been measured in this study utilizing a tunnel diode resonator (TDR) circuit. This is a specially designed LC oscillating circuit that is powered by a tunnel diode with a radio frequency resonance having parts-per-billions sensitivity to sense changes in its natural resonance frequency induced by a sample. The resulting data for the iron-based superconductors will be shown and compared to other types of superconductors that have been measured with the same technique.