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Measuring the London Penetration Depth in Anisotropic Superconductors CHARLES C. AGOSTA, C. MARTIN, I. MIHUT, C. GATETE, Clark University, S.W. TOZER, H.A. RADOVAN, E.C. PALM, T.P. MURPHY, National High Magnetic Field Laboratory — We will show that by measuring the penetration depth in the conducting planes of an anisotropic superconductor and applying a magnetic field parallel to the conducting planes we can get rid of the signal coming from the vortices, and directly measure the London penetration depth, λ_L. Using a tunnel diode oscillator (TDO) in a dilution refrigerator, we have measured λ_L verses magnetic field in $CeCoIn_5$ and found it to be linear, which is consistent with a d- wave order parameter. In the layered organic superconductor α- $(ET)_2HN_4Hg(SCN)_4$, λ_L verses magnetic field follows the shape predicted by BCS theory and an s-wave order parameter. The same measurement in κ-$(ET)_2Cu(NCS)_2$ is also consistent with an s-wave order parameter. The first two results are supported by other types of measurements, but the results for κ-$(ET)_2Cu(NCS)_2$ are puzzling because most other measurements suggest that there are nodes in its order parameter. We will discuss the possible reasons why λ_L is not linear as a function of magnetic field in κ-$(ET)_2Cu(NCS)_2$. We will also discuss how the same measurements under pressure will sort help sort out the roles of impurities and inhomogeneity in these materials. In this context we will describe a new pressure cell we have designed for these TDO experiments, and our preliminary results. Work at Clark supported by NSF-DMR-0331272.

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