Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Evidence of two-gap superconductivity in $Na_{0.35}CoO_2{\cdot}1.3H_2O$ H. Q. YUAN, M. B. SALAMON, D. VANDERVELDE, Dep. of Phys., Univ. Illinois Urbana , P. BADICA, K. TOGANO , K. YAMADA , Inst. for Mat. Res., Tohoku Univ., Japan — The recent discovery of superconductivity in the layered cobalt oxyhydrate $Na_{0.35}CoO_2{\cdot}1.3H_2O$ [1] has attracted considerable attention in the scientific community because of its structural similarity to high-T_c cuprates. Although intensive studies have been performed to understand the nature of superconductivity in this compound, no consensus has been reached on many important issues and the symmetry of order parameter still remains open. The low temperature behavior of the magnetic penetration depth $\lambda(T)$ provides a useful probe of the low-lying excitations in superconductors and hence of the symmetry of the superconducting energy gap. In this contribution, we present a high-precision measurement of $\lambda(T)$ on singe crystalline $Na_{0.35}CoO_2{\cdot}1.3H_2O$ down to 90 mK, using a tunnel-diode based, self-inductive technique at 21 MHz. It is found that $\lambda(T)$ can be fit by a quadratic power-law above $T \simeq 1$ K. However, $\lambda(T)$ changes to an exponential decay at the lowest temperature ($T < 0.8$ K), indicating that the material is fully gapped. Detailed analysis shows that $\lambda(T)$ can be nicely fitted with a two-band model, resembling the case of MgB_2. These findings are consistent with the recent report of specific heat results [2] and suggest s-wave superconductivity in $Na_{0.35}CoO_2{\cdot}1.3H_2O$. [1] K. Takada et al, Nature **53 (2003). [2] R. Jin et al, cond-mat 0410517.**

Huiqiu Yuan
Univ. of Illinois at Urbana and Champaign

Date submitted: 30 Nov 2004 Electronic form version 1.4