Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Superconductivity with extremely large upper critical fields in $\mathbf{Nb_2Pd_{0.81}S_5}$ QIU RUN ZHANG, GANG LI, DANIEL RHODES, ANDHIKA KISWANDHI, TIGLET BASARA, J SUNG, THEO SIEGRIST, National High Magnetic Field Laboratory, Tallahassee, FL, USA, MICHELLE JOHANNES, Center for Computational Materials Science, Naval Research Laboratory, Washington DC, USA, LUIS BALICAS, National High Magnetic Field Laboratory, Tallahassee, FL, USA — Here, we report the discovery of superconductivity in a new transition metal-chalcogenide compound, i.e. $Nb_2Pd_{0.81}S_5$, with a transition temperature $T_c \cong 6.6$ K. Despite its relatively low T_c, it displays remarkably high and anisotropic superconducting upper critical fields, e.g. $\mu_0 H_{c2}$ ($T \to 0$ K) > 37 T for fields applied along the crystallographic b-axis. This value is considerably larger than the value reported for the technologically relevant Nb_3Sn compound ($\mu_0 H_{c2} \sim 30$ T, with $T_c = 18$ K)[1,2]. Its ratio of $\mu_0 H_{c2}$ ($T \to 0$ K) to T_c, is also larger than those of the new Fe based superconductors, e.g. β-FeSe (20 T/8.7 K)[3], $Ba_{1-x}K_xFe_2As_2$ ($\sim$ 70 T/28 K)[4], and even higher than the reported ratio for the Chevrel-phase $PbMo_6S_8$(60T/13.3 K)[5] compound. For a field applied perpendicularly to the b-axis, $\mu_0 H_{c2}$ shows a linear dependence in temperature which coupled to a temperature-dependent anisotropy of the upper critical fields, suggests that $Nb_2Pd_{0.81}S_5$ is a multi-band superconductor. This is confirmed by band structure calculations which reveal nearly cylindrical and quasi-one-dimensional Fermi surface sheets having hole and electron character, respectively.

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Date submitted: 13 Nov 2012 Electronic form version 1.4