Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Hydrostatic High-Pressure Studies to 25 GPA on the Model Superconducting Pnictide LaRu2P2[1] JINHYUK LIM, NEDA FOROUZANI, JAMES SCHILLING, Washington University in St. Louis, ROXANNA FOTOVAT, CHONG ZHENG, Northern Illinois Univ, ROALD HOFFMANN, Cornel Univ. — Prior to the discovery of the Fe-pnictides in 2008, the ruthenium phosphide LaRu2P2 possessed the highest value of the su- perconducting transition temperature, Tc≈ 4 K, in the entire pnictide family. Recently, there has been renewed interest in this compound in an effort to better understand why the Fe-pnictides have much higher values of Tc [1]. In related phosphides superconductivity appears to only be present if the separation be- tween the phosphor ions dp-p in neigh- boring Ru2P2 planes is greater than the critical value 2.8 Å, too great for a P-P covalent bond to be formed. For example, in superconducting LaRu2P2, the value of dp-p is 3.0 Å. To test these ideas directly, we have carried out hydro- static high-pressure studies on single-crystalline LaRu2P2 in a diamond-anvil cell using He pressure medium to pres- sures as high as 25 GPa and temperatures as low as 1.5 K. We find that Tc initially increases under pressure, but suddenly disappears above 2.1 GPa. Since dp-p decreases under pressure, the sudden disappearance of superconductivity is likely due to the formation of a covalent P-P bond between adjacent Ru2P2 planes and a possible structural phase transition.

[1] Razzoli et al., Phys. Rev. Lett. 108, 257005 (2012)

[1]Work at Washington University is supported by the NSF through Grant No. DMR-1104742 and by the Carnegie/DOE through NNSA/DOE Grant No. DE-FC52-08NA28554.

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Date submitted: 04 Dec 2013 Electronic form version 1.4