Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Unexpected Giant Superconducting Fluctuation and Anomalous Semiconducting Normal State in $NdO_{1-x}F_xBi_{1-y}S_2$ Single Crystals XIYU ZHU[1], JIANZHONG LIU, DELONG FANG, Nanjing University, ZHENYU WANG, Chinese Academy of Sciences, JIE XING, ZENGYI DU, HUAN YANG, HAI-HU WEN, Nanjing University, CENTER FOR SUPERCONDUCTING PHYSICS AND MATERIALS TEAM — Experiments on single crystals of BiS_2-based superconductors are highly desired. We report the successful growth of the $NdO_{1-x}F_xBi_{1-y}S_2$ single crystals. Resistive and magnetic measurements reveal that the bulk superconducting transition occurs at Tc = 4.83 K, while an unexpected giant superconducting fluctuation appears at temperatures as high as 2-4 kBTC. Analysis based on the anisotropic Ginzbaug-Landau theory gives an anisotropy $\gamma = \sqrt{m_c/m_{ab}} \approx 30 \sim 45$. Two gap features with magnitudes of about 3.5 $\pm$ 0.3meV and 7.5 $\pm$ 1 meV were observed by scanning tunneling spectroscopy. The smaller gap is associated with the bulk superconducting transition yielding a huge ratio $2\Delta_s^1/k_BT_c$ =16.8, the larger gap remains up to about 26 K. The normal state recovered by applying a high magnetic field shows an anomalous semiconducting behavior. All these suggest that the superconductivity in this newly discovered superconductor cannot be formatted into the BCS picture.

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Date submitted: 11 Nov 2013 Electronic form version 1.4