(8a3)

^{31}P-NMR Study on Pressure-Induced Insulating State in $PrFe_4P_{12}$

H. Kotegawa[1], H. Hidaka[1], Y. Shimaoka[1], T. Miki[1], T. C. Kobayashi[1], K. Fujiwara[2], D. Kikuchi[3], H. Sugawara[4], and H. Sato[3]

[1]Faculty of Science, Okayama University, Okayama 700-8530
[2]Department of Material Science, Shimane University, Matsue 690-8504
[3]Graduate School of Science, Tokyo Metropolitan University, Hachioji, 192-0397
[4]Faculty of Integrated Arts and Sciencies, Tokushima University, Tokushima 770-8502

A high-pressure study displays a metal-insulator (M-I) transition above 2.4 GPa in $PrFe_4P_{12}$ which shows an antiferro-quadrupoler (AFQ) ordering below $T_Q = 6.5$ K at ambient pressure. [1] Since $Pr^{3+}Fe_4P_{12}$ is an uncompensated metal, it is impossible to be the insulator. In the case of $PrRu_4P_{12}$, Lee *et al.,* and Hao *et al.,* have shown the structural transition occurs due to the nesting of Fermi surface in the insulating phase. This structural transition doubles the unit cell, making it possible to be the insulator. In this context, some phase transitions, which doubles the unit cell, are needed in the insulating state of $PrFe_4P_{12}$.

^{31}P-NMR studies on $PrFe_4P_{12}$ at ambient pressure have been performed by Ishida *et al.* and Kikuchi *et al.*. They succeeded in detecting AFQ ordering below T_Q through two sites with different hyperfine coupling constant. We performed ^{31}P-NMR measurement of $PrFe_4P_{12}$ under high pressure up to 3.3 GPa in order to investigate whether AFQ ordering survives even in the insulating state or not, and whether the M-I transition is really phase transition or just crossover phenomenon. In high pressure region, the intensity of NMR signal decreases gradually as decreasing temperature toward the insulating region. At 3.3 GPa, the signal disappears completely below ~ 5 K. The important point is that the signal disappears even though T_1, T_2, and line-width of the NMR spectrum do not show any anomaly. This indicates the M-I transition is a first-order phase transition. However, further experiments are required to elucidate what induces the insulating state.

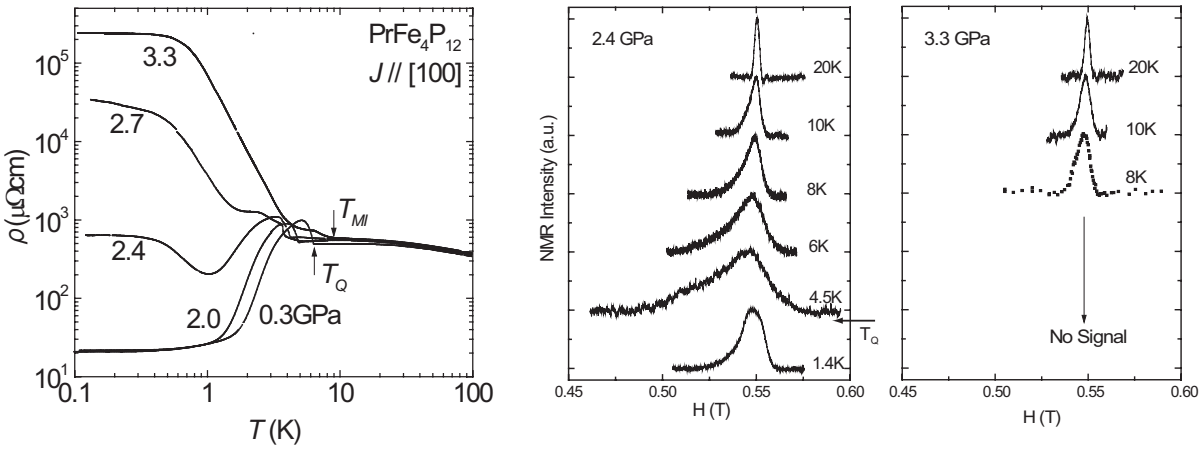

Figure 1: (left): Temperature-dependence of resistivity under several pressures. The insulating behavior appear above 2.4 GPa. (right): NMR spectra under 2.4 GPa and 3.3 GPa. The signal disappears in the insulating region. The intensity of each spectrum is normarized.

[1] H. Hidaka *et al.,* to appear in Phys. Rev. B.