(7a4)

Neutron scattering study on low energy excitations of $PrOs_4Sb_{12}$

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We report inelastic neutron scattering experiments performed to investigate the low energy magnetic excitations of single crystals of the first Pr-based heavy-fermion superconductor $PrOs_4Sb_{12}$. In both superconducting and normal states, the observed excitation clearly softens at a wave vector $Q = (1,0,0)$, which is the same as the modulation vector of the field-induced antiferro-quadrupolar ordering, as shown in Fig. 1, and its intensity at $Q = (1,0,0)$ is smaller than that around zone center. This result directly evidences that this excitonic behavior is derived mainly by a nonmagnetic quadrupolar interaction between 4f electrons. Furthermore the tendency of narrowing of linewidths of excitations below the superconducting transition temperature may suggest that the new 'quadrupolar' excitons are coupled to the heavy-fermion superconductivity.

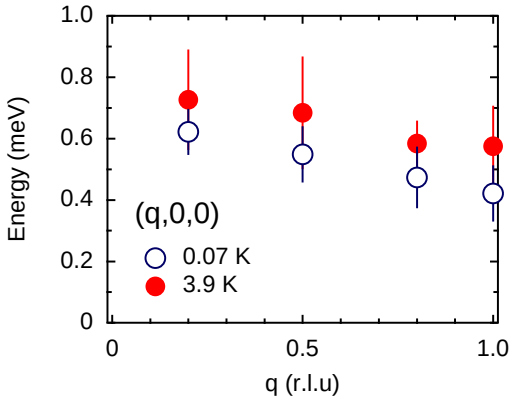

Figure 1: Dispersion relations of $PrOs_4Sb_{12}$ at 0.07 K (open circle) and 3.9 K (closed circle).