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Unusual ordering in c-$NpPd_3$

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$NpPd_3$ exhibits two crystal structures. At room temperature, the equilibrium structure is the dhcp $TiNi_3$-type, but rapid cooling from melt produces the *cubic* $AuCu_3$-type structure. In both cases, the Np-Np distance is 4.1 Å, so that the Np ions are expected to be localised. Both phases of $NpPd_3$ were first studied at the ANL in the early 1970s. Nellis et al measured the magnetic susceptibility and the electrical resistivity of cubic $NpPd_3$, and found evidence of magnetic ordering setting in below $T_N = 54$ K. The magnetic order in this phase was confirmed by Mössbauer and neutron studies. The neutron data revealed several magnetic Bragg peaks with an ordering wave-vector of (½,½, ½). In contrast, no evidence for any long-range magnetic ordering was found for dhcp $NpPd_3$, despite the presence of an anomaly at 30 K in the bulk magnetic data. Our recent measurements of the magnetic (magnetization, susceptibility), thermal (heat capacity) and transport (electrical resistivity, magnetoresistivity, thermopower and Hall effect) properties of cubic $NpPd_3$ indicated highly unusual nature of the magnetic ordering. At T_N, the specific heat exhibits an extremely large peak [as large as 1000 J/(mol K)] and the magnetic susceptibility shows a clear jump. The transport properties of *c*-$NpPd_3$ indicate a dramatic Fermi-surface reconstruction at T_N, which shows up as pronounced anomalies at this temperature in the electrical resistivity, the magnetoresistivity, the Seebeck coefficient and the Hall coefficient.