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Unusual ordering in c-NpPd₃

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NpPd₃ exhibits two crystal structures. At room temperature, the equilibrium structure is the dhcp TiNi₃-type, but rapid cooling from melt produces the *cubic* AuCu₃-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 NpPd₃ were first studied at the ANL in the early 1970s. Nellis et al measured the magnetic susceptibility and the electrical resistivity of cubic NpPd₃, 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 $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$. In contrast, no evidence for any long-range magnetic ordering was found for dhcp NpPd₃, 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 NpPd₃ 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-NpPd₃ 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.