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Abstract: Neutron diffraction study of the magnetic structures of HoB_4

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Magnetic susceptibility, specific heat, and resistivity measurements by Fisk *et al*. have revealed two ordering transitions in HoB_4 at temperatures near 7.1 and 5.7 K. Moreover, the macroscopic measurements indicate that the higher temperature transition is of second order, the lower one of first order. Neutron diffraction measurements on polycrystalline and on single crystal specimens have confirmed these results. The magnetic scattering data have so far resisted a complete interpretation; the following conclusions can, however, be drawn. The magnetic structure in the high temperature phase has a strong oscillatory component, the wave vector of which is equal to $(\pm 0.021, \pm 0.021, 0.425)$ in units of the reciprocal lattice vectors. The magnetic moments are parallel, in sheets normal to the tetragonal c-axis, to one of the four equivalent [100] reciprocal lattice directions. In the low-temperature phase there is a large component of the moments arranged in the simple colinear structure that has been reported for ErB_4 and DyB_4 by W. Schafer *et al*. In both temperature ranges there are additional, unexplained, magnetically scattered intensities. The magnetic phase diagram has been studied in applied fields up to 6.4 T and at temperatures down to 1.8 K. Polarization analysis and classical polarized beam techniques have been applied to the single crystals in selected field and temperature ranges.

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Abstract: Quadrupolar interactions and structural instabilities in $PrAg_{1-x}Cu_x$

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In order to elucidate the unusually strong quadrupole-quadrupole interactions discovered earlier in PrAg[1], magnetic and neutron diffraction studies are being made of the pseudobinary compounds $PrAg_{1-x}Cu_x$. For $PrAg_{0.75}Cu_{0.25}$, which, like PrAg, has a cubic CsCl-type structure, analysis of high-field magnetization data above the antiferromagnetic Néel point ($T_N \sim 9$ K) shows that the effective biquadratic (quadrupolar) coupling is about twice as strong as in PrAg, whereas the average bilinear exchange coupling is slightly weaker. $PrAg_{0.5}Cu_{0.5}$, which has a CsCl-type structure at room temperature, was found to transform to an orthorhombic FeB-type structure (similar to that of PrCu) when it is cooled below ~ 150 K. Detailed comparison of the two structures of $PrAg_{0.5}Cu_{0.5}$ indicates that the instability of the CsCl-type structure probably stems from the softening of certain zone-boundary phonons, which presumably grows as x increases towards 0.5. Such phonons would account for strong effective quadrupolar interactions of negative (antiferro) sign, precisely of the type seen in PrAg and $PrAg_{0.75}Cu_{0.25}$.

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