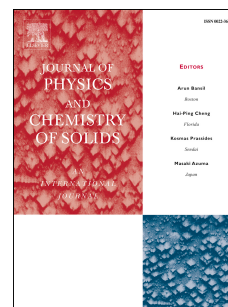


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Magnetic structures of rare earth intermetallic compounds RCuAs_2 ($\text{R} = \text{Pr}, \text{Nd}, \text{Tb}, \text{Dy}, \text{Ho}, \text{and Yb}$)

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Abstract

Neutron scattering studies have been carried out on polycrystalline samples of a series of rare earth intermetallic compounds RCuAs_2 ($\text{R} = \text{Pr}, \text{Nd}, \text{Dy}, \text{Tb}, \text{Ho}$ and Yb) as a function of temperature to determine the magnetic structures and the order parameters. These compounds crystallize in the ZrCuSi_2 type structure, which is similar to that of the RFeAsO (space group $P4/nmm$) class of iron-based superconductors. PrCuAs_2 develops commensurate magnetic order with $\mathbf{K} = (0, 0, 0.5)$ below $T_N = 6.4(2)$ K, with the ordered moments pointing along the c -axis. The irreducible representation analysis shows either a Γ_2^1 or Γ_3^1 representation. NdCuAs_2 and DyCuAs_2 order below $T_N = 3.54(5)$ K and $T_N = 10.1(2)$ K, respectively, with the same ordering wave vector but the moments lying in the a - b plane (with a Γ_9^2 or Γ_{10}^2 representation). TbCuAs_2 and HoCuAs_2 exhibit incommensurate magnetic structures below $T_N = 9.44(7)$ and $4.41(2)$ K, respectively. For TbCuAs_2 , two separate magnetic ordering wave vectors are established as $\mathbf{K}_{I(\text{Tb})} = (0.240, 0.155, 0.48)$ and $\mathbf{K}_{2(\text{Tb})} = (0.205, 0.115, 0.28)$, whereas HoCuAs_2 forms a single $\mathbf{K}_{(\text{Ho})} = (0.121, 0.041, 0.376)$ magnetic structure with 3rd order harmonic magnetic peaks. YbCuAs_2 does not exhibit any magnetic Bragg peaks at 1.5 K, while susceptibility measurements indicate an antiferromagnetic-like transition at 4 K, suggesting that either the ordering is not long range in nature or the ordered moment is below the sensitivity limit of $\approx 0.2 \mu_B$.

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