

SAIP 2011



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Crystalline Electric Field Effects in PrNiGe₂

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Content :

Within the confines of the standard model of rare earth magnetism, the high temperature magnetic properties of rare earth ions in a crystalline environment are identical to the magnetic behaviour of free tri-positive rare earth ions. At low temperatures deviations from free-ion behaviour occur due to the action of an anisotropic crystalline electric field (CEF). For Pr³⁺-ions in a low symmetry crystalline environment it is expected that the 9-fold degeneracy of the spin orbit coupled ground state multiplet associated with the free tri-positive ion should be completely uplifted by the CEF yielding a non-magnetic singlet ground state for the Pr³⁺ 4f-electrons. PrNiGe₂ is known to order ferromagnetically despite the fact that the Pr³⁺ ions occupy the low-symmetry m2m sites in the CeNiSi₂-type structure. This has prompted the current study into the ground state properties of PrNiGe₂. The structure of the CEF-split energy levels in this system could be determined from specific heat measurements. The analyses point to the formation of a pseudo-doublet ground state in the system, and we forward a conceptual explanation of the observed magnetic order in PrNiGe₂ in terms a fortuitous merging of electronic singlet levels into a local level dispensation of higher degeneracy.

Level (Hons, MSc, PhD, other)? :

PhD

Consider for a student award (Yes / No)? :

Yes

Short Paper :

Yes

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