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Transformations in the Ground and Excited (Spin-Orbit) states at the '$\gamma \rightarrow \alpha$' transition in $YbInCu_4$

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We have studied changes in the magnetic spectral response of the ground state (j=7/2) and in the energy of the excitation to the upper spin-orbit state (j = 5/2) which occur at the '$\gamma \rightarrow \alpha$' phase transition in $YbInCu_4$. The Q-dependence of the magnetic response in the 'α'-phase (high-T_K phase) follows the normal Yb^{3+} form factor, eliminating the possibility that the phase transition involves transformation of the 4f state to an itinerant 4f band, with consequent substantial quenching of the orbital moment. Another, even more interesting, observation is that the energy of the spin-orbit excitation (7/2 $\rightarrow$ 5/2) is enhanced by roughly twice the characteristic energy T_K of the ground state response. Similar rates of enhancements of the excitation energies of the upper spin-orbit state have been found in α-Ce and compounds such as $CePd_3$, $CeIn_{3-x}Sn_x$ ($0 \leq x \leq 3$). However, considering that the intrinsic spin-orbit splitting in Yb^{3+} is about five times that in Ce^{3+}, the validity of the usually assumed exponential dependence of the characteristic energy T_K on the energy ε_f of a given state j relative to the Fermi level E_F is brought into question. We discuss the possibility that if the phenomenon is associated with hybridisation of the 4f state with neighbouring ligand electrons then the exponential energy scale could be replaced by an interaction representing the ligand field.