f electrons are localized in heavy-fermion intermetallic: $YbRh_2Si_2$

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After 40 years of intensive studies of heavy-fermion (h-f) intermetallics, of numerous papers in most prestigious journals and the invited talks underlying f-electron itinerant origin of heavy-fermion phenomena, there is more and more experiments showing the almost perfect localization of the f-electrons in the canonical h-f system: $YbRh_2Si_2$. The successful revealing of the Yb^{3+} crystal-field (CEF) states confirms the Quantum Atomistic Solid State Theory (QUASST) worked out by Radwanski *et al.* (Acta Phys Pol. B 31 (2000) 3079, Acta Phys. 7-8 (2007)). QUASST was the only theory, which has claimed from 1992 the existence of the discrete CEF electronic structure and the Kramers doublet ground state in heavy-fermion intermetallics.
The removal of the Kramers degeneracy via spin-dependent interactions is origin of the large specific heat at low temperatures (a hallmark of the h-f phenomena) and of low-energy neutral spin-like excitations. The existing h-f theories will be reviewed, in particular with respect to the theoretical description of f electrons in intermetallics. Such studies should lead to a better understanding of the origin of the magnetism and the formation of the magnetic state.