High Resolution Photoemission Study of CeIn₃

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CeIn₃ is a cubic antiferromagnet crystallizing in AuCu₃ structure, with Neel temperature of 10.2K. It belongs to a family of Ce-based antiferromagnets that become superconducting under pressure. It was recently proposed [1] that dual nature of f-electrons in CeIn₃, in a sense of being simultaneously localized and itinerant, is responsible for co-existence of superconductivity and magnetism. dHvA experiments revealed the existence of heavy, field-dependent quasiparticle bands responsible for the itinerant response, accompanied by light quasiparticles indicative of local moment magnetism. These findings, together with theoretical model [1], would suggest the existence of fine structure in the near-EF region of valence band. Such structure was not seen in previous resonance photoemission work [2].

We have utilized the 4d-4f resonance to investigate the details of the electronic structure of CeIn₃. Our experimental resolution at photon energy of 122eV (at resonance) was 50 meV and all measurements were performed at 12K. In Fig 1 the fine structure is seen as two well separated peaks located within the first 500meV below Fermi level. Together with theoretical modeling and dHvA results, photoemission provides strong support for AF order in CeIn₃ arising from coexistence of itinerant, heavy mass quasiparticles and RKKY exchange mediated local moments.

![CeIn₃ 4d-4f resonance photoemission spectrum taken at 122eV photon energy together with above- and below- resonance spectra. Two-peak structure is clearly seen at resonance within the first 500meV of valence band.](image)

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References