Electronic correlations of CeSb through the devil's staircase transition

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Keywords: strong correlation, transition, magnetism, photoemission, laser

Solids with competing interactions often undergo complex phase transitions with a variety of long-periodic modulations. Among such transition, devil's staircase is the most complex phenomenon, and for it, CeSb is the most famous material, where a number of the distinct phases with long-periodic antiferromagnetostructures sequentially appear below the Néel temperature [1]. An evolution of the low-energy electronic structures and underlying electronic correlations going through the devil's staircase is of special interest to understand its mechanism, which has, however, been elusive despite 40 years of intense research.

In my presentation, I will talk about our recent investigations of the electronic properties undergoing the devil's staircase by using laser-based angle-resolved photoemission spectroscopy. So far, the paramagnetic electronic structure with the semimetallic feature was well documented in detail: two hole pockets of Sb 5*p* at Γ point and an electron pocket of Ce 5*d* at X point [2]. The high-energy resolution and bulk-sensitivity achieved by utilizing our low-energy laser source ($h\nu = 7$ eV) now reveals the significant reconstruction of these itinerant bands and the many-body interactions, which have so far evaded from the experimental detection. The reconstruction of conducting bands to the 4*f* order is sensitively changed at each distinct transition of the devil's staircase, and it exposes the strong electronic anisotropy across T_N. The change of the spectral property against magnetic reconstructions is surprisingly dramatic [3]. Moreover, we discovered a new type of electron-boson coupling between the mobile electrons and crystal-electric-field excitations of the 4*f*-orbitals, which renormalizes the Sb 5*p* band prominently, yielding a remarkable kink at very low-energy. This coupling strength of the many body state is exceedingly strong and exposes anomalously enhancement during the devil's staircase transition [4].

REFERENCES

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