MAR15-2014-000778

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Strange metal without magnetic instability in $\beta-\mathbf{YbAlB_4}$

SATORU NAKATSUJI, ISSP, University of Tokyo

Many prototypical quantum critical materials found within the class of $4f$ heavy fermion compounds are known to have an almost integral valence and appear at the border of magnetism. An exception to this rule was recently discovered in $\beta-YbAlB_4$, which exhibits quantum criticality despite strong mixed valency.[1,2] Ultrapure single crystals of this material exhibit intrinsically singular thermodynamic and transport behaviors, which are extremely sensitive to a magnetic field.[3,4,5]. In particular, T/B scaling of the magnetization has been observed over four decades of T/B, projected to extend down to fields as small as 0.1 mT. In this talk, we will discuss our results on the zero field criticality by the T/B scaling in a broad regime of T and B,[6] and through an extensive series of pressure measurements.[7] We will show that the intrinsic quantum criticality of $YbAlB_4$ occupies an extended region of pressure, indicating a formation of a phase. Furthermore, we will present that the strange metal region is clearly surrounded and separated from a high-pressure magnetic instability by a finite pressure range of Fermi liquid behavior.

This work is based on the collaboration with Yosuke Matsumoto, Takahiro Tomita, Kentaro Kuga, Yoshiya Uwatoko, Yasuyuki Shimura, Piers Coleman, Andriy H. Nevidomskyy, E. O'Farrell, T. Sakakibara, Y. Karaki, S. Suzuki, H. Cao, D. MacLaughin, M. Okawa, S. Shin

[1]S. Nakatsuji, et al., Nature Phys. **4**, 603 (2008).
[2]M. Okawa, et al., Phys. Rev. Lett. **104**, 247201 (2010).
[3]Y. Matsumoto, et al., Science **331**, 316 (2011).
[4]Y. Machida, et al., Phys. Rev. Lett. **109**, 156405 (2012).
[5]M. Sutherland et al., arXiv:1408.0033
[6]Y. Matsumoto et al., arXiv:1407.6142.
[7]T. Tomita et al., preprint