Research Highlights

Electronic structure of optimally doped novel superconductor La(O,F)BiS_2

The newly-discovered layered superconductor, Ln(O,F)BiS_2, discovered in 2012, achieves a maximum *T*c of 10.6 K. The superconductivity emerges by carrier doping to the parent compound.

There have been no reports on the direct observation of the electronic structure of Ln(O,F)BiS_2 in the optimal doping range, which is an important factor to consider in a discussion of the superconducting mechanism.

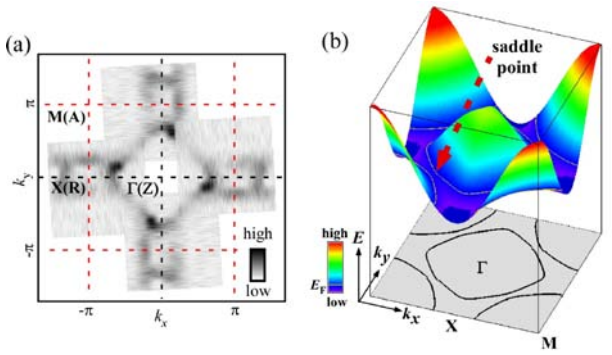

Figure caption: (a) Experimentally determined Fermi surface (black part) and (b) schematic view of the overall band structure of La(O,F)BiS_2 predicted by first principles calculations.

Now, Kensei Terashima and colleagues at Okayama University have clarified the electronic structure of nearly optimal doped La(O,F)BiS_2.

The team grew single crystal samples by a flux method. They then performed photoemission experiments at BL-28A of Photon Factory and BL25SU of SPring-8.

The Fermi surface topology of optimally doped BiS_2 is about to change due to the presence of van Hove singularity (saddle point) in its electronic structure, which agrees well with the prediction by first principles calculations which take the spin-orbit coupling into account.

The optimal *T*c could be realized by E_F-crossing of the van Hove singularity in the density of states. On the other hand, despite its higher DOS, *T*c of optimally-doped La(O,F)BiS_2 is lower than that of the related compound, under-doped Nd(O,F)BiS_2. Thus there are probably other factors also enhancing *T*c in this system, which will need to be clarified by further study.

Reference:

- Authors: K. Terashima[1,2], J. Sonoyama[1], T. Wakita[1,2], M. Sunagawa[1], K. Ono[3], H. Kumigashira[3], T. Muro[4], M. Nagao[5], S. Watauchi[5], I. Tanaka[5], H. Okazaki[6], Y. Takano[6], O. Miura[7], Y. Mizuguchi[7], H. Usui[8], K. Suzuki[8], K. Kuroki[8], Y. Muraoka[1,2], and T. Yokoya[1,2]
- Title of original paper: Proximity to Fermi-surface topological change in superconducting $LaO_{0.54}F_{0.46}BiS_2$
- Journal, volume, pages and year: *Physical Review B* **90**, 220512(R) (2014).
- Digital Object Identifier (DOI): 10.1103/PhysRevB.90.220512

- Journal website: journals.aps.org/prb/abstract/10.1103/PhysRevB.90.220512
- Affiliations: [1]Graduate School of Natural Science and Technology, and Research Laboratory for Surface Science, Okayama University., [2]Research Center of New Functional Materials for Energy Production, Storage, and Transport, Okayama University., [3]High Energy Accelerator Research Organization (KEK), Photon Factory., [4]Japan Synchrotron Radiation Research Institute (JASRI)/SPring-8., [5]Center for Crystal Science and Technology, University of Yamanashi., [6]National Institute for Materials Science., [7]Department of Electrical and Electronic Engineering, Tokyo Metropolitan University., [8]Department of Physics, Osaka University.
- Department website: http://www.science.okayama-u.ac.jp/~surface/eng

