Electronic structure of a newly discovered, optimally doped superconductor

June 24 2015

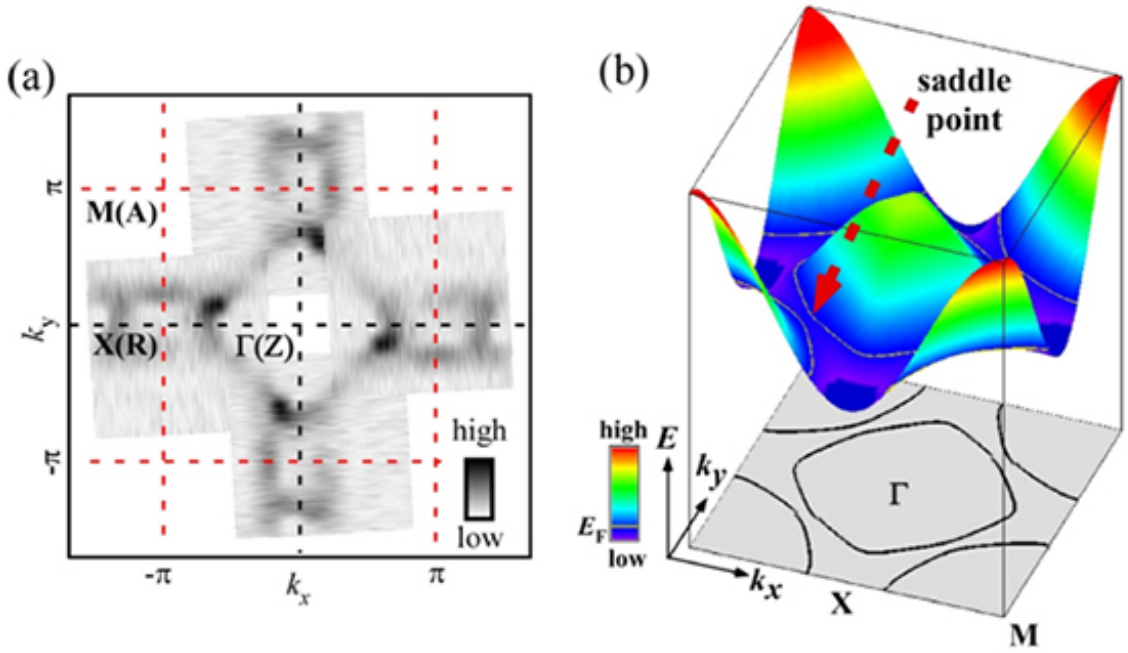

Figure caption: (a) Experimentally determined Fermi surface (black part) and (b) schematic view of the overall band structure of La(O,F)BiS_2 predicted by first principles calculations.

The newly-discovered layered superconductor, Ln(O,F)BiS_2, discovered in 2012, achieves a maximum Tc 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.

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 Tc could be realized by EF-crossing of the van Hove singularity in the density of states. On the other hand, despite its higher DOS, Tc 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 Tc in this system, which will need to be clarified by further study.

More information: "Proximity to Fermi-surface topological change in superconducting $LaO_{0.54}F_{0.46}BiS_2$." *Phys. Rev. B* 90, 220512(R) – Published 22 December 2014. journals.aps.org/prb/abstract/ … 3/PhysRevB.90.220512

Provided by Okayama University