A remarkable step toward next-generation energy-conservation

June 29 2011, By Mikiko Tanifuji

Tohoku University, Osaka University and Japan Science and Technology Agency (JST) announced that they succeeded in directly observing electron spins in a topological insulator. The work has been published in *Physical Review Letters* with the lead author Seigo Souma, Assistant Professor of Tohoku University.

The charge of electron has been a basic carrier of information. However, another entity of electron, i.e. spin, is also expected to be an information carrier in the next generation systems. Topological insu-lator is a promising material recently recognized for the working spin, or a material for spintronics since its "edge" (e.g. surface on a bulk material) serves as a conducting path depending on the spin pola-rization. Direct observation of spin states will be a key step to control electron spins in the material.

Researchers have performed spin-resolved photoemission spectroscopy of a topological insulator Bi2Te3 and present the first direct evidence for the existence of the out-of-plane spin component on the surface state. The magnitude of the out-of-plane spin polarization reaches maximally 25% of the in-plane counterpart. Its existence is presumed to come from the hexagonally deformed Fermi surface in momentum space, since no out-of-plane spin component is observed in another topological insulator $TlBiSe_2$ with circular Fermi surface.

Although a problem remains in the quantitative difference from theoretical prediction, researchers stated that the direct measurement of

electron spins is a remarkable step toward a next-generation energy conservation device.

More information: S. Souma, et al, "Direct measurement of the out-of-plane spin texture in the Dirac-cone surface state of a topological insulator", *Physical Review Letters*, Vol. 21, No. 12, pp. 216803 (2011) [4 pages] Published May 25, 2011

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