scientaomicron

Application Note
Laser ARPES with ARTOF 10k

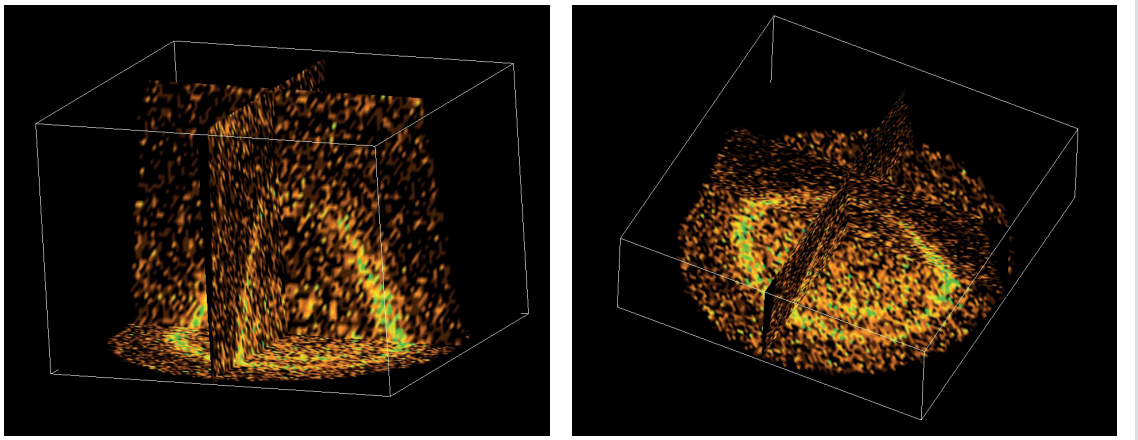

Figure 1. The topological insulator Bi_2Se_3 has been studied by Laser ARPES at MIT, USA. These are the first band structure results using the ARTOF 10k spectrometer and both the bulk and surface bands are visible even though the sample was probed at room temperature and in non-optimal vacuum.

In ordinary insulators such as diamond the occupied and unoccupied electronic states are separated by a large energy gap. This gap prevents current flow when an electric field is applied. In topological insulators however, electrons can bypass the energy gap by moving in surface states. This new class of materials exhibit unusual properties which may be important for quantum computing.

Recent ARPES results from Scienta hemispherical analysers by Hasan and Cava et al. (Nature Physics, June 2009) reviled a new member of the topological insulator family. The new discovery is Bi_2Se_3 which has now also been investigated using laser ARPES and a Scienta ARTOF 10k by the Gedik group at MIT, USA. The Bi_2Se_3 data displayed here was taken at room temperature and with vacuum in the10^{-7} Torr range. The laser photon wavelength used in the experiment was 200 nm and the output power was 1 µW at a repetition rate of 5 kHz. The photon pulse width was 100 fs.

The Scienta Omicron ARTOF 10k was set to measure in swept mode using a 50% energy window around 2 eV kinetic energy. The measurement time using the 5kHz laser was 2 hours (4000 events/s). As the instrument collects data in a full ±15° cone the complete Bi_2Se_3 band structure is revealed in one measurement.

Data courtesy:
Gedik Group, MIT, USA
http://web.mit.edu/gediklab