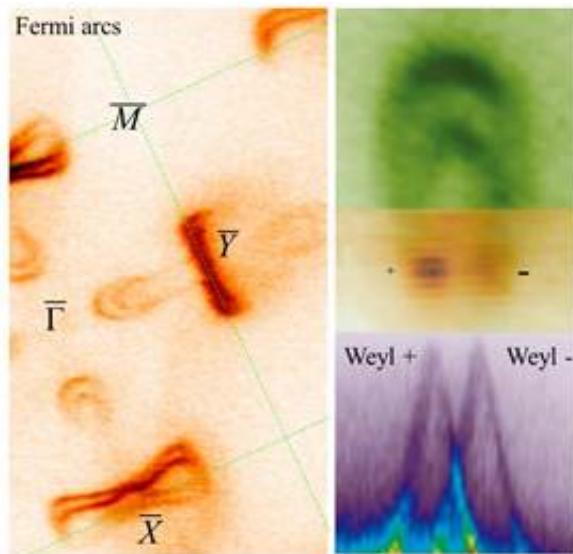


Weyl fermion discovery named Top Ten Breakthrough of 2015 by Physics World

December 11 2015



A data image (ARPES measurements) showing electron distributions in a Weyl fermion material TaAs. (Left) Surface motion of Weyl electrons are seen in a crescent-shaped Fermi surface (Fermi arc) in the data. (Right) Weyl fermionic electrons disperse like light (inverted "V" shaped, linear) in the bulk of the material. Credit: Su-Yang Xu and M. Zahid Hasan, Princeton University

Princeton University Professor of Physics M. Zahid Hasan is one of three physicists whose efforts to observe Weyl fermions, an elusive massless particle theorized 85 years ago, have been named among the Top Ten Breakthroughs of 2015 by *Physics World* magazine. Hasan shares the honor with Marin Soljacic, of the Massachusetts Institute of

Technology, and with Zhong Fang and Hongming Weng of the Chinese Academy of Sciences, whose research teams independently found evidence of the fermion.

Proposed by the mathematician and physicist Hermann Weyl in 1929, Weyl fermions have long been regarded as possible building blocks of other subatomic particles. If applied to next-generation electronics, the fermions could allow for a nearly free and efficient flow of electricity and thus greater power.

Hasan led an international team that reported their discovery in the journal *Science* July 15, 2015. The researchers discovered the Weyl fermion in a synthetic metallic crystal called tantalum arsenide (TaAs) that the Princeton researchers designed in collaboration with scientists at the Collaborative Innovation Center of Quantum Matter in Beijing and National Taiwan University. The work was supported by the Gordon and Betty Moore Foundation and the U.S. Department of Energy.

The team from MIT, together with researchers from Zhejiang University in China, published in the same issue of *Science* evidence of Weyl particles in the form of bosons found in a very different material known as photonic crystals. Scientists from the Chinese Academy of Sciences published similar results July 31, 2015 in the journal *Physical Review X*.

The Princeton team included numerous researchers from Princeton's Department of Physics, including graduate students Ilya Belopolski, Nasser Alidoust and Daniel Sanchez; Guang Bian, a postdoctoral research associate; associate research scholar Hao Zheng; and Madhab Neupane, a Princeton postdoctoral research associate now at the Los Alamos National Laboratory; and Class of 2015 undergraduate Pavel Shibayev.

Provided by Princeton University

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