For the past 60 years, progress in information technology has been governed by Moore's law, which states that the number of transistors on a semiconductor chip doubles every 18 months. However, this remarkable trend is drawing to a close, mostly because the electrons that carry current in chips move like cars driving through a crowded marketplace, swerving around obstacles and dissipating too much of their energy as heat. The recent discovery of a new state of matter, the topological insulator, may lead to a new paradigm of information processing, in which electrons moving in opposing directions are separated into well-ordered lanes, like automobiles on a highway. This talk will explain the basic principles behind this amazing discovery.

Shoucheng Zhang was born in Shanghai and received his BS degree from the Free University of Berlin in 1983 and PhD from the State University of New York at Stony Brook in 1987. He joined the faculty at Stanford in 1993. He is a condensed matter theorist known for his work on topological insulators, spintronics and high temperature superconductivity. He is a fellow of the American Physical Society, a fellow of the American Academy of Arts and Sciences and a foreign member of the Chinese Academy of Science. He is the recipient of a number of awards including the Guggenheim fellowship in 2007, the Alexander von Humboldt research prize in 2009, the Johannes Gutenberg research prize in 2010, the Europhysics prize in 2010, the Oliver Buckley prize in 2012, the Dirac Medal and Prize in 2012 and the Physics Frontier Prize in 2013 for his theoretical prediction of the quantum spin Hall effect and topological insulators.

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