



# 复旦大学物理系 Colloquium

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## Exploration of the Fu-Kane scheme for topological quantum computation

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**Abstract:** In 2008, Fu and Kane proposed to induce p-wave-like superconductivity at the interface of an s-wave superconductor and a topological insulator. Since then, many hybrid structures have been proposed/tested. Signatures of Majorana zero modes (MZMs) have been observed in structures containing semiconducting nanowires, topological insulators, Chern insulators, iron chains, etc. However, the original proposal of Fu and Kane – to construct Josephson trijunctions on topological insulators, which could potentially serve as the building blocks for topological quantum computers – largely remains unexplored experimentally. In this talk, I will report our systematic studies on the Josephson devices constructed on the surface of  $\text{Bi}_2\text{Te}_3$ . We demonstrate that the Majorana phase diagram for Josephson trijunction proposed by Fu and Kane is correct. The minigap at the center of the trijunction was found to close linearly when the devices enter the MZM regions of the phase diagram, yet re-open slightly inside the MZM regions due to the finite width effect of the junctions. Our result is in favor of the Fu-Kane scheme of searching for scalable topological quantum computing on two-dimensional platforms.



**CV:** Professor Li Lu received his B.S in physics at Nanjing University in 1982 and received his Ph. D. in Condensed Matter Physics from Institute of Physics, Chinese Academy of Sciences (IOP-CAS) in 1992. He worked as a research associate in the department of physics, University of California, Berkeley during 1992-1995. He then joined in IOP-CAS, where he has been a professor since 1996. Prof. Li Lu is the director of Daniel Chee Tsui Laboratory, and the director of the Huairou branch, IOP-CAS. Prof. Li Lu's current research interests include topological superconductivity and Josephson devices for topological quantum computation.