THE UNIVERSITY OF HONG KONG

Department of Physics
THE UNIVERSITY OF HONG KONG

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Epitaxial Large-gap topological insulator on semiconductor for seamless device integration

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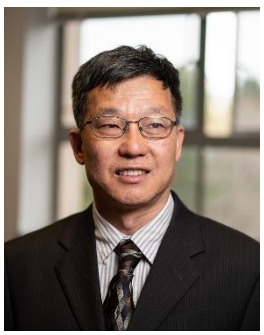
Abstract:

Significant advances have been made in fundamental research of topological insulators (TIs), yet their device applications remain elusive. We propose an approach towards seamless integration of two-dimensional (2D) TIs into semiconductor devices. Using first-principles calculations, we show that heteroepitaxially grown III-V semiconductor ultrathin films can self-convert into 2D TIs. Remarkably, on GaSb(111) monolayer GaAs1-xBix becomes universally a 2D TI at any alloy concentration, x, enabled by natural formation of semiconductor heterojunctions. For the GaAs-rich monolayer, having type-II (III) band alignment with GaSb, an intriguing interfacial band offset inversion emerges between surface Ga-s and substrate Sb-p bands; for the GaBi-rich monolayer, with type-I (I') alignment, the conventional intra-surface band gap inversion arises between Ga-s and Bi-p bands. The lattice-matching epitaxy of GaAs0.25Bi0.75 alloy enables growth of thin-film 2D TIs with a gap up to ~330 meV. Our findings pave the way to engineering wafer-scale large-gap 2D TIs to potentially operate at room temperature.

Biography:



Prof. Feng Liu is currently a Distinguished and Ivan B. Cutler endowed chair Professor in the Department of Materials Science and Engineering at University of Utah. His research interests lie in the theoretical modeling and computer simulation, from electronic to atomic and to mesoscopic scales, to study a wide spectrum of physical behavior of materials, with a special focus on surfaces/interfaces, thin films and low-dimensional quantum materials. His best-known work includes theoretical modeling of self-assembly/self-organization of quantum dots and quantum wires in epitaxial growth of strained thin films, prediction of organic two-dimensional topological materials and surface-based epitaxial topological states, and prediction of many-body quantum states of yin-yang flat bands. He is recipient of 2023 Davisson-Germer Prize in Atomic or Surface Physics. He is a fellow of American Physical Society.

ANYONE INTERESTED IS WELCOME TO ATTEND!

Thursday, November 6, 2025, 3:30pm

Room 522, 5/F, Chong Yuet Ming Physics Building, The University of Hong Kong

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Phone: 28592360 Fax: 25599152. Anyone interested is welcome to attend.