Silicon-Based Artificial 2D Dirac Material for THz Plasmonics

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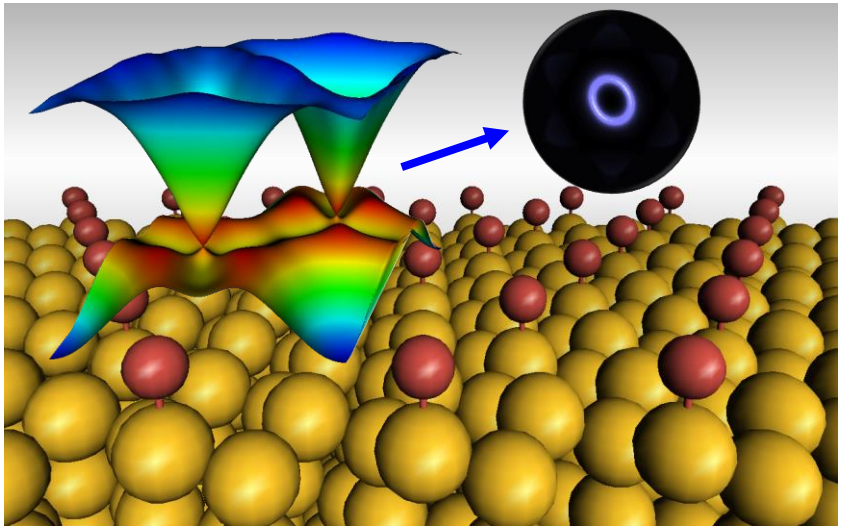
Discovery: Self-assembly of 1/3 monolayer of bromine on Si(111) surface leads to formation of an anisotropic surface Dirac band, which can be used to excite a tunable THz plasmon.

Approach: Predictive first-principles band structure and plasmon calculations.

Results and Significance: We have demonstrated a novel approach to design substrate-supported 2D materials whose electronic bands are completely isolated from the underlying substrate bands, so that they behave electronically like freestanding 2D materials, but are structurally stable. Our findings ease the way for applications of 2D materials due to the inherent compatibility with the current semiconductor technology.



Self-assembled Si(111) surface with 1/3 monolayer Br coverage. The inset are Si-based anisotropic surface Dirac band and anisotropic excited plasmon dispersion in 2D momentum space.

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