Graphene-capped bismuthene on SiC as a platform for correlated quantum spin Hall edge states

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Epitaxial bismuthene on SiC(0001) hosts symmetry-protected metallic edge states within a large bulk band gap, establishing it as a promising two-dimensional topological insulator for high-temperature quantum spin Hall (QSH) transport. Here we realize bismuthene islands by intercalating Bi beneath zero-layer graphene (ZLG) on SiC(0001) followed by hydrogen treatment, yielding well-defined edges with controlled terminations. Spectroscopic measurements demonstrate that the edge states reside inside the bulk band gap and remain charge-neutral. The graphene overlayer interacts only weakly with the bismuthene, preserving its topological character while providing environmental protection. Notably, the one-dimensional edge channels exhibit signatures of enhanced electronic correlations relative to freestanding bismuthene, suggesting proximity-induced modification of the QSH edge physics. These results establish graphene-capped bismuthene as a robust and tunable platform for correlated quantum spin Hall states [1].

References:

[1] Ngo, Huu Thoai, et al. "Graphene-capped bismuthene on SiC as a platform for correlated quantum spin Hall edge states." arXiv preprint arXiv:2603.02397 (2026).

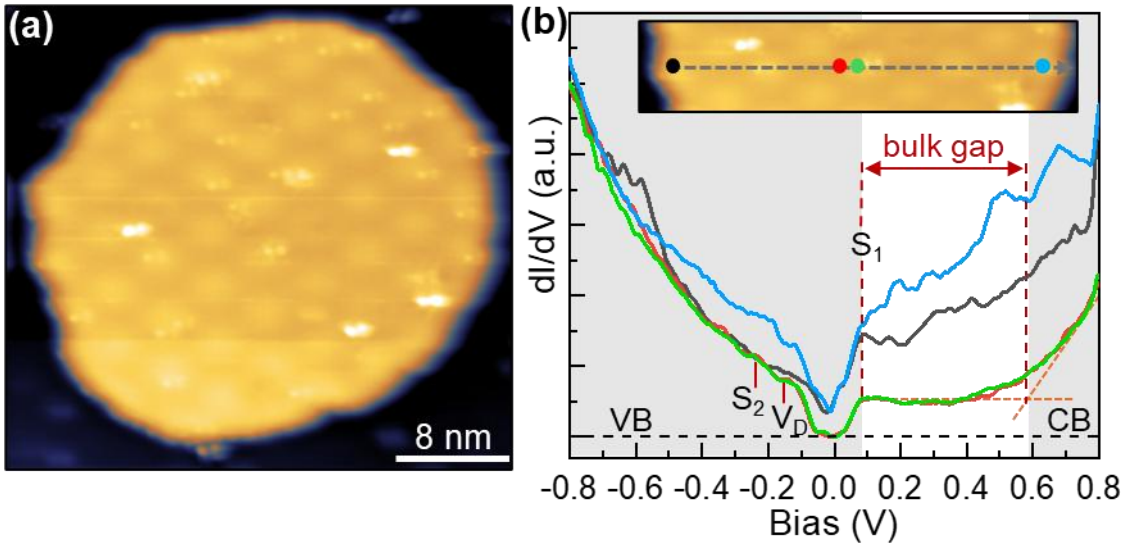

Fig. 1: (a) STM topography of a bismuthene-intercalated ZLG/SiC island (+1.5 V, 400 pA). (b) Tunneling dI/dV spectroscopy recorded at different positions (marked by colored circles) along with the grey-dashed arrow, as indicated in the inserted image (cut off from Fig. 1a). The spectra were measured at +0.8 V, 450 pA, T = 4.5 K. The Dirac point is denoted as V_D. S_1 and S_2 represent the top and next energy levels of the valence band (VB), respectively. The black-dashed line represents the zero dI/dV intensity.