

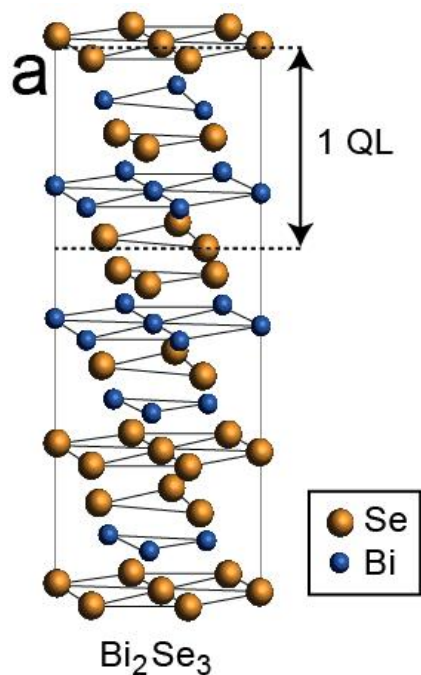
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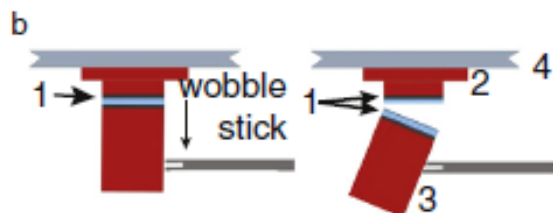
New features of the Nanolab@ISM: the case of antimonene



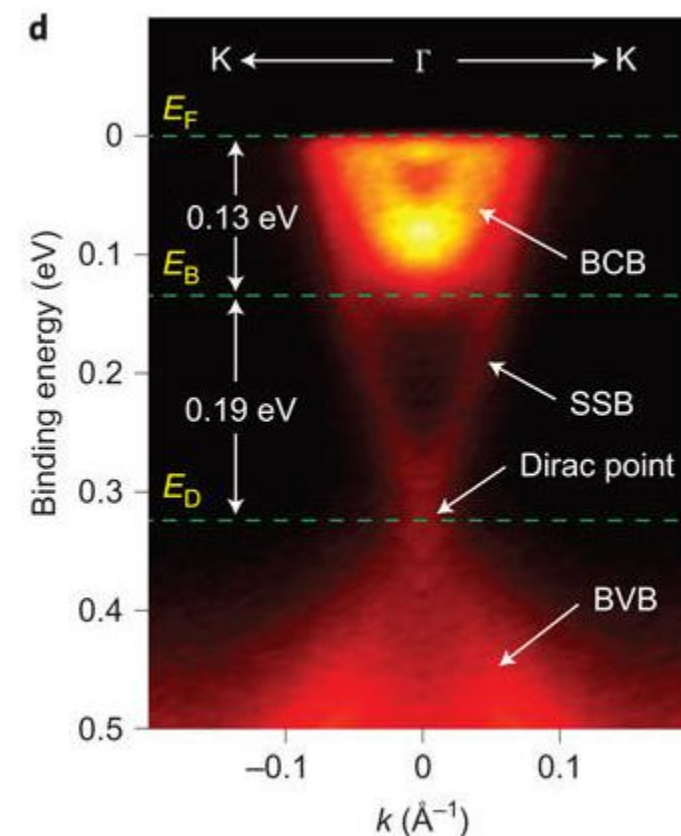
The prototypical topological insulator : Bi_2Se_3



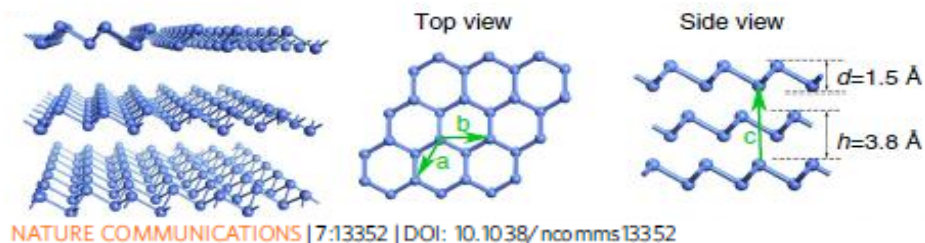
- QL: stacks of alternate Se-Bi layers, with hexagonal structure
- van der Waals interaction between QLs



- Exfoliation in UHV
- Surface clean at atomic level
- Triangular and other kind of native defects



An interesting adsorbate : antimonene



- Predicted structure for bilayer antimony (antimonene): **buckled honeycomb**
- Sb layer height **0.37 nm**

PHYSICAL REVIEW B 85, 201410(R) (2012)

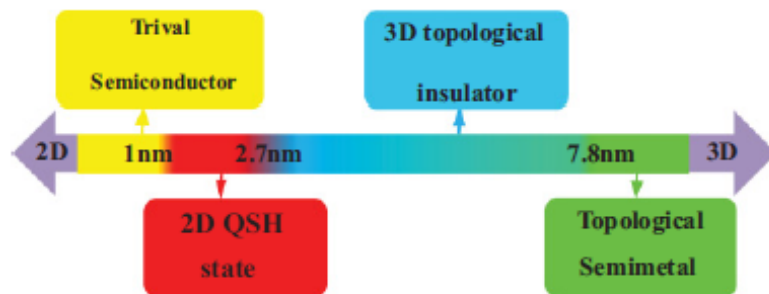
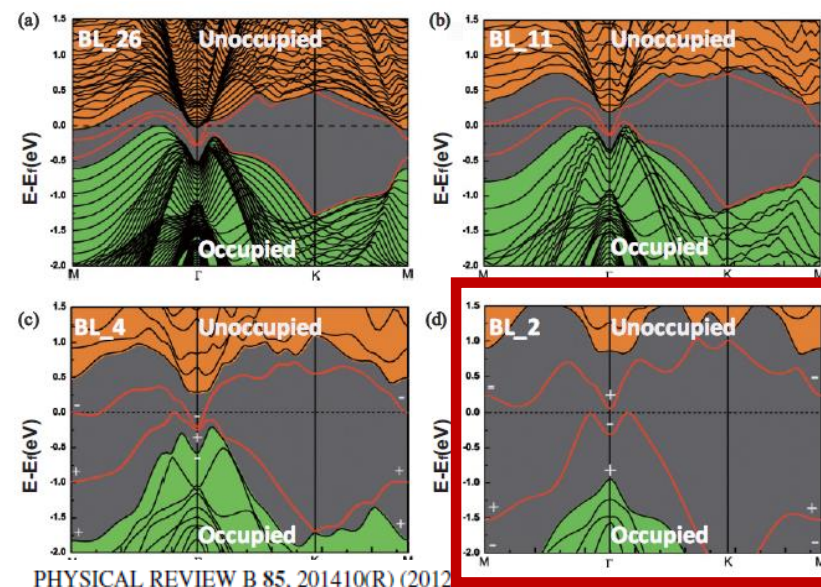


FIG. 4. (Color online) The phase transition diagrams as a function of the film thickness from trivial semiconductor to topological semimetal.



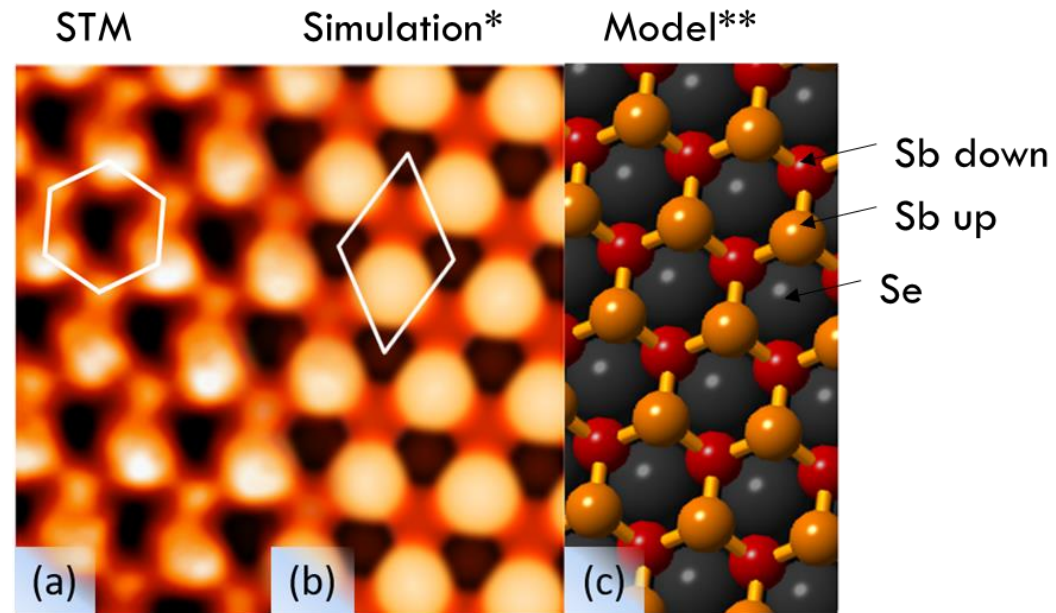
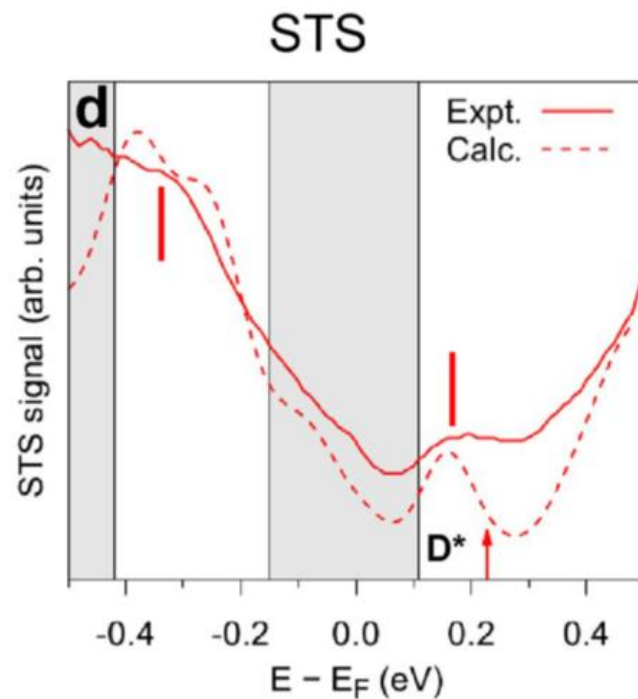
Band structure depends on the thickness



below 4 antimonene layers, semiconducting behavior
→ **trivial insulator**

What we have done : topography and spectroscopy

ACS Nano 2019, 13, 10481–10489

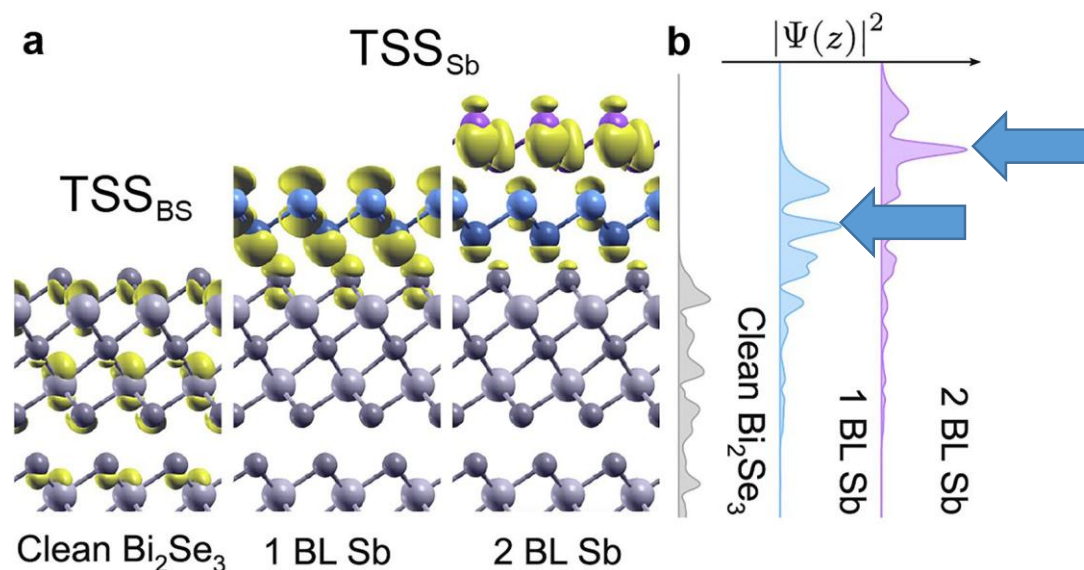
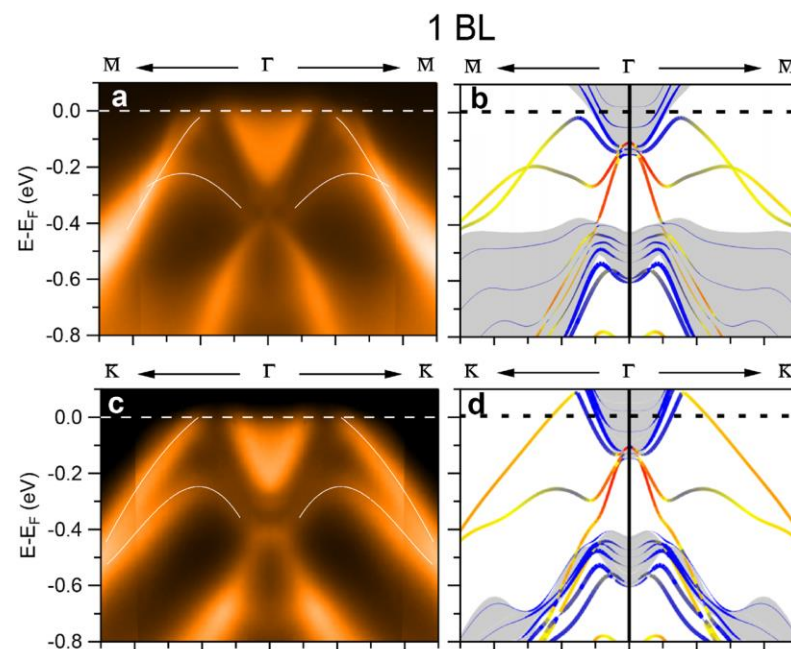


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** C. Hogan, CNR-ISM, Roma

What we have shown : topologization of the antimonene

Scientific Reports | (2020) 10:14619 |



However, no signature by STM,STS !

Cu(111)

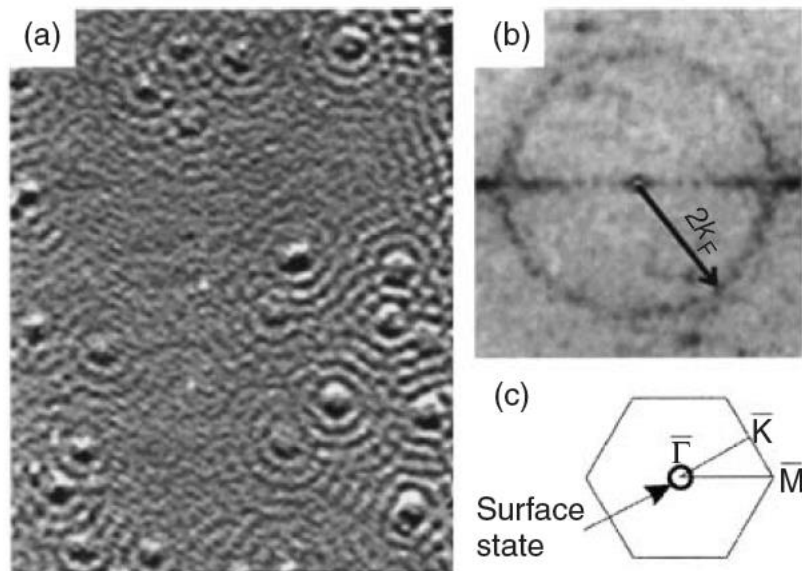


Figure 9.5 Standing waves of surface states. (a) Topographic image ($42.5 \times 55 \text{ nm}^2$) of Cu(111) at $V_b = -5 \text{ mV}$, $T = 150 \text{ K}$. Ripples of interference patterns spreading out from point defects are visible. (b) Fourier transformation of the image in (a). (c) Illustration of the surface Brillouin zone of Cu(111). (d)

What could be done :

Signature of
the presence of
TSS :
dissipationless
and robust
conduction
against defects

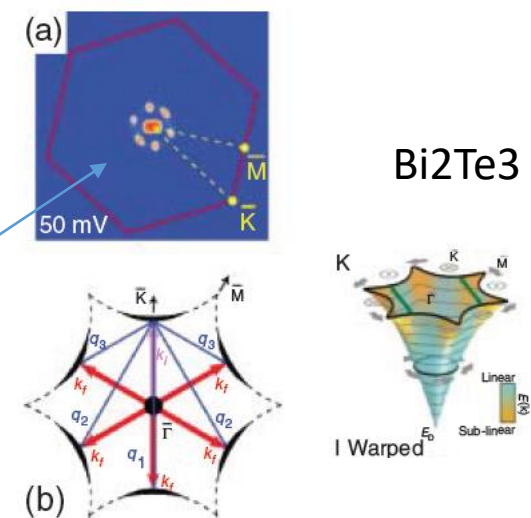
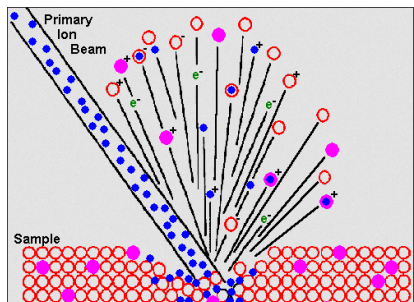
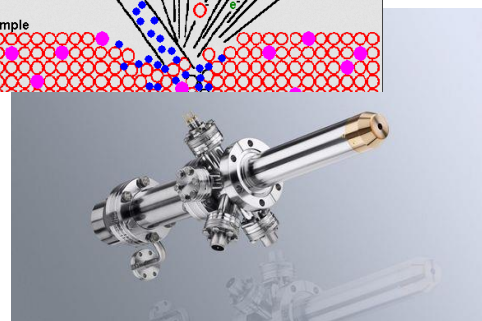


Figure 9.6 Fourier-transformed conductance maps (FT-STs) of topological insulators. (a) Fourier transform of a dI/dV map on a $\text{Bi}_2\text{Te}_3(111)$ surface. Directions in q -space are indicated. Hexagons in (a) and (c) are the surface Brillouin zones of the respective materials. (b) Possible scattering vectors q 's and incident and scattered vectors k 's on a sketch of a constant-energy contour of



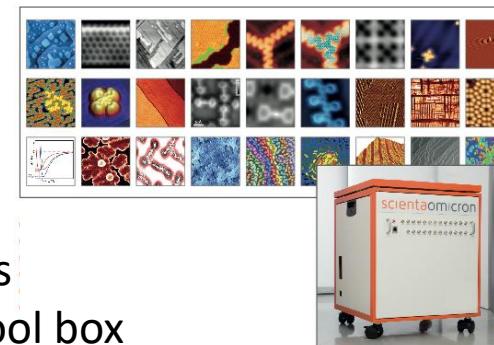
New ion sputtering system

- Differentially pumped
- Scannable surface
- High stability

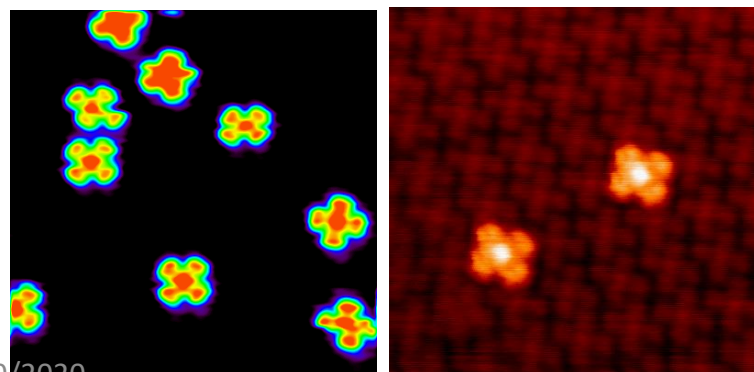


New acquisition system - MATRIX 4 Scienta Omicron

- High speed low noise electronics
- Manipulation and lithography tool box
- User defined macro



New deposition chamber dedicated to organic materials connected to the STM apparatus



Thank you for your attention!

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*Open Research Infrastructure to
support companies operating in the
field of micro-nanoelectronics*

