2025 Poster Competition

Contribution ID: **11** Type: **not specified**

Proximity-Effect-Driven Superconductivity in Two-Dimensional Bi Thin Films on Al(111)

Wednesday, 26 March 2025 13:41 (3 minutes)

Two-dimensional superconductors are crucial for exploring quantum phenomena and understanding high-temperature superconductivity. They are vital for developing superconducting nanoelectronics and exhibit unique transitions under magnetic fields. By depositing or sandwiching a metal thin film with strong spin orbital coupling on a bulk superconductor is a promising route to realize 2D superconductors. In this study, we have deposited Bi on Al(111) substrate at T = 250K using a E-beam evaporator. Our findings revealed distinct phases by using low-temperature scanning tunneling microscopy (LT-STM). We observed the Bi/Al(111) hexagonal $(\sqrt{3}\times\sqrt{3})$⊠30°, Kagome-(3 × 3) and honeycomb-(3 × 3) with respect to the (1 × 1) unit cell of Al(111) substrate have identified. Moreover, based on the atomically resolved STM images and bias-dependent line profiles, and density functional theory (DFT), we have constructed structural models for all phases, as well as atomically localized density of state spectra are measure with scanning tunneling spectroscopy (STS). Line spectroscopy measurements can also reveal the proximity effect on superconductivity substrates in relation to different phases. In future, we have planned to systematically study the band structure by angle resolved photoemission spectroscopy (ARPES) to realize the how electrons affect Cooper pairs in superconducting substrate.

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Presenter: SUNG, Kuan-Ying

Session Classification: Poster Talks

Track Classification: Condensed Matter Experiment