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Evolution of Topological Surface States in Tunable Topological Insulators GUANGGENG YAO, ZIYU LUO, WENTAO XU, YUANPING FENG, XUE-SEN WANG, National Univ of Singapore — $Bi_{1-x}Sb_x$ ($0.07<x<0.22$) is the first generation of 3D topological insulators (TIs), possessing a bandgap and topological surface states (SSs) generated by spin-orbit coupling In fact, within the whole range of $0<x<1$ (i.e. from pure Bi to pure Sb), a topological phase transition has to occur as the system is twisted from topologically trivial to nontrivial phases, even though it becomes a semimetal hosting a negative indirect gap Therefore, taking advantage of Fourier-transform scanning tunneling spectroscopy (FT-STS) and *ab initio* calculations, we investigate the progressive evolution of topological SSs in the tunable $Bi_{1-x}Sb_x$ ($0<x<1$) materials grown by means of molecular beam epitaxy In alloys with several representative compositions, quasiparticle interference (QPI) patterns of SSs exhibit dramatic dependence on x values, indicating that intra-surface scatterings are ultimately determined by band structures and the associated spin textures. Additionally, the corresponding simulated QPI patterns are also revealed based on *ab initio* calculations. Such systematic studies of the $Bi_{1-x}Sb_x$ alloy family can be further explored to tailor surface energetic and transport properties for potential applications in quantum information, spintronics and many other topological quantum phenomena.

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