物理科学科 セミナー

講師： Trang Xuan Chi 氏

（東北大学大学院 理学研究科 物理学専攻 佐藤研究室 博士課程１年）

日時：2017 年 12 月 13 日（水） 16:00 - 17:00

場所：万有館３階会議室

題目：High-resolution ARPES study of $TlBi_{1-x}Sb_xTe_2$

Three-dimensional topological insulators (3D TIs) are a new state of quantum matter with an insulating bulk band and a conducting surface state protected by time-reversal symmetry. It is expected that the 3D TIs show unusual topological quantum effects which can be applied to spintronic devices and quantum computation. The realization of such ideas requires the truly bulk-insulating TIs with tunable surface states. One of useful strategies is to gradually replace the composition in a ternary alloy, like $Bi_{2-x}Sb_xTe_{3-y}Se_y$ [1] (BSTS), leading to an effective compensation of donor/acceptor-type defects, *i.e.* a shift of the chemical potential and tunable surface state. In this study, we have performed angle-resolved photoemission spectroscopy (ARPES) of a new insulating TI platform, the $TlBi_{1-x}Sb_xTe_2$ (TBST) system, and determined the evolution of band structure as a function of Bi/Sb ratio.

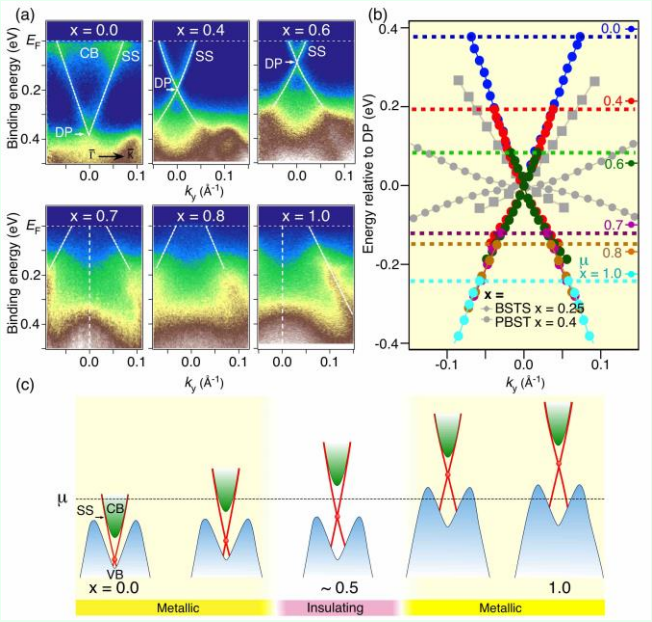

Figure 1: (a) The evolution of band dispersion in TBST along the $\bar{\Gamma}\bar{K}$ direction (b) Composition dependence of the Dirac-cone band dispersion relative to the DP of TBST, compared with other systems. (c) Schematic band diagram of TBST as a function of *x*.

To see the evolution of electronic states on Sb substitution, we have performed systematic ARPES measurements along the $\bar{\Gamma}\bar{K}$ cut [2]. The evolution for various *x* values, shown in **Fig 1(a)**, demonstrates tunable Dirac carriers in TBST. Moreover, we have found that chemical potential shifts by 0.6 eV with respect to the Dirac point. This value is much larger than that of other TI systems such as BSTS [1] and $Pb(Bi_{1-x}Sb_x)_2Te_4$ [3] as shown in **Fig. 1(b)**. More importantly, the Dirac velocity of TBST is as large as 5.4 eVÅ along the $\bar{\Gamma}\bar{K}$ direction, highest among known TIs. In my presentation, we discuss the discuss the overall band diagram of TBST [**Fig. 1(c)**] and discuss the relationship between spectroscopic and transport properties.

[1] T. Arakane *et al.*, Nat. Commun. **3**, 636 (2012).
[2] C. X. Trang *et al.*, Phys. Rev. B **93**, 165123 (2016).
[3] S. Souma *et al.*, Phys. Rev. Lett. **108**, 116801 (2012).

講師紹介 ： Trang Xuen Chi 氏

講師の Trang さんは、新学術領域研究（研究領域提案型）「トポロジーが紡ぐ物質科学のフロンティア」における「若手励起プログラム」にて単結晶成長に取り組まれるために当学に２週間滞在する予定であり、その機会を利用してセミナーをお願いした。まだ博士課程の学生ではあるが、トポロジカル絶縁体の光電子分光実験の最前線で活躍する優秀な方であり、セミナーでは最先端の話をしていただく予定である。 （文責・理学部 瀬川耕司）

お問い合わせ：京都産業大学・理学部事務室
Tel 075-705-1463