Lifshitz Transition across the Ag/(Cu111) Superlattice Band Gap Tuned by Interface Doping

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The two-dimensional, free-electron-like band structure of noble metal surfaces can be radically transformed by appropriate nanostructuration. A case example is the triangular dislocation network that characterizes the epitaxial Ag/Cu(111) system, which exhibits a highly featured band topology with a full band gap above EF and a hole-pocket-like Fermi surface. Here we show that controlled doping of the Ag/(Cu111) interface with Au allows one to observe a complete Lifshitz transition at 300 K; i.e., the hole pockets fill up, the band gap entirely shifts across E_F, and the Fermi surface becomes electron pocket-like.

References:

[1] Z. M. Abd El-Fattah, M. Matena, M. Corso, F. J. García de Abajo, F. Schiller, and J. E. Ortega, Phys. Rev. Lett.,107, 066803 (2011).

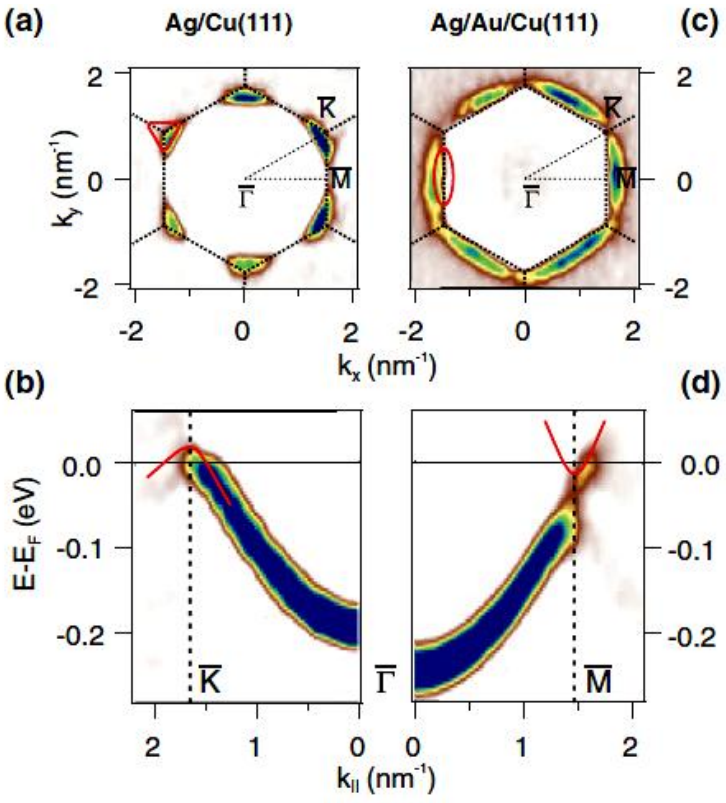

FIG. 1 Fermi surface map of (a) 1 ML Ag/Cu(111) that significantly changes after doping with (c) 0.4 ML of Au. Data are taken at room temperature with angle resolved photoemission. The dotted lines mark the zone boundary edges and the solid lines define hole and electron pockets at $\bar{K}$ and $\bar{M}$, respectively. The corresponding surface bands are shown along (b) $\bar{K}$ and (d) $\bar{M}$ symmetry directions. All images show the second derivative the photoemission intensity.