Electronic Structure of Vicinal Surfaces Studied by ARPES: Case of InAs(111)

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Abstract. Atomic staircases are among the simplest lateral nanostructures. In particular, electrons belonging to Shockley states of (111)-oriented noble metal surfaces are excellent test systems to explore the basic electronic properties in one-dimensional superlattices by means of angular photoemission (ARPES) [1,2]. These surfaces are characterized by strong emissions from free-electron-like surface states that scatter at step edges.

The scattering of electrons at surface defects, such as atomic and molecular adsorbates and monatomic steps, has been made widely popular by scanning tunnelling microscopy (STM) [3]. Observed interference patterns mirror fundamental properties of solid crystals related to electron transport and quantum confinement, such as the inelastic lifetime and quantum coherence of a scattered electron. However, even at noble metal surfaces, considered as model systems, the nature of the step potential is more complex and fundamental questions remain open [1].

InAs(111) A and B surfaces are known to support a two-dimensional electron gas (2DEG) exhibiting a multitude of fundamental physical phenomena that can be of major importance for technological applications. The 2DEG, observed for the first time by Olsson *et al*. [4], is related to the charge accumulation layer induced by band bending. We have investigated by ARPES the electronic structure of the InAs(111) prepared by molecular beam epitaxy (MBE). On InAs(111)-B we obtained a large splitting in the 2DEG than cannot be explained by the Rashba or Dresselhaus effects. STM images on the MBE prepared surface show array of equally spaced, monatomic, parallel steps. So, the 2DEG splitting can be attributed to the superlattice band folding depending on the step lattice constant [5].

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