Spin-Split Bands in a One-Dimensional Chain Structure

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Gold atom chains on vicinal Si(111) surfaces exhibit an unusual doublet of half-filled bands, whose origin has remained uncertain [1-4]. The splitting is identified by angle-resolved photoemission as a spin splitting induced by the spin orbit interaction, in agreement with a theoretical prediction by Sánchez-Portal et al. [5]. Thereby we use the pattern of avoided band crossings at a superlattice zone boundary [6]. Two out of four crossings are avoided, with a mini-gap \( E_G = 85 \) meV and a \( k \)-offset of 0.05 Å\(^{-1}\).

Figure 1: A spin splitting caused by spin-orbit interaction (top) can be distinguished from other splittings (bottom) via the pattern of avoided crossings at the zone boundary ZB\(2\times1\). In the first case, the avoided crossings are offset horizontally (in \( E \)), in the second vertically (in \( k_x \)).

Figure 2: Angle-resolved photoemission data of the band crossings near the 2x1 zone boundary (raw data on top and second derivative at the bottom).

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References: