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Metal-insulator transitions of atomic wires on Si surfaces

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A strong updated motivation to study the electronic properties of one-dimensional (1D) metallic wires lies in the quest for the breakdown of the Fermi liquid framework, which has long been one of the key ideas in condensed matter physics. In very recent days, this field of researches has been enriched by finding unprecedented forms of 1D material systems with metallic electrons such as carbon nanotubes and atomic wire systems on solid surfaces. For the case of surface atomic wires, most notably the regular arrays of atomic chains formed on stepped Si surfaces by the adsorption of metals, the observation of spin-charge separation, an exotic manifestation of the non-Fermi liquid property, was claimed recently. For the reason, the ground state properties of the Au/Si(553), Au/Si(557), and In/Si(111) surfaces with interesting 1D metallic bands were investigated. The coexistence of triple- and double-period lattice distortions at low temperature was observed the Au/Si(553) surface. On the Au/Si(557) surface, the proximal two half-filled bands were found to show different temperature-dependent electronic transitions. The In/Si(111) surface with three metallic bands was studied to figure out how an interband interaction contributes to the ground state of a charge density wave.