HL 54 Metal-insulator transitions

Time: Friday 11:15–11:30 Room: BEY 154

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Scanning tunneling spectroscopy of magnetic-field -induced localization in InSb — •Katsushi Hashimoto[1], Focko Meier[1], Jens Wiebe[1], Markus Morgenstern[2], and Roland Wiesendanger[1] — [1]Institute of Applied Physics, University of Hamburg, D-20355 Hamburg — [2]Institute of Physics, RWTH Aachen University, D-52056 Aachen

Using scanning tunneling spectroscopy (STS), we study the microscopic nature of localization in three dimensional metallic n-InSb with a low carrier concentration of 1.4 $\times 10^{14} cm^{-3}$. First, we confirmed by transport measurements that extreme quantum limit (EQL) and a metal-insulator (MI) transitions caused by magnetic-field-induced localization occur at $B_{EQL} \approx 150$ mT and $B_{MI} \approx 280$ mT. The microscopic measurements using STS are performed on cleaved InSb (110) in ultra high vacuum at 0.3 K. When the B-field is set to 0 mT, dI/dV maps at a sample bias voltage (V_s) of 0 mV show two-lobe-like maxima in the local density of state (LDOS), which are merged at a negative V_s. The observed LDOS features are interpreted as quantized states confined by the potential valley, such as p-like and s-like states. They, however, abruptly vanish at B_{EQL}. This can be correlated to enhanced electron-electron interactions with respect to the potential disorder. Furthermore, we find that the confined states are recovered above B_{EQL} and diminish as the B-field approaches B_{MI}, suggesting that localization due to enhanced electron-donor interactions modifies the confined states.