Thesis proposal

Sondheimer oscillations and quantum transport

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Numerous old experiments detected Sondheimer oscillations in ballistic elemental metals. In this case, electric conductivity in the plane perpendicular to the magnetic field oscillates periodically as a function of magnetic field (and not the inverse of magnetic field as in the case of Shubnikov-de Haas oscillations). Sondheimer oscillations are classified as a semi-classical phenomenon. But according to our recent findings, this is not true. In cadmium crystals, we found an empirical scaling for the amplitude of the oscillations across a forty-fold variation of thickness. Oscillating amplitude is set by the quantum of conductance, the magnetic length, and the geometry of the Fermi surface. Explaining this empirical expression is a challenge to the condensed-matter physics. We aim to explore other elemental metals provide input for a quantum theory of Sondheimer oscillations. The crystals for this study will be tailored using Focused Ion Beam (FIB) technology in Philip Moll's laboratory in Hamburg.

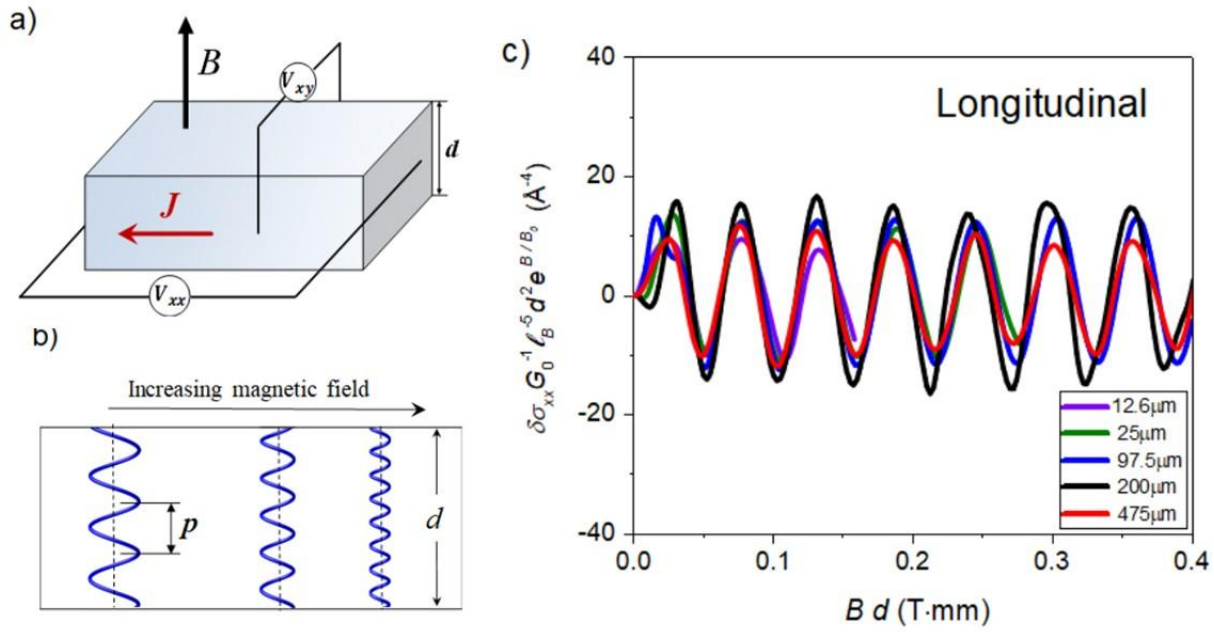

Figure 1- a) *The set-up: Magnetic field applied perpendicular to a thin sample. b) The helical trajectory of electrons and its evolution with increasing field. c) The quantization of the amplitude of the oscillating conductivity.*