HL 13: Invited Talk: Bernd Kästner

Time: Monday 12:45–13:15 Location: FOE Anorg

Invited Talk HL 13.1 Mon 12:45 FOE Anorg

Semiconductor quantized current and voltage standard — •Bernd Kaestner — Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig

From the groundbreaking work of Josephson it became clear that superconducting solid state devices allow to generate a quantized voltage only defined by an applied excitation frequency f and two fundamental constants, namely the electron charge e and Planck constant h. The Josephson effect has been successfully applied in the field of electrical quantum metrology as voltage standard. Though superconductors show many other astonishing properties semiconductors have been the most relevant class of material for microelectronics. The generation of a quantized voltage by an all semiconductor device has not been possible yet. Here we report on the realization of a semiconductor quantized voltage source allowing to generate voltages V = f *(h/e) upon input of an AC voltage with frequency f. The design of the device can be regarded as a semiconductor integrated quantized circuit. It consists of a non-adiabatic single-electron pump [1] being able to drive quantized currents through high impedance loads. The pumping mechanisms and potential accuracy are discussed with respect to applications as a quantum current standard. When operating such a pump at frequency f and monolithically integrating it with a Quantum Hall device in series the functionality of quantized voltage generation can be implemented. The device shows robust operation up to frequencies of a few GHz.

[1] M. D. Blumenthal, B. Kaestner, L. Li, et al., Nature Physics 3, 343 - 347 (2007).