Transport in graphene: interfaces, disorder and device-layout

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Graphene has been identified to be a high-potential candidate to design truly two-dimensional nanoelectronics devices with functionalities which exceed the current performance of state-of-the-art electronics and may be a viable path towards the post-CMOS era.
The reasons for this are many fold, though key-properties to be mentioned are the high mobilities for both electron-like and hole-like charge-carriers in graphene even at elevated temperatures and the comparably low spin-orbit and hyperfine coupling. These properties can be deduced from the peculiar lattice-structure of graphene, which is an atomically flat (two-dimensional) hexagonal carbon-atom lattice formed of two triangular sublattices, as well as the low atomic mass of the carbon atoms. Graphene, thus, consists only of surface which on one hand provides it with the remarkable properties it has, but on the other hand makes it significantly susceptible to any type of disorder (adsorbates, dopants, substrate, etc.) and interfacial effects (e.g. presence of electrodes). In this presentation the impact of interfaces, disorder and device-layout on the electronic response of graphene will be discussed. Magnetotransport measurements carried out on graphene monolayers will be presented using the fundamental quantum-Hall-effect as tool to demonstrate the electronic response to the above-mentioned parameters, thereby illustrating that each of these needs to be considered for a successful implementation of graphene into strategies for novel nanodevice applications and concepts.