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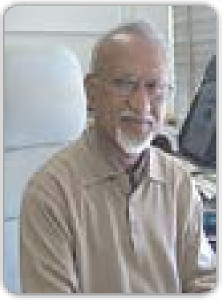

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Quantum electronic transport and conductance anomaly in quasi-1D systems

Electronic transport in quasi-one dimensional (1-D) systems is mainly studied in quantum point contact (QPC) and quantum wire devices. It was first reported in QPCs of high electron mobility devices of GaAs/GaAlAs heterostructure, where steps of differential conductance (G normalized to a quantum value $G_0 = 2e^2/h$) was observed as the gate voltage was varied. Since 1988 a number of other 1-D systems from Si metal-oxide field effect transistors, GaAs type other hetero-structures and constricted graphenes etc., exhibited the quantized steps. Apart from quantized steps of universal nature (having its occurrence at integral values n=1, 2, 3, etc., for $G/G_0 = n$) there seems to be anomalies observed in many of the above systems at the nonintegral values. Generally there are two types of anomalies: (i) Thomas and coworkers are first to identify an anomalous structure in the conductance below the first quantized step in GaAs QPCs at about 0.7 ($2e^2/h$). It has been argued that this (0.7 anomaly) is an intrinsic property caused by many-body effect, which appears to arise independent of the materials system. Although 0.7 anomaly has been discussed abundantly in the literature, a careful observation of conductance features in all the 1D conductors would reveal anomalies at various conductance values apart from at 0.7. They occur clearly at some elevated temperature and at nonzero magnetic fields. (ii) Another anomaly has been identified in the nonlinear transport regime at low temperatures as zero-bias peak in the differential conductance while sweeping the drain bias. It is called "zero-bias anomaly" (ZBA). Explanation of these anomalies is mainly by two ideas: (1) an assumption of spontaneous spin polarization (SSP) and (2) presence of a many-body state arising out of Kondo physics. In this talk we shall critically discuss experimental findings and present various theoretical methods to explain the observed anomalies.

Biography

Mukunda P Das is School Professor in Theoretical Physics. He is a Fellow of American Physical Society, Institute of Physics (UK) and Australian Institute of Physics. His research interest concerns the fundamental aspects of condensed matter, which include Superconductivity, Vortex Matter, Bose-Einstein Condensation, Meso- and Nanoscopic Systems, Strongly Correlated Electrons, Density Functional Theory and Theory of Disordered States. He is member of Editorial Boards of many international journals, namely *J. Physics: Condensed Matter* (IOP) (2002-12), and *ASN J. NanoSci and Nanotech* (IOP).

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