Applying Magnetic Field to Carbon based Low Dimensional Materials: from Aharonov Bohm Effects to the Landau Level formation

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In this talk, we will discuss several magnetic-field dependent transport phenomena in carbon nanotubes based materials [1]. First on will review the Aharonov-Bohm phenomenon in weakly disordered metallic nanotubes, when an external magnetic field is applied parallel to the tube axis. The position of the Fermi level and the nature of underlying disorder will be shown to critically affect the corresponding magnetofingerprints, in agreement with experimental observations. Calculations are performed within a simple tight-binding model, and the effect of the magnetic field is modelled by the Peierls substitution. The presence of impurity-induced quasibound states (as appearing in chemically doped carbon nanotubes) will be also shown to yield switching from negative to positive magnetoresistance [2]. In a second part, the occurrence of Landau levels for magnetic applied perpendicular to the nanotube axis will be discussed in the light of recent experiments [3].

References