MAGNETO-TRANSPORT IN DOUBLE WALL CARBON NANOTUBES : NEW PHENOMENA UNDER 60T

B. Lassagne, G. Fedorov, M. Sagnes, B. Raquet, J-M Broto
Laboratoire National des Champs Magnetiques Pulsés, UMR 5147
143 av. de rangueil 31342 Toulouse, France

F. Triozon and S. Roche
Commissariat à l'Energie Atomique, DSM/DRFMC/SPSMS and DRT/LETI/DIHS/LMNO,
17 rue des Martyrs, 38054 Grenoble, Cedex 9 France.

Theoretical studies on electronic transport properties of carbon nanotube (CN) demonstrate that small diameter CN behave like unconventional mesoscopic system [1,2]. Both an applied magnetic field and the location of the chemical potential tune the electronic density of states at the Fermi level. Indeed, it is expected that field induced Aharonov-Bohm (AB) oscillations of the conductivity due to the boundary conditions along the circumference of the tube are a function of the electronic/electrostatic doping. The situation gains in complexity when, in addition to doping effects, disorder is randomly introduced along the tube. For instance, in the quasi-ballistic regime, weak localization (WL) due to backscattering along the circumference of the tube, flux-dependent density of states (DOS) oscillations and Fermi level location interplay the magneto-transport in a very unusual manner [1].

Here, we present transport and magneto-transport experiments on hole-doped DWNT in air, using the 62T pulsed magnetic field *LNCMP* facilities. Resistivity versus temperature and differential conductivity experiments give evidences for electronic transport through an interacting disorder metal. Our high magnetic field measurements are mainly focused on the high kinetic energy regime, $eV>kT$, involving massive and massless subbands. In the high temperature regime, large positive magneto-conductance which reaches saturation around 60T gives evidence for quasi-2D WL in DWNT. At low temperature, both geometrical field configuration and gate voltages drastically change the magnitude and the sign of magneto-resistance (Fig.1).

This unconventional magneto resistance behavior is ascribed to the magnetic field effect on the CN band structure, which is probed by tuning the location of the Fermi level. We bring experimental evidence of van Hove singularities displacement under the high magnetic field regime and its interplay with the magneto-transport.

References :

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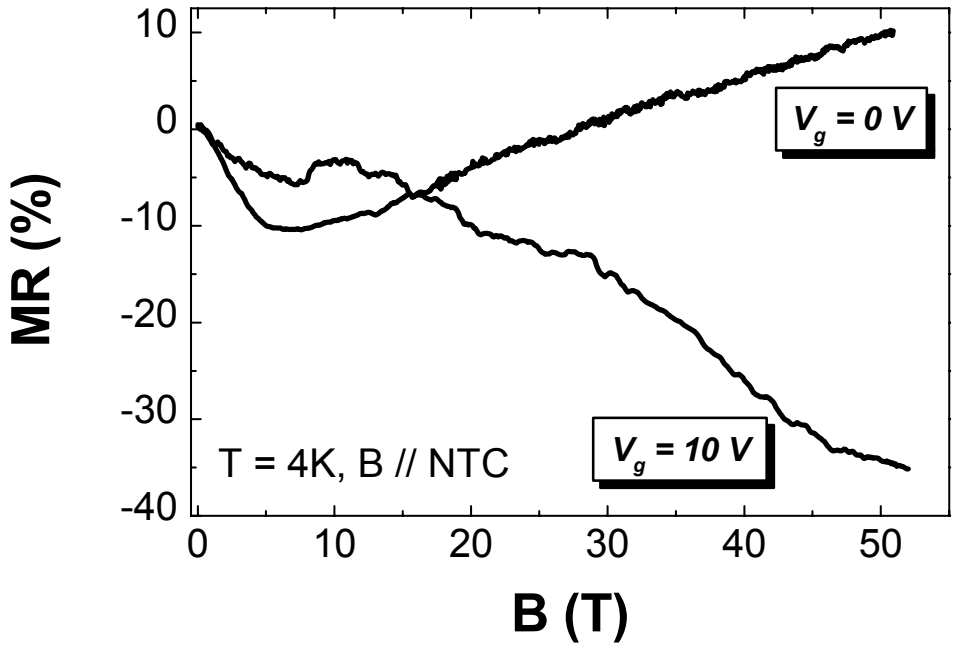

Fig. 1 : High field magneto-resistance $\Delta R(B)/R$ up at 4K on a DWNT for an applied magnetic field parallel to the tube axis and two different back gate voltages, V_g = 0V and 10V.