Subject: [S3 Seminar] F. Telesio, "Dephasing in Strongly Anisotropic Black Phosphorus", 20.03.2017 h 16.00
From: Communications <communications@nano.cnr.it>
Date: 17/03/2017 12:34
To: nano@nano.cnr.it

CNR NANO S3 SEMINAR ANNOUNCEMENT

Speaker **Francesca Telesio**

Affiliation NEST, Istituto Nanoscienze-CNR and Scuola Normale Superiore, Pisa, Italy

Title Dephasing in Strongly Anisotropic Black Phosphorus

Date & Time Monday March 20, 2017 - 16:00

Â Venue S3 Seminar Room, Physics Building, FIM Department, Modena

Host Deborah Prezzi

Abstract Black phosphorus (bP) is a direct band gap semiconductor, which, thanks to its layered structure, can be exfoliated down to the monolayer. It attracted great interest for various properties, among which anisotropic transport, optical, and thermoelectric properties have been recently observed and related to the puckered structure of bP layers [1]. Here we present recent results on bP devices, in particular experimental observation of weak localization in a 65 nm-thick black phosphorus field effect transistor [2]. Weak localization (WL) is a quantum effect, related to coherent scattering at low temperatures. Using the Hikami-Larkin-Nagaoka model [3], the dephasing length L_φ (or inelastic scattering length) can be inferred from weak localization. Our study is performed for various gate voltages (V_g), in the hole-doped regime, at temperatures down to 250mK. L_φ is found to increase with increasing hole density, attaining a maximum value of 55 nm at a hole density of approximately $10^{13}cm^{-2}$. The temperature dependence of L_φ was also investigated. Above 1K it decreases, with a weaker temperature dependence than $T^{-1/2}$, the one expected for electron-electron interaction in two dimensions. Rather, the observed power law was found to be close to that observed previously in quasi-one-dimensional systems such as metallic nanowires and carbon nanotubes. We attribute this result to the puckered structure of bP which forms a strongly anisotropic medium for localization. Therefore, the anisotropic structure of black phosphorus plays a crucial role also for quantum interference effects such as WL.

References:
[1] F. Xia, H. Wang, and Y. Jia, Nat. Commun. 5, 4458 (2014).
[2] N. Hemsworth, V. Tayari, F. Telesio, S. Xiang, S. Roddaro, M. Caporali, A. Ienco, M. Serrano-Ruiz, M. Peruzzini, G. Gervais, T. Szkopek, and S. Heun, Phys. Rev. B 94, 245404 (2016).
[3] G. Bergmann, Phys. Rep. 107, 99 (1984)

***francesca.telesio@nano.cnr.it**

Please check the complete list of NANO Seminar here http://www.nano.cnr.it/?mod=men&id=116.

***** To NEST researchers: if you are interested in following this seminar by video transmission, please write to vconf@nano.cnr.it*****