

Integer Quantum Hall Effect in Trilayer Graphene

W. Escoffier¹, J.M. Poumirol¹, A. Kumar¹, C. Faugeras², D. P. Arovas³,
M. M. Fogler³, P. Guinea⁴, S. Roche⁵, M. Goiran¹ and B. Raquet¹

¹ LNCMI, CNRS, 143 av. de rangueil, 31400 Toulouse, France.

² LNCMI, CNRS, 25 rue des Martyrs, 38042 Grenoble, France.

³ Department of Physics, Univ. of California - San Diego, 9500 Gilman Drive, California 92093, USA.

⁴ Instituto de Ciencia de Materiales de Madrid, CSIC, Cantoblanco E28049 Madrid, Spain.

⁵ Centre d'Investigaci en Nanociencia i Nanotecnologia (CSIC-ICN), UAB, 08193 Barcelona, Spain

walter.escoffier@lncmi.cnrs.fr

The Integer Quantum Hall Effect (IQHE) constitutes the hallmark of two-dimensional systems subjected to a strong perpendicular magnetic field. So far, three different realizations of 2D systems displaying distinctive IQHE features have been reported in the literature. These are conventional semiconducting heterostructures, graphene and bi-layer graphene. In the case of graphene-based systems, it has been anticipated that the dynamics of charged carriers drastically change every time an extra graphene layer is added [1,2]. Therefore, the LL spectrum of N-layer graphene systems would display unique IQHE features eventually characterizing their $N\pi$ Berry's phase [3]. This property particularly applies to trilayer graphene for which 3π Berry's phase would drastically change the sequence of QH plateaus as compared to mono or bi-layer graphene systems. Making use of both Raman spectroscopy and high field magneto-transport, we report for the first time on a fourth type of IQHE in tri-layer graphene. The sequence of QH resistance plateaus is similar to graphene, however the $\nu=2$ QH plateau is missing. The experimental data are supported by a theoretical analysis where both the Bernal and rhombohedral stacking order have been considered. We notice that a nice comparison between theoretical and experimental results is achieved only for the rhombohedral stacking order. At very high magnetic field, the QH resistance tends to vanish as the system is driven close to CNP. We show that the presence of charge puddles is necessary to explain this trend, which is further confirmed by analysing the zero-field temperature and carrier density dependence of the resistance [4].

References

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Figures

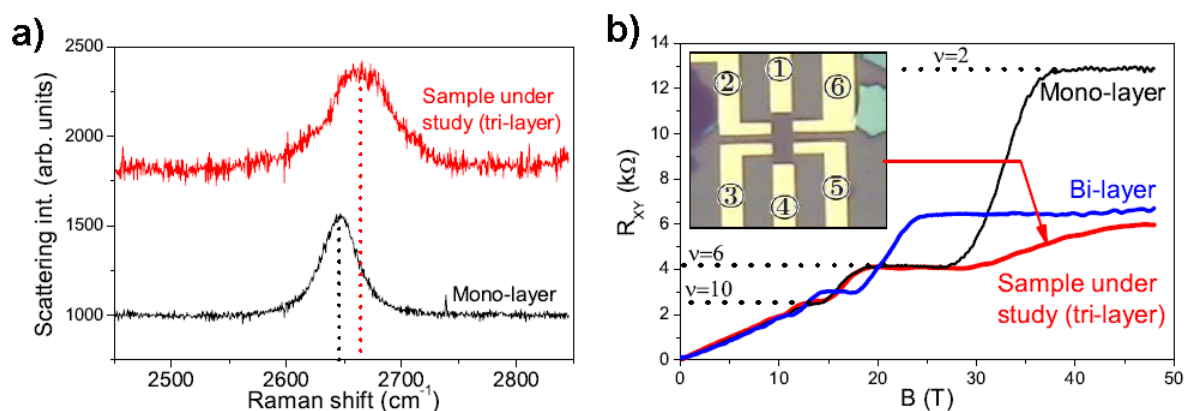


Figure caption: a) Raman spectra of the sample under study (graphene trilayer) and monolayer graphene for comparison. b) High field Quantum Hall resistance for monolayer, bilayer and trilayer graphene. Inset : optical image of the sample under study.