Two-electron multiplets in bilayer graphene quantum dots

Samuel Möller[1]

L. Banszerus[1], A. Knothe[2], C. Steiner[1], E. Icking[1], K. Watanabe[3], T. Taniguchi[4], L. Glazman[5], V. Fal'ko[2], C. Volk[1], C. Stampfer[1]

[1]*RWTH Aachen University, Otto-Blumenthal-Str. 1, 52074 Aachen, Germany*

[2]*National Graphene Institute, University of Manchester, Manchester M13 9PL, United Kingdom*

[3]*International Center for Materials Nanoarchitectonics, NIMS, 1-1 Namiki, Tsukuba 305-0044, Japan*

[4]*Research Center for Functional Materials, NIMS, 1-1 Namiki, Tsukuba 305-0044, Japan*

[5]*Departments of Physics and Applied Physics, Yale University, New Haven, CT 06520, USA*

samuel.moeller@rwth-aachen.de

Graphene quantum dots (QDs) are considered promising candidates for spin and valley-based quantum computing [1]. Here, we report on finite bias spectroscopy measurements of the two-electron spectrum in a gate defined bilayer graphene (BLG) QD for varying magnetic fields. The spin and valley degree of freedom in BLG give rise to a rich magnetic field dependent spectrum. We find that the two-electron states are split into multiplets of 6 orbital symmetric and 10 orbital anti-symmetric states, which are separated by 0.4 – 0.8 meV [2]. The symmetric multiplet exhibits an additional splitting due to lattice scale interactions. With the help of detailed calculations, we are able to determine that inter-valley scattering and 'current-current' interaction constants are of the same magnitude in BLG [3, 4].

References

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[4] Y. Lemonik et. al., Phys. Rev. B **85**, 24545 (2012)

Figures

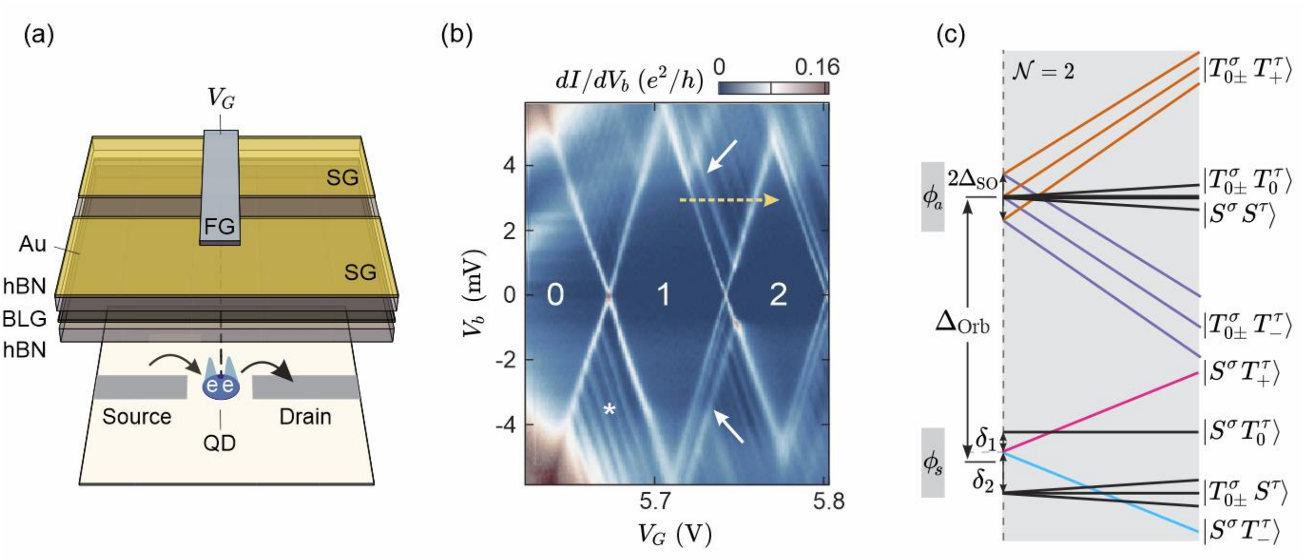

Figure 1: (a) Device schematic illustrating the formation of a QD via soft-confinement. **(b)** Coulomb diamonds for N = 0, 1, 2 electrons in the QD. White arrows highlight excited states. **(c)** Two-particle spectrum in a BLG QD as a function of perpendicular magnetic field.