# Commensurability oscillations in graphene

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At low perpendicular magnetic fields, a periodically modulated 2DEG exhibits 1/B-periodic commensurability oscillations (COs) of the longitudinal magneto-resistance $R_{xx}$, first observed by Weiss et al. [1]. Their minima can be described by the condition $2R_c = (\lambda - {}^1/_4)a$, where $R_c$ is the cyclotron radius, $a$ the superlattice period and $\lambda$ an integer index number.
We report on the first experimental observation of COs in a 1D graphene superlattice, employing a locally acting few-layer graphene patterned bottom gate and a graphene-hexagonal boron nitride heterostructure transferred on top. The interplay of two adjustable gate voltages $V_p$ and $V_g$ of the patterned- and global back gate, respectively, gives rise to a widely tunable potential modulation. The appearance of COs in the unipolar transport regime of this superlattice system suggests that the mean free path exceeds several lattice periods. The CO-minima coincide with the predicted positions for a purely electrostatic, small potential modulation. Moreover, our measurements confirm strong robustness of the COs in graphene with respect to temperature [2].

References

[1] D. Weiss et al., Europhys. Lett, 8 (1989) 179
[2] A. Matulis and F. M. Peeters, Phys. Rev. B, 75 (2007) 125429

Figures

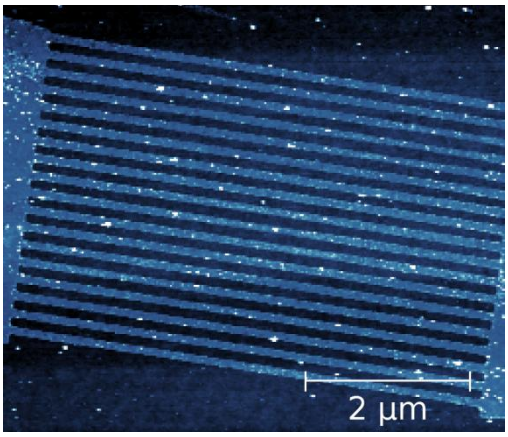


**Figure 1:** AFM-image of the few-layer graphene bottom gate prior to the transfer of the graphene-hBN heterostructure

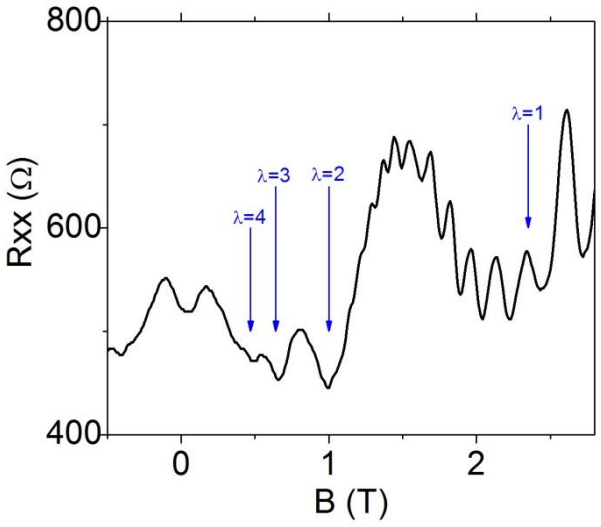


**Figure 2:** Commensurability oscillations in graphene at $V_p$ = 2.1 V and $V_g$ = 25 V. The blue arrows mark the predicted minima for a periodic electrostatical modulation. Above 1T, superimposed Shubnikov-de Haas oscillations start to become visible.