High-field 1/f noise in hBN-encapsulated graphene transistors

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In this talk, I will present our study of the 1/f noise in high-mobility hBN-encapsulated graphene transistors under high bias [1]. Flicker (1/f) noise, albeit ubiquitous in condensed matter devices, still lacks an understanding of its intrinsic origin. Being important for modern quantum technologies [2], this understanding becomes a crucial issue, and graphene appears as a model material in this respect thanks to its high quality and versatility. Previous studies of flicker noise in graphene [3] have concentrated on the low-bias regime, analysed with the conventional Hooge formula [4].
We examine 1/f noise in a large series of high-quality devices over an extended bias range including the non-linear intraband velocity saturation regime as well as the graphene-specific Zener interband regime. Based on extensive transport, low-frequency noise and microwave noise-thermometry analysis, we report on a velocity flicker scaling, and we introduce a phenomenological model in the spirit of the quantum-coherent bremsstrahlung interpretation of flicker noise [5]. Our model introduces a modified Hooge formula that accounts for non-linear regimes, and it supports a light-matter coupling interpretation of electronic flicker noise.

References

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Figures

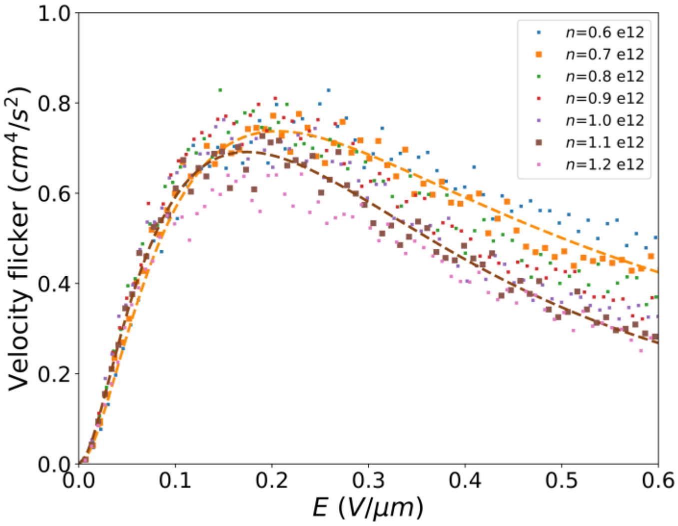

Figure: Velocity flicker noise measured in a high-mobility graphene transistor, as function of bias electric field for different dopings, demonstrating a quasi-scaling. The noise level presents a bell-shape with respect to bias, that is accounted for by a modified Hooge formula (dashed lines) in the non-linear velocity saturation regime.