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Generalized Voigt broadening in graphene-based electromechanical nanosensors

New nanosensors and protocols for molecular detection in aqueous environments at room temperature are highly desirable for their potential application in DNA sequencing and in vivo cell studies. Due to their electromechanical properties, graphene provides a platform for electromechanical sensing under these conditions. We have investigated this idea by analyzing representative models. In particular, we have derived analytic expressions for the current, the electromechanical susceptibility, and signal-to-noise ratio. These expressions reveal the relative importance of thermal fluctuations, strain and geometric properties in the signal and electromechanical response. We find that as a result of the environmental fluctuations, electromechanical structures have an electron transmission function that follows a generalized Voigt profile, in close analogy to the inhomogeneous lineshapes found in spectroscopic and diffraction studies. These results allow us to formulate optimal sensing protocols in terms of detector parameters, and give the underlying mechanics and fundamental operational principles for graphene deectometry.

References

[1] Ochoa M. A., Zwolak M. arXiv:1811.05486 (2018)