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Magnetic moment measurements of gyroscopically stabilized graphene nanoplatelets levitated in an ion trap JOYCE COPPOCK, University of Maryland, College Park, PAVEL NAGORNYKH, University of Texas, Austin, JACOB MURPHY, University of Maryland, College Park, BRUCE KANE, Laboratory for Physical Sciences, College Park, MD and Joint Quantum Institute, University of Maryland, College Park — Measurement of small magnetic effects in 2D materials can be facilitated by decoupling the material from its substrate using particle trapping techniques. We investigate the mechanical and magnetic properties of a rotating micron-scale graphene nanoplatelet levitated in a quadrupole electric field trap in high vacuum. Its motion is observed optically, via the scattering of a low-power laser beam. Illumination by a circularly polarized laser causes the nanoplatelet to rotate at frequencies of 10-40 MHz. Frequency locking to an applied RF electric field stabilizes the nanoplatelet so that its axis of rotation is normal to its surface. We find that residual slow dynamics of the axis orientation are determined by an applied magnetic field. From frequency- and field-dependent measurements, we observe one magnetic moment arising from the rapid rotation of the charged nanoplatelet and one originating from diamagnetism, and we estimate their magnitudes. We determine a gyromagnetic ratio corresponding to the rotational moment and discuss our measurements of diamagnetism in the context of theories of the properties of graphene. Our measurements imply a torque sensitivity of better than 10^{-23} N-m.

Joyce Coppock
University of Maryland, College Park

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