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Development of a quadrupole trap apparatus for UHV measurements of levitated graphene JOYCE COPPOCK, PAVEL NAGORNYKH, IAN MCADAMS, BRUCE KANE, University of Maryland, College Park — Completely decoupling graphene from any substrate opens up new possibilities for measurement of its electrical and mechanical properties as well as the exploration of novel methods of crystal growth and fabrication of 2D materials. We levitate a charged micron-scale few-layer graphene-like flake in an electrical AC quadrupole trap and induce rotation using a circularly polarized laser beam [1]. We aim to achieve an ultra-high vacuum (UHV) environment ($<10^{-9}$ Torr), which will allow us to conduct experiments on graphene lattice stretching (via rotation at frequencies greater than 100 MHz), to perform thermodynamic measurements on the particles as they are heated by the laser, and to avoid chemical contamination of the particles. Measurements of particles in UHV require two technologies: (1) the reliable capture of particles and their introduction into a UHV environment, and (2) a center-of-mass cooling method to prevent particle loss. This talk will focus on the first challenge. We will discuss improvements to the sample preparation and to the trapping procedure, describe a method of transferring particles from the initial capture trap to a second trap in a UHV chamber, and present a model of the trap potential. Finally, we will discuss preliminary work on the deposition of particles onto a conducting substrate after they have been cooled and oriented parallel to the substrate. [1] Kane, B.E. *Phys. Rev. B.*, **82**, 115441 (2010).

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