Ultra-low friction of gold nanocrystals on graphene

Masa Ishigami, Associate Professor, Department of Physics, University of Central Florida

Recent calculations [Guerra et al, Nature Materials, 9 634 (2010)] have predicted that gold nanocrystals slide on graphite with two radically different friction coefficients depending on their speeds. At low speeds (~µm/sec), nanocrystals on graphite are expected to possess higher friction, consistent with previous studies of thermal diffusion of gold on graphite and on graphene. At high sliding speeds in the range of 100 m/sec, nanocrystals are expected to behave radically differently, with a vanishing drag and, therefore, minimal friction. Such high speeds are not easily accessible by atomic force microscopy (AFM), a commonly used to measure nanoscale friction.

My research group has measured friction of gold nanocrystals with diameter ranging from 3 to 5 nm on graphene at speeds up to 35.6 cm/sec. We find the friction at high speeds to be an order of magnitude lower than predicted previously by Guerra et al. I will discuss our measurement technique, the experimental results, the origin of the observed friction (which is even lower than expected!), and possible potential applications of graphene in friction reduction technologies.