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Dynamics of 2D Colloidal Crystals Under Microscopic Shear
COLM KELLEHER, PAUL CHAIKIN, New York University — Since the early 1980's, 2D colloidal crystals have been used as model systems for studying a variety of basic problems in condensed matter physics - for instance, the KTHNY theory of melting, and the "Thomson problem" of finding the ground states of crystals in curved space. However, many non-equilibrium phenomena, such as the response of these crystals to external forces, remain poorly understood. We study systems of 2D colloidal crystals which are formed when charged PMMA microspheres bind to a flat oil-water interface. Using optical tweezers, we apply forces to individual particles, or selected groups of particles, in the crystal lattice. These forces can be precisely controlled in time, space and intensity. We then use video microscopy to study defect formation and dynamics in the crystal. We are particularly interested in the issue of reversibility of dislocation dynamics - as shown recently [Irvine et al. *PNAS* **2013** 110 (39)], simple dislocation-dislocation interactions tend to be reversible, while more complex, many-dislocation interactions tend to be irreversible. This talk will discuss the above topics in the context of an experiment where the crystal was sheared periodically between two parallel rows of optically trapped colloids.

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