Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Cooperative dynamics in ultrasoft 2D crystals JORIS SPRAKEL, Wageningen University, BEREND VAN DER MEER, MARJOLEIN DIJKSTRA, JASPER VAN DER GUCHT, Utrecht University — The creation, annihilation, and diffusion of defects in crystal lattices play an important role during crystal melting and deformation. Although it is well understood how defects form and react when crystals are subjected to external stresses, it remains unclear how crystals cope with internal stresses. We report a study in which we create a highly localized internal stress, by means of optical tweezing, in a crystal formed from micrometer-sized colloidal spheres and directly observe how the solid reacts using microscopy. We find that, even though the excitation is highly localized, a collective dance of colloidal particles results; these collective modes take the form of closed rings or open-ended strings, depending on the sequence of events which nucleate the rearrangements. Surprisingly, we find from Brownian Dynamics simulations that these cooperative dynamics are thermally-activated modes inherent to the crystal, and can even occur through a single, sufficiently large thermal fluctuation, resulting in the irreversible displacement of 100s of particles from their lattice sites.

Joris Sprakel
Wageningen University

Date submitted: 13 Nov 2014 Electronic form version 1.4