Abstract Submitted
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Melting of Temperature-Sensitive 3D Colloidal Crystals AHMED ALSAYED, YILONG HAN, ARJUN YODH, University of Pennsylvania — We employ thermally responsive monodisperse microgel colloidal spheres to study the melting mechanisms of colloidal crystals [1]. The particle diameter decreases with increasing temperature and leads to volume fraction changes that drive phase-transitions. We will describe observations of a variety of phenomena. Premelting, the localized loss of crystalline order near defects (e.g. grain boundaries) at volume fractions above the bulk melting transition, is directly observed by video microscopy, and is characterized by monitoring the first peak position of the particle pair correlation function. We find the position of the first peak shifts toward smaller particle separations at the onset of premelting. After Delaunay triangulation, mean square rotational and translational fluctuations of bonds were measured close to and away from defects. The behavior of all such quantities exhibits increased disorder near the defects. By locally heating the material within a crystal domain, we also studied the superheating and melting of a perfect 3D crystal. Finally, the introduction of weak attractions between spheres reveals free-floating 3D crystal 'blobs' which can be made to melt and recrystallize by tuning the temperature. [1] A. M. Alsayed, M. F. Islam, J. Zhang, P. J. Collings, A. G. Yodh, Science **309**, 1207 (2005). This work was supported by grants from NSF (DMR-0505048 and MRSEC DMR05-20020) and NASA (NAG8-2172).

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