Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Melting Mechanisms of 3D Colloidal Crystals A.M. ALSAYED, M.F. ISLAM, J. ZHANG, A.G. YODH, Department of Physics and Astronomy — We study the melting mechanisms of 3D colloidal crystals using aqueous suspensions of thermally responsive NIPA microgel colloidal particles. Below 32 ^{o}C, the particle radius decreases approximately linearly with increasing temperature. We use this effect to tune the volume fraction of nearly hard-sphere aqueous NIPA colloidal suspensions from 0.74 to 0.54. Using video tracking microscopy, we measured the Lindemann parameter of particles within the crystal as a function of temperature. Interestingly, we find that melting of the 3D colloidal crystals starts at grain boundaries and free surfaces, rather than isolated vacancies or dislocations. Very near the melting temperature, the Lindemann parameter for particles near the grain boundaries and free surfaces was $\sim$0.16; the parameter decreased approximately exponentially with distance into the bulk crystal. These works has been partially supported by NSF through MRSEC DMR-0203378 and DMR-079909 and by NASA grant NAG8- 2172.

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Date submitted: 22 Dec 2004 Electronic form version 1.4