Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Rheology of Soft Colloids Near Rigidity Onset: Critical Scaling, Thermal and Non-thermal Responses[1] YE XU, ANINDITA BASU, TIM STILL, PAULO ARRATIA, University of Pennsylvania, ZEXIN ZHANG, Soochow University, KERSTIN NORDSTROM, University of Pennsylvania, JERRY GOLLUB, Haverford College, DOUGLAS DURIAN, ARJUN YODH, University of Pennsylvania — We study the rheological behavior of colloidal suspensions composed of soft sub-micron-size hydrogel particles across the liquid-solid transition. Specifically, steady-state and frequency-dependent rheometric measurements of three-dimensional mono- and bi-disperse colloidal suspensions are carried out as a function of volume fraction. We found the shear stress versus strain-rate curves exhibit very similar critical scaling features characteristic of jamming transition reported in microfluidic experiments [1] and simulation [2,3]. On the other hand, the observed stresses and shear rates near rigidity onset differ significantly in suspensions with different particle size and stiffness. We understand the difference by normalizing the measured stress and strain-rate data by thermal stress and time scales, as suggested by recent simulation work [2,3]. In this context, the normalized data in our systems reside in a regime wherein thermal effects are important, though suspension rheology across the full range of microgel particle experiments appear to exhibit both thermal and athermal mechanisms. [1] K. N. Nordstrom, et al., Phys. Rev. Lett., 2010. [2] A. Ikeda, et al. Phys. Rev. Lett., 2012. [3] A. Ikeda, et al. Soft Matter, 2013.

[1]This work was supported by the NSF DMR12-05463, DMR-1305199, PENN MRSEC DMR11-20901, NASA NNX08AO0G grants. T. S. thanks DAAD for his postdoctoral fellowship.

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Date submitted: 15 Nov 2013 Electronic form version 1.4