Two-Dimensional Melting of Microgel Colloidal Crystals\textsuperscript{1} YI-LONG HAN, NA YOUNG HA, AHMED ALSAYED, ARJUN YODH, Department of Physics and Astronomy, University of Pennsylvania — We investigate the phase behavior of 2D colloidal crystals composed of NIPA (N-isopropyl acrylamide) microgel spheres whose diameters can be temperature-tuned. The measurement of a variety of densities of defects, order parameters and correlation functions (static and dynamic) are reported and are in agreement with KTHNY theory at least some of the time. In contrast to previous experiments we use the divergence of translational and rotational susceptibilities (i.e. fluctuations of the corresponding order parameters) to determine the phase transition points. This approach avoids some ambiguities inherent in the other analyses and clearly resolves the intermediate hexatic phase between the solid and liquid phases. Our measurements uncover a novel premelting stage in solid and suggest that traditional analysis methods can incorrectly associate the premelting stage with the hexatic phase. In separate measurements of the melting of two-layer square lattices, we also observed a 'middle' phase.

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