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Homogeneous Melting of 3D Superheated Colloidal Crystals[1] ZIREN WANG, FENG WANG, YI PENG, YILONG HAN, Department of Physics, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, SOFT MATTER & VIDEO MICROSCOPY LAB TEAM — We locally superheated the interior of thermal-sensitive microgel colloidal crystals and measured the homogenous melting by video microscopy. The nucleation was typically started from a local strong-vibrating region instead of precursor defects. We found that the nucleation time $t \sim (\phi - \phi_m)^{-2}$ and critical nucleus size $r^* \sim (\phi - \phi_m)^{-1}$ as predicted by the classical nucleation theory, while the observed non-spherical critical nuclei and the merging of subcritical nuclei are beyond the classical nucleation theory. At the superheated limit where the incubation time vanishes, the Lindemann parameter approaches 0.18 which just equals to that at the liquid-solid interface. Beyond the superheated limit, the melting becomes like a spinodal decomposition rather than a nucleation process.

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