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Colloidal Gas-Liquid Condensation induced by the Critical Casimir Effect DUC NGUYEN, SUZANNE FABER, GERARD H. WEGDAM, PETER SCHALL, University of Amsterdam — We explore a new temperature control over colloidal phase formation by using the Critical Casimir effect. This effect allows direct control over particle interactions via temperature-dependent solvent fluctuations: In analogy to the confinement of fluctuations of the electromagnetic field between two dielectrics (quantum mechanical Casimir effect), the confinement of fluctuations of a critical solvent leads to an attraction between surfaces that are immersed in this solvent. This allows exquisite temperature control over the interactions of colloidal particles that are suspended in this critical solvent. We show that this temperature control allows us to "freeze" a dilute colloidal gas into a dense colloidal liquid, and a crystalline solid. By using confocal microscopy, we follow these phase transitions directly in real space, and we measure the particle pair potential. We show that we can quantitatively account for the gas-liquid condensation by using Van der Waals theory. We study the growth of colloidal liquid droplets by following the mean droplet radius <R> with dynamic light scattering. We find <R> $\sim$ t1/2 and <R> $\sim$ t1/3 indicating that the droplets form by nucleation, followed by diffusion limited growth.

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