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Colloidal gas-liquid transition: tuning nucleation and growth by Critical Casimir forces DUC NGUYEN, PhD, PETER SCHALL, Dr — The nucleation and growth of the liquid phase has been well studied in simulations, but direct experimental observations remain challenging. Here we present a detailed study of the colloidal gas-liquid transition induced by Critical Casimir forces that allow direct control over particle interactions via temperature-dependent solvent fluctuations. We show that with the direct control over particle interactions we can "freeze" a dilute colloidal gas into a dense colloidal liquid. By using dynamic light scattering to follow the evolution of liquid aggregates we observe three clearly distinct regimes: nucleation, interface limited- and diffusion limited growth. We elucidate these regimes directly in real space by using confocal microscopy. In the nucleation regime, we determine the Gibbs free energy, interfacial tension and chemical potential of the liquid aggregates directly from their size distribution. In the growth regime, we can directly follow the attachment of particles, and the collapse of liquid aggregates to large drops. Our critical Casimir colloidal system allows us to control all stages of nucleation and growth with temperature, thereby providing unprecedented insight into this gas-liquid transition.

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