Testing conformal invariance in near-critical colloidal suspensions

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Abstract

Both the critical Casimir interaction between two colloids immersed in a critical medium as well as the according interaction between two plates confining such a fluctuating medium are governed by the scaling functions known from conformal field theory. They are two special cases of a vast variety of possible geometries which are all connected via conformal mappings. However, near criticality conformal invariance no longer holds true and the geometry of the system has an effect on the form of the according scaling functions. Assuming that the geometric scaling variable from conformal field theory is nevertheless sufficient in the scaling regime of a near-critical system, we use the exact critical Casimir interaction scaling function of the Ising universality class in cylinder geometry with variable aspect ratio and open boundaries to expand the predictions to colloidal suspensions. Therefore we discuss which length scale is suitable for the temperature scaling variable and compare our results with Monte Carlo studies of two-dimensional systems of colloidal particles with according boundary conditions.

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