Critical Casimir forces in many-body systems

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We use mean field calculations to study the scaling functions associated to the critical Casimir forces for a system consisting of two spherical colloids immersed in a binary liquid mixture near its consolute point and facing a homogeneous substrate. We first focus on the normal and lateral critical Casimir forces acting on one of the colloids, for several geometrical arrangements and boundary conditions, from which we find interesting features such as a change of sign when varying either the position of one of the colloids or the temperature. By subtracting the pairwise forces from the total forces we are able to calculate the many-body forces acting on one of the colloids. We have found that the many-body contribution to the total critical Casimir force is more pronounced for smaller colloid-colloid and colloid-substrate distances, as well as for temperatures close to a critical value, where the many-body contribution to the total forces can reach up to 25%.