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Critical point particle number fluctuations from molecular dynamics

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We study fluctuations of particle number in the presence of a critical point by utilizing molecular dynamics simulations of the classical Lennard-Jones fluid in a periodic box. The numerical solution of the N-body problem naturally incorporates all correlations, exact conservation laws, and finite size effects, allowing us to study the fluctuation signatures of the critical point in a dynamical setup. We find that large fluctuations associated with the critical point are observed when measurements are performed in coordinate subspace, but, in the absence of collective flow and expansion, are essentially washed out when momentum cuts are imposed instead. We also analyze phase separation and fluctuations in the coexistence region of the first-order phase transition.

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