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van der Waals droplets balancing between liquid and vapor

Dynamics of heated droplets of particles interacting with Lennard-Jones potential are simulated by employing the classical molecular dynamics (CMD). Such large aggregates represent an example a finite system exhibiting the van der Waals equation of state in thermodynamic limit which properly characterizes the existence of spinodal region relevant for liquid-gas phase transition. We analyze an exact evolution of microcanonical ensemble of such droplets with statistically distributed deposited energy corresponding to a temperature T. At small T the system displays liquid like behavior when droplets cool down by evaporation. While particles evaporate the expansion momentum on the droplet surface decreases. It gives rise to a loop like trajectory in (density, temperature) plane. The system never enters inside the instability region. At high excitation energy the droplets enter the instability region from the gas phase. The temperature never increases and no loop behavior shows up. At transitional temperatures the van der Waals droplets experience critical evolution resembling the second order liquid-gas phase transition. Such criticality occurs at a mixture of liquid- and gas-like events and leaves the signatures in properties multifragmentation. We analyze features of such critical events in statistics, correlations and fluctuations of fragment mass distribution. Possible effects of droplet magnetization are discussed.

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