LARGE DEVIATIONS FOR CLUSTER SIZE DISTRIBUTIONS IN A CLASSICAL MANY-BODY SYSTEM

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We study a classical many-body system with pair-interaction given by a stable Lennard–Jones potential. This interaction has an attractive term, which induces the formation of clusters of the particles. For fixed inverse temperature $\beta \in (0, \infty)$ and fixed particle density $\rho \in (0, \infty)$, we derive a large-deviation principle for the distribution of the cluster sizes in the thermodynamic limit. Afterwards, we show that the rate function Γ-converges, in the low-temperature dilute limit $\beta \to \infty$ and $\rho \downarrow 0$ such that $-\beta^{-1} \log \rho \to \nu \in (0, \infty)$, towards some explicit rate function. This function has precisely one minimising cluster size configuration, which implies a law of large numbers for the cluster sizes in this decoupled limit. This is joint work with S. Jansen and B. Metzger. The limiting rate function appeared in earlier work with A. Collevecchio, P. Mörters and N. Sidorova, when the two limits (the thermodynamic and low-temperature dilute limit) were coupled with each other.