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Global thermodynamics and linear response theory for liquid-gas transitions under heat conduction

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We propose global thermodynamics for heat conduction states in contact with two heat baths in the linear response regime. To characterize the heat conduction states, we introduce a global temperature from the spatial average of the kinetic energy density. Accordingly, for all thermodynamic quantities, we define global thermodynamic variables satisfying thermodynamic relations. Next, we discuss the liquid-gas coexistence state under constant pressure. As the result of the global thermodynamics, the position of the liquid-gas interface is predicted by a variational principle. It is found that a supercooled gas is observed near the interface as a stable steady state. We also discuss the liquid-gas coexistence on the basis of the linear response theory.

This work was collaborated with Shin-ichi Sasa.

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