Droplet Motion Driven by Liquid-vapor Transition at Three-phase Contact Line

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Recently, the dynamic van der Waals theory (DvdWT) has been presented for the study of hydrodynamics in one-component fluids with liquid-vapor transition in inhomogeneous temperature fields. We first derive the hydrodynamic boundary conditions at the fluid-solid interface for the DvdWT using conservation laws and the positive definiteness of entropy production together with the Onsager reciprocal symmetry. We then employ the DvdWT to study the droplet motion driven by thermal gradients on solid substrates. The effect of thermal singularity at the liquid-vapor-solid three phase contact line is investigated. The droplet motion predicted by the continuum hydrodynamic model is also observed and semi-quantitatively verified by performing molecular dynamics simulations for confined one-component two-phase fluids.