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Exact Results for the Behavior of the Thermodynamic Casimir Force in a Model of Film System with a Strong Surface Adsorption

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Abstract. When masless excitations are limited or modified by the presence of material bodies one observes a force acing between them generally called Casimir force. Such excitations are present in any fluid system close to its true bulk critical point.

We derive exact analytical results for both the temperature and external ordering field behavior of the thermodynamic Casimir force within the mean-field Ginzburg-Landau Ising type model of a simple fluid or binary liquid mixture. We investigate the case when under a film geometry the boundaries of the system exhibit strong adsorption onto one of the phases (components) of the system. We present analytical and numerical results for the (temperature-field) surface of the force in both the critical region of the film close to its finite-size or bulk critical points as well as in the capillary condensation regime below the finite-size critical point.