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Aspect-ratio dependence of thermodynamic Casimir forces ALFRED HUCHT, DANIEL GRUENEBERG, FELIX M. SCHMIDT, Fakultaet fuer Physik, Universitaet Duisburg-Essen, 47058 Duisburg, Germany — We consider the three-dimensional Ising model in a $L_\perp \times L_\parallel \times L_\parallel$ cuboid geometry with finite aspect ratio $\rho = L_\perp/L_\parallel$ and periodic boundary conditions along all directions. For this model the finite-size scaling functions of the excess free energy and thermodynamic Casimir force are evaluated numerically by means of Monte Carlo simulations [1]. The Monte Carlo results compare well with recent field theoretical results for the Ising universality class at temperatures above and slightly below the bulk critical temperature T_c. Furthermore, the excess free energy and Casimir force scaling functions of the two-dimensional Ising model are calculated exactly for arbitrary ρ and compared to the three-dimensional case. We give a general argument that the Casimir force vanishes at the critical point for $\rho = 1$ and becomes repulsive in periodic systems for $\rho > 1$.

[1] Alfred Hucht, Daniel Grüneberg, and Felix M. Schmidt, Phys. Rev. E 83, 051101 (2011)

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