Casimir interactions in Ising strips with boundary fields: exact results

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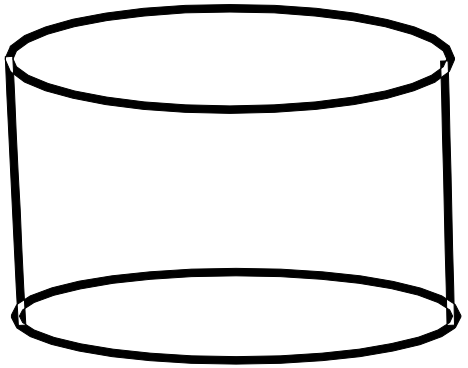
Fisher and de Gennes $$\frac{F_{\text{Casimir}}}{k_B T_C} = \frac{1}{L^d}\vartheta\left(L/\xi\right)$$



Privman and Fisher $$N\mathcal{F}_{Cas}(x) \to -\frac{x}{e^x + 1}.$$

Evans and Stecki $$f^X = -\frac{k_B T}{4\pi}\int_{-\pi}^{\pi}\frac{d\omega\, y(\omega)}{g(\omega)e^{2Ny(\omega)}+1}$$

$$F_{cas} = -\frac{k_B T}{\pi} \int_0^{\pi} du \ln \left[1 + \exp\left(-M\hat{\gamma}(u) \right) \right]$$

$$f_{cas}(cyl.) = -\frac{k_B T}{4\pi} \int_{-\pi}^{\pi} du \, \hat{\gamma}(u) \left[1 - \tanh\left(M\hat{\gamma}(u)/2 \right) \right]$$

$$M^2 \bar{f}_{cas}(cyl.) \ \rightarrow \ -\frac{k_B T}{\pi} \int_{-\infty}^{\infty} dy (x^2 + y^2)^{1/2} \left[1 - \tanh\left((x^2 + y^2)^{1/2} \right) \right]$$

$$F^a_{cas}(cyl.) = -\frac{k_B T}{\pi} \int_0^{\pi} du \, \ln\left[1 - \exp\left(-M\hat{\gamma}(u)\right)\right]$$

$$M^2 \bar{f}^a_{cas}(cyl.) \rightarrow \frac{k_B T}{\pi} \int_{\infty}^{\infty} dy \, (x^2 + y^2)^{1/2} \left[\coth\left((x^2 + y^2)^{1/2}\right) - 1\right]$$

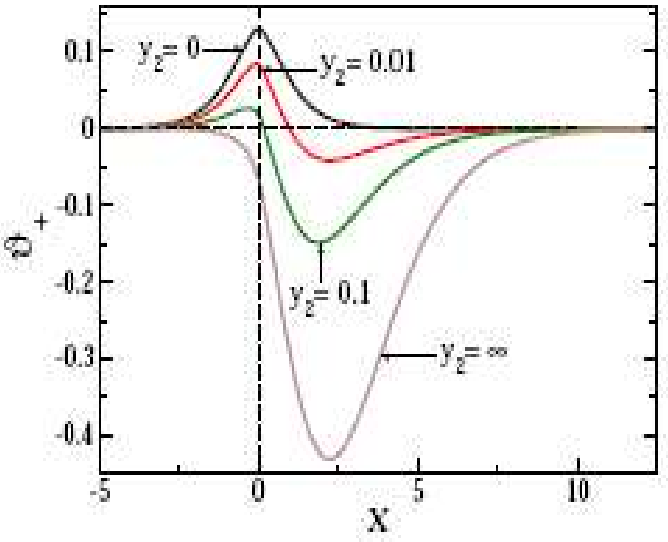


FIG. 1: (color online) The scaling function $\vartheta_+(x, y_1, y_2)$ of the critical Casimir force (7) for the isotropic lattice with $K_1 = K_2$, $y_1 = h_1^2 N = \infty$ and for the several values of $y_2 = h_2^2 N$.

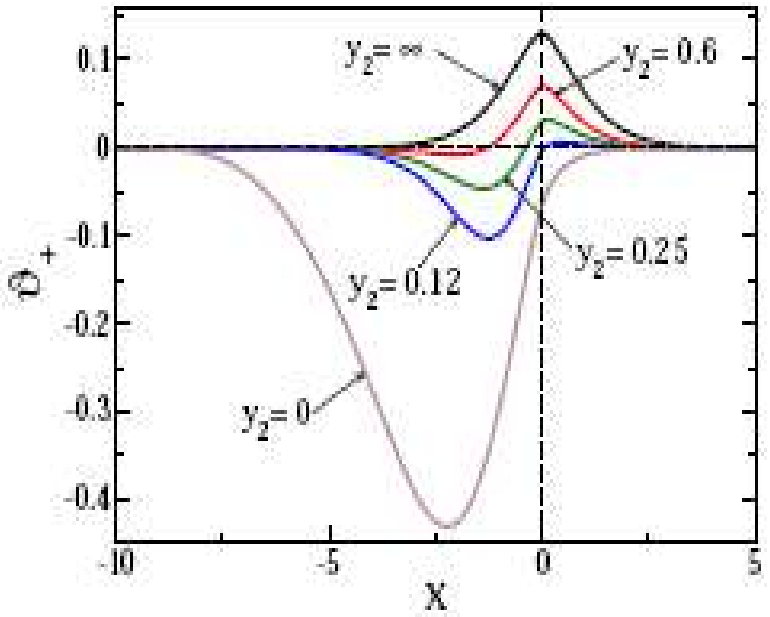


FIG. 2: (color online) The scaling function $\vartheta_+(x, y_1, y_2)$ of the critical Casimir force (7) for the isotropic lattice with $K_1 = K_2$ $y_1 = h_1^2 N = 0$ and for the several values of $y_2 = h_2^2 N$.

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arXiv:0912.0104v1

Boundary conditions and the critical Casimir force on an Ising model film: exact results in one and two dimensions
J. Rudnick, R. Zandi, A. Shackell, and D.B. Abraham
arXiv:1001.0994v1