Small system corrections on SPM

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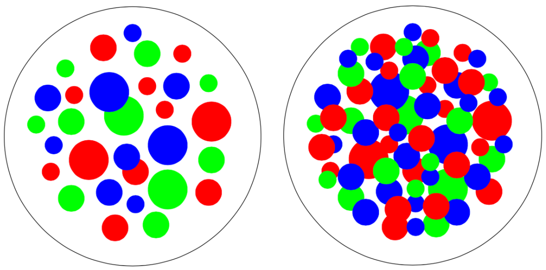
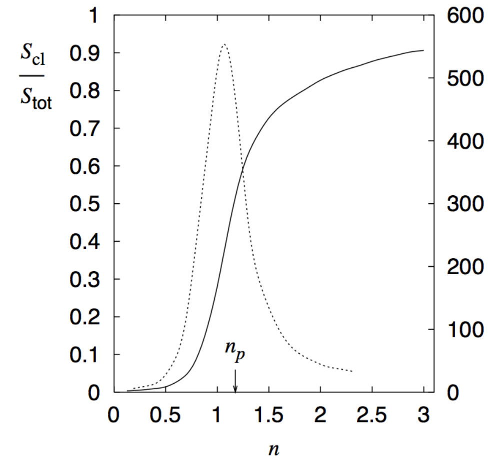
$$\eta = \frac{r_0^2 N}{ab}. \qquad \varepsilon = \sqrt{1 - \frac{b^2}{a^2}}$$





$$a^2 = \frac{r_0^2 N}{\eta\sqrt{1-\varepsilon^2}}; \qquad b^2 = \frac{r_0^2 N\sqrt{1-\varepsilon^2}}{\eta}.$$

Once determined a and b, we take a random point (x, y) distributed in the rectangle $[-(a - r_0), a - r_0] \times [-(b - r_0), b - r_0]$ according with a density profile. This point is the center of the string and it is included in the string population if satisfies the following condition

$$\frac{x^2}{(a - r_0)^2} + \frac{y^2}{(b - r_0)^2} \leq 1.$$

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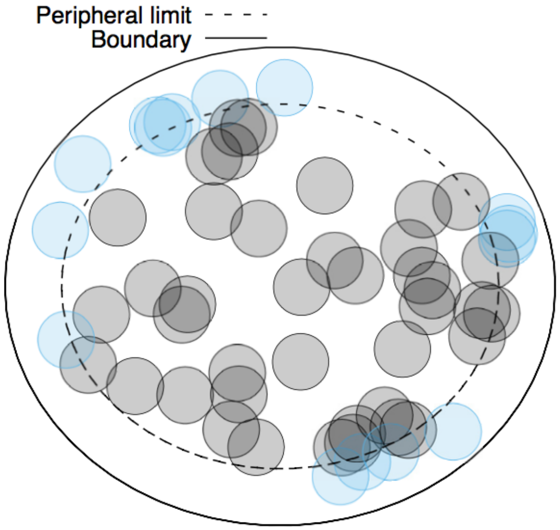
The constrictions will only consider strings completely embedded in the elliptical region. In this way, we can generate all N strings needed to build the percolating system. Note that with this construction, in the limit $\varepsilon = 0$, we recover the particular case for a SPM bounded by circles

The solid line is the elliptic boundary of the system and the dashed line represents the internal peripheral limit needed to define a spanning cluster. Blue circles are the peripheral strings satisfying the relation

$$\frac{x^2}{(a-2r_0)^2} + \frac{y^2}{(b-2r_0)^2} > 1.$$



In this way, we assure that there is a spanning cluster in the string system if the largest cluster has more than one peripheral string and the largest distance between the peripheral strings is greater than $2(b - 2r_0)$. This ensure that the spanning cluster at least cross-over the system through the minor semi-axes.

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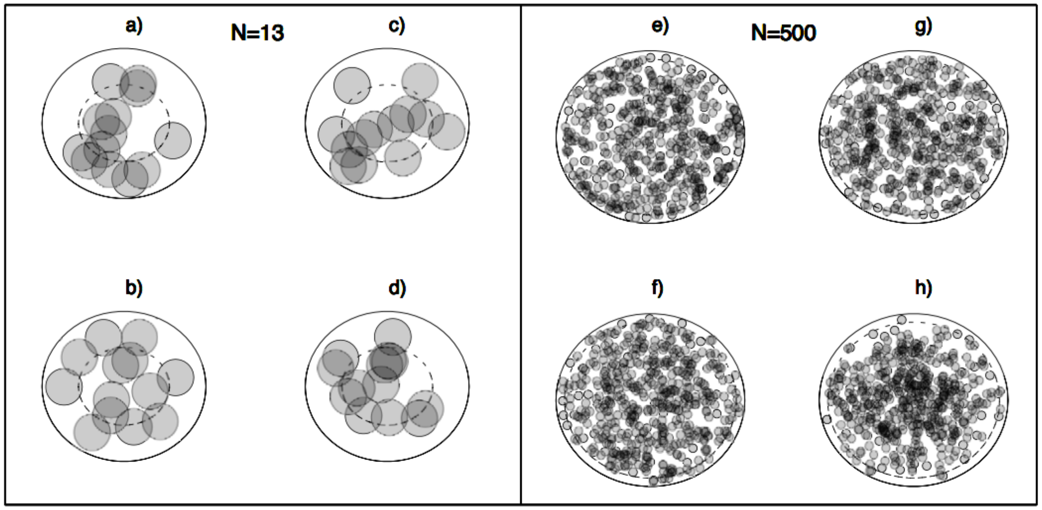
Density Profiles

$$f(x,y) = \frac{1}{2\pi\sigma_a\sigma_b}\exp\left[-\frac{1}{2}\left(\frac{x^2}{\sigma_a^2}+\frac{y^2}{\sigma_b^2}\right)\right];$$

σ_a and σ_b are standard deviations over the semi-axis of the ellipse

$$\sigma_a = (a-r_0), \qquad \sigma_b = (b-r_0);$$
$$\sigma_a = (a-r_0)/2^{1/2}, \quad \sigma_b = (b-r_0)/2^{1/2};$$
$$\sigma_a = (a-r_0)/2, \qquad \sigma_b = (b-r_0)/2.$$

1s, $2^{1/2}$s y 2s



Samples of a percolating system for different density profiles. Left box: String systems at $N = 13$, $\eta = 0.7$ and $\varepsilon = 0.4$, for the models a) Uniform, b) $1s$, c) $2^{1/2}s$ and d) $2s$; Right box: String systems at $N = 500$, $\eta = 1.1$ and $\varepsilon = 0.4$, for the models e) Uniform, f) $1s$, g) $2^{1/2}s$ and h) $2s$.

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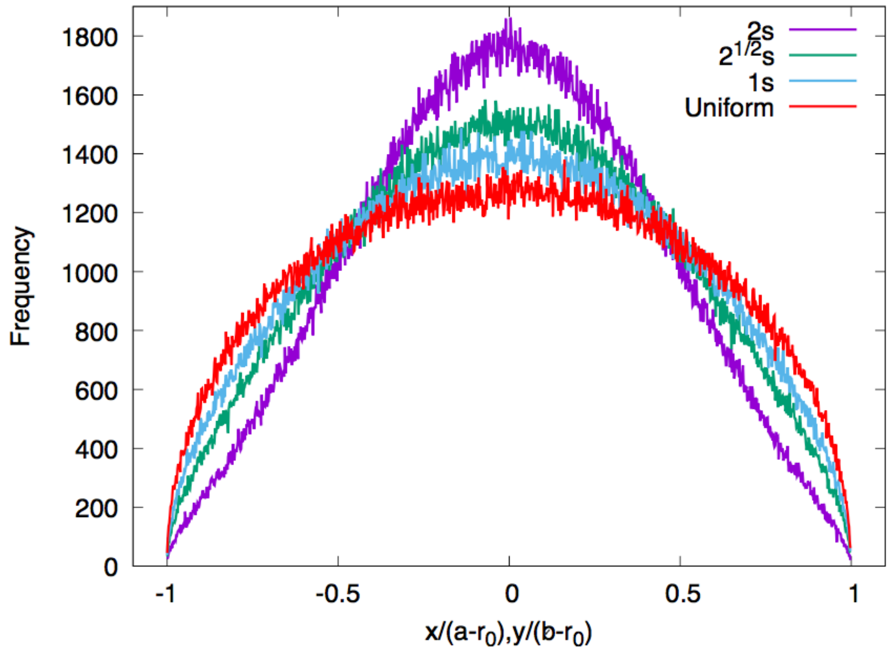

Projection of the disc position distribution over the axis of the ellipse for the profile functions. The histograms were built with a 10^6 generated positions for lel. The distributions are normalized to the semi-axis value to eliminate the ce on the number of discs N, ε and η.

Among profiles there is not much differences but we expect to have larger differences as we increase the number of strings. As the number of peripheral discs decrease the percolation threshold becomes higher

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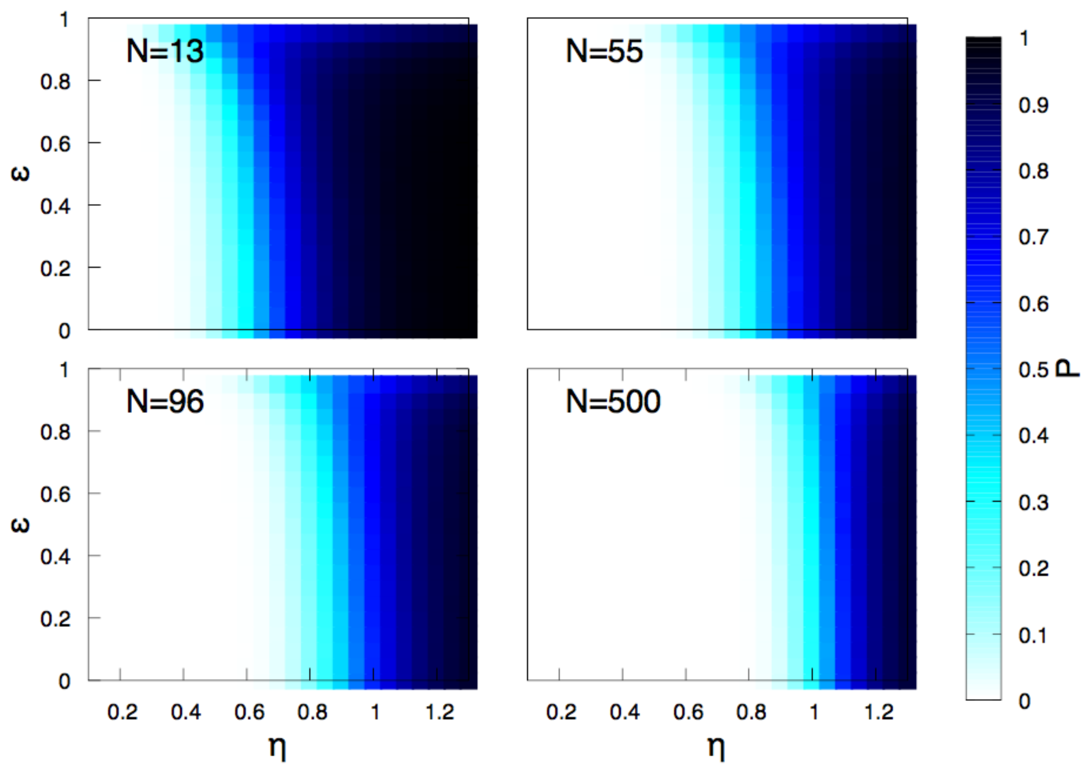
The percolation threshold appears when the derivative ∂P/∂η takes its maximum value



The percolation probability shows an evident shift as a function of N and high eccentricity dependence associated with a finite size effect.

·e 4: Percolation probability P as a function of filling factor η and eccentricity ε for different values of a number of strings N with Uniform density profile.

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For largest values of N, the percolation probability becomes independent of the eccentricity and the phase transition appears around the percolation threshold for the continuum percolation in the thermodynamic limit.

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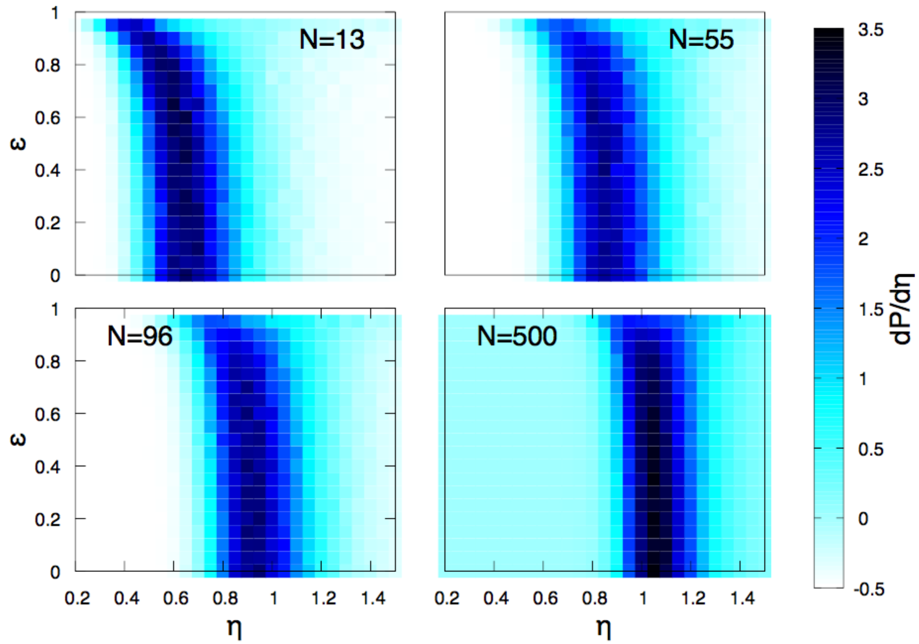

: A derivative of the percolation probability with respect to filling factor η in the Uniform model.

$$P(\eta) = \frac{1}{1 + \exp\left(-\sum_{k=0}^{4} a_k \eta^k\right)}$$

the fraction of occupied/connected sites belonging to the spanning cluster

To obtain the value of η_c, the equation $P(\eta_c) = 0.5$ has to be solved. However, for N = 500 and the model with Gaussian density profiles, we use

$$P(\eta) = \frac{1}{2}\left[1 + \tanh\left(\frac{\eta - \eta_c}{\Delta L}\right)\right]$$

where η_c is the percolation threshold and ΔL is the width of the percolation transition. In Fig. 7, we show the best fit obtained for the percolation probability as a function of filling factor for different values of η and N in string percolating systems with Uniform density profile

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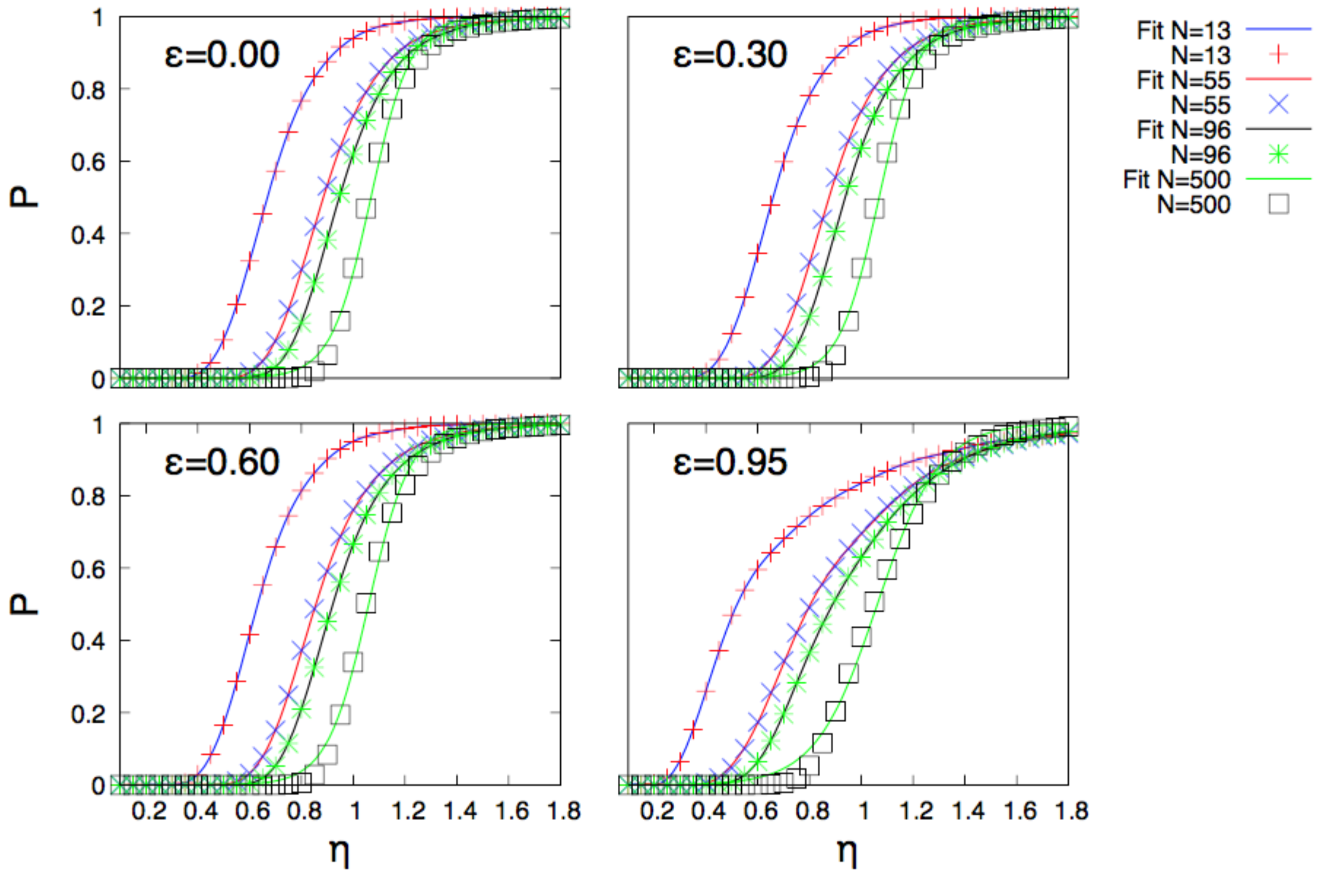

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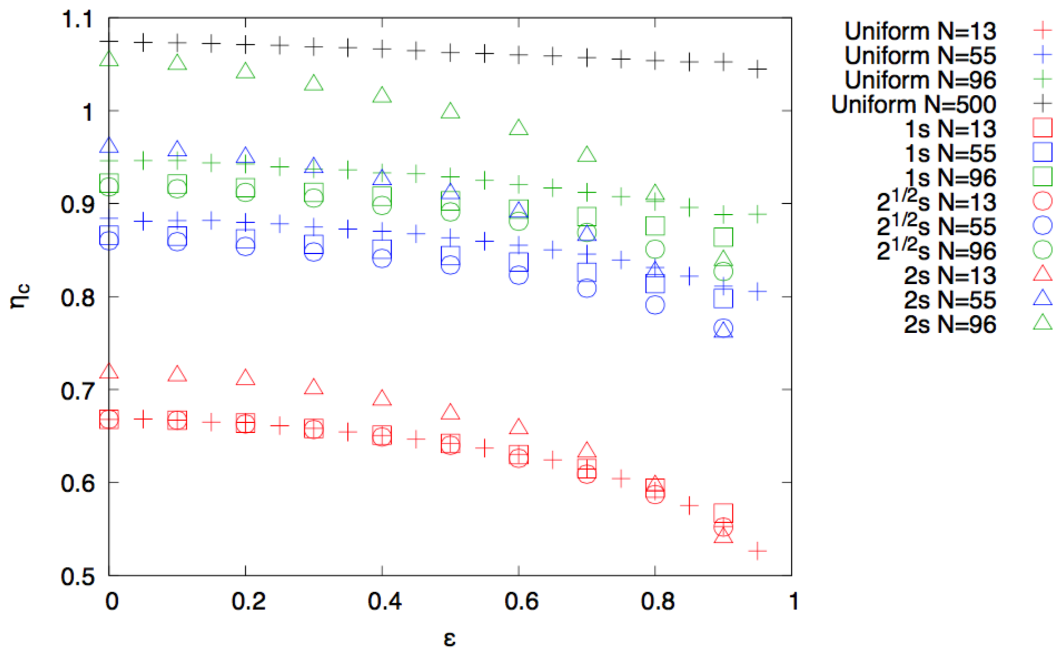

Percolation threshold η_c as a function of eccentricity (ε) for different values of N with the different density profiles: Uniform (crosses), and Gaussian: $1s$ (squares), $2^{1/2}s$ (circles) and $2s$ (triangles).

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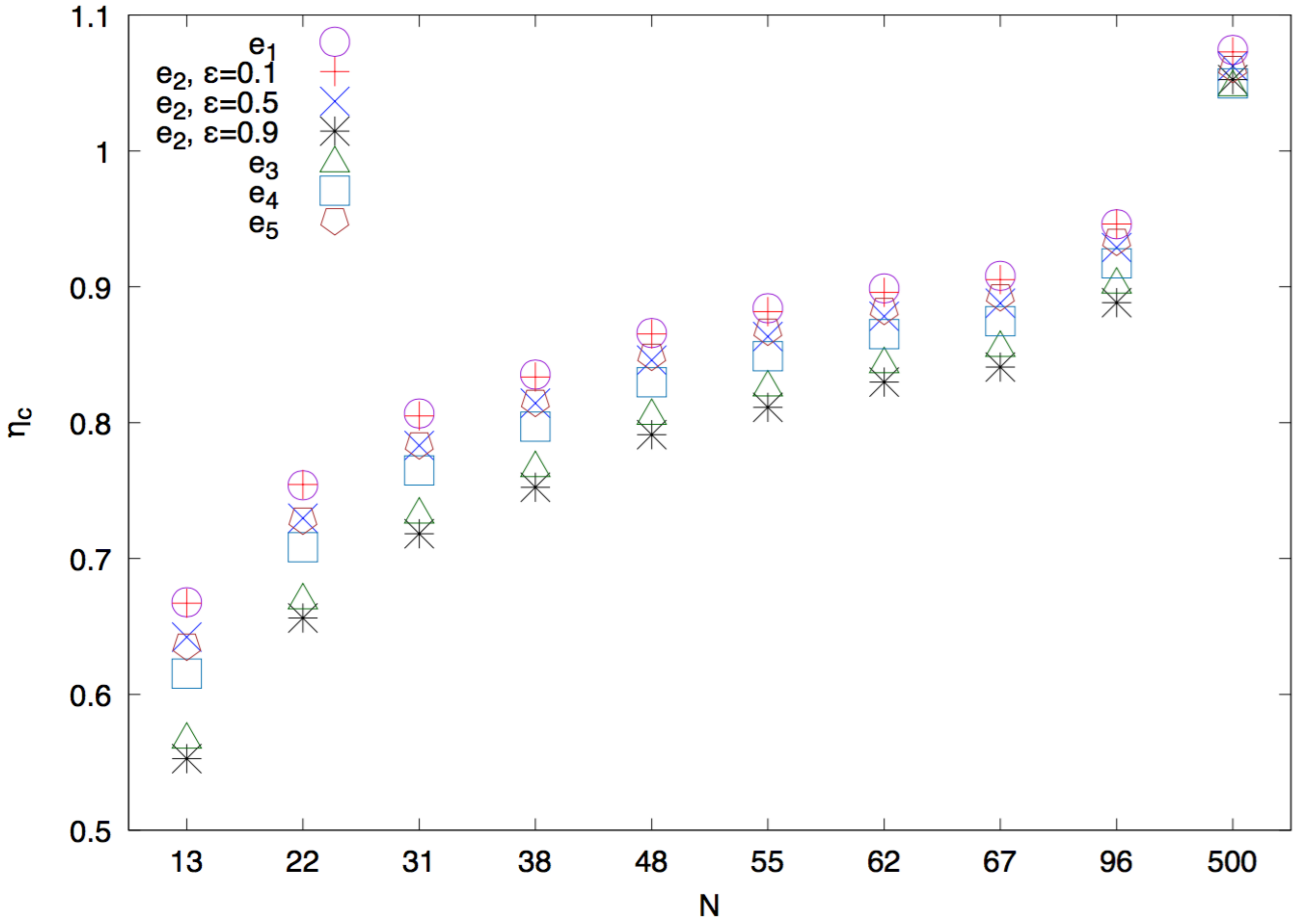

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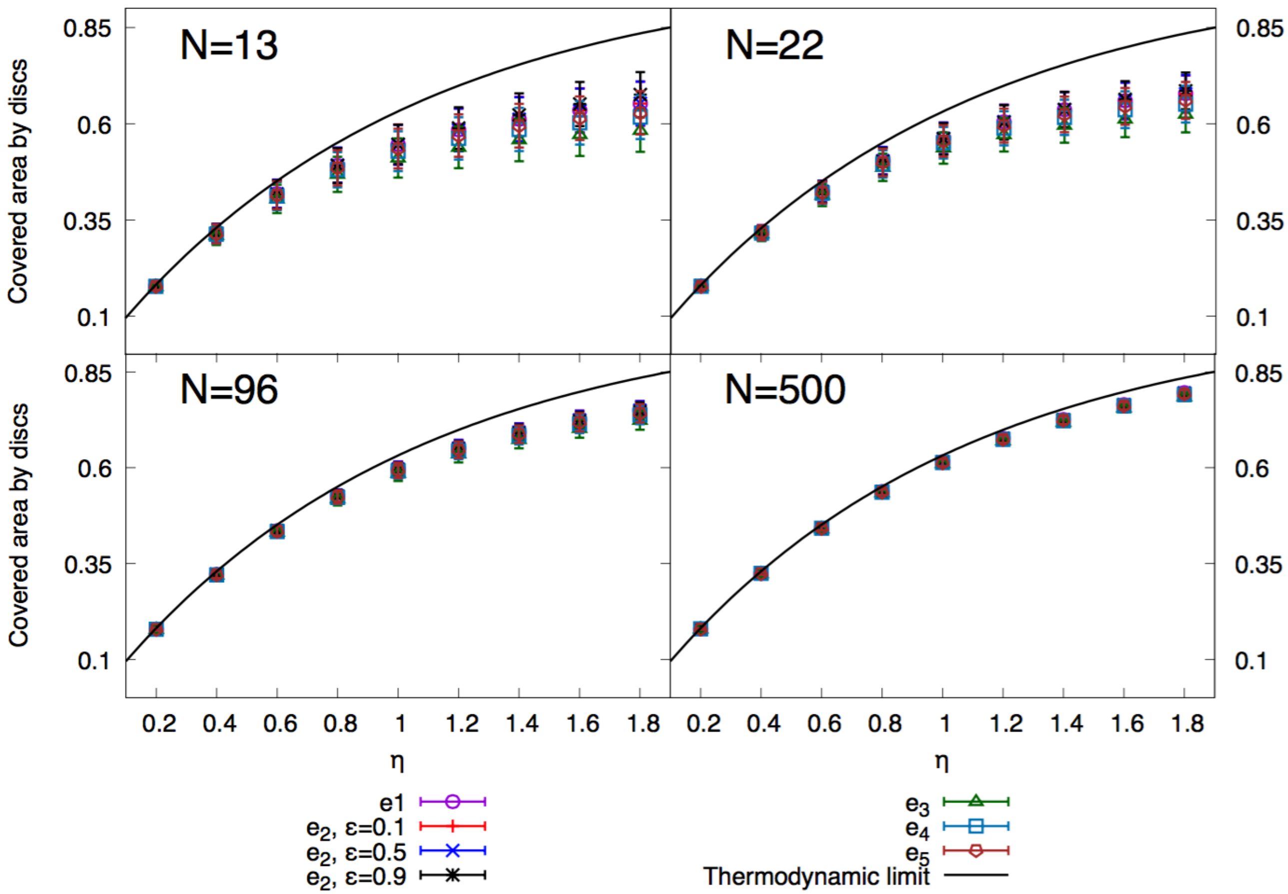

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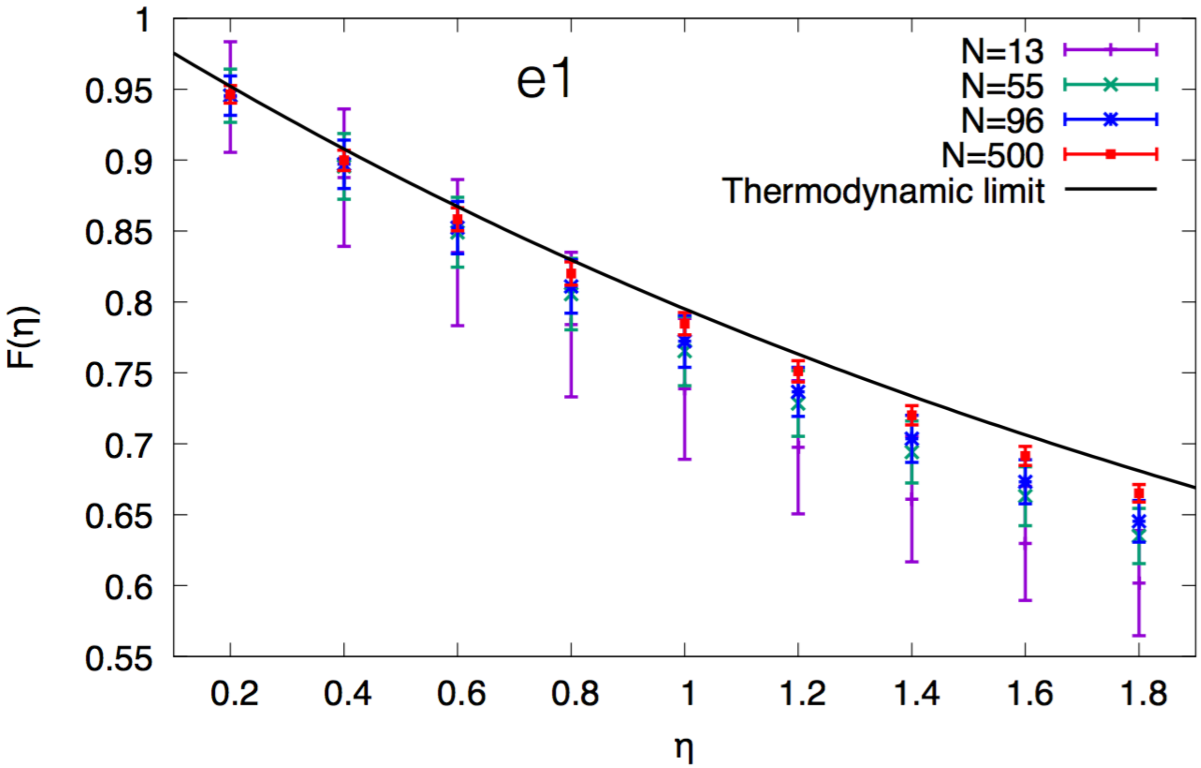
$$\frac{\eta}{1-\exp(-\eta)} \equiv \frac{1}{F^2(\eta)} \longrightarrow \mu = N_S F(\eta)\mu_1 \ ; \ \langle p_{\rm T}^2\rangle = \langle p_{\rm T}^2\rangle_1 / F(\eta)$$



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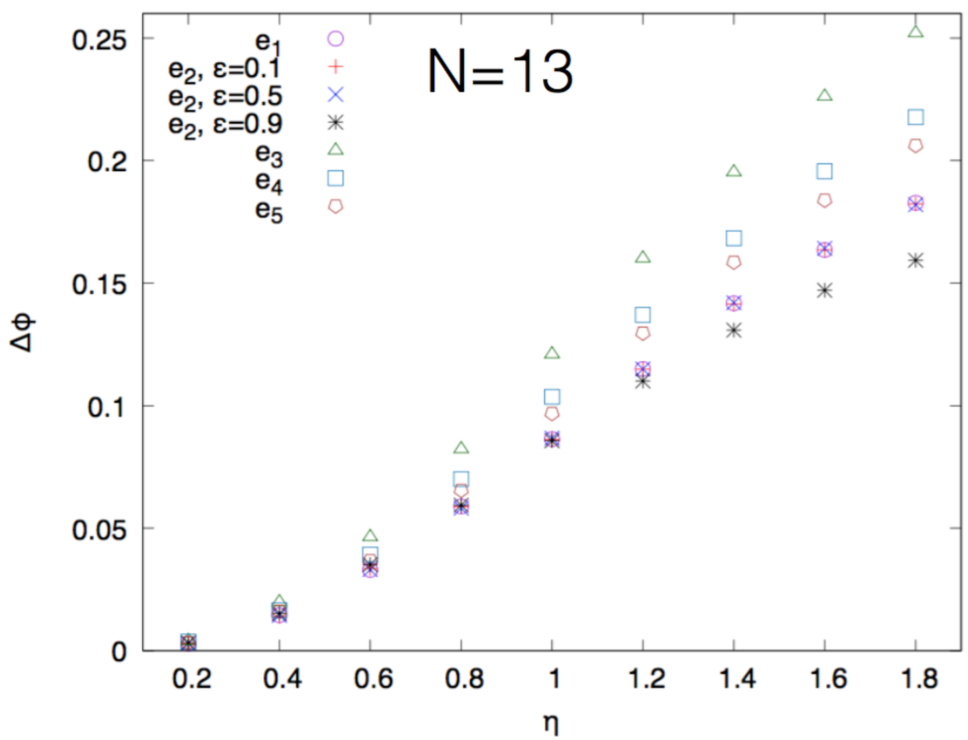
$$\Delta\phi = \phi - \phi_{Num}$$



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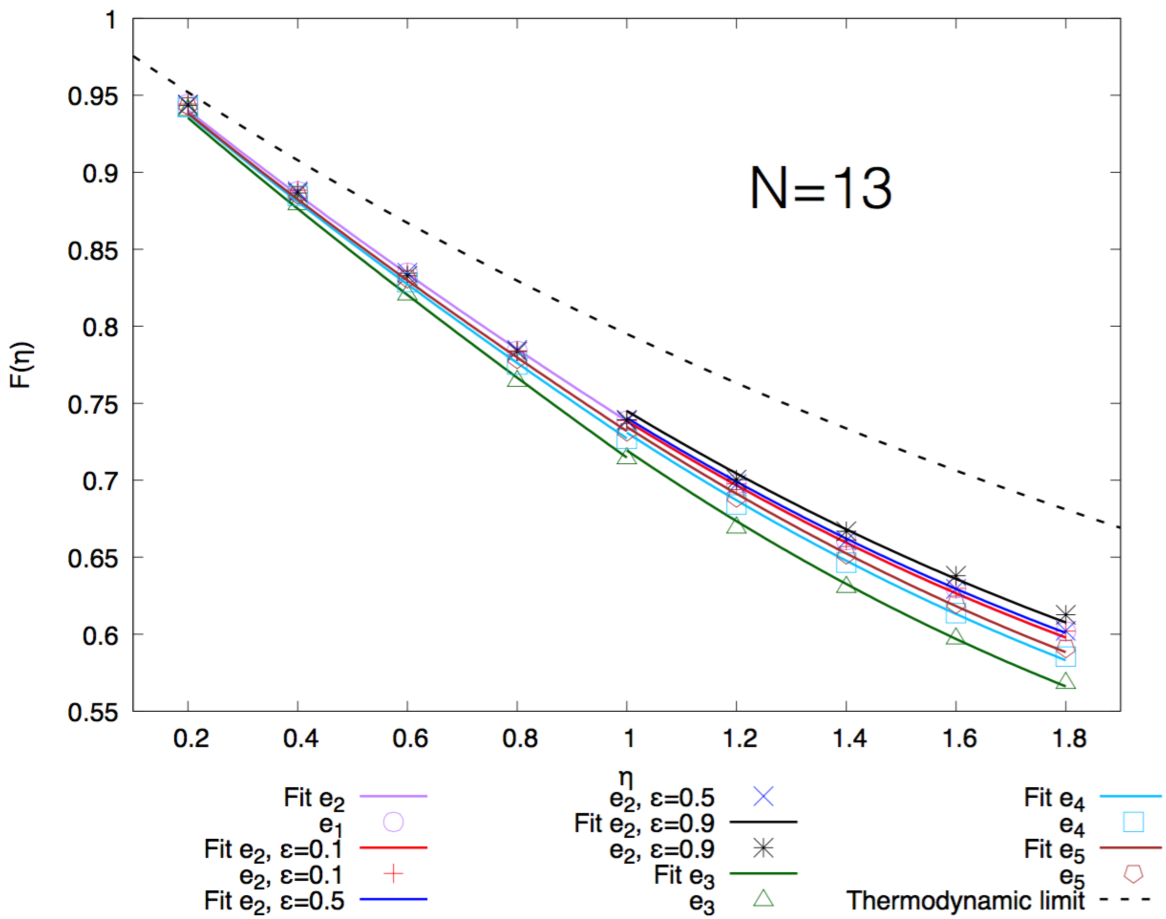

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$$F_{Num} = \left(1 - \frac{\Delta\phi}{\phi}\right)^{1/2} F$$

The geometric scaling function

$$F_{Num} = \sqrt{\phi_{Num}/\eta}$$

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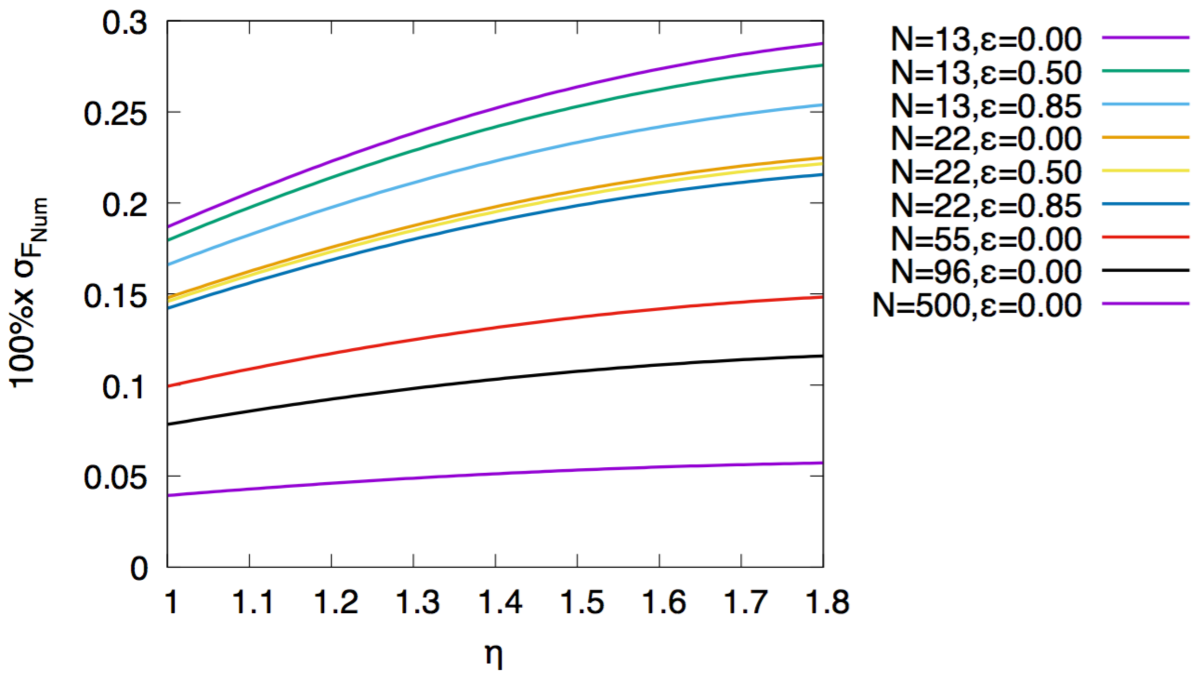
$$\sigma_{F_{Num}} \approx 0.015 F \frac{\Delta\phi}{\phi}\left(1+\frac{\Delta\phi}{\phi}\right)$$



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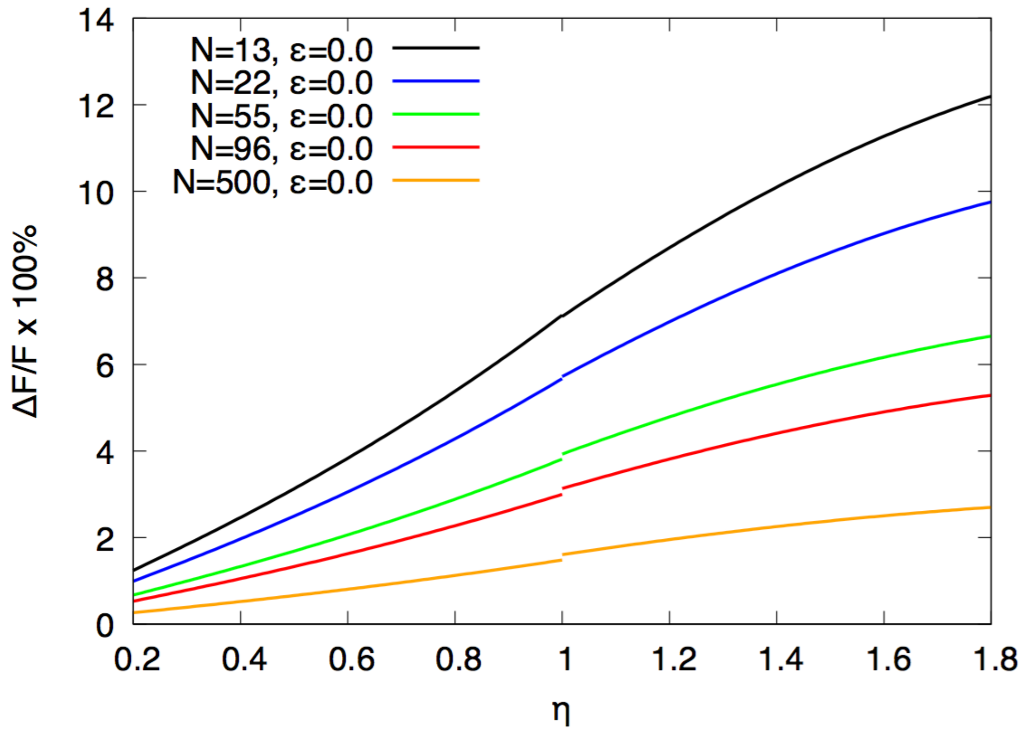
$$\Delta F = F - F_{Num}$$



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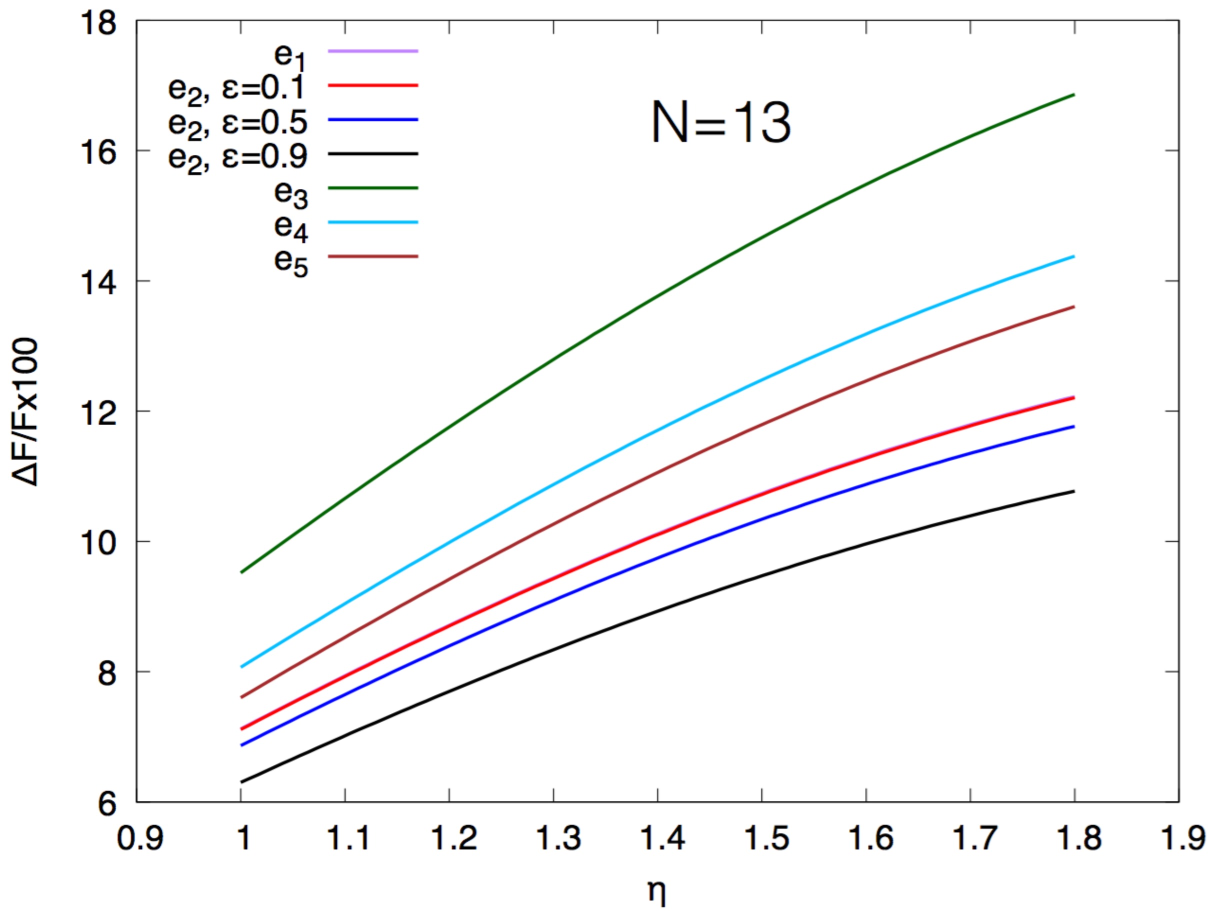

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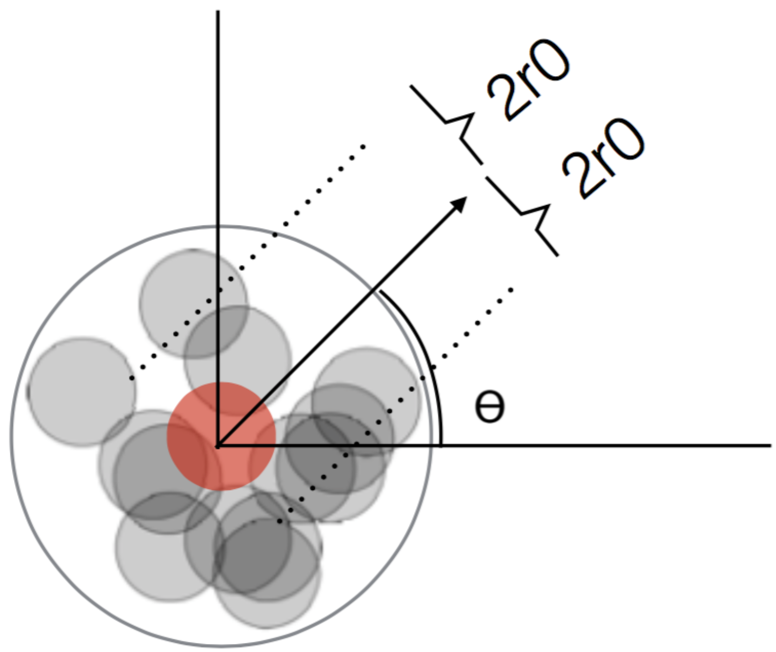

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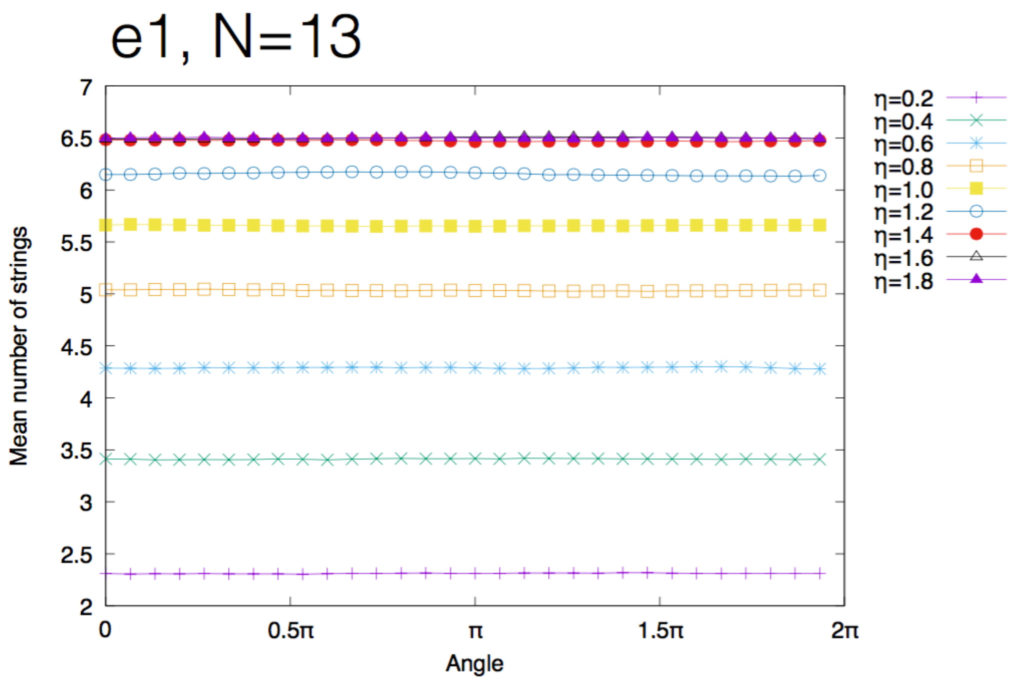

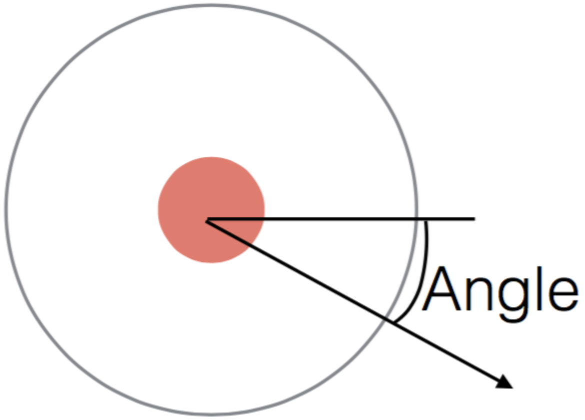

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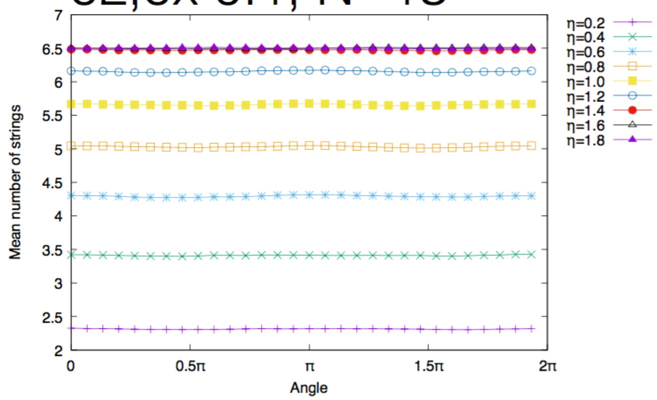
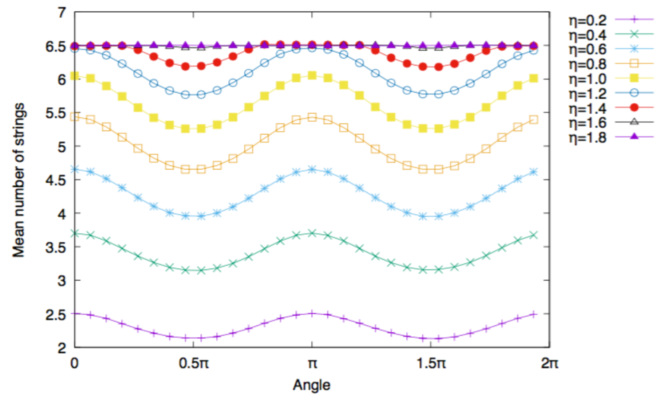
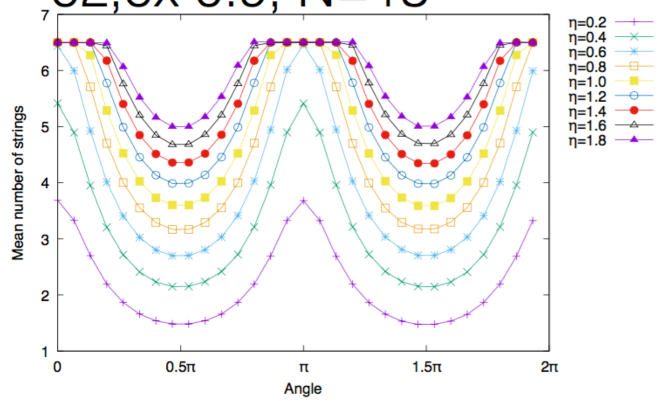
e2,ex 0.1, N=13

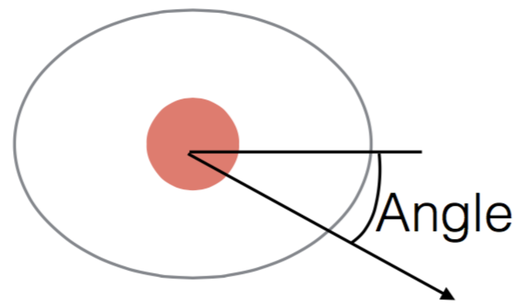


e2,ex 0.5, N=13



e2,ex 0.9, N=13





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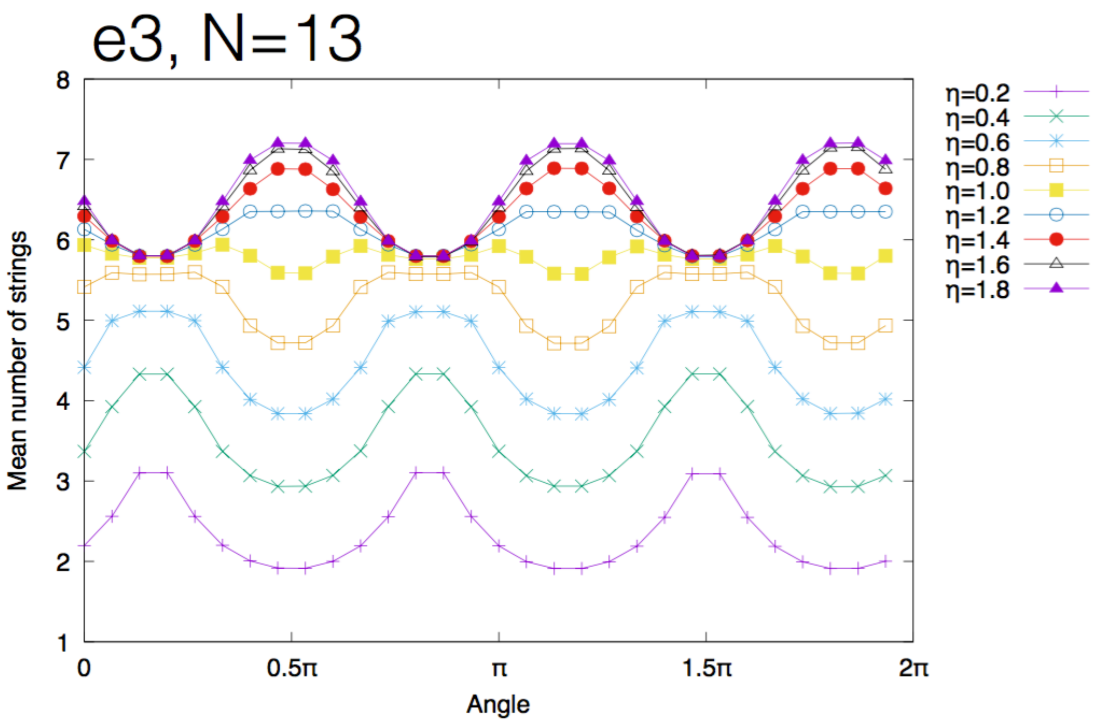

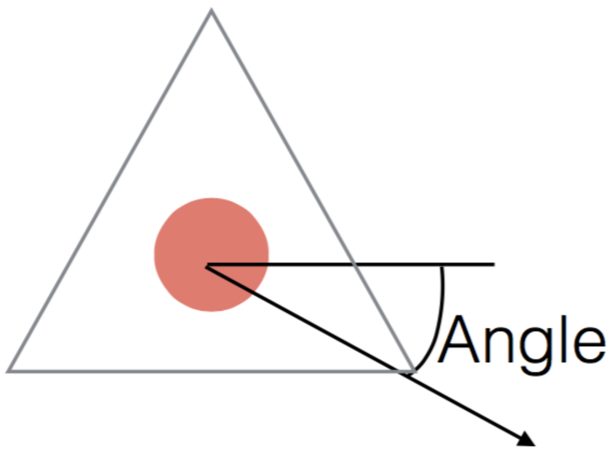

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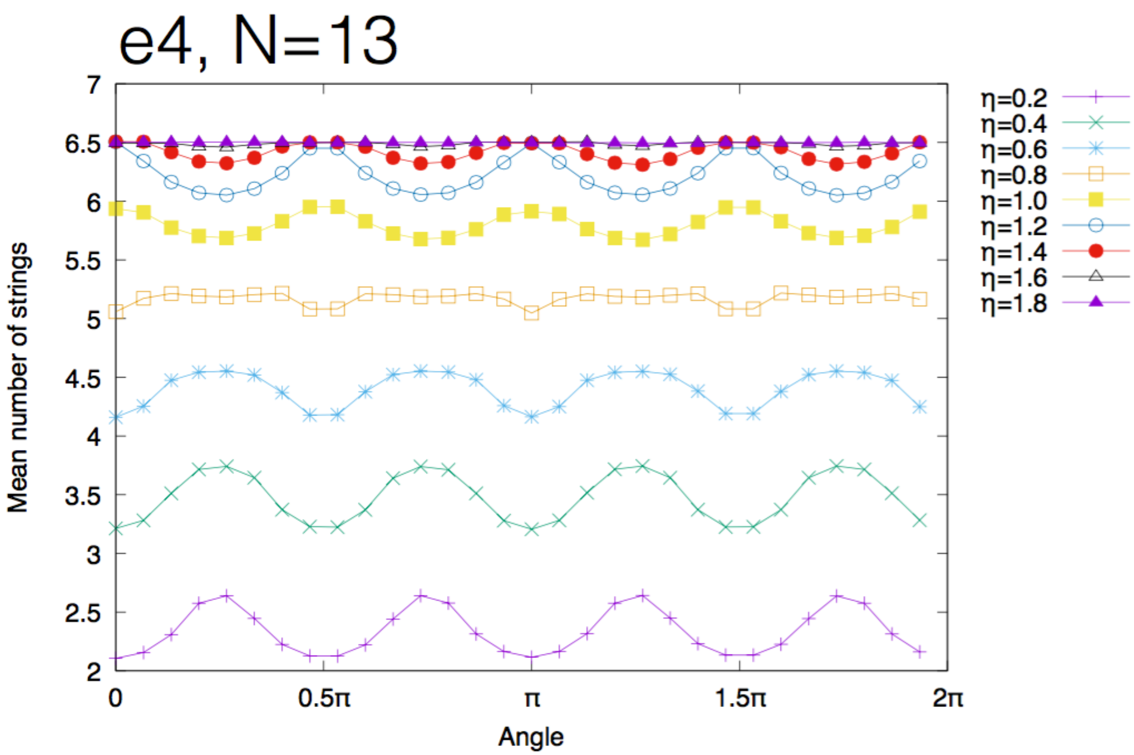

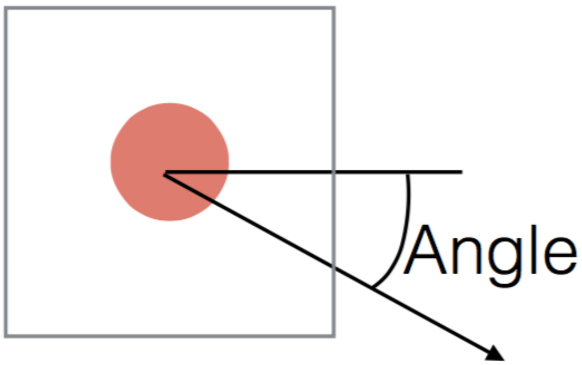

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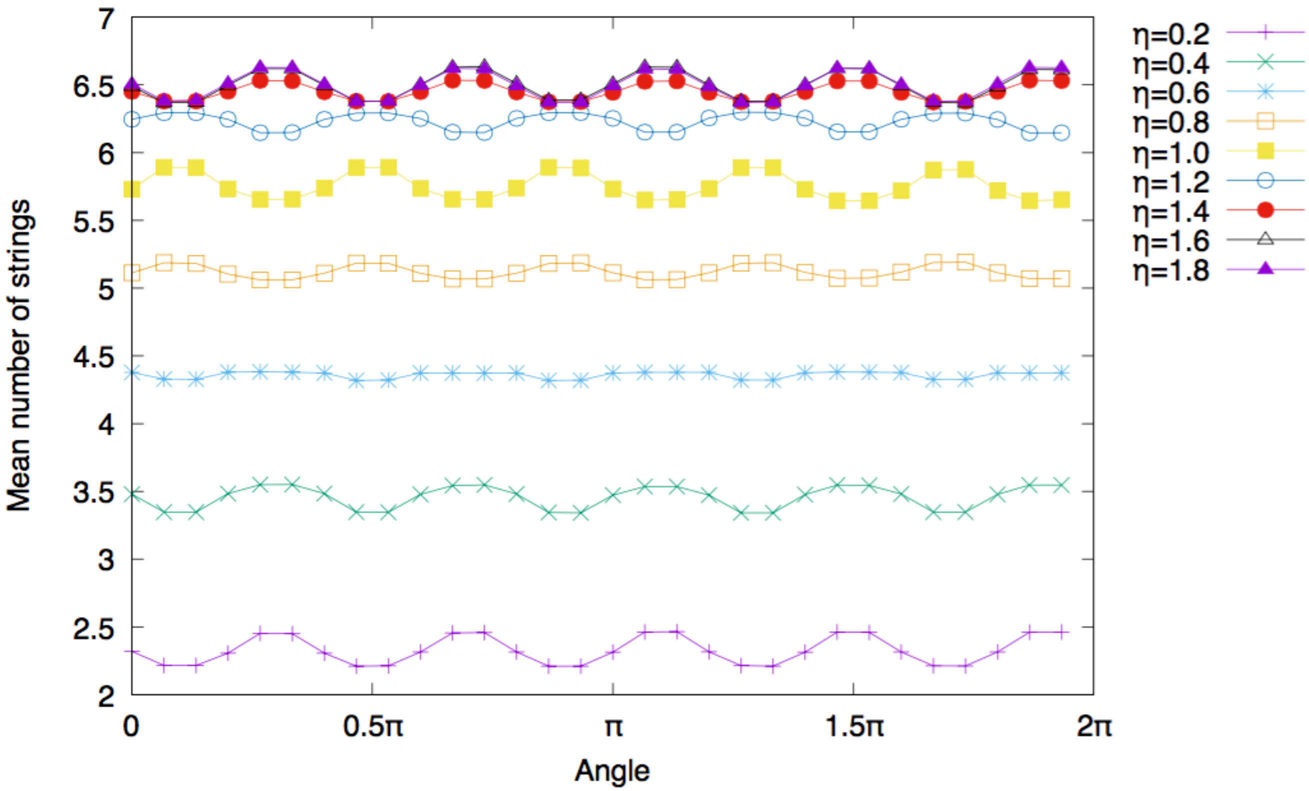
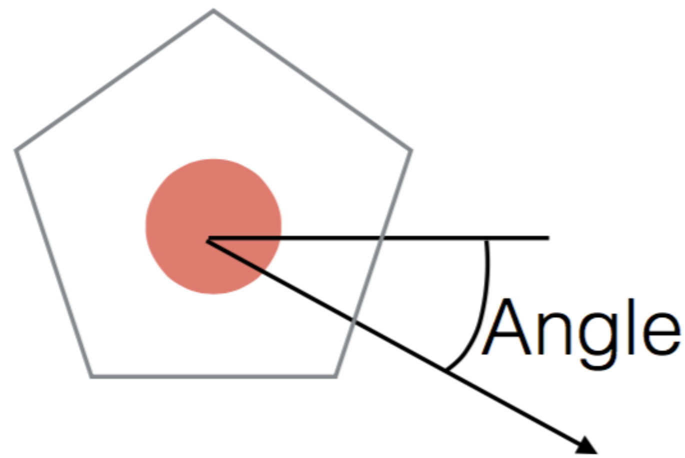
e5, N=13





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Thank you !!!!

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