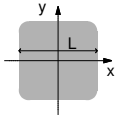


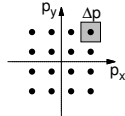
FINITE SIZE EFFECTS IN EFFECTIVE MODELS

Finity system
with linear size L

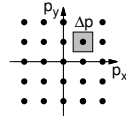


Fourier
 $\Rightarrow$
(and simplification)

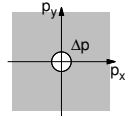
Cubic volume
with APBC



Cubic volume
with PBC



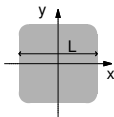
Low momentum
cutoff (spherical)



Problem: still critical behavior in mean-field models

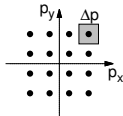
FINITE SIZE EFFECTS IN EFFECTIVE MODELS

Finity system
with linear size L

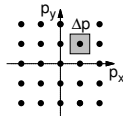


Fourier
 $\Rightarrow$
(and simplification)

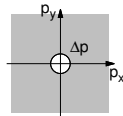
Cubic volume
with APBC



Cubic volume
with PBC



Low momentum
cutoff (spherical)



Problem: still critical behavior in mean-field models

Keep integration

$$\mathcal{Z} = \int \mathcal{D}\phi e^{-\beta \mathcal{U}(\phi)} \xrightarrow{\text{singlemode}} \int_{-\infty}^{\infty} d\phi e^{-\beta \mathcal{U}(\phi)} \quad (1)$$

Then

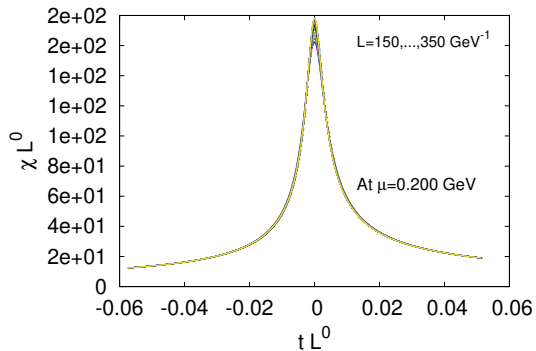
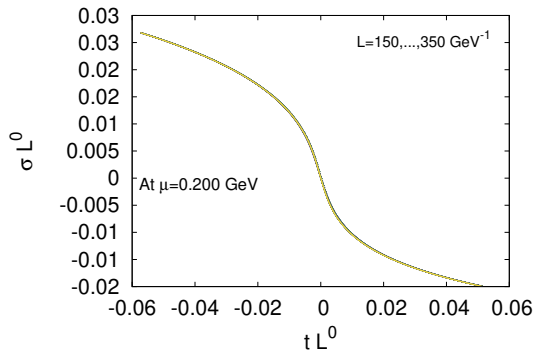
$$\langle \phi \rangle = \frac{1}{\mathcal{Z}} \int_{-\infty}^{\infty} d\phi \phi e^{-\beta \mathcal{U}(\phi)} \quad (2)$$

Potential to be used: $\sim N_f = 1$ quark-meson model $\Rightarrow \mathcal{U}(T, \mu, h)$

Note: T, μ, h have to be related to Ising variables. Every $\chi_k^{T, \mu, h}$ scales as external field.

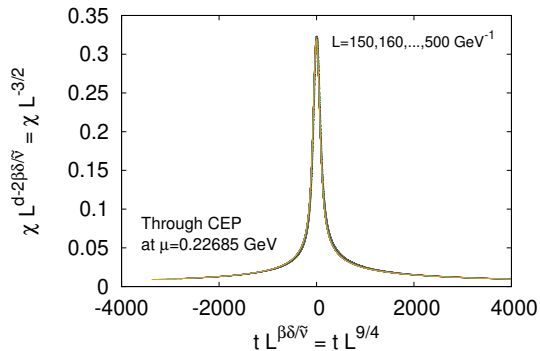
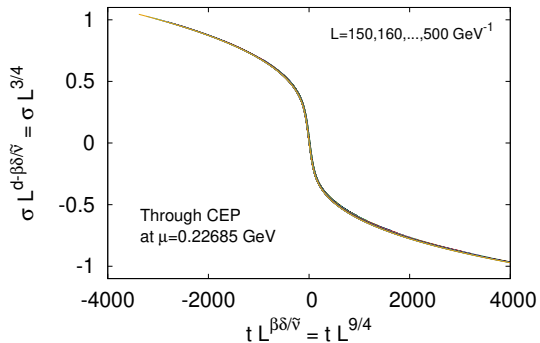
CROSSOVER: NO SCALING

Expectation: $\sigma(tL^0) \propto L^0, \chi(tL^0) \propto L^0$



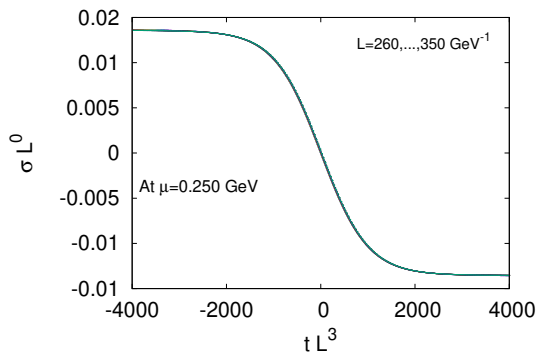
SCALING FUNCTIONS: SECOND ORDER

Expectation: $\sigma(tL^{\beta\delta/\tilde{\nu}}) \propto L^{\beta\delta/\tilde{\nu}-d}$, $\chi(tL^{\beta\delta/\tilde{\nu}}) \propto L^{2\beta\delta/\tilde{\nu}-d}$ (hyperscaling violation!)

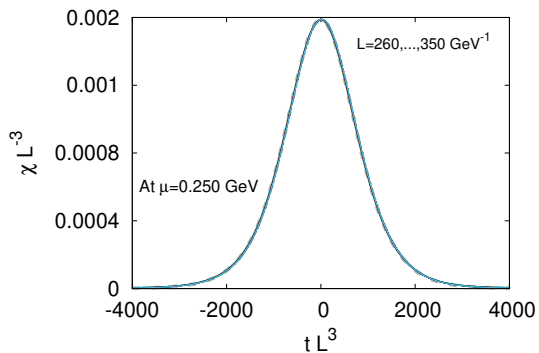


SCALING FUNCTIONS: FIRST ORDER

Expectation: $\sigma(tL^3) \propto L^0, \chi(tL^3) \propto L^3$

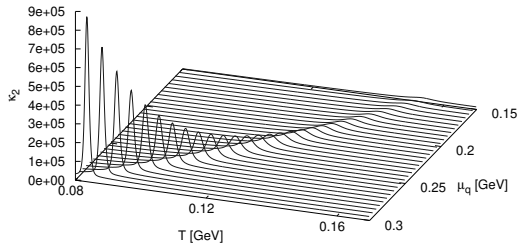


(coexistence)

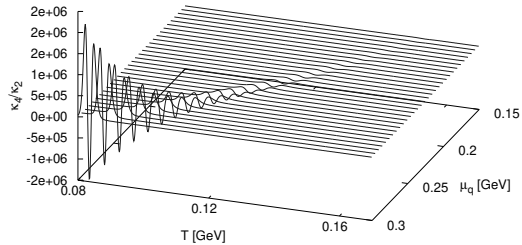


No extremum along the transition line

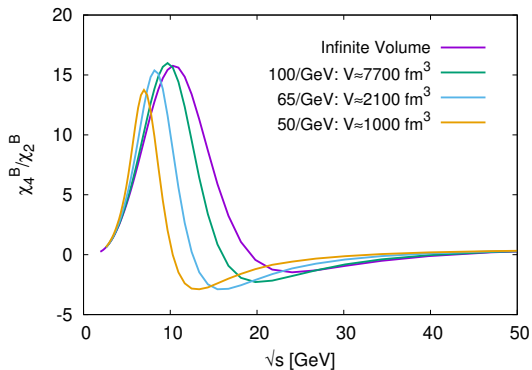
κ_2



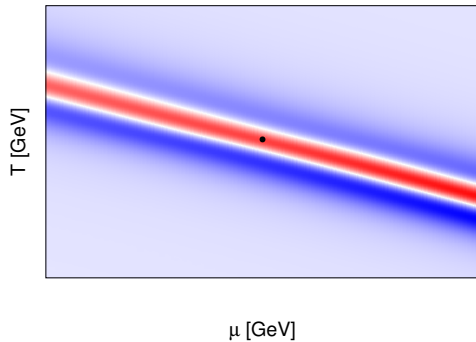
κ_4/κ_2



Dip peak structure of χ_4/χ_2 due to freeze-out-phase transition separation



n



Double Gaussian probability distribution

$$P_{DG}(\phi) = \frac{A}{(2\pi T)^{1/2}} \left[e^{(\eta \sigma_a + \frac{1}{2} \eta^2 \chi_a) \frac{L^d}{T}} e^{-\frac{(\phi - \sigma_a - \eta \chi_a)^2}{2\chi_a} \frac{L^d}{T}} + e^{(\eta \sigma_b + \frac{1}{2} \eta^2 \chi_b) \frac{L^d}{T}} e^{-\frac{(\phi - \sigma_b - \eta \chi_b)^2}{2\chi_b} \frac{L^d}{T}} \right] \quad (3)$$

with proper normalization, that gives

$$\begin{aligned} \langle \phi \rangle_{DG} &= \lambda_a U_a + \lambda_b U_b, \\ \chi_{DG} &= \chi_a U_a + \chi_b U_b + \frac{L^d}{T} (\lambda_b - \lambda_a)^2 U_a U_b. \end{aligned} \quad (4)$$

Fluctuation between minima/phases.