Finite temperature and δ-regime in the Schwinger model

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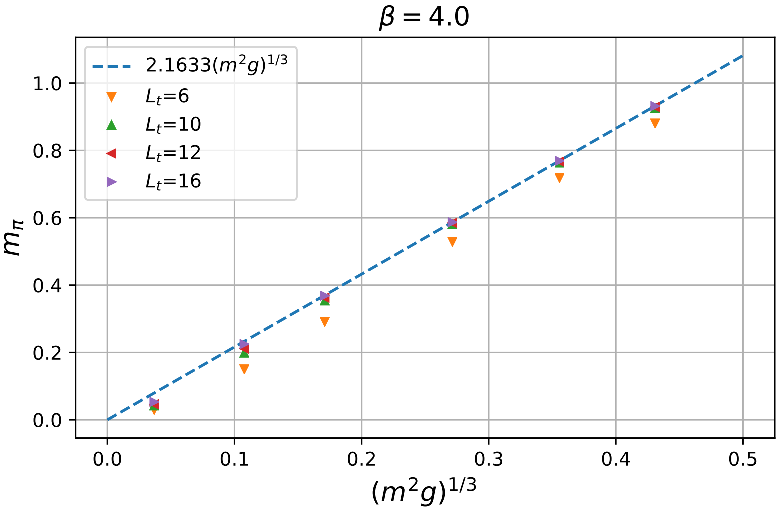
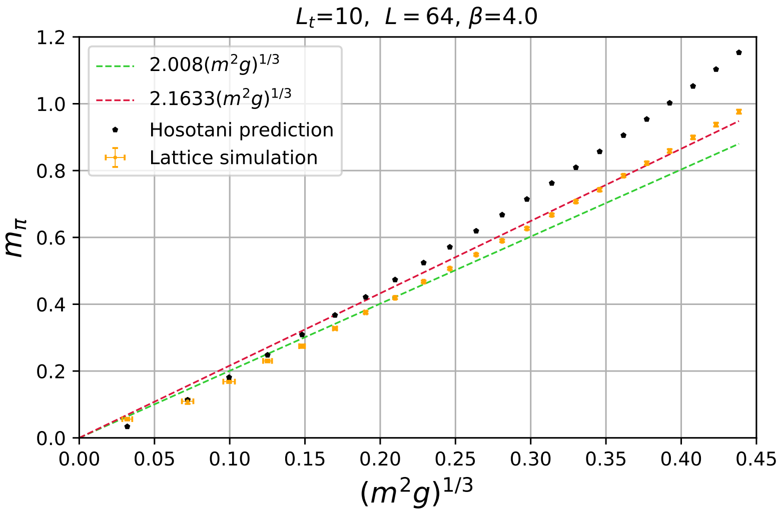
Schwinger model

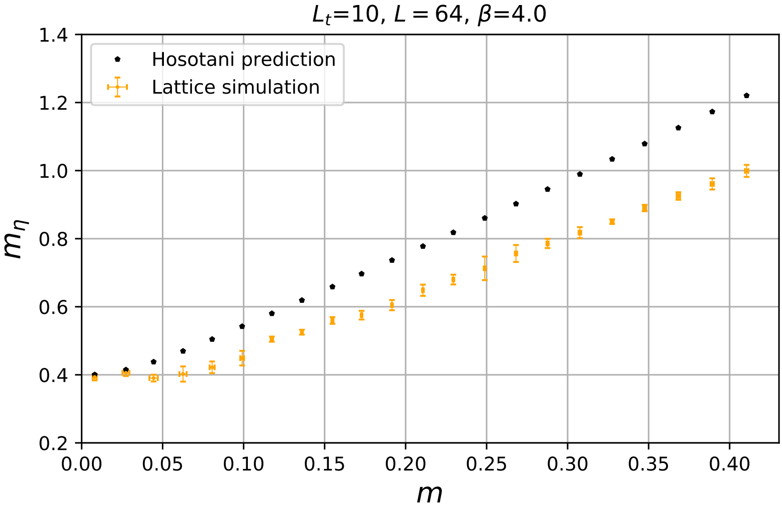
Finite temperature - Hosotani prediction



Pion mass - Hosotani vs. lattice simulation



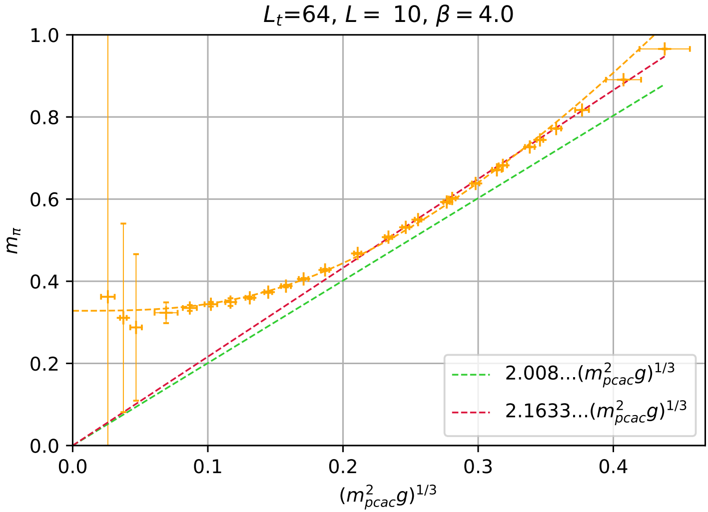
Pion mass - Hosotani vs. lattice simulation



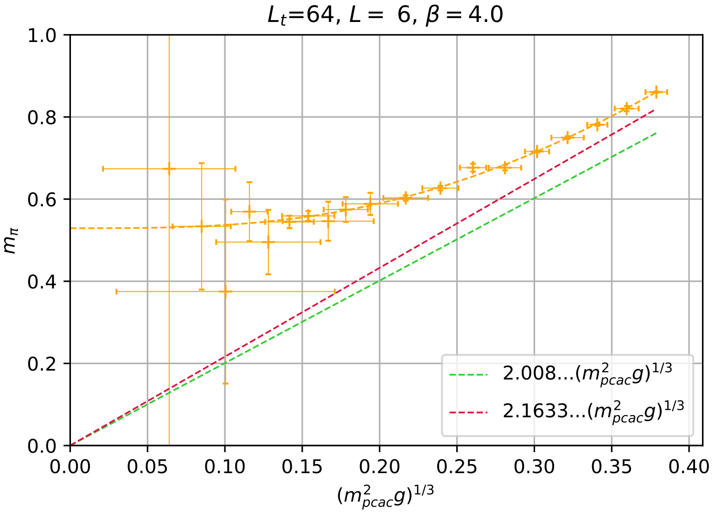
δ-regime

Hasenfratz/Niedermayer prediction

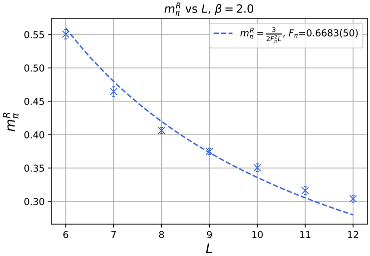
Residual pion mass plateau

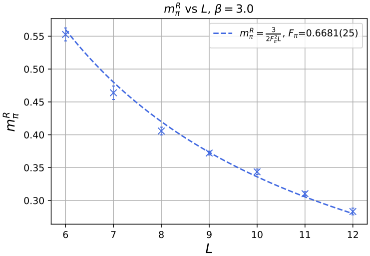


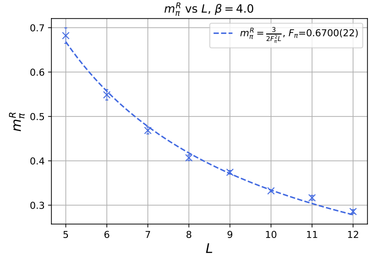
Residual pion mass plateau



1 / L confirmed by lattice simulation







$$F_\pi = 0.7$$

Witten-Veneziano formula

In the chiral N-flavor Schwinger model the Witten-Veneziano formula is simplified to [Seiler and Stamatescu, 1987]

$$m_\eta^2 = \frac{2N}{F_\eta^2}\chi_T^{que}$$

Mass of the η particle is known analytically [Belvedere et al. 1979]

$$m_\eta^2 = \frac{N}{\pi\beta}$$

and there is also continuum prediction for χ_T^{que} [Seiler and Stamatescu, 1987]

$$\beta\chi_T^{que} = \frac{1}{4\pi^2}$$

Quenched topological susceptibility

By using an alternative definition of topological charge

$$Q_S = \frac{1}{2\pi} \sum_P \sin(\theta_P)$$

[Bardeen et al., 1998] were able to analytically compute χ_T^{que} on the lattice

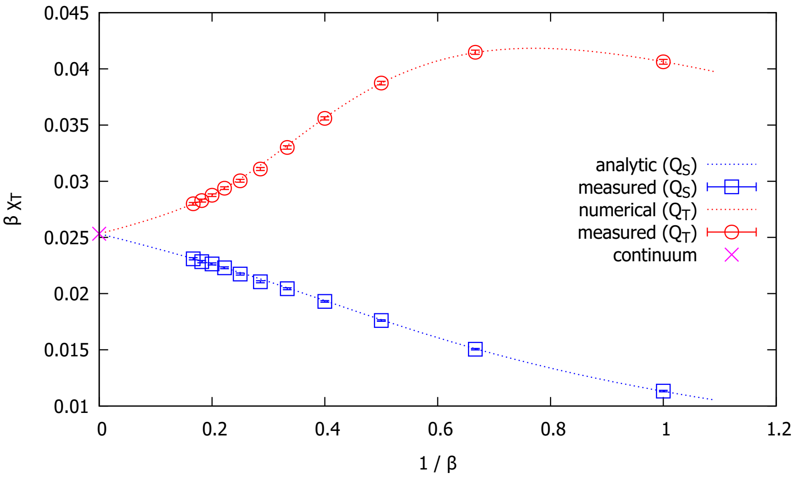
$$\beta \chi_T^{que} = \frac{I_1(\beta)}{4\pi^2 I_0(\beta)}$$

For the usual definition of topological charge

$$Q_T = \frac{1}{2\pi} \sum_P \theta_P$$

it is not possible to find analytic solution, but using the same line of reasoning it is possible to numerically compute χ_T^{que} to arbitrary precision.

Quenched topological susceptibility



F_η versus F_π