Localization of Dirac modes in the SU(2)-Higgs model at finite temperature

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Motivation

- connection between deconfinement and chiral symmetry restoration in QCD is still not fully understood
- low Dirac modes could be key in understanding this connection
- chiral symmetry breaking is controlled by the density of low modes (Banks-Casher relation)
- deconfinement is signalled by the ordering of Polyakov loops
- islands of fluctuations in the sea of ordered Polyakov loops are favorable for Dirac modes $\Rightarrow$ Dirac modes localize
  \[ \text{[Bruckmann et al. (2021)]} \]
- this mechanism is general: test it in other gauge theories with a deconfinement transition $\Rightarrow$ SU(2)-Higgs model
  \[ \text{[G. Baranka and M. Giordano (2023)]} \]
Localization in the SU(2)-Higgs model

- localized/delocalized modes occupy finite amount/fraction of volume
- mode size \( \sim L^\alpha \) (\( \alpha \): fractal dimension)
- modes are localized up to the mobility edge \( \lambda_c \)

\[ \beta = 2.1, \kappa = 1.0 \text{ (Higgs phase)} \]

\( N_s = 20, 24 \)
\( N_s = 24, 28 \)
\( N_s = 28, 32 \)
Localization absent in confined phase, \( \lambda_c \to 0 \) at the crossover

\[ \kappa = 0.3 \]

\[ \beta \]

\[ \lambda_c \]

\[ P \text{ average} \]