

Worldline simulation of the massless Schwinger model on the lattice

(Daniel Göschl, Christof Gattringer)

(Means: Massless QED in 2D with staggered fermions)

Conventional representation (2 flavors):

$$Z = \int D[U] D[\bar{\psi}, \psi] D[\bar{\chi}, \chi] e^{-S_G - i\theta Q[U] - S_\psi[U, \bar{\psi}, \psi] - S_\chi[U, \bar{\chi}, \chi]}$$

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- **Complex action problem from 2 sources:**
topological term and finite density.

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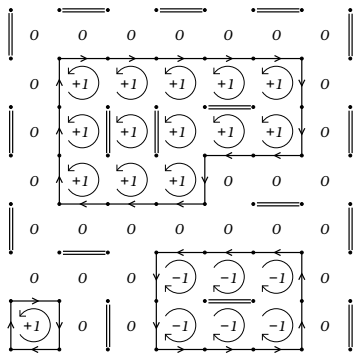
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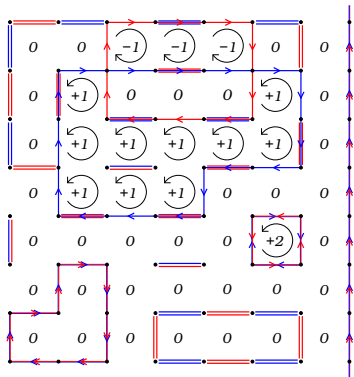
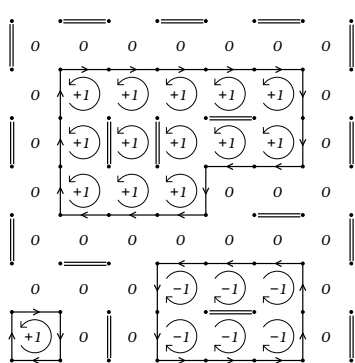
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- **Complex action problem from 2 sources:**
topological term and finite density.
- **Solution:** $\psi, \bar{\psi}, \chi, \bar{\chi}, U \longrightarrow$ **dual variables:**
worldlines for matter, worldsheets for gauge fields

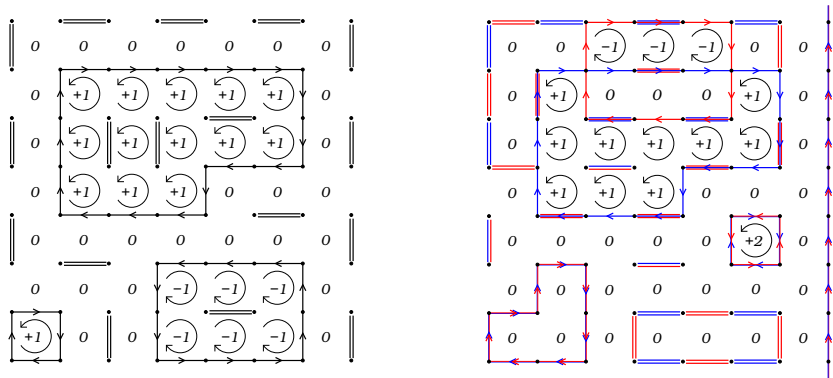
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⇒ **Update strategy:** Combination of local, global and worm updates

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1-flavor:

- No chemical potential (charge conservation)
- Algorithm works well

2-flavors:

- Inefficient: Topologically stabilized configurations appear
- Interesting problem for a future canonical simulation