Strong coupling study of Aoki phase in Staggered-Wilson fermions

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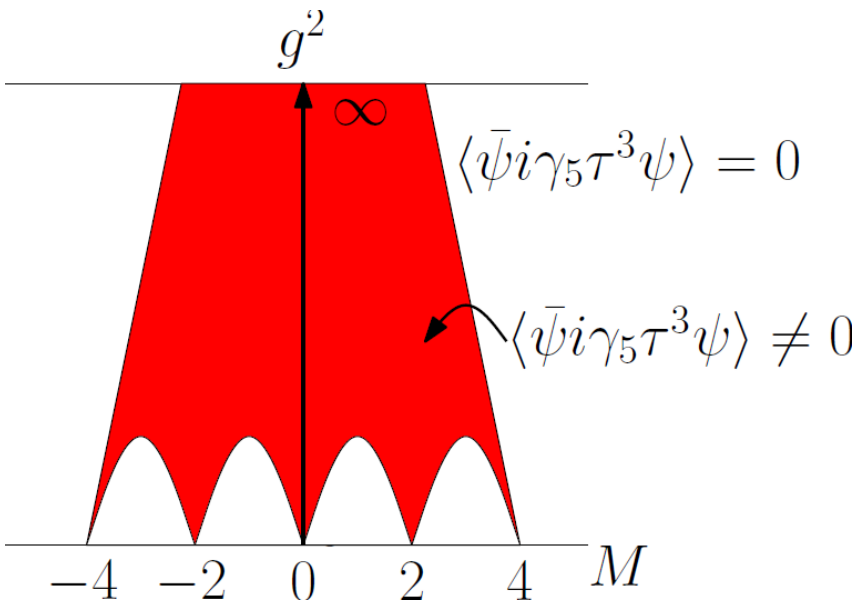
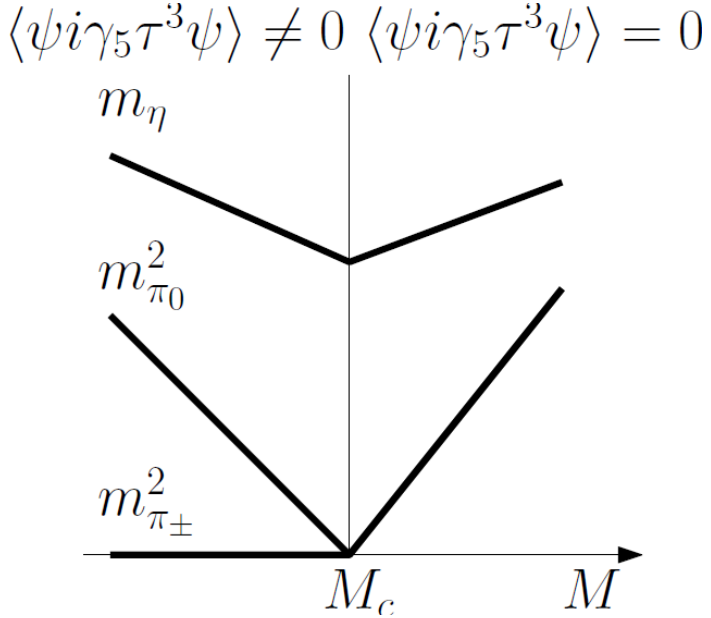
PoS (LAT2011), 108 (2011) [arXiv:1110.1231].

Phase structure in Wilson Fermion

- Aoki Phase
  - Parity-flavor symmetry is spontaneously broken in some quark mass region. Aoki (1984)…
- Quark mass tuning ➔ Chiral limit





Staggered-Wilson Fermion

- Flavored Mass : Generalized Wilson terms [Misumi's talk]
  - Adams : $N_f = 2$
  - Hoelbling : $N_f = 1$

Adams (2010, 2011), Hoelbling (2011).
Creutz, Kimura, Misumi (2010)

- Aoki phase in Staggered-Wilson fermion ?

Purpose

- Applicability of Staggered-Wilson (Overlap) fermion
  - Chiral limit

- Previous study
  - Lattice Gross-Neveu model with flavored mass [Kimura's talk]
    Creutz, Kimura, Misumi (2011)

This Study

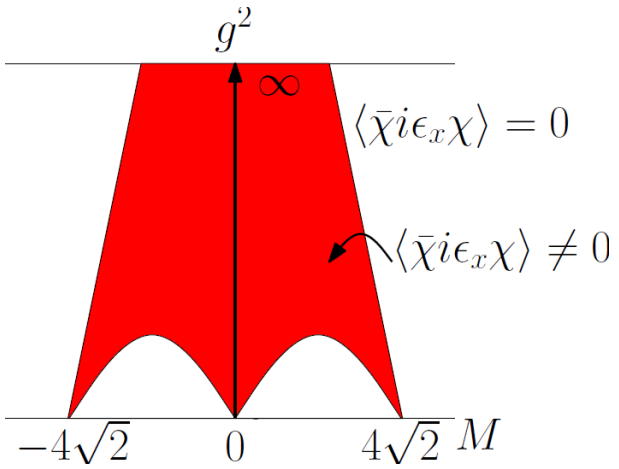
- We study Aoki phase of Staggered-Wilson fermion in strong coupling lattice QCD.

- Method (similar to analysis in Wilson fermion)
  - Hopping parameter expansion ➔ Parity broken ?
  - Effective potential analysis ➔ vacuum

- Staggered-Wilson Fermion
  - Adams type , Hoelbling type

Results

- Aoki phase exist.
- Critical mass (M_c) ➔chiral limit



$$\langle\bar{\chi}i\epsilon_x\chi\rangle \neq 0 \text{ for } |M| < M_c$$
$$m_\pi^2 = 0 \text{ for } |M| = M_c$$

- We can perform the lattice simulation with staggered-Wilson fermions by tuning mass parameter.