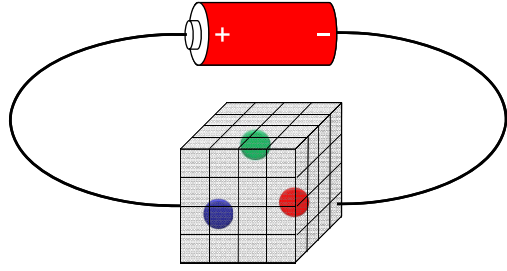


Strong external electric fields in lattice QCD



Arata Yamamoto (RIKEN)

PRL 110, 112001 (2013)

"Minkowskian" electric field in the Euclidean space-time

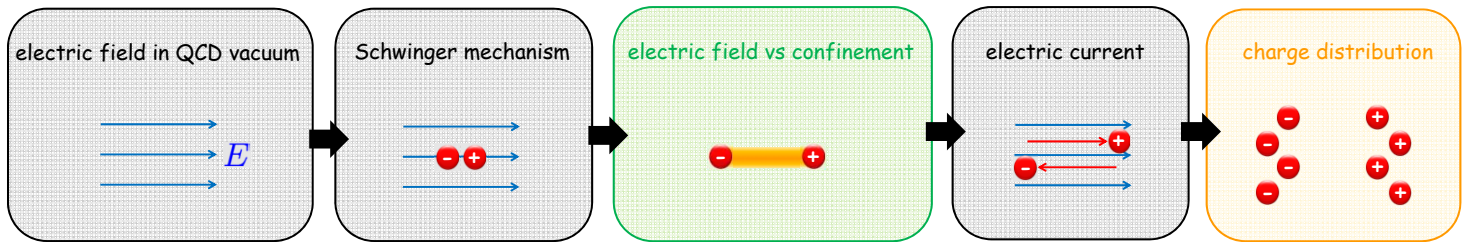
$$i\partial_0 + qA_0(x) - \mu \rightarrow -\partial_4 + qA_0(x) - \mu$$

physical electric charge

$$q = \left(\frac{2e}{3}, -\frac{e}{3}\right) \quad \text{sign problem}$$

"isospin" electric charge

$$q_3 = \left(\frac{e}{2}, -\frac{e}{2}\right) \quad \text{NO sign problem}$$

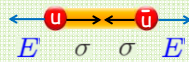


meson condensation



threshold
 $V > m_\pi^+ + m_\pi^-$

deconfinement



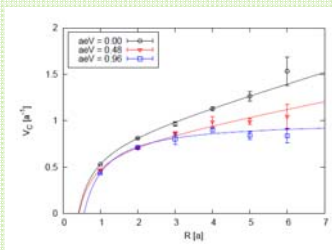
threshold
 $V > m_\pi^0$
 $\frac{e}{2}E > \sigma$

"charged" Wilson loop

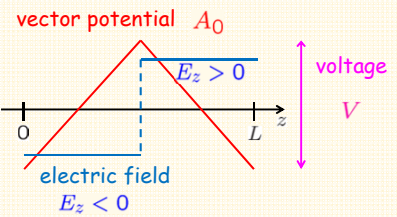
$$\langle W_C \rangle = \langle \text{tr} \prod_{\text{loop}} U_\mu u_\mu \rangle$$

"charged" heavy-quark potential

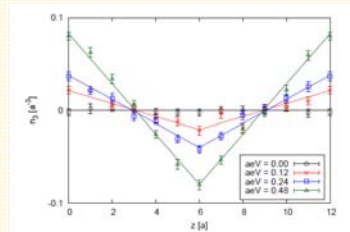
$$V_C(R) \simeq \left(\sigma - \frac{e}{2}E\right)R + \frac{A}{R} + \text{const.}$$



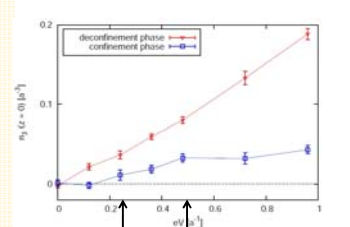
simulation setup



charge density distribution



voltage dependence



meson condensation
 deconfinement (in a finite volume)