

Temporal Chiral Spiral in Strong Magnetic Fields

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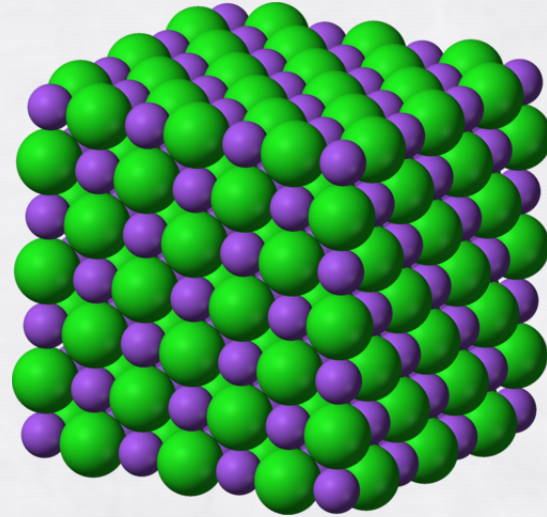
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Reference: arXiv:1309.0012 [hep-ph]

Temporal inhomogeneity in the QCD vacuum?

○ Crystal

- Specially periodic order



○ Quantum time crystal [Wilczek2012]

- Time-periodic order
- Broken time-translational symmetry in the vacuum

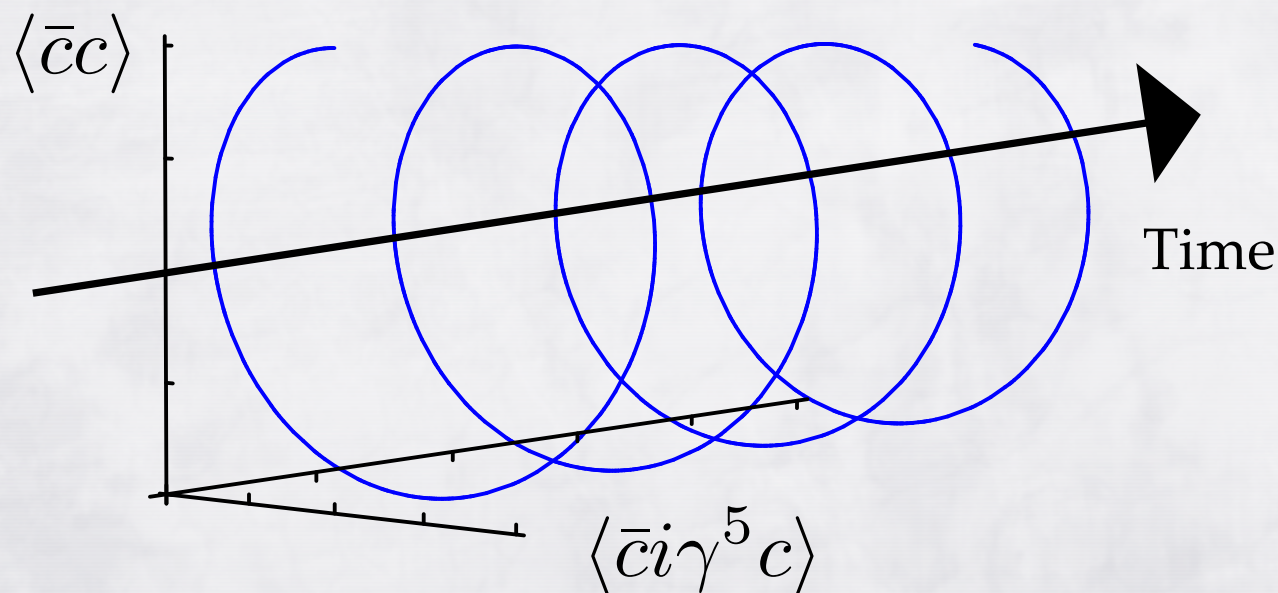
In QCD?

Temporal inhomogeneity in the QCD vacuum?

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- Chiral spiral
 - Local formation of chiral condensates in a spiral form
- Temporal analogue to the chiral spiral

Temporal chiral spiral



Temporal chiral spiral induced by electric fields

- QCD vacuum at strong magnetic and finite electric fields
- Explicit derivation in the $B \rightarrow \infty$ limit ($E \parallel B$)

$$\langle \bar{c}c \rangle = \langle \bar{c}c \rangle_0 \cos \left(\frac{2e}{\square + m_\gamma^2} E \right)$$

$$\langle \bar{c}i\gamma^5 c \rangle = \langle \bar{c}c \rangle_0 \sin \left(\frac{2e}{\square + m_\gamma^2} E \right)$$

- More details → Poster session

Temporal chiral spiral induced by electric fields

○ Instantaneous electric field: $E(t) = (E_0/m_\gamma)\delta(t)$

