ANOMALOUS ENHANCEMENT OF DILEPTON PRODUCTION DUE TO DIQUARK FLUCTUATION IN DENSE QUARK MATTER

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Color superconductivity (CSC)
- Induced by diquark condensation
- Low-temperature & High-density
- Difficult to observe in experiments

Two problems exist in observing CSC in HIC:
1. $T$ of the system produced by HIC is high.
2. CSC may be realized only in the early stage.

Experiments for dense region with high statistics!

We calculate the effects of soft modes due to diquark fluctuations on DPR.

2-flavor NJL model
\[
\mathcal{L} = \bar{\psi} i \partial \tau \psi + \mathcal{L}_S + \mathcal{L}_C
\]
\[
\mathcal{L}_S = G_S[(\bar{\psi} \psi)^2 + (i \bar{\psi} \gamma_5 \tau_3 \lambda \psi)^2]
\]
\[
\mathcal{L}_C = G_C(\bar{\psi} i \gamma_5 \tau_2 \lambda \bar{\psi})(\bar{\psi}^C i \gamma_5 \tau_2 \lambda C \psi)
\]

$G_S = 5.01 \text{ MeV}$, $\Lambda = 650 \text{ MeV}$
Kitazawa, Koide, Kunihiro, Nemoto (2002)

Soft modes
They develop around $T_C$ of CSC.
\[
\Xi(k, \omega) = G_C + \ldots
\]

T-matrix approx.
Kitazawa, Koide, Kunihiro, Nemoto (2005)

Thermodynamic potential: One loop of soft modes

- They are known in condensed matter theory.
  : electric conductivity of metallic SC at $T > T_C$
- Ward Identity of $\Pi^{\mu \nu}$ is satisfied by considering them.

Summary
- We calculated the contribution of “soft mode” to the “DPR” to observe CSC at HIC.
- We considered AL, MT and DOS terms, which satisfy $W$-I of $\Pi^{\mu \nu}$.
- Enhancement of DPR in low-$M$ region was observed.
- The enhancement would be used for a signal of CSC in HIC!