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Nonrelativistic Nambu-Goldstone modes of generalized global symmetries and new dynamic critical phenomena in QCD

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We study the effects of dynamical electromagnetic fields on the second-order chiral phase transition of QCD under a background magnetic field. We show that the interaction between the photon and the neutral pion through the quantum anomaly causes the type-B Nambu Goldstone (NG) mode associated with the spontaneous breaking of the generalized global symmetries. Furthermore, we find that such a novel NG mode leads to the new dynamic universality class beyond the conventional Hohenberg and Halperin's classification. We also argue a possible realization of this new dynamic universality class in 3-dimensional Dirac semimetals.

Primary author: Mr SOGABE, Noriyuki (Keio University)

Presenter: Mr SOGABE, Noriyuki (Keio University)

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