# Exploring the chirality and criticality of QCD matter with effective field theory for fluctuating hydrodynamics

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# Main targets of this presentation

1. Baryon fluctuations near the QCD critical point
   - Small system in heavy-ion collisions ⟶ “Non-Gaussian”
     M. Stephanov (2009)
   - Need a systematic dynamical framework under expanding background

2. Anomaly-related chiral transport phenomena
   - The chiral magnetic effect (CME), etc.
   - Few studies on the fluctuation effects of hydrodynamic modes, c.f., long-time tails P. Kovtun and L.G. Yaffe (2003) etc.

# Effective field theory (EFT) for fluctuating hydrodynamics

M. Crossley, P. Glorioso, H. Liu (2017)

F.M. Haehl, R. Loganayagam, M. Rangamani (2016)

K. Jensen, N. Pinzani-Fokeeva, A. Yarom (2018)

- Symmetries & constraints from microscopic Schwinger-Keldysh formalism
- A systematic approach to long-range & long-timescale dynamics

Application to the QCD matter for the first time

NS, N. Yamamoto, and Yi Yin, JHEP **2021,** 131 (2021)

NS and Yi Yin, JHEP **2022,** 124 (2022)

# In this talk, I will discuss

Applications of EFT for fluctuating hydrodynamics to

1. Non-Gaussian fluctuation dynamics near the QCD critical point

   NS and Yi Yin, JHEP **2022,** 124 (2022)

   - Evolution equations as Schwinger-Dyson equations
   - A closed-form solution to the leading order fluctuations

2. Chiral media under external magnetic field

   NS, N. Yamamoto, and Yi Yin, JHEP **2021,** 131 (2021)

   - Positive magnetoresistance induced by the CME and hydrodynamic fluctuations