

C3NT Workshop on QCD Critical End Point and Effective Field Theory Methods (CEP-EFT 2026)

October 19–22, 2026, Wuhan, China

Building 9, 409, Central China Normal University

Navid Abbasi











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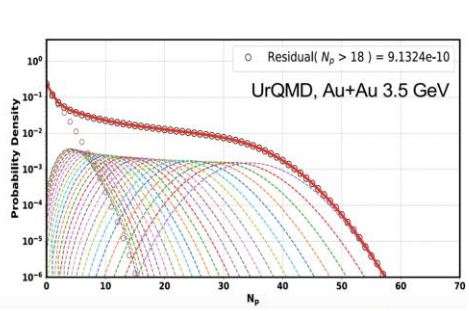


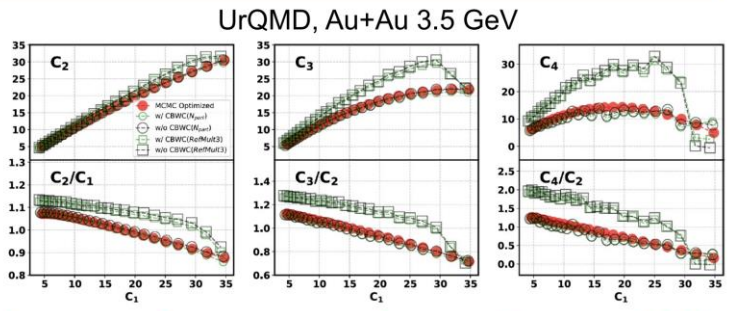
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1. Can Cumulants Reconstruct the Whole Distribution?

Speaker: Xiaofeng Luo

A New Approach (CIGAR) to Suppress VF





Centrality-Independent Genuine cumulant Analysis frRamework (CIGAR)

Edgeworth expansion :

$$\sigma p(\sigma x) = Z(x)\left\{1 + \sum_{s=1}^{\infty}\left[\sigma^s \sum_{\{k_m\}} He_{s+2r}(x) \prod_{m=1}^{s} \frac{1}{k_m!}\left(\frac{S_m+2}{m+2}\right)^{k_m}\right]\right\}$$

Z. Wang (汪朝辉), XFL, Phys. Lett. B 871, 139984 (2025)

Z. Wang (汪朝辉), CPOD 2025

where Chebyshev-Hermite polynomials H_{e_n} is defined as: $H_{e_n}(x) = (-1)^n exp(x^2/2)\frac{d^n}{dx^n}exp(-x^2/2)$

- Using Edgeworth Expansion to reconstruct the proton number distribution with cumulant as parameters
- New Method (CIGAR) has been verified to effectively suppress the volume fluctuations (VF) , which is applied to the STAR data analysis. New results at FXT energies will be presented at QM2027

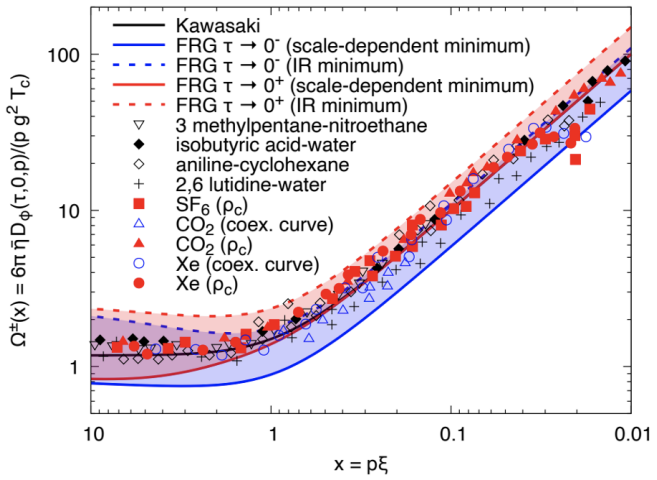
- P(N) contains the full fluctuation information.

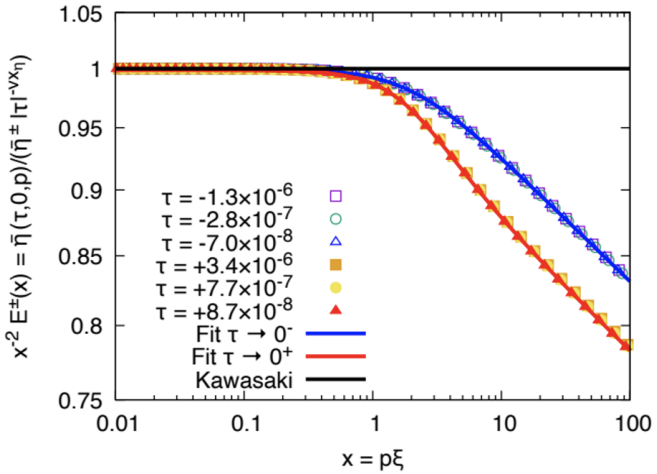
Is this reconstruction controlled, and how many cumulants are enough to reproduce the physically relevant tails of P(N)?

2. When Is One Loop Not Enough?

Speaker: Lorenz von Smekal, (Yong-rui Chen)

$$\tau = \frac{T - T_c}{T_c}, \qquad h = \frac{H}{H_0}.$$



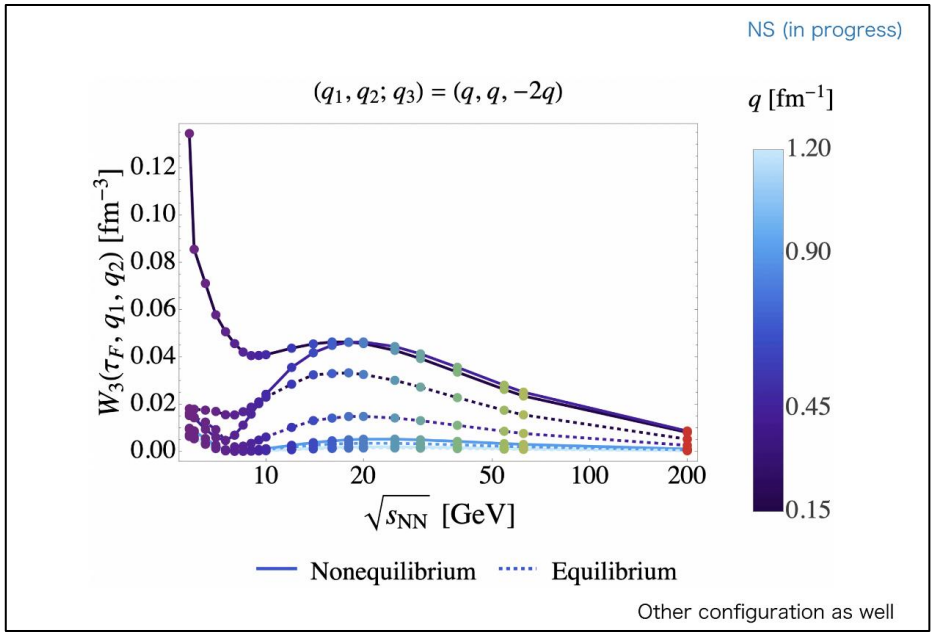


Lorenz's FRG reveals at least two effects absent in the Kawasaki approximation:

1. different scaling functions when approaching Tc from above and below;.
2. weak critical scaling of shear viscosity: $\eta_{\rm shear} \sim \xi^{x_\eta}, \qquad x_\eta \simeq 0.05.$

3. How Much Physics Beyond Hydrodynamics Do We Need for the Critical Signal?

Speaker: Nori Sogabe

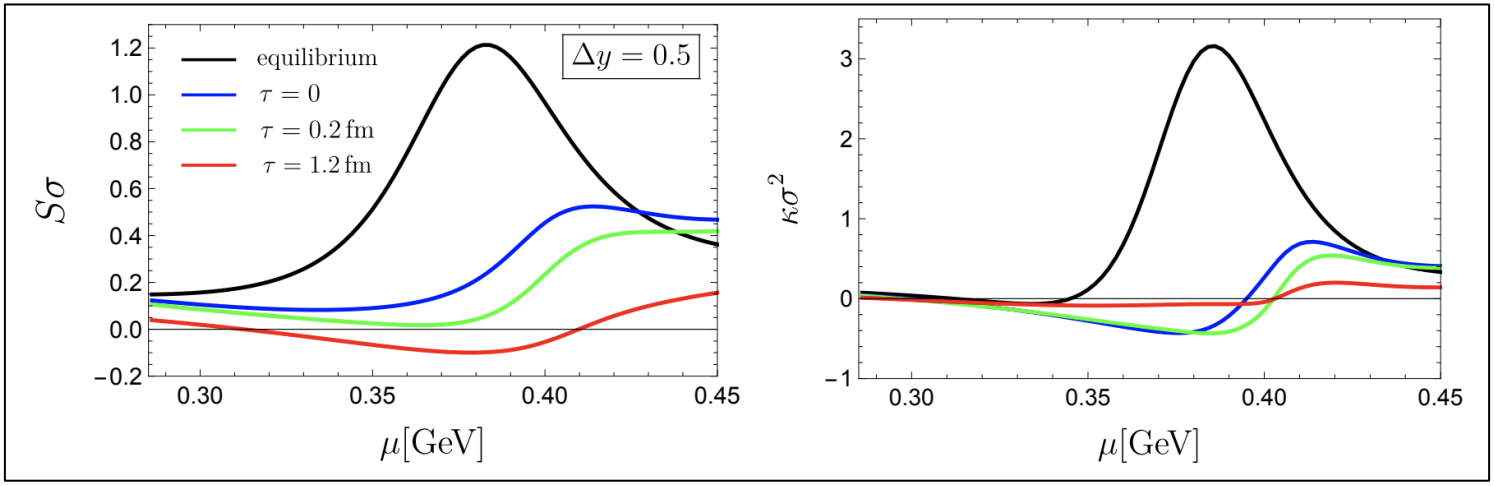


So this suggests that the critical signal we care about experimentally may be controlled mainly by long wavelength hydrodynamic modes. Then the question is:

how much room is actually left for nonhydrodynamic or higher-gradient corrections in the observables relevant to the CEP?

4. Can Memory Conceal the Critical Point?

Speaker: Shanjin Wu



$$\partial_t n + \nabla \cdot J = 0\,,$$

$$\tau\,\partial_t J_i + J_i = -\,\lambda\,\nabla_i \alpha + \sqrt{\sigma T}\,\eta_i\,.$$

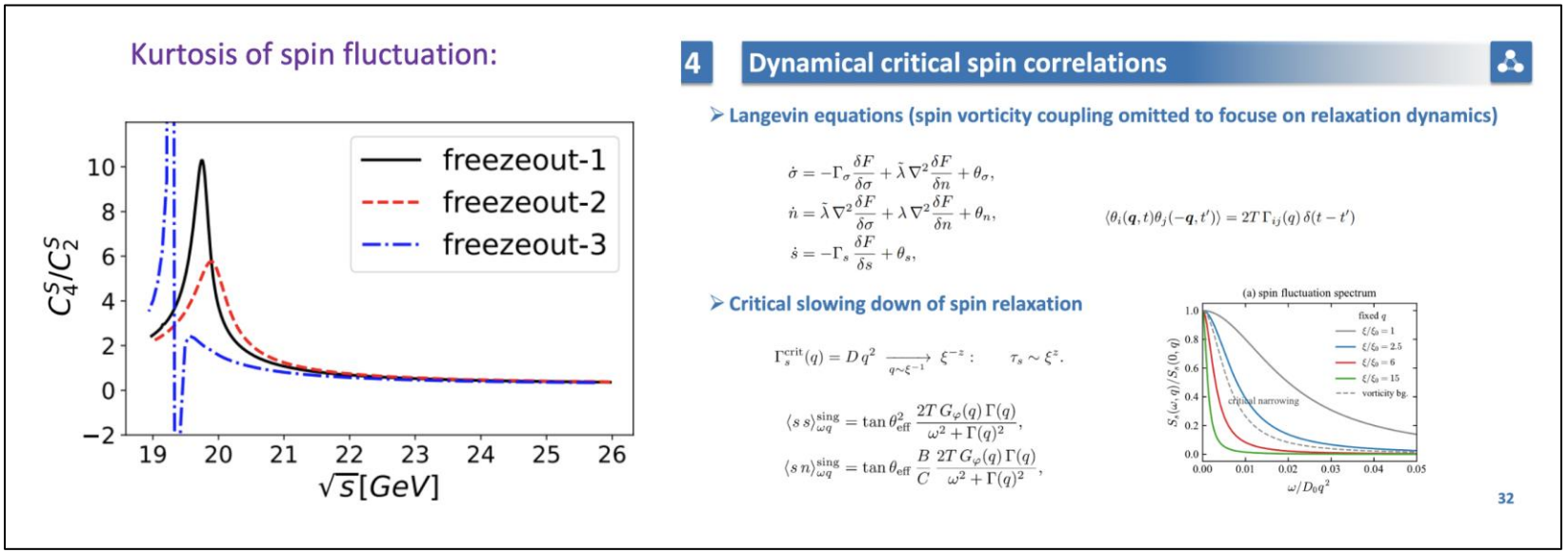
$$C_N(\Delta) = \int \left[\prod_{i=1}^{N} \frac{dq_i}{2\pi}\, A_\Delta(q_i)\right] \delta\left(\sum_{i=1}^{N} \frac{q_i}{2\pi}\right) W_N(q_1, \ldots, q_N; t)$$

A weak or displaced non-monotonic signal

does not by itself rule out the possibility that the system passed near a CEP!

5. Do Critical Spin Cumulants Survive Realistic Dynamics?

Speaker: Xu-Guang Huang



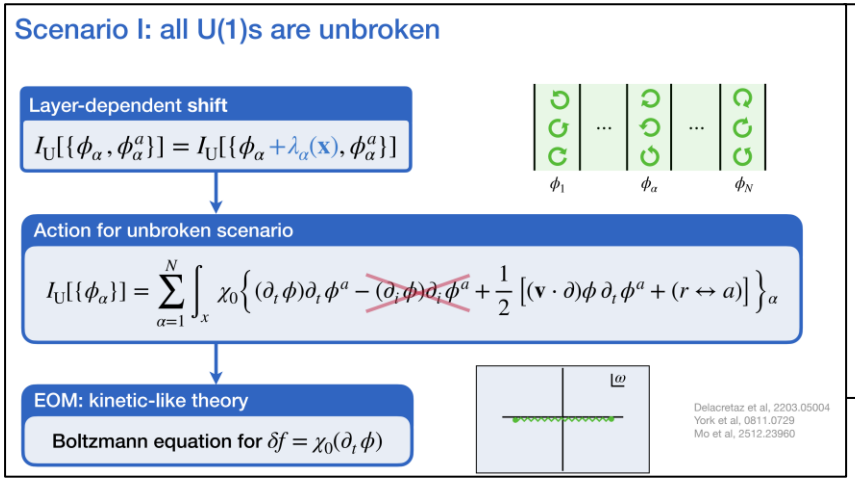
The static critical enhancement is clear, but its dynamical robustness remains to be established. The spin–vorticity coupling has been omitted and only relaxational dynamics has been retained.

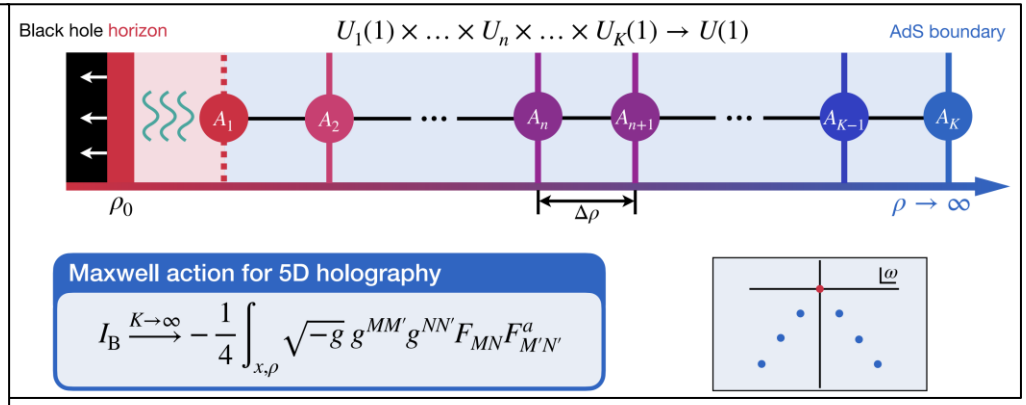
Restoring that coupling can modify the relaxation rate and mode mixing of the spin fluctuations before freeze-out!

Are the enhanced spin cumulants near the CEP robust once spin–vorticity coupling is restored?

6. Can Shift Symmetry Know the Coupling?

Speaker: Xin An



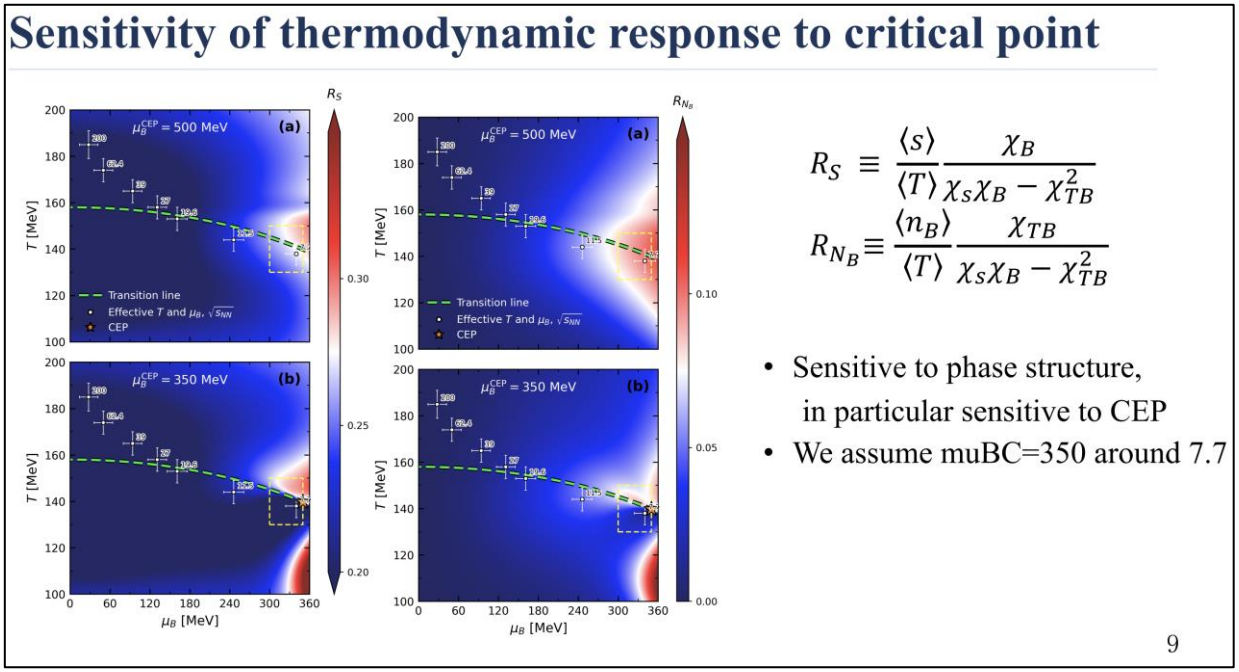


Different shift-symmetry realizations reproduce kinetic-like and holographic-like spectra.

Is there any microscopic map between the coupling strength of the underlying theory and the realization of the hidden shift symmetries?

7. Can Linear Response Compete with Higher-Order Cumulants in the CEP Search?

Speaker: Li Yan + Yu-Shan Mu

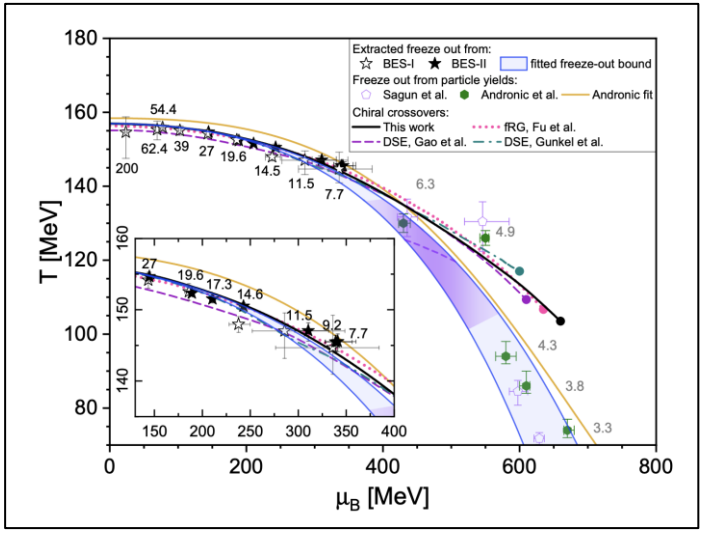


The idea is to use ultra-central collisions and extract thermodynamic response coefficients from lower-order event-by-event correlations, looking for a minimum or vanishing response near the CEP

Which strategy remains more robust once realistic backgrounds and the breakdown of the linear-response approximation near the CEP are included?

8. Is Freeze-out Still a Thermodynamic Point Near the CEP?

Speaker: Yi Lu



$$\frac{\chi_2^B}{\chi_1^B}(T_f, \mu_{B,f}) = \frac{C_2}{C_1}$$

$$\frac{\chi_3^B}{\chi_1^B}(T_f, \mu_{B,f}) = \frac{C_3}{C_1}$$

But close to the critical point, where relaxation becomes slow, the measured cumulants may no longer correspond to the instantaneous equilibrium susceptibilities at freeze-out.

Does the notion of a unique thermodynamic freeze-out point remain well defined there, or do we need a dynamical freeze-out trajectory instead?

9. How Universal Are the Quasihydrodynamic Universality Classes?

Speaker: Lorenzo Gavassino

Universality classes

In general, many different systems fall within the same EFT classification in the linear regime (i.e. have the same IR degrees of freedom). Hence, we can pick one physical representative for an entire universality class of models.
Examples:

EFT	Representative
$(\mathbf{1}_C \oplus \mathbf{1}_C \oplus \cdots) \oplus (\mathbf{1}_Q \oplus \mathbf{1}_Q \oplus \cdots)$	Chemistry
$(\mathbf{1}_C \oplus \mathbf{1}_C \oplus \cdots) \oplus (\mathbf{1}_Q \oplus \mathbf{1}_Q \oplus \cdots) \oplus \mathbf{3}_C$	Chemically active ideal fluid
$\mathbf{1}_C \oplus \mathbf{3}_Q$	Cattaneo
$\mathbf{1}_C \oplus \mathbf{3}_C \oplus \mathbf{5}_Q$	Israel-Stewart shear viscosity at zero chemical potential
$\mathbf{1}_C \oplus \mathbf{3}_C \oplus \mathbf{5}_Q \oplus \mathbf{5}_Q$	MIS* at zero chemical potential
$\mathbf{1}_C \oplus \mathbf{1}_C \oplus \mathbf{1}_Q \oplus \mathbf{3}_C \oplus \mathbf{3}_Q \oplus \mathbf{5}_Q$	Full Israel-Stewart at finite chemical potential

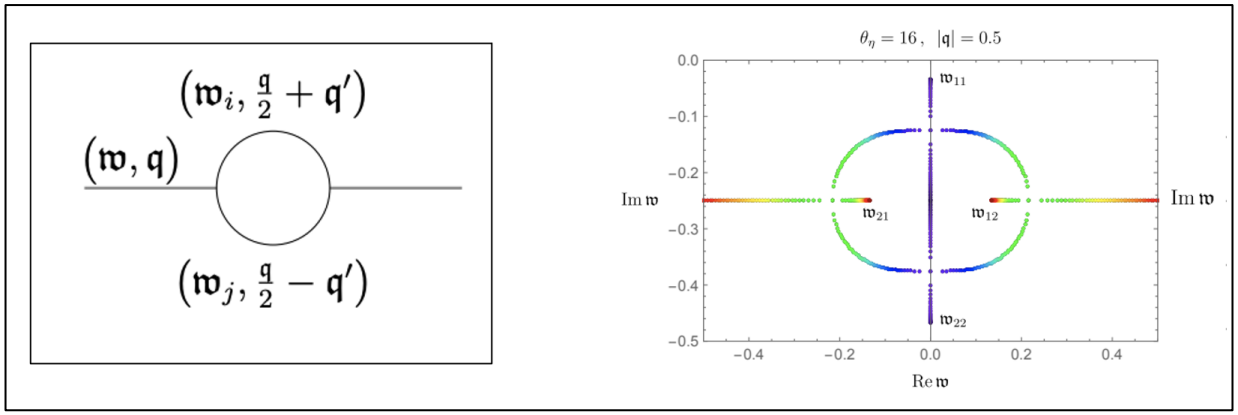
A broad family of quasihydrodynamic theories can be classified according to their IR degrees of freedom. At linear order, systems with the same slow-mode content can be represented by the same effective theory.

1. Once nonlinear couplings between the slow modes are included, can two systems that belong to the same class at linear response become genuinely different effective theories?

2. The construction assumes a parametrically clean separation between fast and slow relaxation scales. What happens when this separation is only moderate??

10. What Is the Spacetime Imprint of Hydrodynamic Nonanalyticity?

Speaker: Sara Tahery, Dong-Lin Wang, (Matthis Harhoff)



Nonlinear hydrodynamic fluctuations generate nonanalyticities in the retarded correlators.

In time domainS, this becomes the familiar long-time power-law tail.

How are hydrodynamic long-time tails encoded in experimentally measurable final-state correlations after freeze-out?

11. Can Criticality Threaten Causality?

Speaker: Defu Hou, (Leon Sieke, Koichi Murase)

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Linear causality and stability constraints on relativistic second-order magnetohydrodynamics

Yiwei Qiu[a], **Duan She**[b,a] **and Defu Hou**[a]

Nontrivial causality and stability constraints for second-order relativistic magnetohydrodynamics. schematically

$$v_{\text{front}}^2 \sim \frac{\eta}{(\epsilon + p)\tau_\pi}, \qquad \frac{D}{\tau_J}$$

If we approach the CEP, does critical slowing down automatically keep the theory inside the causal and stable domain, or can the critical scaling of transport coefficients drive some modes outside it?

Thanks to all of you!



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Thank you for your attention!