Opinion of a ”perfect liquid” lover

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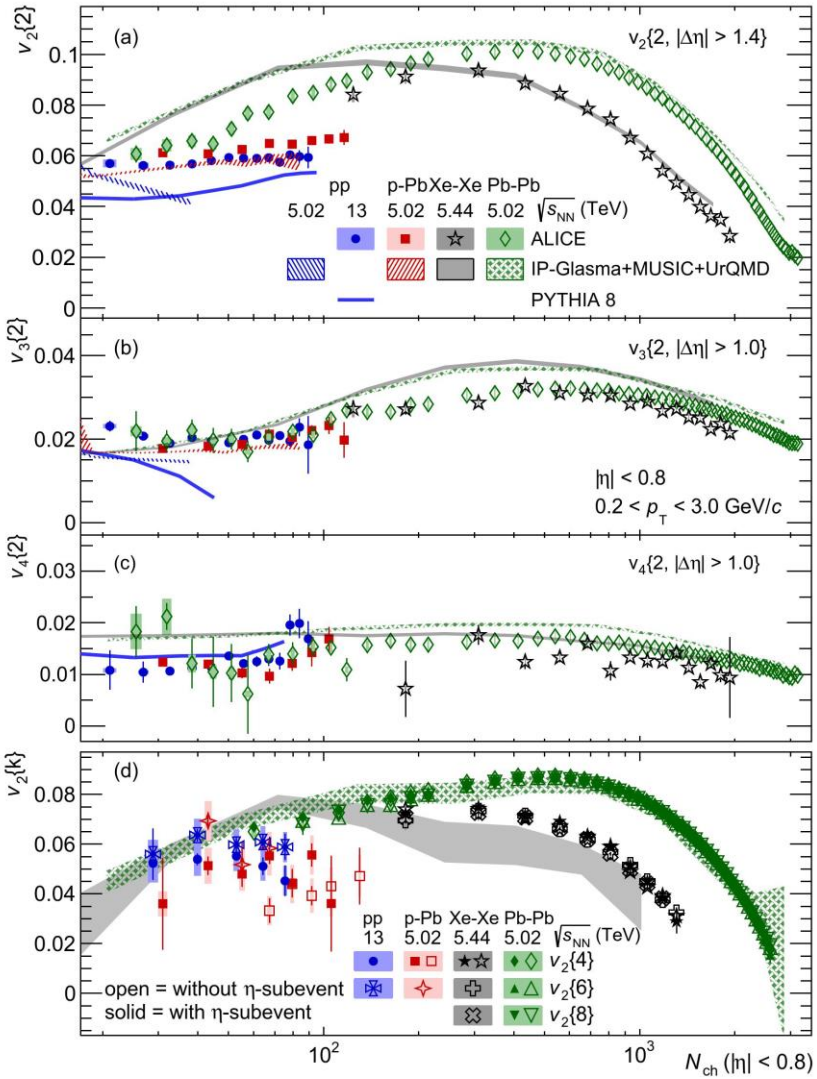
My answers

- Does IS flow-like correlations (e.g., CGC "flow") play a significant role for v_2, v_3 in small systems?
  - No (see for example morning talks): p-Au vs d-Au, but also ee $\rightarrow$ WW
    - Interesting if Bjoern and Raju agrees
- In my view, all evidence points to IS geometry + FS interactions
  - Consistent with strangeness enhancement where we know that FS interactions are needed

Is it the same mechanism in small and large systems?

PRL 123, 142301 (2019)



- My logic: large system is reference
  - v_3 driven by fluctuations → same small systems ✓
  - v_2 driven by geometry in large system → larger than small systems ✓
- Caveat: AMPT?
  - Escape mechanism
    - Will assume hydro in the following

Are the underlying microscopic processes also perfect?

- My logic: small system must contain answer
- Perfect liquid (hydro with $\eta/s \approx 1/4\pi$)
  - Little or no diffusion/dissipation
  - Strongly interacting: mean free path ≈ 0
    - Explains no onset of flow in small systems

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    - Explains no onset of flow in small systems
- Almost reversible (why I fell in love with it)
- A hard lover?

Perfect QCD – a new Universal approach to soft QCD #1
Peter Christiansen (Lund U. (main)) (Dec 10, 2022)
Published in: *Rev.Mex.Fis.Suppl.* 3 (2022) 4, 040901 • Contribution to: WWND 2022 • e-Print: 2301.13467 [hep-ph]
pdf DOI cite claim reference search 0 citations

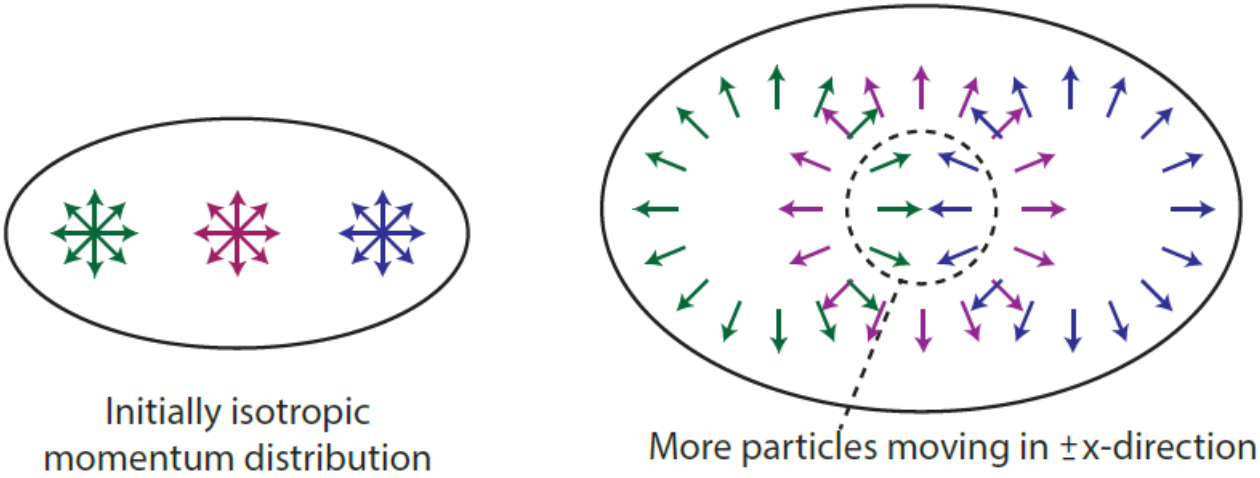
Link

What Quark-Gluon Plasma in small systems might tell us about nucleons #2
Peter Christiansen (Lund U.) (Sep 11, 2017)
e-Print: 1709.03415 [hep-ph]
pdf cite claim reference search 0 citations

Link

Weakly coupled kinetic theory: non-perfect flow

https://arxiv.org/abs/1803.02072



Abstract: "… As a non-vanishing mean free path is indicative of non-minimal dissipation, this challenges the perfect fluid paradigm of ultra-relativistic nucleus-nucleus and hadron-nucleus collisions."

- My opinion: very ambitious effort (e.g., IS+geometry → hydro), but also high price!

How do we make progress?

- My opinion:
  - Focus less on describing the data as well as possible and more about **unique signatures**
  - Focus less on measuring “more of the same” and more about **new observables**

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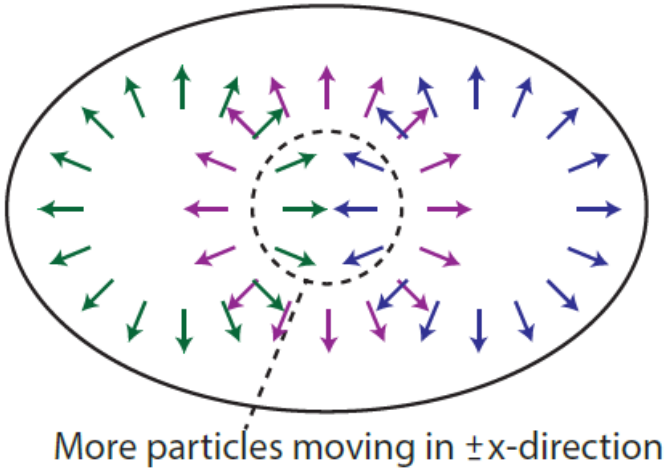
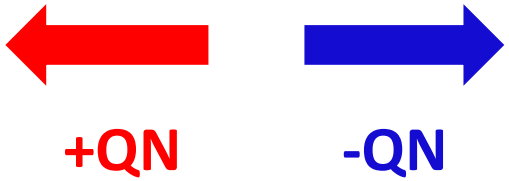
  - Focus less on measuring "more of the same" and more about **new observables**
  - **Alternative descriptions such as Angantyr/Ropes/shoving offer unique opportunities to look at our amazing achievements from a different perspective!**
    - Next idea is based on our local CLASH!
    - CLASH workshop write up: EPJ A 56 (2020) 11, 288

Proposing another observable: Quantum Number (QN) correlations

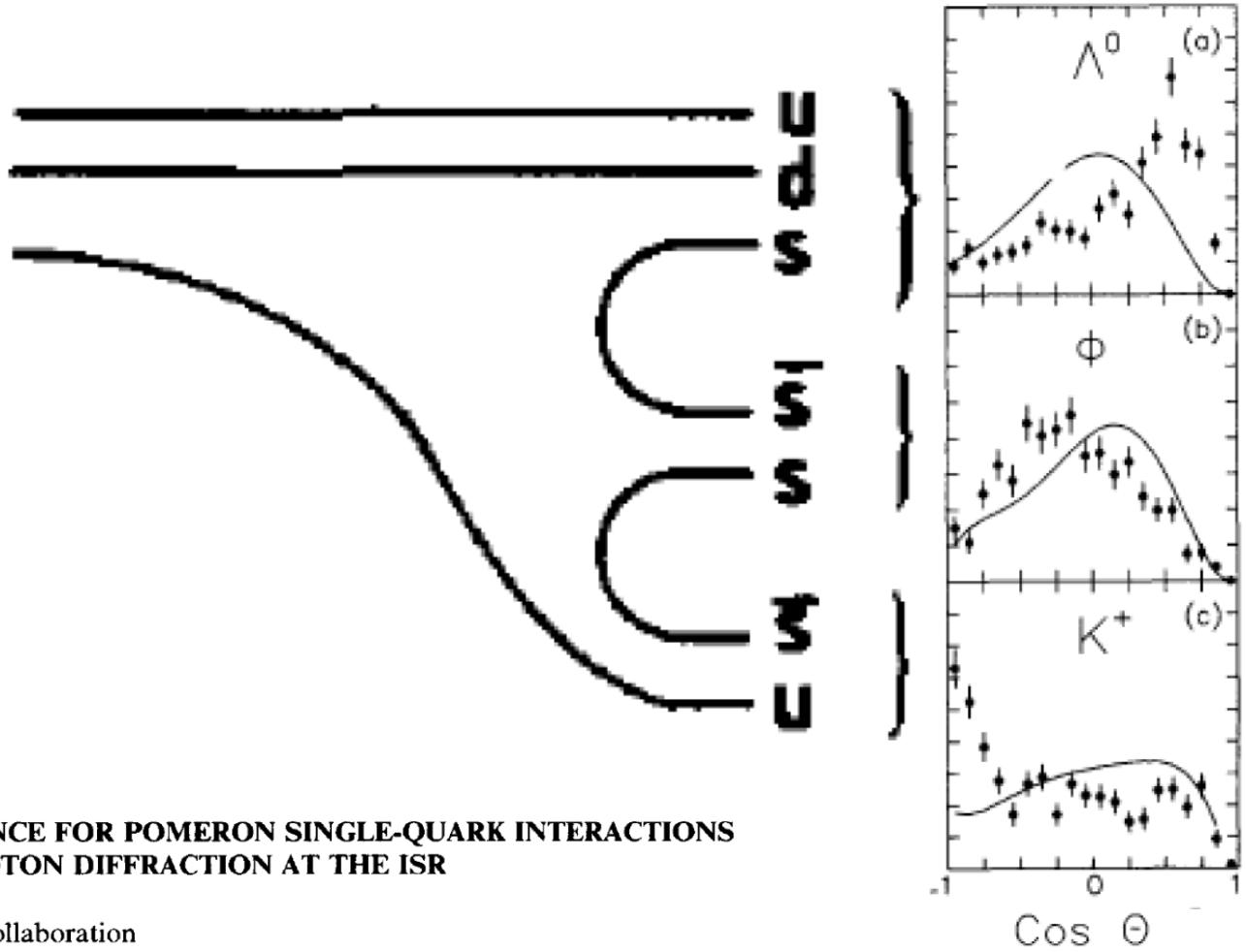




- Focus on QN that are pair produced
  - Strangeness, Baryon number (LHC)
- Can we observe a “non-minimal dissipation”?

Same idea used to validate string models

Phys.Lett. 163B (1985), 267



EVIDENCE FOR POMERON SINGLE-QUARK INTERACTIONS IN PROTON DIFFRACTION AT THE ISR

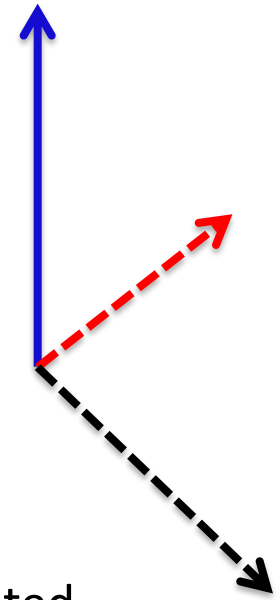
R608 Collaboration

Solid lines are calculations for isotropic phasespace

Example: Ξ-K correlation functions

Trigger on : $\Xi\ (ssd)$

Measure where balancing QN ends up:
$K^+\ (u\bar{s})$, $\bar{p}\ (\bar{u}\bar{u}\bar{d})$,
$\bar{\Lambda}\ (\bar{u}\bar{d}\bar{s})$, $\bar{\Xi}\ (\bar{s}\bar{s}\bar{d})$



Subtract the uncorrelated production via the same QN correlations:
$K^-\ (s\bar{u})$, $p\ (uud)$, $\Lambda\ (uds)$,
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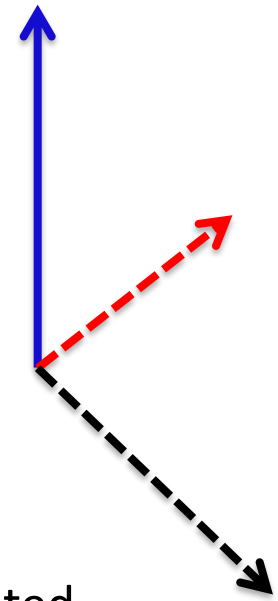

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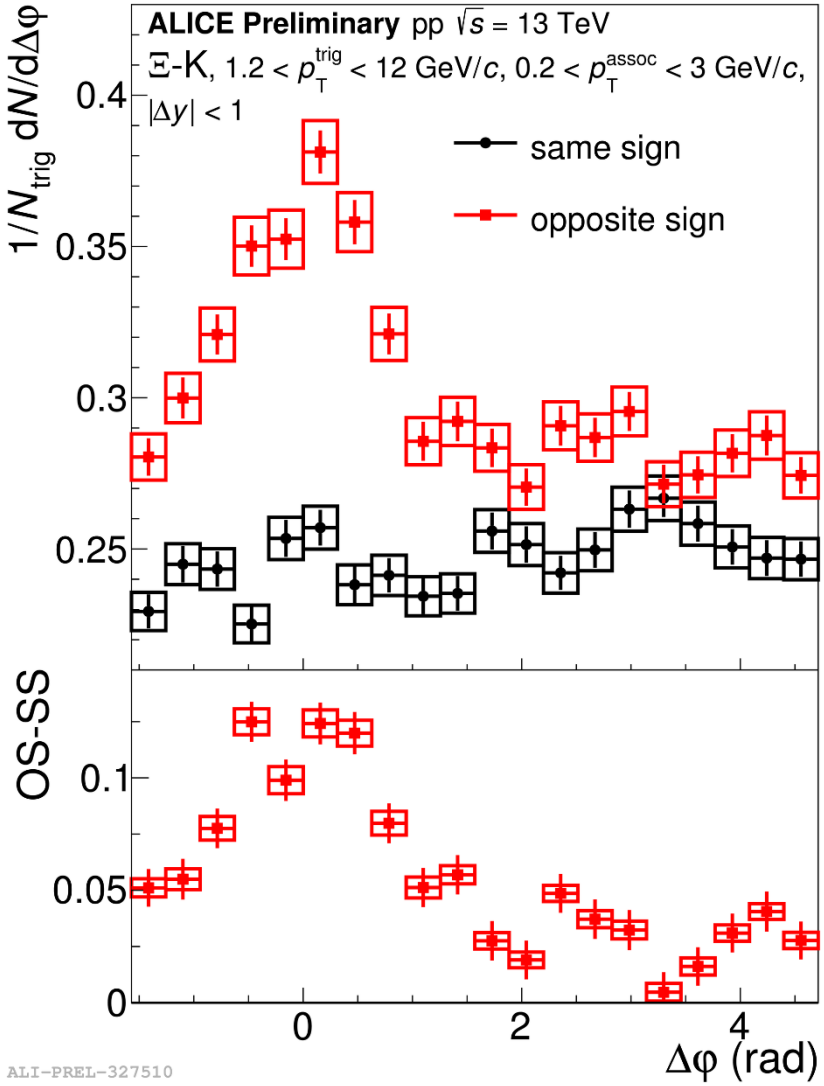
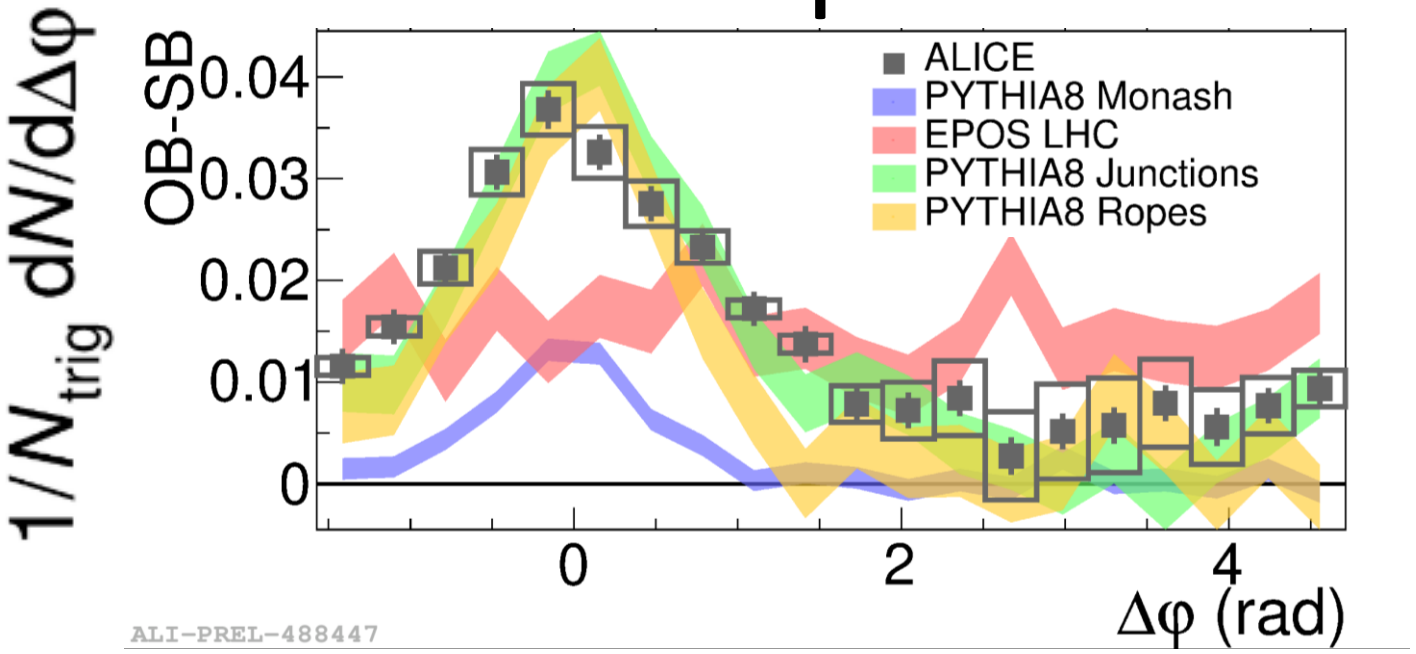


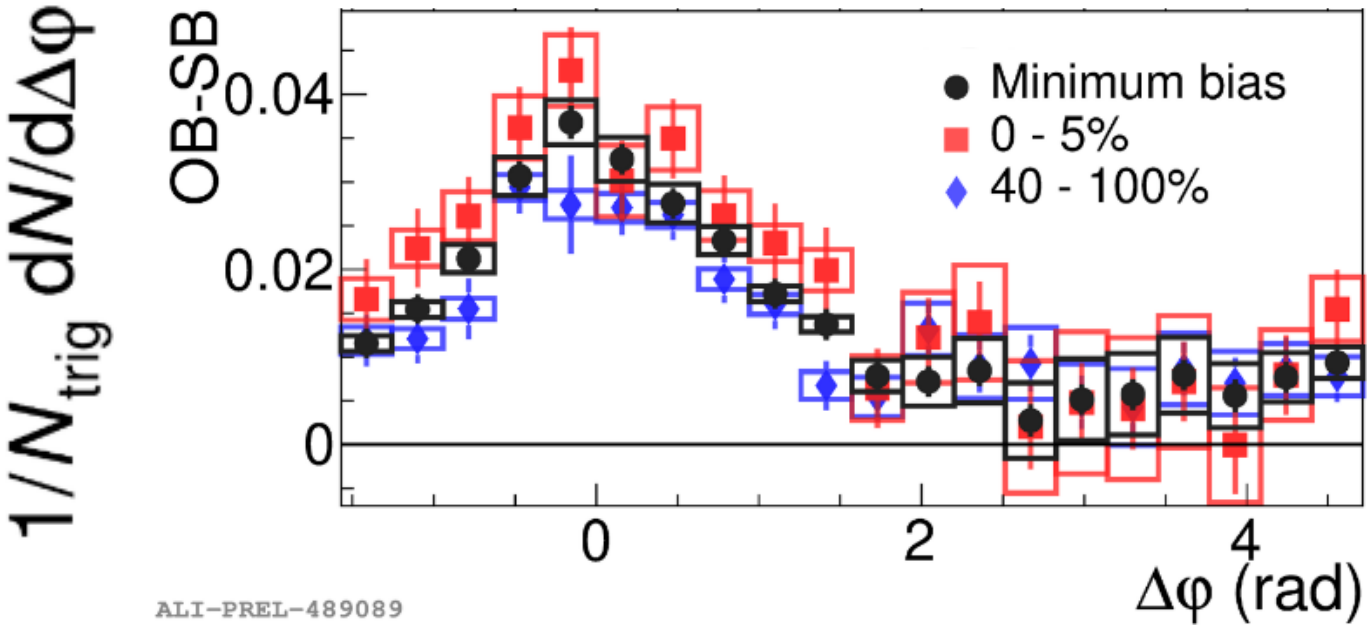
Results in MB pp collisions

Ξ-p



- Microscopic production mechanism can be constrained!

Little multiplicity dependence



Ξ-p

- No change in production mechanism (?)
- No increasing diffusion/dissipation (thermalization?)
  - The correlations appear to be perfect!
  - What is deconfinement for a perfect liquid?

Thank You!