Measurement of Non-flow Correlations and Elliptic Flow Fluctuations in Au+Au collisions at RHIC

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• Event-by-event fluctuations of azimuthal particle anisotropy in Au + Au collisions at 200 GeV
  B. Alver et. al. (PHOBOS), PRL 104, 142301, 2010

• Non-flow correlations and elliptic flow fluctuations in Au-Au collisions at 200 GeV
  B. Alver et. al. (PHOBOS) PRC 81, 034915, 2010

• Collision geometry fluctuations and triangular flow in heavy-ion collisions
  B. Alver, G. Roland, PRC 81, 054905 (2010)

See poster for details.
Initial geometry fluctuations reconciles elliptic flow for Cu+Cu and Au+Au collisions.

PHOBOS PRL 98, 242302 (2007)
Prediction: Elliptic flow fluctuations

If initial geometry fluctuations are present, $v_2$ should fluctuate event-by-event at fixed $N_{\text{part}}$ or $b$.

$$\frac{\sigma_\varepsilon}{\langle \varepsilon \rangle} \text{ vs. } N_{\text{part}}$$
Measuring elliptic flow fluctuations

Event-by-event $v_2^{obs}$ distribution

A new methodology has been developed to account for:
- Statistical fluctuations
- Detector effects
- Non-flow correlations
Elliptic flow fluctuations

The measured elliptic flow fluctuations agree with predictions from initial geometry fluctuations.

\[ \frac{\sigma(v_2)}{\langle v_2 \rangle} \text{ vs. } N_{\text{part}} \]
A triangular anisotropy arises in the initial geometry from event-by-event fluctuations which develops a triangular flow analogous to elliptic flow.

\[ \frac{dN}{d\phi} = \frac{N}{2\pi} \left( 1 + \sum 2v_n \cos(n(\phi - \psi_n)) \right) \]

\[ v_2 = \langle \cos(2(\phi - \psi_2)) \rangle \]

\[ v_3 = 0 \]

\[ v_2 = \langle \cos(2(\phi - \psi_R)) \rangle \]

\[ v_3 = \langle \cos(3(\phi - \psi_3)) \rangle \]
Long range correlations are well described by 3 Fourier Components.
Conclusion

• A new methodology has been developed to measure non-flow correlations and elliptic flow fluctuations.

• Initial geometry fluctuations provide a consistent picture of flow and correlations results.
  - System size dependence of elliptic flow
  - Elliptic flow fluctuations
  - Triangular flow (ridge and away side)

• Triangular flow provides a new handle on the initial collision geometry and hydrodynamic evolution of the system.

See poster for details. Thanks!