

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Measurement of the azimuthal anisotropy for charged particle production in Pb+Pb collisions at $\sqrt{s_{NN}}=2.76$ TeV and in p+Pb collisions at $\sqrt{s_{NN}}=5.02$ TeV with the ATLAS detector at the LHC

By

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Measurements of the p_T , η and centrality dependence of the flow harmonics v_n in Pb+Pb collisions at $\sqrt{s_{NN}}=2.76$ TeV with the ATLAS detector at the LHC are presented. Consistent measurements of harmonics v_2-v_6 are done via event-plane and two-particle correlation methods. Dipolar flow v_1 associated with initial dipole asymmetry is also measured via two-particle correlations using a two-component model that accounts for momentum conservation effects. These coefficients can be used to study the initial geometry as well as the hydrodynamic response of the medium to the initial geometry. Sizable values of the odd harmonics, especially v_3 are observed, indicating significant event-by-event fluctuations in the initial geometry. Interesting scaling relations in the p_T and centrality dependence of the v_n are shown. It is also demonstrated that the long-range structures seen in two-particle correlations such as the *ridge* and the *cone* are entirely accounted for by collective flow.

The fluctuations in the initial collision geometry from one event to another are further investigated by measuring the event-by-event distributions for harmonics v_2-v_4 . These measurements are done for charged particles with $p_T > 0.5$ GeV and also separately for particles with $0.5 < p_T < 1.0$ GeV and with $p_T > 1.0$ GeV, and are shown to have an identical shape when scaled to have the same mean. These distributions are shown to contain more information than that obtained via multi-particle cumulant methods. These measurements are compared with different initial geometry and final-state interaction models.

A large set of correlations between two and three harmonic planes Φ_n of different orders are measured. These correlation measurements are complimentary to the v_n measurements and are shown to be able to differentiate between initial geometry effects and effects that set in during the expansion of the medium by comparing with theoretical models.

Two-particle $\Delta\eta$ - $\Delta\phi$ correlations in p+Pb collisions at $\sqrt{s_{NN}}=5.02$ TeV are also measured. Long-range correlations are observed along $\Delta\eta$ at $\Delta\phi \sim 0$ that increase with increasing event-activity. A symmetric long-range correlation is also shown to exist at $\Delta\phi \sim \pi$ which is obtained by subtracting out the expected contribution from recoiling dijets. These correlations are shown to be similar to those seen in Pb+Pb collisions suggesting similar physics in both systems.

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Program: Physics

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