

# **Stony Brook University The Graduate School**

## **Doctoral Defense Announcement**

### **Abstract**

**Azimuthal Anisotropy Measurement of Neutral Pion and Inclusive Charge Hadron**

**Production in Au+Au Collisions at  $\sqrt{s_{NN}} = 62$  and 39 GeV**

**By**

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By colliding heavy ions that are accelerated to relativistic speed, deconfined nuclear matter (referred to as Quark Gluon Plasma, QGP) is created at the Relativistic Heavy Ion Collider (RHIC). Existing data of RHIC allows the access to the high temperature, low baryon chemical potential regime of the QCD phase diagram, and results with rich physics insights have been produced. Further understanding of the nuclear matter requires exploration of other regions of the QCD phase diagram. Therefore, RHIC has embarked on a beam energy scan program involving colliding gold nuclei at various energies. During the 2010-2011 operation period, the data collected at PHENIX detector consists of datasets obtained at  $\sqrt{s_{NN}} = 200, 62, 39$  and 7.7 GeV.

One particularly effective probe of the hot QCD matter is the anisotropy of particle production, characterized by Fourier coefficients  $v_n$ .  $v_2$  at low  $p_T$  describes collective behavior of the nuclear matter, and measurement at 200 GeV suggests a hydrodynamic flow of hot QCD matter at partonic level with small but finite viscosity. On the other hand, at high  $p_T$  region  $v_2$  reflects path-length dependence of energy loss of hard partons and sensitive to details of transport models.  $\pi^0$ 's could be constructed in a wide  $p_T$  range, therefore has the unique advantage of probing both  $p_T$  ends. Details of  $\pi^0 v_2$  measurement of Au+Au collisions at  $\sqrt{s_{NN}} = 62$  and 39 GeV are presented.

Great attention has been given to higher order harmonics  $v_n$  ( $n > 2$ ) recently. They are originated from initial geometry fluctuations, and thus capable of providing additional constrains on the initial geometry models, the uncertainty associated with which is one main obstacle that prevents a precise extraction of the properties of QGP. In the dissertation study,  $v_n$  ( $n = 2, 3, 4$ ) of inclusive charge hadrons are measured via the construction of higher order event planes. Results are obtained for  $\sqrt{s_{NN}} = 62$  and 39 GeV collisions. The comparisons of the results to the existing ones of 200 GeV at RHIC, and to the recently measured results from LHC are discussed.

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**Time:** 10:00am

**Place:** Physics D-122

**Program:** Physics

**Dissertation Advisor:** R. Lacey & J. Jia