

Study of Jets in Quark Gluon Plasma with Parton Identification

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【Outline of survey】

At a few microseconds after the birth of the Universe or deep inside a super dense star, it is expected that there is another state of the matter where quarks and gluons are not confined to hadrons, i.e. Quark-Gluon Plasma (QGP). The study of this new state is deeply connected to a basic question of the natural science, and because of that, it is one of the major topics of the physics today. Experimental study to create and investigate the property of the QGP has been carried out at Brookhaven National Laboratory and also at CERN. Relativistic Heavy Ion Collider (RHIC) has been operated since 2000, and a lot of interesting features have been found; namely, early thermalization, hydro-dynamical behavior and characteristic hadronization mechanism. All these features support the formation of QGP in the RHIC collision.

For the study of property of the QGP, it is believed that the measurement of jets is one of the most powerful tools. For example, if one measures the angle of Mach cone, the sound velocity in the gluon field can be determined. From the measurement of the characteristic energy loss of partons in the QGP, the information of the gluon density can be obtained.

Having the new era opened by the LHC accelerator, it is very important to carry out systematic measurements and comparisons of RHIC and LHC data.

In particular, the study of jet behavior would be one of the key issues in this field.

【Expected results】

- A new device suitable for jet triggering and identification will be developed and constructed.
- Carry out studies of jet both at RHIC-PHENIX and LHC-ALICE experiments for the systematic comparison.
- Challenge the identification of primary parton fragmenting to jets of particles, which is very difficult in the heavy ion collision because of backgrounds due to the anisotropy and the high multiplicity. Identification of the primary parton would provide crucial information.

【References by the principal investigator】

- Quark-Gluon Plasma. K. Yagi, T. Hatsuda and Yasuo MIAKE, Cambridge Monographs on Particle Physics, Nuclear Physics and Cosmology, Cambridge University Press, 2005
- Formation of dense partonic matter in relativistic nucleus-nucleus collisions at RHIC: Experimental evaluation by the PHENIX collaboration. K. Adcox, T. Chujo, S. Esumi, Y. Miake et al., Nucl.Phys.A 757:184-283,2005.

【Term of project】 FY2008– 2012

【Budget allocation】

65,400,000 yen (direct cost)

【Homepage address】

<http://utkhii.px.tsukuba.ac.jp/>