Proposal of Molecular-type International Workshop

Workshop subject: Exotics from heavy ion collisions

Abstract (2-3 lines): We investigate the production of exotic hadrons and interactions between short-lived particles in high-energy heavy-ion collisions. Thermal and recombination formation mechanisms of hadrons are discussed, and we try to predict exotics hadron production rate. We also propose new heavy multiquark configurations and discuss ideas to study multiquark configurations from heavy ion collisions.

Number of participants: 8-15
Period: May 17-30
Budget request: 800,000 yen

Research conductor: Su Houng Lee (Yonsei/Visiting professor in YITP.)

Core participant: C.M. Ko (Texas A&M).

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Other participants: A. Hosaka, D. Jido, T. Hyodo, H. Fujioka, K. Fukushima, C. Nonaka, M. Asakawa, T. Nagae, Choong-Jae Yoon, In-Kwon Yoo, Huan Z. Huang, Marina Nielsen.

It becomes almost confident that deconfined dense matter consisting of quarks and gluons are created in high-energy heavy-ion collisions at RHIC. In addition to the study of hot quark-gluon matter, RHIC also serves as a factory of various hadrons, including exotic hadrons. Since the collision energy is high, strange quarks are almost thermally and chemically equilibrated. In addition, abundant charm quarks are created and they form charmed hadrons in the final state. The freeze-out temperature and chemical potential, and their time evolution are extensively studied, then hadron production mechanism in the soft region is relatively well-known.

Under this extreme condition, various kind of proposed exotics, such as tetra quarks ($X, Y, Z..$), pentaquarks (Θ^+, ...), as well as newly proposed heavy multiquark configurations should be also made. In addition, well-known freeze-out temperature and chemical potential enable us to evaluate the production rate, as long as they are thermally produced. When we consider other mechanisms such as recombination, their production rates are sensitive to the size, the number of quarks in that hadron, di-quark component in QGP, and so on. Thus the production rate would tell us the nature of those exotics. Another interesting point is that it would be possible to access the interaction amonng short-lived particles. Abundant short-lived hadrons are simultaneously produced in RHIC, and it would be possible to measure their interactions via the final state interactions. For example, $\Lambda\Lambda$ and ΞN interactions may be measured by using the modification of the two-hadron momentum correlation functions.

In this molecule-type workshop, we would like to discuss the formation of exotics in relativistic heavy-ion collisions. Through the discussions among professional researchers of exotic hadrons and high-energy heavy-ion collisions, we will predict new heavy multiquark configurations, estimate the production rate of various exotic hadrons, and we would like to propose new ideas in analyzing RHIC data in view of these exotic hadrons and exotic interactions.