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# Study of high baryon density QCD matter at J-PARC-HI

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The QCD phase diagram has been explored in the high temperature side at RHIC and LHC, while the high density side is barely explored. Systematic studies of the QCD matter from Bevalac to LHC energies have suggested that the highest density QCD matter can be reached around the AGS energies (sqrt(s_{NN})=~5-GeV) where a rich production of strange hadrons is expected.

The future heavy-ion program at J-PARC (J-PARC-HI) is focused to explore such a highest density QCD matter. The J-PARC-HI will accelerate ions up to Uranium with the cms energy of sqrt(s_{NN})=2-6.2-GeV at the beam rate up to 1.0e+11 ions per cycle, five orders of magnitude higher than that of AGS. We could reach as 8-10 times higher density as the normal nuclear matter with the Uranium ions. The heavy-ion acceleration scheme consists of a new linac and a booster as the injector, followed by the existing 3-GeV Rapid-Cycling Synchrotron (RCS) and 50-GeV Main Ring (MR). The booster design is much advanced since last year by a new charge exchange injection scheme and multi-charge state acceptance.

Taking advantage of the very high intensity beam, we introduce new event selection quantities, such as strangity (strange hadron fraction) and baryonity (net baryons), on top of the conventional centrality variable, which would exclusively select high-density matter events. We will then primarily measure the probes that were not measured at AGS, namely, electromagnetic probes (photons and lepton pairs), higher-order flow of particles and the fluctuation of conserved charges such as net-baryons. We will also perform systematic measurement of conventional hadronic observables.

A large acceptance heavy-ion spectrometer based on a Toroidal magnet has been designed for the high density QCD matter study. We will show the updated acceleration scheme as well as the detector performance and expected physics result.

A search for the exotic hadrons and nuclei such as dibaryons, kaonic nuclei, and measure hypernuclei is also possible at this cms energy. We will also discuss about this measurement.

## Preferred Track

Future Experimental Facilities, Upgrades, and Instrumentation

## Collaboration

Other

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