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Heavy-ion physics studies for the Future Circular Collider

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This presentation will give an update on the projected accelerator performance and on the physics studies for a heavy-ion programme at FCC-hh. Operating FCC-hh with heavy-ion beams would provide Pb-Pb and p-Pb collisions at centre-of-mass energies of 39 and 63 TeV, respectively, per nucleon-nucleon collisions. Updated estimates indicate that a luminosity of about 30/nb could be integrated during a one-month Pb-Pb run, that is more than one order of magnitude above the maximum projections for the LHC. The large increase in centre-of-mass energy and luminosity opens interesting physics opportunities.
The Quark-Gluon Plasma (QGP) state produced in Pb-Pb collisions at 39 TeV is expected to have initial temperature and energy density substantially larger than at LHC energy, a stronger flow field and freeze-out volume twice as large. The larger temperature could entail novel features, like changes in the quarkonium spectrum and abundant in-medium production of charm quarks. The latter could determine an increase in the number of degrees of freedom of the QGP (from 3 to 4 quark flavours) and provide a new tool to study its temperature evolution. New, rarer, hard probes would be available, like boosted top quarks, which could give access to the time-evolution of the medium properties, e.g. of its opacity. The physics of high-density gluon densities at small Bjorken-x and the onset of saturation can be studied using high-energy p-A and A-A collisions, as well as the gamma-A interactions produced in ultra-peripheral (electromagnetic) collisions of nuclei. At FCC-hh, the increase in centre-of-mass energy of a factor seven with respect to the LHC will extend the kinematic coverage in x and Q^2, providing access to the region down to x< 10^-6 with perturbative probes like heavy quarks and quarkonia and down to x< 10^-4 with W, Z and top.

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