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NICA project: challenges for heavy ion collider

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The global scientific goal of the NICA/MPD (Nuclotron-based Ion Collider fAcility / Multy Purpose Detector) project under realization at JINR is to explore the phase diagram of strongly interacting baryonic matter in the region of a high compression and temperature. The proposed program allows one to search for possible signs of the phase transitions and critical phenomena in heavy ion (up to Au+Au) collisions up to to energies of 11 GeV in nucleon- nucleon center-of-mass system.The collider experiment provides optimal conditions for efficient energy scan measurements. However, the accelerator task to reach required average luminosity of the order of 10^27 cm^-2*s^-1 is challenging: in contrast with a high energy collider the luminosity is limited by Lasslet tune shift, the beam-beam parameter is almost negligible. A flexible procedure of the beam storage and short bunch formation is to be applied to provide maximum peak luminosity in a wide energy range. The application of beam cooling methods is mandatory in order to suppress luminosity dilution due to the intra-beam scattering. A solution of these and other problems is demonstrated in the case of the NICA collider design.

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