

Statement by the German ALICE Community as input to the European Strategy for Particle Physics

In two joint workshops organized by the German Committee on Elementary Particle Physics KET, the German Committee on Hadronic and Nuclear Physics KHuK and the German Committee on Astroparticle Physics KAT in December 2017 at DESY and in May 2018 at Bonn also the prospects of high energy nuclear collisions at colliders to study a net-baryon free quark-gluon plasma were presented both from a theoretical and an experimental perspective and received a broad discussion by the entire German community. A corresponding statement was formulated and consented at the May workshop.

As high energy nuclear collisions are funded in Germany via Nuclear and Hadronic Physics programs, this statement was eventually not part of the KET communication. Since KHuK did not issue its own statement as input for the European Strategy, the German groups working experimentally and theoretically on ALICE are transmitting the consensus of the community in the following.

Heavy Ion collisions at substantially increased luminosity and energy open excellent new possibilities to study strongly interacting matter at high temperature. Here a quark-gluon plasma is formed similar to the conditions as they existed in the early universe on a nanosecond to microsecond timescale and that are also accessible theoretically in lattice QCD. In the future, it will be possible to uncover connections between macroscopic properties of the relativistic quantum fluid and the underlying microscopic QCD Lagrangian.

In particular, this will be possible using new, up to now not accessible observables. Measurements of identified particles at very low transverse momenta ($p_t < 20$ MeV/c) are of particular interest to characterize the macroscopic properties of the expanding QCD fluid. The development of a new nearly massless detector using the most modern radiation hard silicon technologies is now possible, based on the breakthroughs achieved for the ALICE upgrade towards LHC Run-3 and Run-4. **Measurements with such a next generation experiment could already take place at the HL-LHC starting from 2030 and might find a natural continuation at accelerators with even higher energies.**

The German ALICE community wishes to express its strong interest in the realization of such a next generation LHC heavy ion experiment as follow-up to the presently approved LHC heavy ion program.

Prof. Johanna Stachel
Spokesperson, representing the BMBF Forschungsschwerpunkt 202 – ALICE
stachel@physi.uni-heidelberg.de

