HK 76: Invited Talks IV

Time: Friday 11:00–12:30 Location: HSZ/0002

Invited Talk HK 76.1 Fri 11:00 HSZ/0002

Thermalization of heavy quarks in the QGP — •Federica Capellino — Physikalisches Institut Heidelberg, Heidelberg, Germany

Heavy-ion collision experiments allow us to study the high-temperature deconfined phase of QCD, the quark-gluon plasma (QGP). Heavy quarks (i.e. charm and beauty) are powerful tools to characterize the transport properties of the QGP. Although they are initially produced out of kinetic equilibrium via hard partonic scattering processes, recent experimental measurements of charmed hadrons pose the question regarding the possible thermalization of heavy quarks in the medium. Exploiting a mapping between transport theory and fluid-dynamics, we will show how a fluid-dynamic description of the dynamics of charm quarks in the QCD plasma is feasible. Calculations for heavy-flavor observables which assume charm quarks to be in local thermal equilibrium with the plasma will be shown in comparison with experimental data. The model-to-data comparison is a fundamental step towards constraining the spatial- and momentum-diffusion coefficient of the QGP.

Invited Talk HK 76.2 Fri 11:30 HSZ/0002

Hadron structure in Lattice QCD — •Konstantin Ottnad — PRISMA+ Cluster of Excellence and Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

Quantum chromodynamics (QCD) at low energies gives rise to a plethora of states as quark and gluons become bound in hadrons. Among these hadronic states are nucleons which account for the bulk part of visible matter in the universe. Due to their dynamical origin they are not pointlike particles but exhibit a rich and complex internal structure which is studied extensively in both experiment and theoretical studies.

Concerning the theoretical side, lattice QCD provides the obvious framework for ab initio hadron structure calculations as it is the only known method to deal with QCD in the non-perturbative regime from first principles. In recent years it has finally become feasible to obtain precise physical results with fully controlled systematics from such lattice calculations of hadron structure observables. Still, this remains a very challenging and computationally expensive endeavour as these calculations are always affected by a notorious signal-to-noise problem that hinders the extraction of groundstate matrix elements.

In this talk I will outline some of the essential methods used to carry out state-of-the-art hadron structure calculations within lattice QCD and discuss recent results from the Mainz group for nucleon matrix elements at zero and nonvanishing momentum transfer.

Invited Talk HK 76.3 Fri 12:00 HSZ/0002

LISA: LIfetime measurements with Solid Active targets — •Kathrin Wimmer — GSI Helmholtzzentrum für Schwerionenforschung GmbH

The coexistence of single-particle and collective degrees of freedom in atomic nuclei gives rise to various exotic phenomena. In nuclei with very asymmetric proton-to-neutron ratios, the strong nuclear interaction drives shell evolution which alters the orbital spacing, and in some cases even the ordering present in stable nuclei. In the absence of large gaps between orbitals, nuclei can take on non-spherical shapes and their excitations proceed through coherent and collective motion of many nucleons. Where and how collectivity emerges from the single-particle dynamics of protons and neutrons is an open question in nuclear structure physics that will be addressed with LISA in a unique way. The aim of the LISA (LIfetime measurements with Solid Active targets) project is to develop a novel method for lifetime measurements in atomic nuclei. Lifetimes probe the collectivity of a nucleus through its electromagnetic transition properties. The experimental approach is based on active solid targets and will dramatically enhance the scope of measurements of excited-state lifetimes and thus transition probabilities achievable in exotic nuclei. Coupled to state-of-the-art gamma-ray tracking detectors such as AGATA, this novel instrument will overcome the present challenges of lifetimes measurements with low-intensity beams of unstable nuclei. In this talk, I will present an overview of the LISA project and show the potential for future physics experiments at FAIR.