HK 31: Hauptvorträge I

Zeit: Mittwoch 11:00–12:30 Raum: S1/01 A1

Hauptvortrag HK 31.1 Mi 11:00 S1/01 A1

Extracting two- and three-particle resonances from the lattice — •Maxwell Hansen — Helmholtz Institut Mainz, Mainz, Germany

The theory of the strong force, QCD, is non-perturbative at low energies. For this reason, numerical techniques are needed to extract the low-lying resonance spectrum from the underlying theory. Lattice QCD offers a numerically tractable non-perturbative method that can be systematically improved to reach reliable physical predictions. However, numerical lattice calculations are necessarily performed in a finite volume and with Euclidean time coordinates. This greatly complicates the calculation of scattering amplitudes, which are needed to study resonances. In this talk I discuss formalism that circumvents these issues, allowing one to rigorously extract scattering observables and determine resonance widths and masses. The approach, based on early work from Martin Lüscher, is to us the finite-volume energy spectrum as the lattice observable, and then map it via non-perturbative formal relations to the desired scattering amplitudes. I will summarize the formal work of Lüscher and its modern extensions and also give examples of how the method has been applied in state-of-the-art calculations.

Hauptvortrag HK 31.2 Mi 11:30 S1/01 A1

Exploring the phase structure and dynamics of QCD — •Jan M. Pawlowski — Heidelberg University, Heidelberg, Germany

The past years have seen tremendous progress in the description of Quantum Chromodynamics at vanishing and finite temperature and density with functional approaches, such as the functional renormalisation group or Dyson-Schwinger equations. Within these approaches QCD correlation functions of quarks, gluon and hadrons are computed non-perturbatively from first principles.

In the present talk I will discuss results for the phase structure of QCD at finite temperature and density, as well as for thermodynamical obserables such as the pressure and the trace anomaly. The approach is also applied to baryon number fluctuations.

By now functional approaches also allow for a direct computation of transport coefficients in QCD. First results concern the temperature dependence of the shear viscosity over entropy ratio in Yang-Mills theory and QCD. The talk concludes with a discussion of the further prospects for our understanding of the phase structure and dynamics of QCD.

Hauptvortrag HK 31.3 Mi 12:00 S1/01 A1

Precision mass measurements and more at ISOLTRAP — •Frank Wienholtz for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität, Institut für Physik, Greifswald, Germany

Mass spectrometers at radioactive ion-beam facilities have to cope with ever-more demanding measurement conditions in order to succeed in gathering new data on the binding energy of exotic nuclei. These conditions are also quite diverse, ranging from cases in which the isotopes of interest are only produced in very low yields of some ions per second to others in which the ions of interests, although produced in reasonable quantities, are accompanied by isobaric contaminations several orders of magnitude more abundant. Furthermore, the purification and mass measurement processes have to be fast enough in order to reach exotic isotopes far away from the valley of stability, where half-lives drop well below hundred milliseconds.

The ISOLTRAP setup situated at the ISOLDE facility at CERN has been upgraded throughout the years to handle these extreme situations and determine further unknown binding energies on the way to an increased understanding of nuclear structures. This contribution will present the current status of the setup and with a focus on the most recent results. The topics range from the investigation of the N = 82 shell closure using neutron-rich cadmium masses, which are relevant for the rapid neutron capture process of nucleosynthesis, to nuclear structure studies around the double magic (Z=28, N=50) nucleus Ni-78 by probing exotic Cu isotopes. In addition, new measurements of rubidium, strontium and krypton isotopes in the mass A=100 region will be presented, which shed new light on a well-known shape-transition region of the nuclear chart. As an extension of the standard use of the ISOLTRAP setup, fast and highly selective single-ion counting techniques have been combined recently with the Resonant Ionization Laser Ion Source (RILIS) of ISOLDE. This combination allowed in-source laser-spectroscopy measurements for the study of shape coexistence. The new detection capabilities available at ISOLTRAP as well as recent on-line results will be presented.