HK 16: Invited Talks - III

Time: Wednesday 14:00–16:00 Location: H1

Invited Talk HK 16.1 Wed 14:00 H1

Short-Range Correlations in neutron-rich nuclei — •Meytal Duer — TU Darmstadt, Darmstadt, Germany

When nucleons come in close proximity they experience the short-range part of the nucleon-nucleon interaction. These states are referred to as Short-Range Correlated (SRC) nucleon-nucleon pairs, with large relative momentum and small cente-of-mass momentum with respect to the Fermi momentum. SRC pairs are formed as temporary fluctuations with high density, several times the nuclear saturation density. These are densities that exist in neutron stars, but are difficult to study in the lab.

Most of the knowledge we have to date about SRC comes mainly from electron scattering experiments. These demonstrated that at any given moment, about 20% of the nucleons in nuclei are members of such neutron-proton SRC pairs. Electron scattering experiments are limited, however, to stable nuclei. To overcome this limitation, to access very neutron-rich nuclei, radioactive-ion beams are the only way to do so. The next generation of proposed experiments includes the use of hadronic probes in inverse kinematics.

Our recent experiment at JINR, Russia showed for the first time that SRC pairs are accessible in inverse kinematics. This showcases a new ability to study SRC in short-lived exotic nuclei at the R3B setup at GSI and in the future at FAIR. The first experiment with radioactive nucleus, ^{16}C, will be performed at R3B in 2022. A successful experiment will pave the way for systematic studies of the neutron excess for example along isotopic chains.

Invited Talk HK 16.2 Wed 14:30 H1

The BGOOD experiment at ELSA - exotic structures in the light quark sector? — •Thomas Jude for the BGOOD-Collaboration — Physikalisches Institut, Universität Bonn

The recent discoveries of the pentaquark, P_C, states and XYZ mesons in the charmed quark sector initiated a new epoch in hadron physics. The existence of exotic multi-quark states beyond the conventional three and two quark systems has obviously been realised. Intriguingly, similar states may be evidenced in the light, *uds* sector in meson photoproduction. Access to a low momentum exchange and forward meson production region is crucial. The BGOOD photoproduction experiment is uniquely designed to explore this kinematic region; it is comprised of a central calorimeter complemented by a magnetic spectrometer in forward directions.

Our results indicate a peak-like structure in the $\gamma n \rightarrow K^0\Sigma^0$ cross section consistent with a meson-baryon interaction model which predicted the charmed P_C states. The same $K^*\Sigma$ molecular nature of this proposed N*(2030) is also supported in our measurement of $\gamma p \rightarrow K^+\Lambda(1405)(\rightarrow \pi^0\Sigma^0)$. Additionally, a sharp drop in the $\gamma p \rightarrow K^+\Sigma^0$ cross section at very forward angles is observed.

In the non-strange sector, coherent meson photoproduction off the deuteron enables access to proposed dibaryon states. Preliminary data supports recent experimental claims of isoscalar and isovector dibaryons.

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Invited Talk HK 16.3 Wed 15:00 H1

The Muon g-2 Experiment at Fermilab — •Martin Fertl for the Muon g-2-Collaboration — Institute of Physics and Excellence Cluster PRISMA+, Johannes Gutenberg University Mainz, 55099 Mainz, Germany

The E989 collaboration has recently published the most precise measurement of the muon anomalous magnetic moment a_μ with an uncertainty of 460 ppb. The new experimental world average of a_μ (with an uncertainty of 350 ppb) differs by 4.2 standard deviations from the Standard Model prediction provided by the Muon g-2 Theory Initiative. The emerging results from ab-initio lattice QCD calculations allow to scrutinize this tantalizing hint for physics beyond the Standard Model for the first time in a three way comparison. To extract the value of a_μ a clock comparison experiment is performed with spin-polarized muons confined in a superbly controlled electric and magnetic field environment. The deviation of the Larmor from the cyclotron frequency, the anomalous spin precession frequency, is determined while a high-precision measurement of the magnetic field environment is performed using nuclear magnetic resonance techniques. I will discuss the most recent result from the first science data run in 2018 and will report on the experimental improvements implemented to achieve the ultimate goal of 140 ppb uncertainty on a_μ.

Invited Talk HK 16.4 Wed 15:30 H1

The muon (g-2) from lattice QCD and experiments: 4.2 sigma, indeed? — •Zoltan Fodor — University of Wuppertal

Twenty years ago, in an experiment at Brookhaven National Laboratory, physicists detected what seemed to be a discrepancy between measurements of the muon's magnetic moment and theoretical calculations of what that measurement should be, raising the tantalizing possibility of physical particles or forces as yet undiscovered. The Fermilab team has just announced that their precise measurement supports this possibility. The reported significance for new physics is 4.2 sigma just slightly below the discovery level of 5 sigma. However, an extensive new calculation of the muon's magnetic moment using lattice QCD by the BMW-collaboration reduces the gap between theory and experimental measurements. The lattice result appeared in Nature on the day of the Fermilab announcement. In this talk the theoretical aspects are summarized with two possible narratives: a) almost discovery or b) Standard Model re-inforced. Details of the lattice calculation are also shown.