HK 24: Invited Talks I

Time: Wednesday 11:00–12:30 Location: Kurt-Alder HS Chemie

Invited Talk HK 24.1 Wed 11:00 Kurt-Alder HS Chemie
PUMA: low-energy nuclear physics with antiprotons — •Alexandre Obertelli — TU Darmstadt, Darmstadt, Germany

The antiProton Unstable Matter Annihilation (PUMA) experiment aims at investigating the neutron skin of stable and radioactive nuclei by use of antiproton-nucleus annihilation. The experiment, approved in 2021 at CERN, will collect antiprotons from the ELENA low-energy ring of the Antimatter Factory before transporting them in a compact particle trap to the ISOLDE radioactive ion beam facility, located a few hundred meters away. At ISOLDE, the particle trap will be connected to the low-energy radioactive ion beam line to receive short-lived rare nuclei. The annihilation between matter and antimatter will occur inside the particle trap, which is surrounded by particle detectors to detect and reconstruct annihilation events. Future perspectives to produce hypernuclei from low-energy antiproton annihilations at the Antimatter Factory of CERN and to investigate their structure will be introduced.

Invited Talk HK 24.2 Wed 11:30 Kurt-Alder HS Chemie
How well do we know the vector quarkonia? — •Nils Hüsken — Johannes Gutenberg-Universität Mainz

Quarkonia, mesons made from a heavy quark and an anti-quark, are considered to be the strong interaction analogues to the hydrogen atom. As such, the spectrum of the $c\bar{c}$ charmonium and $b\bar{b}$ bottomonium hadrons can be calculated using familiar methods from quantum mechanics. Experimentally, below the threshold for the decay into pairs of charm- (bottom-)flavoured hadrons the observed states match these calculations very well. Above that threshold, however, experiments have found a large number of new, exotic hadrons that do not match our expectations for regular quarkonium hadrons - the XYZ states. In e^+e^- annihilation experiments, vector mesons with the same spin and parity as the photon are produced copiously, and indeed exotic vector-states like the $Y(4230)$ and $\Upsilon(10753)$ have been reported in both the charmonium and bottomonium regions. Their interpretation is a matter of hot debate and largely depends on our knowledge of the highly excited regular vector quarkonium states. In this talk, I will summarize the experimental situation of the vector quarkonia, highlight the open questions relating to exotic hadrons, and present the ongoing effort to shed light on both the regular and exotic vector quarkonia above the open-flavour thresholds.

Invited Talk HK 24.3 Wed 12:00 Kurt-Alder HS Chemie
Precision redefined: Unlocking new frontiers with Monolithic Active Pixel Sensors — •Bogdan-Mihail Blidaru for the ALICE Germany-Collaboration — GSI Helmholtzzentrum, Darmstadt

CMOS Monolithic Active Pixel Sensors (MAPS) have emerged as key-enabling detector technologies for heavy-ion experiments, meeting the stringent requirements of high granularity, low mass, excellent spatial resolution, and robust radiation tolerance demanded by these high-density collision environments. Several variations of MAPS developed using mainstream CMOS imaging technologies have been or are successfully being used in experiments (STAR, ALICE ITS2), while some are planned for current and future upgrades (ITS3, ALICE3, Belle2, CBM, LHCb trackers, mu3e), and even prospective FCC-ee detectors.

The recent shift to deeper submicron nodes enhances integration density and enables larger wafer sizes. Alongside process modifications this allows CMOS MAPS to be competitive in terms of radiation hardness with their hybrid counterparts. Moreover, with sensitive layers only few tens of microns thick, the sensors can be thinned even below 50μm, at which point they become flexible enough to be bent into truly cylindrical shapes with radii as small as 2 cm. Combined with processing options such as stitching, this added flexibility allows fabrication of entire detector half-cylinders from a single sensor, substantially reducing support structures and overall material budget. These developments pave the way toward near-massless detector concepts.

This contribution offers an overview of some emerging CMOS MAPS technologies and their applications in heavy-ion physics.