

HK 19: Invited Talks

Time: Wednesday 11:00–13:00

Location: MED 00.915

Invited Talk HK 19.1 Wed 11:00 MED 00.915
Nucleosynthesis of heavy elements in explosive astrophysical environments — •DANIEL SIEGEL — Institut für Physik, Universität Greifswald

The astrophysical origin of about half of the elements heavier than iron - those synthesized via rapid neutron capture (the r-process) - remains an open problem. Multimessenger astronomy with gravitational waves has revolutionized the way we observe the Universe and linked neutron-star mergers to r-process nucleosynthesis via emission from the radioactive decay of r-process nuclei (a kilonova). However, ample evidence ranging from first-principle arguments to observations of stellar spectra of metal-poor stars and Galactic archeology indicate that a significant if not dominant fraction of r-process nucleosynthesis should be associated with the death of massive stars. Starting from neutron-star mergers, I will discuss recent theoretical and observational developments on heavy-element formation in the death of (massive) rotating stars (collapsars, magnetorotational supernovae, and the accretion-induced collapse of white dwarfs). As new observational capabilities such as the James Webb Space Telescope yield first exquisite results, multi-messenger astronomy may soon lead to new and perhaps surprising answers to the long-standing, fundamental question of how the Universe creates its heaviest elements.

Invited Talk HK 19.2 Wed 11:30 MED 00.915
Recent results from laser spectroscopy with CRIS at ISOLDE: nuclear structure studies and beyond — •JESSICA WARBINEK for the CRIS-Collaboration — CERN, Switzerland — KU Leuven, Belgium

Over the past decade, collinear resonance ionization spectroscopy (CRIS) has developed into a versatile platform for studying atomic and nuclear properties of rare and short-lived quantum systems. CRIS enables high-precision measurements of trends in nuclear charge radii, electromagnetic moments, and the determination of nuclear spins across the nuclear chart, even for isotopes produced at rates as low as a few tens of ions per second. Recent advances have significantly improved the sensitivity toward the most exotic isotopes and expanded the scope and versatility of the technique.

CRIS has opened a new experimental frontier through the first study of short-lived radioactive molecules, in particular RaF, which provide promising platforms for precision tests of fundamental symmetries and searches for physics beyond the standard model at low energies. The production and studies of negative molecular ions further lay the groundwork for proposed future cooling and trapping approaches.

This contribution highlights recent results from CRIS and experimental developments instrumental in achieving them. Future opportunities for precision studies of exotic nuclei at ISOLDE will be outlined.

Invited Talk HK 19.3 Wed 12:00 MED 00.915
QCD at FAIR: Strong QCD Across Communities — •JOHAN MESSCHENDORP¹ and FRANK NERLING^{1,2} — ¹GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — ²Institut für Kernphysik, Goethe-Universität Frankfurt, Frankfurt, Germany

Hadron physics lies at the intersection of several communities, linking QCD theory and effective approaches to emergent phenomena in hadrons and nuclei, the behavior of strongly interacting matter under extreme conditions, and the macroscopic properties of compact stars. In this plenary talk, we will highlight the synergy and added value of a coherent mid- and long-term hadron-physics agenda at GSI/FAIR (“QCD at FAIR”) as a common language, leveraging shared facilities across fields – from precision studies of hadron-hadron interactions and hadron spectroscopy to in-medium modifications and electromagnetic transition form factors – thereby connecting hadron and nuclear structure, heavy-ion physics, and astro(particle) physics. We outline a staged roadmap from SIS18 to SIS100 and, ultimately, high-intensity antiproton beams at HESR, and discuss the resulting impact on ‘strong QCD’.

Invited Talk HK 19.4 Wed 12:30 MED 00.915
New Directions in Micropattern Gaseous Detector Technologies — •PHILIP HAUER — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — Forschungs- und Technologiezentrum Detektorphysik, Universität Bonn

Micropattern Gaseous Detectors (MPGDs) have become a cornerstone technology in modern particle, hadron, and nuclear physics experiments, providing charged-particle tracking over large areas with high spatial resolution, exceptional rate capability, and a minimal material budget. The next generation of experiments demands even greater performance regarding high-rate and low material budget.

This talk will review the research and development activities driving this evolution. A crucial step is to further improve on the amplification stage by using novel approaches including optimized geometries or advanced materials. Concurrently, the research path extends beyond these core advancements to address systemic challenges. This includes the development of stable high-voltage powering schemes for large-area detectors, and the design of highly integrated, radiation-tolerant readout electronics.

This talk reviews recent advancements and directions in MPGD technologies. The practical realization will be illustrated through their implementation in exemplary current detectors and their role in the design of upcoming experiments, underlining how continued MPGD innovation is essential to unlock the physics potential of future experiments.

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