T 43: Invited Overview Talks II

Time: Wednesday 13:45–15:45 Location: ZHG011

Invited Overview Talk T 43.1 Wed 13:45 ZHG011
Advances in Silicon Detectors — •Matthias Hamer — Physikalisches Institut, Universität Bonn

Silicon detectors play a crucial role in modern particle physics experiments, highly performing in demanding environments. Many planned experiments put ever higher requirements on these detectors in terms of radiation dose, hit, data and trigger rates, timing, radiation length and more.

In my presentation I will talk about recent advances in the design of silicon detectors and detail how these advances enable upcoming experiments to meet these requirements. I will cover developments for hybrid and monolithic silicon tracking detectors and silicon calorimeters. I will highlight novel features that have been successfully implemented already, as well as the path ahead towards the realisation of some of the most challenging experiments yet.

Invited Overview Talk T 43.2 Wed 14:15 ZHG011
Exploring the dark universe: the experimental quest for axions and ALPs — •Julia K. Vogel — Fakultät für Physik, TU Dortmund, Otto-Hahn-Str. 4A, D-44227 Dortmund, Germany

Axions and axion-like particles (ALPs) are hypothetical particles predicted in extensions of the Standard Model (SM) of particle physics. Originally proposed as a solution to the strong CP problem in strong interactions, axions have since gained prominence due to their potential role as dark matter candidates. ALPs, more broadly, arise in various beyond-the-SM theories, such as string theory. Both are characterized by extremely low masses and weak couplings to ordinary matter, making them elusive yet fundamental to understanding the universe's hidden structure.

Experimental searches for axions and ALPs span a diverse range of techniques. Haloscopes, helioscopes, and laboratory-based experiments use cutting-edge technologies to detect faint axion signals, while astrophysical and cosmological observations provide indirect constraints. These efforts leverage advances in resonant cavities, magnet technology, and high-intensity lasers to probe unexplored parameter space. The ongoing quest for axions and ALPs is not only a test of theoretical models but a potential gateway to groundbreaking discoveries in physics.

In this talk we will review the landscape of axion and ALP searches introducing the various types of experimental setups employed to look for these hypothetical particles. We will also discuss current results and outline future prospects.

Invited Overview Talk T 43.3 Wed 14:45 ZHG011
Overview on coherent elastic neutrino nucleus scattering and successful first detections — •Janina Hakenmüller — Duke University, Durham, USA

Coherent elastic neutrino nucleus scattering (CEvNS) refers to the standard model process when the neutrino interacts with the nucleus as a whole. The cross section is enhanced by the neutron number squared of the target nucleus, which is ideal for a precision test of the standard model and to look for physics beyond the standard model. Neutrino energies below 50 MeV are required for a coherent interaction. The observable is the tiny recoil of the nucleus hit by the neutrino, which poses a huge challenge on the noise threshold of the detectors. A multitude of experiments with different technologies at different neutrino energies is desirable. The COHERENT collaboration was the first to observe CEvNS at the spallation neutron source at the Oak Ridge national laboratory, USA, with a CsI scintillating crystal in 2017. This was followed by two more successful observations, the most recent one in 2023 with high-purity germanium (HPGe) spectrometers. At lower neutrino energies, the CONUS collaboration also employs HPGe detectors at the Leibstadt power plant, Switzerland, to observe CEvNS for the first time at reactor site with the first data taking run concluded in 2024. The NUCLEUS experiment located at the Chooz reactor, France, and currently under commissioning aims at achieving the lowest energy threshold of these experiments with their cryogenic calorimeters. In my talk, I will present the current status of these experiments and achieved results followed by an outlook on the future.

Invited Overview Talk T 43.4 Wed 15:15 ZHG011
Shifting paradigms in Gravitational-wave Astrophysics — •Imre Bartos — University of Florida

The decade since the first detection of gravitational waves brought about several transformational discoveries. The LIGO and Virgo observatories detected more and heavier black holes than anticipated; the first detection of a neutron star merger through gravitational waves and across the electromagnetic spectrum provided invaluable insights on the production of the heaviest elements in the universe; and a particularly heavy black hole was discovered that could have not come from stellar core collapse. With the exponentially increasing rate of discoveries over the next decade and a half, gravitational waves are all but guaranteed to further shift our astrophysical paradigms. The talk will primarily focus on one of these shifting paradigms: the merger of black holes that was historically considered to be "dark" events producing only gravitational waves, but new observations point towards a brighter, more impactful, multimessenger picture.