EP 10: Astroparticles: Invited topical talks (joint session T/EP)

Time: Thursday 14:00–15:40 Location: T-H15

Invited Topical Talk EP 10.1 Thu 14:00 T-H15

LND - A ("Made in Germany") Radiation Monitor Operating at the far Side of the Moon — •Sönke Burmeister[1], Shenyi Zhang[2], Jia Yu[1], Zigong Xu[1], Stephan Böttcher[1], and Robert Wimmer-Schweingruber[1] — [1]Institut für Experimentelle und Angewandte Physik, Uni Kiel — [2]NSSC, Chinese Academy of Science

Space Radiation is one of the major concerns in human space flight. Of course, this also applies to human exploration of the Moon. On the lunar surface, this consists of chronic exposure to galactic cosmic rays and sporadic solar particle events. The interaction of this radiation field with the lunar soil leads to a third component that consists of neutral particles, i.e., neutrons and gamma radiation. Chang'E 4 is the Chinese mission that landed on the far side of the Moon on January 3rd, 2019. It consists of a lander, a rover, and a relay spacecraft. The LND (Lunar Lander Neutrons and Dosimetry) instrument that was built by CAU is located inside the lander under an opening lid. It consists of a stack of ten segmented Si solid-state detectors (SSDs), which form a particle telescope to measure charged particles (electrons from 0.5 MeV to several MeV, protons 8-35 MeV, and heavier nuclei 17-75 MeV/nuc). A special geometrical arrangement allows observations of fast neutrons (and gamma-rays) that are also important for dosimetry purposes. Thermal neutrons are measured by using a very thin Gd conversion foil sandwiched between two SSDs. The Lunar Lander Neutrons and Dosimetry experiment aboard China's Chang'E 4 lander has made the first ever measurements of the radiation exposure to both charged and neutral particles on the lunar surface.

Invited Topical Talk EP 10.2 Thu 14:25 T-H15

Energetic Pulsar Environments and the Origins of Galactic Cosmic Rays — •Alison Mitchell — Erlangen Centre for Astroparticle Physics, FAU, Erlangen, Germany

Cosmic Rays - and their origins - have fascinated Physicists for over a hundred years. Within our Milky Way Galaxy, particles are known to reach energies beyond the so-called Cosmic Ray *knee*, a spectral break at ~3 PeV in the all particle cosmic ray spectrum. However, evidence for the particle accelerators reach PeV energies - PeVatrons - has proven elusive. Only within the last five years have astrophysical sources of gamma-rays above 100 TeV been identified; gamma-rays produced through interactions of particles with PeV energies. Many of these sources are associated with known energetic pulsars.

In this talk, I will review the current census of PeVatrons and discuss implications for our understanding of pulsar environments. There are several open questions to grapple with: Which particle species are being accelerated - leptonic or hadronic? How are the particles transported through the surrounding medium? What is the maximum energy limit for particle acceleration in pulsar environments? In the near future, data from current and forthcoming facilities will help us to address these questions.

Invited Topical Talk EP 10.3 Thu 14:50 T-H15

Looking forward to exciting physics with FASER — •Felix Kling — DESY

Physics searches and measurements at high-energy collider experiments traditionally focus on the high-pT region. However, if particles are light and weakly-coupled, this focus may be completely misguided: light particles are typically highly collimated around the beam line, allowing sensitive searches with small detectors, and even extremely weakly-coupled particles may be produced in large numbers there. The FASER experiment will use the opportunity and extend the LHC's physic potential by searching for long-lived particles and studying neutrino interactions at TeV energies. In this talk, I will present the physics potential of FASER for new physics searches, neutrino physics and QCD and astro-particle physics.

Invited Topical Talk EP 10.4 Thu 15:15 T-H15

Astroparticle physics at the LHC: Exploring the forward region with cross-section measurements — •Hans Dembinski — Fakultät Physik, Technische Universität Dortmund, Dortmund, Germany

Astroparticle physics is the study of the non-thermal universe with gamma rays, neutrinos, and cosmic rays. Cosmic rays are abundantly produced in cosmic accelerators, like supernova remnants. Some gamma rays and neutrinos are produced indirectly in interactions of cosmic rays with matter in the source, and cosmic rays interact with Earth's atmosphere to produce air showers, which are observed by ground-based cosmic ray observatories and contribute the main background to gamma ray and neutrino observatories. QCD cross-sections for the forward production of hadrons with light and heavy flavor are therefore needed to interpret astroparticle measurements. The experiments at the Large Hadron Collider (LHC) have powerful instruments to measure forward production, but data are more sparse compared to central production. I will summarize the state-of-the-art of forward cross-section measurements at the LHC from the point of view of astroparticle physics and give an outlook into the opportunities in near future with the upcoming run of the LHC and the planned pilot run with oxygen beams.