Colloquia for the succession Prof. M. Pohl, September 18, 2020
Room 222 Sciences-I; Zoom ID: 9390885475

8:30 – 9:30
Prof. Andrii Neronov, Université de Paris-Diderot et Université de Genève
Title: Universe at Highest Energy Frontiers
Abstract: The high-energy Universe is an amazing laboratory which provides a wealth of possibilities for exploration of the limits of our knowledge of the laws of Nature. Our knowledge of the Universe is based on "multi-messenger" data: signals from astronomical sources coming in the form of photons, neutrinos, gravitational waves and cosmic rays. I will review the status of the multi-messenger astronomy and concentrate at the high-energy ends of different observational windows on the Universe. I will show how the energy frontiers of astronomy could be extended beyond 10-100 TeV in the gamma-ray messenger channel, beyond 10 PeV in the neutrino channel and into 1e20 eV in the ultra-high-energy cosmic ray messenger channel. This will require a combination of approaches involving space and ground-based detectors which use the Earth atmosphere as a giant imaging high-energy particle calorimeter. Extension of the energy frontiers of astronomy will allow to advance understanding of the origin of cosmic rays, of cosmic magnetic fields, of the mechanisms of activity of black holes and will possibly reveal the nature of the dark matter.

9:35 – 10:35
Dr. Mercedes Paniccia, DPNC Université de Genève
Title: Precision measurements of cosmic rays in space: challenges and opportunities
Abstract: The study of cosmic rays in space allows to address unresolved fundamental issues of physics such as the asymmetry between matter and antimatter in the Universe, the nature of dark matter and the existence of exotic forms of matter. More than a century after the discovery of cosmic rays, a complete theoretical model capable of explaining experimental observations is still missing. In the last decade, the Alpha Magnetic Spectrometer, installed on the International Space Station, has opened a new era of precision measurements of cosmic rays providing essential new information relevant to these questions. I will review the current AMS results and ongoing research activities, highlighting their enormous impact on the understanding of the properties of cosmic rays. I will conclude by giving a perspective on the potential discoveries with AMS in the coming years and in the future with newly proposed space missions.

10:40 – 11:40
Dr. Michael Unger, Karlsruhe Institute of Technology
Title: Cosmic Particles at Extreme Energies
Abstract: Cosmic rays are the highest energy messengers of astrophysical phenomena in the Universe. The sources of these particles are unknown and it is one of the great puzzles of modern astrophysics how they are accelerated to macroscopic energies of $>10^{20}$ eV.
In this talk I will highlight recent experimental results on ultrahigh-energy cosmic rays, discuss their implications on our understanding of the physics and astrophysics at extreme energies and introduce ideas and plans for the next generation of cosmic-ray
observatories.

11:45 – 12:45
Prof. Xin Wu, DPNC Université de Genève
Title: Particle Physics in Space: from X-rays to PeV particles
Abstract: Space Astroparticle Physics has been making rapid progress in recent years. Advanced particle detection technologies developed for accelerator experiments have been successfully applied to instruments deployed in space. Unprecedented measurement precisions have been achieved, and the frontier of direct cosmic ray detection has been pushed to the 100 TeV, and soon to the PeV, region. In addition, cutting-edge particle detection technologies are being applied to advanced x-ray and gamma-ray space instruments. Space astroparticle physics has become an essential ingredient of the emerging field of multi-messenger astrophysics. In this talk I will give an overview of the current status of space astroparticle physics, and use several current and future projects (DAMPE, HERD, POLAR-2, PAN and eXTP) as examples to illustrate the science impact and technology advancement of this growing research field.