Plenary Talk PV I Tue 9:00 PVa

Physics-Informed AI for Image Reconstruction in PET — •Andrew Reader — King's College London, United Kingdom

The powerful capabilities of artificial intelligence (AI) have led to an exciting paradigm shift in methodology for many fields in medicine and physics, including inverse problems and image reconstruction. This presentation reviews the application and great promise of AI for image reconstruction in positron emission tomography (PET). Medical imaging with PET provides important information for disease diagnosis and research, but its full potential is constrained by noisy data, and limited spatial resolution. Recently, AI has led to new methodologies for PET image reconstruction, which help tackle these limitations. Starting with direct AI methods, new hybrid reconstruction algorithms which combine the AI paradigm with imaging physics and statistical models for PET are then reviewed. These physics-informed AI methods unfold existing iterative reconstruction methods in order to include deep-learned neural networks within them. They use deep learning for the components which we do not confidently know (such as how exactly to remove noise and enhance spatial resolution), while preserving decades of research progress in image reconstruction for the components that we do know (the imaging physics and noise distribution). Physics-informed AI holds great promise not only for next-generation PET image reconstruction, but also for inverse problems in general throughout medicine and physics.

Plenary Talk PV II Wed 9:00 PVa

Recent physics highlights of experiments at the LHC — •Wolfgang Wagner — Bergische Universität, Wuppertal, Germany

The experiments at the Large Hadron Collider (LHC) are in the process of exploiting the full data set recorded in Run 2 of the world's most powerful accelerator. In the years of 2015 to 2018 the LHC exceeded its design luminosity for proton-proton collisions by a factor of two, leading to large high-quality data sets ready for scrutinizing the standard model of particle physics in multiple ways. The analyses performed by the experimental collaborations ATLAS, CMS, LHCb and ALICE cover a wide range of particle physics: precise measurements of Higgs-boson couplings to other standard model particles, testing the consistency of the Brout-Englert-Higgs mechanism, establishing and measuring rare top-quark production processes, exploring flavour transitions and CP violation in bottom- and charm-hadron decays, observing new exotic hadrons and finally direct searches for physics beyond the standard model, including the production of supersymmetric particles, leptoquarks, vector-like quarks, additional Higgs bosons, generic resonances and dark matter candidates. Heavy-ion collisions are used to study the quark-gluon plasma, exploring quantum chromodynamics in extreme conditions. The presentation provides an overview of analysis highlights obtained in the past year at the LHC.

Evening Talk PV III Wed 19:30 PVp

Geschüttelt, nicht gerührt! – James Bond im Visier der Physik — •Metin Tolan — TU Dortmund

Nach einer kurzen Einführung über die DPG und Metin Tolan, präsentiert dieser die youtube-Premiere seines Vortrags mit dem Titel „Geschüttelt, nicht gerührt! – James Bond im Visier der Physik". Danach steht Prof. Dr. Metin Tolan für Fragen zur Verfügung.

Plenary Talk PV IV Thu 9:00 PVa

Roadmap for Accelerator Development in Response to the 2020 Update of the European Strategy for Particle Physics — •Michael Benedikt — CERN, Geneva, Switzerland

The European Strategy for Particle Physics was updated in 2020 and emphasizes two interrelated high-priority future initiatives. It encourages the *particle physics community* to *ramp up its R&D effort focused on advanced accelerator technologies, in particular that for high-field superconducting magnets*, and it requests that *Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage.* Both requests are well aligned with the proposed Future Circular Collider (FCC) program, which consists of a luminosity-frontier high-energy electron-positron collider (FCC-ee) as first stage, followed by an energy-frontier hadron collider (FCC-hh) as second stage. Such integrated FCC project promises the most far-reaching physics program for the post-LHC era, and it could serve the particle physics community through the end of the 21st century. Among other innovative accelerator technologies, the Strategy Update explicitly mentions bright muon beams and energy recovery linacs (ERLs), either of which could be an integral component of later FCC additions or upgrades. This presentation will summarize the conceptual designs of FCC-ee and FCC-hh, covering the machine concepts and the R&D plan for key technologies, and some of the proposed future additions or upgrades.

Prize Talk PV V Fri 9:00 PVa

On top of Dark Matter searches at the LHC — •Priscilla Pani — DESY, Hamburg and Zeuthen, Germany — Laureate of the Hertha Sponer Prize 2020

Astrophysical observations have provided compelling evidence for the existence of a non-luminous component of the universe: Dark Matter. If Dark Matter is a particle, characterised by weak-scale interactions with the Standard Model, it can be recreated in the high-energy proton-proton collision at the Large Hadron Collider (LHC) at CERN. The LHC experiments have a vast and diversified experimental programme, designed in collaboration with the theoretical community, which aims to discover and precisely measure dark matter. In this talk I will provide an overview of this programme, outlining both the fundamental assumptions and the experimental challenges of this effort. Finally, I will briefly detail one specific aspect of these searches, which focus on the particularly interesting possibility that the interaction between ordinary matter and Dark Matter is mediated by new scalar particles that extend the Higgs sector.