Seminar on Particle Physics Phenomenology and Experiments

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Search for sources of CP violation with the ATLAS detector at the LHC

Monday, 7 October 2024 13:00 (1 hour)

Charge Parity violation is one of Sakharov's conditions, necessary to explain the asymmetry between matter and antimatter in the Universe. The Standard Model (SM) of particle physics, being the most successful theory of particle physics to date, does not provide sufficient sources of CP violation to explain the excess of matter measured. This is one of the arguments suggesting that the SM is valid only at the energies probed so far and should be completed by new physics manifesting at higher energies.

The SM Effective Field Theory (SMEFT) provides a theoretical framework to constrain new physics parameters within the energy range reachable at LHC. This talks provides an overview of the results obtained by the ATLAS collaboration on CP violating SMEFT parameters in the bosonic sector and presents the strategies implemented in that goal.

Presenter: BOUDET, Leo (LAPP-Annecy, France)

Contribution ID: **2**   Type: **not specified**

Machine learning for polarization measurement in Vector Boson Scattering at the LHC

Monday, 21 October 2024 13:00 (1 hour)

Vector Boson Scattering (VBS) is a rare and complex process that occurs during high-energy proton-proton collisions at the Large Hadron Collider (LHC), observed with the ATLAS detector. Polarization, an intrinsic property related to the spin of the particles, can be observed by analyzing the characteristic of the decay products of the Vector Bosons. This plays a crucial role in better understanding the Higgs Mechanism, the longitudinal polarization is directly linked to the electroweak spontaneous symmetry breaking and arise from the mass obtained by the boson. This phenomenon is highly constrained by the Standard Model (SM), precise measurement could lead to hints of new physics beyond our current model. Machine Learning (ML), and particularly Deep Neural Networks (DNNs), enhance our ability to better handle the discrimination of this kind of process and the polarization states. The usage of high dimensional input parameters that cover various crucial aspects for the initial particles or their decay products help to probe the VBS process. Consequent Monte-Carlo generated samples are used to train those DNNs and are made to mimic the data produced at the LHC and collects by ATLAS. Those novel techniques were used to make observation of gauge boson joint-polarisation states in $W^\pm Z$ production from pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector and the very first observation of both a W and a Z boson simultaneously polarised longitudinally. This achievement also includes the measurement of joint helicity fractions and both the inclusive and differential cross sections with good agreement with the Standard Model predictions.

Presenter: DUBAU, Mathis (LAPP-Annecy, France)

Contribution ID: **3**   Type: **not specified**

Non-invasive identification of substances with neutrons and lasers: status and prospects

Monday, 4 November 2024 13:00 (1 hour)

In an era of growing armed conflicts and the threat of terrorist attacks, the search for effective methods for detecting and neutralizing hazardous materials is becoming particularly important. They are important not only in the context of protecting the population but also the natural environment. The seminar will discuss methods for detecting explosives and other hazardous substances using neutrons and laser-induced plasma. They enable non-invasive and fast determination of the stoichiometry of the tested substance and are based on the use of neutrons interaction with matter and spectroscopy of gamma radiation generated as its result. This allows for determining not only the shape but also the stoichiometry of the tested objects. Using neutrons is a good alternative or complement to the techniques used so far, and its potential may be increased even more by subsequent application of Laser-Induced Breakdown Spectroscopy (LIBS).

Presenter: SILARSKI, Michał (Jagiellonian University)