

ATLAS and CMS Dark Matter searches: results and future opportunities

Monday, November 7, 2022 2:30 PM (30 minutes)

There are many astrophysical observations and cosmological evidence for the existence of dark matter (DM), but little is known of its particle nature. The Standard Model (SM) does not predict its existence, however, numerous theories beyond the Standard Model (BSM) provide viable candidates for DM. Common candidates in many of these theoretical models are the weakly interacting massive particle (WIMP). If DM weakly interacts with the SM it could be produced at the Large Hadron Collider (LHC) experiments, escaping the detector and leaving a large missing transverse momentum as its signature. The ATLAS and CMS experiments have developed a broad search program for DM candidates and their interactions, including resonance searches for mediator particles which would couple DM to the SM, searches with large missing transverse momentum in the final states produced in association with other SM particles (light and heavy quarks, photons, Z and H bosons, as well as additional heavy scalar particles) called mono-X searches. There is a variety of models probed by those searches, including the Higgs portal model where the Higgs boson mediates the interactions between dark and SM sectors, the DM simplified model studying the energy scale of a mediator particle and dark matter particles, and the DM model with extended Higgs sectors (2HDM+a), which is a simplest gauge-invariant extension and provides a rich phenomenology. Many interesting results using the LHC full Run 2 pp collision data collected at 13 TeV have been achieved, in particular, the interpretations are made for various theoretical models and more complex final states. A review of the latest results of the DM searches at the ATLAS and CMS collaborations is presented, with emphasis on the future opportunities in run3 and beyond, including systematic limitations and new trigger schemes.

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Session Classification: Plenary

Track Classification: All