Contribution ID: **11** Type: **Talk**

The NA64-e experiment at CERN

Wednesday, November 9, 2022 4:45 PM (15 minutes)

One of the most compelling arguments motivating the search for physics beyond the Standard Model (SM) is the need to explain the nature of Dark Matter (DM). Despite an extensive experimental program that combined direct, indirect, and detection at colliders, to date, no conclusive results about DM particle nature have been determined. Among the DM theories, DM particles in the mass range 1 MeV - 1000 MeV (also called Light Dark Matter or LDM) represent a theoretically well-grounded option if a new DM-SM interaction mechanism is introduced. A simple hypothesis is based on the introduction of a new vector boson (Dark Photon or A') interacting with the SM photon (through a feeble kinetic mixing) and with the DM particles. In this scenario, the A' can be generated by the interactions of charged particles with ordinary matter and subsequently decays into LDM particle pair.

The NA64-e experiment at CERN exploits the 100 GeV SPS electron beam impinging on a thick active target (an electromagnetic calorimeter) to measure the energy deposited by each incoming particle. If an A' is produced in the target, the LDM daughter particles leave the detector without further interactions, resulting in a measurable "missing energy", defined as the difference between the beam and the measured "visible" energy. In this context, NA64 searches for large-missing-energy events in which a null activity in the downstream veto systems is detected. To date, NA64 has collected 2.84×10^{11} electrons on target. Zero events with missing energy > 50 GeV and no activity within the veto systems were observed. These results allowed the collaboration to set the most competitive limits in the LDM parameter space.

Recently, a missing energy measurement with a positron-beam has also been considered in NA64-e, connected to the POKER (POsitron resonant annihilation into darK mattER) ERC project. The use of a positron beam allows strongly enhancing LDM production by exploiting the electron-positron annihilation process. This also provides a clean signal signature associated with the underlying resonant reaction dynamics, translating into a peak the missing energy distribution whose position depends solely on the mass of the A'. The growing interest in this new approach motivated the NA64 collaboration to perform a preliminary feasibility study running the experiment with a 100 GeV positron beam in the current experimental setup.

This talk will present the latest NA64-e results, including an update regarding the positron beam run, and the plans for the future activities.

Author: BISIO, Pietro (INFN-Genova)

Presenter: BISIO, Pietro (INFN-Genova)

Session Classification: High-intensity frontier

Track Classification: All