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Light Dark Matter search with the NA64-e Experiment at Cern SPS

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The Dark Matter (DM) puzzle is one the major topics of modern physics. Several astrophysical and cosmological observations suggest that DM makes the vast majority of the mass of the Universe but, to date, its elementary properties remain unknown. In addition to gravity, DM could interact with ordinary matter through a new force, mediated by a new vector boson (Dark Photon, Heavy Photon or A'), kinetically mixed with the Standard Model (SM) photon. The NA64-e experiment at Cern SPS explores this theoretical scenario, using a 100 GeV electron beam impinging on a thick active target (electromagnetic calorimeter, ECAL). The interaction of the beam with the target may produce a Dark Photon, subsequently decaying in a pair of DM particles, flying away from the detector carrying a significant part of the primary electron energy. The signature of the A' production is a significant missing energy, defined as the difference between the energy of the incoming electron of the beam and the energy deposited in the ECAL. In order to reject events were SM processes result in the production of highly penetrating particles (such as muons, pions, neutrons...) escaping the active target and mimicking the signal signature, NA64-e features a large hadronic calorimeter, used as an active veto, placed downstream the ECAL.
With no positive DM evidence in 2.84×10^{11} electrons on target, the NA64-e experiment set the most competitive limits in a significant portion of the A' parameter space. During fall 2022, together with the electron-beam data-taking, NA64-e collected data with a positron beam, in order to exploit the intense positron annihilation mechanism for DM production. This talk will present the NA64-e status and its future prospects, reporting on the progresses on the analysis of data collected in 2022 in both electron and positron mode.

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