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The DarkMESA Experiment

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. In the extracted beam operation (150 MeV, 150 μA) the P2 experiment will measure the weak mixing angle in electron-proton scattering in 10,000 hours operation time. Therefore, the high-power beam dump of this experiment is ideally suited for a parasitic dark sector experiment — DarkMESA.

The experiment is designed for the detection of Light Dark Matter (LDM) which in the simplest model couples to a massive vector particle, the dark photon γ'. It can potentially be produced in the P2 beam dump by a process analogous to photon bremsstrahlung and can then decay in Dark Matter (DM) particle pairs $\chi\overline{\chi}$. A fraction of them scatter off electrons or nuclei in the DarkMESA calorimeter.

In a first stage 1,000 high density PbF_2 Cherenkov radiators from a previous experiment will be used. In further stages Pb-glass is added incrementally.

Within a MadGraph and Geant4 simulation the accessible parameter space was estimated. The experimental setup was optimized and further concepts were investigated.

DarkMESA-Drift is such an additional approach. A directional Time Projection Chamber (TPC) filled with CS_2 at low pressure serves as DM detector. With the nuclear recoil threshold being in the keV range the accessible parameter space can be extended.

Collaboration / Activity

MAGIX-Collaboration

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