Contribution ID: **72** Type: **poster**

An introduction to DAMIC-M experiment

Wednesday, 15 September 2021 10:21 (1 minute)

The DAMIC-M project is devoted to the exploration of the hidden sector and the search for light Dark Matter particles using Charge-Coupled Devices (CCDs). It follows the DAMIC at SNOLAB experiment which pioneered the detection of new particles through their interaction with the nucleus or the electrons of the bulk silicon of fully depleted CCDs.. A kilogram-sized target mass will be installed at the Modane underground laboratory (LSM, France) which offers an excellent low background environment for rare-event search. DAMIC-M detectors demonstrate several technological advancements including the implementation of the skipper technique, and custom front-end control and read-out electronics. Skipper CCDs can perform multiple non-destructive measurements of the pixel charge that allow for a read-out noise of a fraction of an electron. With a 15μm x 15μm pixel area, 675μm thickness and the ability of 3D reconstruction using the diffusion of the particle track, the spatial resolution of our CCDs allows for the follow-up of radioactive chains, a powerful tool to discriminate genuine particle interaction from in situ radioactive decays. Together with an extremely careful fabrication procedure that controls the contaminant and the generation of bulk radioactive contamination by cosmic ray spallation, the single electron resolution will guarantee a detection energy threshold of only a few eVs, pushing the sensitivity of DAMIC-M by at least one order of magnitude better than previous experiments. I will present the current status of DAMIC-M describing our technological challenges and the solutions we have adopted. I will introduce our method to measure and mitigate the bulk radioactive contamination and discuss the ongoing assembly of a prototype detector (the Low Background Chamber) aiming at validating our design options.

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Session Classification: Posters Session 1 (Applications in Astro-particle Physics; Applications in Astronomy, Planetary and Space Science; Applications in Life Sciences and Biology)

Track Classification: Applications in Astro-particle Physics