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# Search and exploration of the Dark Sector with the DAMIC-M experiment

- Thèses, Stages, Formation et Enseignement - Propositions de thèses 2021 -



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**Title :** Search and exploration of the Dark Sector with the DAMIC-M experiment

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**Team :** Rayonnement Cosmique et Matière Noire ; group DAMIC-M

**Description :**

The DAMIC-M group, for Dark Matter In CCD at the underground laboratory of Modane, is developing within the LPNHE an innovative and ultra-sensitive detector for the search for light dark matter and the exploration of the hidden sector. Winner of the prestigious European Advanced Grant grant funding Research Council, we are opening a thesis grant for the period 2020-2023 devoted to the commissioning of this detector in 2021-2022) and the data taking followed by analysis for dark matter research during 2022 and 2023.

Dark matter represents more than 80% of the matter content in the Universe but has still not been observed in terrestrial laboratories. It's only by its gravitational influence and its effects on the evolution of the primordial Universe and the formation of structures that the proofs of its existence have considerably strengthened in recent decades. These indirect measurements unfortunately do not allow precise determination of its nature and properties. A direct detection is therefore at the heart of contemporary fundamental research.

Funded at European level in 2018, this project covers all the development and operating phases over its allocated 5 years. The first years were dedicated to research and developments on the detector (CCD skipper and associated electronics), monitoring background noise and optimizing the installation from detailed simulations of the experimental apparatus. In 2021 we will proceed with the installation at Modane of a prototype detector whose operation will last one year. Then in early 2022 we will start the installation and the operation of the final detector.

The thesis work will start with the exploitation of the prototype detector and the installation and commissioning of the final detector taking into account the lessons collected by the exploitation of the prototype detector. Then, in a second step, the exploitation and analysis of the data from the final detector will begin. Several subjects of analyses will be possible, ranging from research of light WIMPS, to that of leptophilic dark matter or the search for photons of the dark sector.

The student will be required to present his work regularly in working meetings of the collaboration which is highly international with in particular very strong links with the University of Chicago and of Seattle in the United States. An internship with the supervisory team will allow you to familiarize yourself with the project as well as with the tools essential for its implementation.

**Work location:** LPNHE, Paris

**Possible trips:** University of Chicago, University of Seattle, Modane Underground Laboratory (LSM)

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