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Study and realization of a detector based on CCD for the search of dark matter

- Thèses, Stages, Formation et Enseignement - Propositions de thèses antérieures - Propositions de thèses 2018 -



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Team « Rayonnement Cosmique et Matière Noire » (RCMN); experiment : DAMIC-M

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Titre : Etude et réalisation d'un détecteur à base de CCD pour la recherche de matière noire.

Funding : this PhD proposal is funded.

Title: Study and realization of a detector based on CCD for the search of dark matter.

LPNHE's dark matter group is involved in the Dark Matter In CCD experiment at the underground laboratory in Modane (DAMIC-M). This experiment aims to explore the existence of light or leptophilic dark matter with unparalleled sensitivity thanks to an innovative detector using Charge Coupled Devices (CCD).

Funded at the European level this project covers, over 5 years, all phases of development and exploitation. The first years will be dedicated to research and development on the detector (CCD skipper and associated electronics), the control of background noise and the optimization of the installation from detailed simulations of the experimental setup. In a second time we will proceed to the installation and operation of the detector at Modane for a data taking period of approximately one year that will conclude with the analysis and publication of the results.

The thesis subject that we propose, the financing of which is guaranteed, concerns in particular the detector R&D and optimisations of the installation through detailed simulations. On the CCD side and associated electronics the goal is to achieve a readout noise lower than a fraction of electron (0.5 or less) through the use of an ultra low noise integrated electronics that is developed at LPNHE and using a repetitive and non-destructive CCD readout technology (skipper mode). On the radioactive background noise and optimisation of the setup the goal is to reach 0.1dru (DRU = event per keV per kilo and per day).

These goals are ambitious but our preliminary studies show that they are within our reach. The student armed with a particle physics training or astroparticle training will also need to have a solid interest in instrumental developments. Start of the thesis in October 2018.

The student will be required to regularly present his work in the working meetings of the collaboration. An internship with the supervising team will familiarize you with the project as well as the tools indispensable for its implementation.

Location : LPNHE - Paris

Possible trips : University of Chicago, Laboratoire Souterrain de Modane (LSM), national and international conferences.

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