Seminário, Sexta 28/03/2025 14:00h

Local: Auditório DRCC

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Title: Characterization of an Argon-based Dark Matter detector with ReD and ReD+ The Recoil

Abstract: Directionality project (ReD) within the Global Argon Dark Matter Collaboration aims to characterize the light and charge response of a small argon dual-phase Time Projection Chamber (TPC) to neutron-induced nuclear recoils. The main goals of the project are to probe for the possible directional dependence suggested by the previous SCENE experiment and to study the response to very low-energy nuclear recoils. Sensitivity to directionality and to low-energy recoils are both key assets for future argon-based experiments looking for Dark Matter in the form of WIMPs, as the forthcoming DarkSide-20k. The first measurement of ReD consisted in the irradiation of the TPC with a neutron beam at the INFN, Laboratori Nazionali del Sud (LNS), Catania. The correlation of the ionisation and scintillation signals, which is a possible handle to measure the recoil direction of nuclei, was studied in detail for 70 keV nuclear recoils, using a neutron beam produced via the reaction p(7Li,7Be)n from a primary 7Li beam delivered by the TANDEM accelerator of LNS. A dedicated measurement to characterize the response of the TPC to very low-energy nuclear recoils (< 10 keV) was then carried out in 2023 at INFN Sezione di Catania. The charge yield is a critical parameter for the experiments searching for Dark Matter in the form of low-mass WIMPs and measurements in Ar below 10 keV are scarce in the literature. The TPC was irradiated by neutrons produced by an intense 252Cf fission source in order to produce low-energy Ar recoils, such to cover the gap down to 2 keV. A further improvement down to 0.4 keV is foreseen within the ReD+ project. A new optimized TPC will be firstly irradiated with 252Cf neutrons. A new measurement run will follow, using mono-energetic neutrons produced by a DD neutron gun by the University of Sao Paulo. In this seminar, the experimental setups used for the two ReD campaigns, the preliminary results from data analysis and the future perspectives will be presented and discussed.