

Contribution ID: **25** Type: **Parallel Talk**

Dark Neutrons as Dark Matter: Collisions in Halos and Direct Detection from Dark CP Violation

Thursday, 3 December 2026 14:30 (30 minutes)

We consider confining gauge theories with a non-vanishing topological angle θ, which induces CP-violating interactions among dark pions and dark baryons, with dark matter consisting of dark neutrons. The θ term generates scalar pion–baryon couplings analogous to the CP-violating pion–nucleon interactions of QCD. These interactions give rise to an attractive long-range Yukawa potential mediated by the dark pions, whose strength is proportional to θ. Since the dark pions are naturally light pseudo-Goldstone bosons, the resulting force can lead to sizable dark matter self-interactions, providing a simple and theoretically motivated realization of the self-interacting dark matter paradigm. We also investigate the implications for direct detection in scenarios where the dark sector communicates with the Standard Model through a dark photon portal. The θ term induces dark electric dipole moments proportional to θ, which couple directly to the electric fields of nuclei and can substantially enhance direct detection rates. We show how the underlying interactions shape the recoil spectra and discuss the possibility of identifying the CP-violating origin of the signal through its time dependence. Finally, we analyze the interplay between dark matter self-interactions and direct detection signals, showing that both are controlled by the same CP-violating parameter. Our results demonstrate that the topological angle θ can play a central role in determining the phenomenology of composite dark matter.

Academic position of the presenting author

Postdoctoral Researcher

Primary authors: LANDINI, Giacomo (LNF-INFN); Dr GARCIA-CELY, Camilo (CSIC-IFIC); FIGUEROA, Pablo (CSIC-IFIC)

Presenter: LANDINI, Giacomo (LNF-INFN)

Session Classification: Parallel Talks-SD:704

Track Classification: Dark Matter