



JOINT EUROPEAN MASTER IN NUCLEAR PHYSICS

Academic Year 2025/2026

MASTER THESIS PROPOSAL

TITLE: Anomaly detection and data quality studies for KM3NeT/ORCA neutrino telescope

SUPERVISOR(S): Iván MOZÚN MATEO, Chiara F. LASTORIA

SUPERVISOR(S) contact- email: mozun@lpccaen.in2p3.fr Telephone: +34 633 562 708
email: lastoria@lpccaen.in2p3.fr Telephone: +33 2 31 45 25 18

UNIVERSITY/RESEARCH CENTER: Laboratoire de Physique Corpusculaire (LPC)

ABSTRACT

The KM3NeT/ORCA detector is a neutrino telescope installed in the Mediterranean Sea optimized for the study of atmospheric neutrino oscillations through the detection of Cherenkov light emitted by charged particles produced by the interaction of neutrinos with matter [1-2].

The proposed research topic will consist of the analysis of the experimental data, focusing on an incomplete section of the detector with between 6 and 18 lines deployed. It will involve studies on data quality and anomaly identification. First, the student should study the main sources of background contamination of the detector, composed of atmospheric muons, the decay of the 40K contained in seawater as well as bioluminescence, to be properly identified and rejected. Then, the student should focus on identifying sparks events and improve the methodology to remove these events for physics analysis. It will consist on developing efficient techniques and a Snakemake pipeline to do so [3]. The aim of these studies will be to understand the limitations of selecting sparks, relate them to real physics events and improve the current state-of-the-art sparks selection. The final objectives will be to quantify the effect and impact on the sensitivity studies of neutrino oscillation parameters.

[1] <https://www.km3net.org/>

[2] Letter of Intent for KM3NeT 2.0, Journal of Physics G: Nuclear and Particle Physics, 43 (8), 084001, 2016 [arXiv:1601.07459].

[3] <https://snakemake.readthedocs.io/en/stable/index.html>