



ERASMUS MUNDUS JOINT MASTER IN NUCLEAR PHYSICS

Academic Year 2026/2027

MASTER THESIS PROPOSAL

TITLE: Transformer-Based Event Reconstruction for Neutrino Physics with KM3NeT/ORCA

SUPERVISOR(S): Antonin VACHERET, Benoît GUILLON

SUPERVISOR(S) contact- email: vacheret@lpccaen.in2p3.fr Telephone: 02.31.45.29.69
email: guillon@lpccaen.in2p3.fr Telephone: 02.31.45.25.47

UNIVERSITY/RESEARCH CENTER: Université de Caen Normandie.
Laboratoire de Physique Corpusculaire de Caen

ABSTRACT

(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

KM3NeT/ORCA is the low-energy neutrino telescope of the KM3NeT research infrastructure. Its main goal is to study neutrino oscillations and determine the Neutrino Mass Ordering (NMO), one of the remaining open questions in neutrino physics. The detector is expanding rapidly, with 34 of its 115 detection lines currently operational.

The LPC KM3NeT group is developing advanced analysis methods in preparation for the NMO measurement. This internship will focus on improving nuT, a transformer-based algorithm for neutrino event reconstruction, with the aim of increasing the sensitivity of KM3NeT/ORCA to neutrino-oscillation measurements. The project may lead to a PhD on this topic.

The student will work at the interface of neutrino physics, detector response, and machine learning. They will contribute to the development and evaluation of next-generation transformer models for event reconstruction.

The internship will take place within the LPC KM3NeT group, which has expertise in detector instrumentation, calibration, data analysis, and machine learning for scientific applications.

A strong interest in neutrino and particle physics is expected. Good programming skills in Python are required, and experience with machine-learning libraries such as PyTorch would be an advantage.