

GeV-PEV NEUTRINO (ASTRO)PHYSICS WITH ANTARES AND THE KM3NET TELESCOPES

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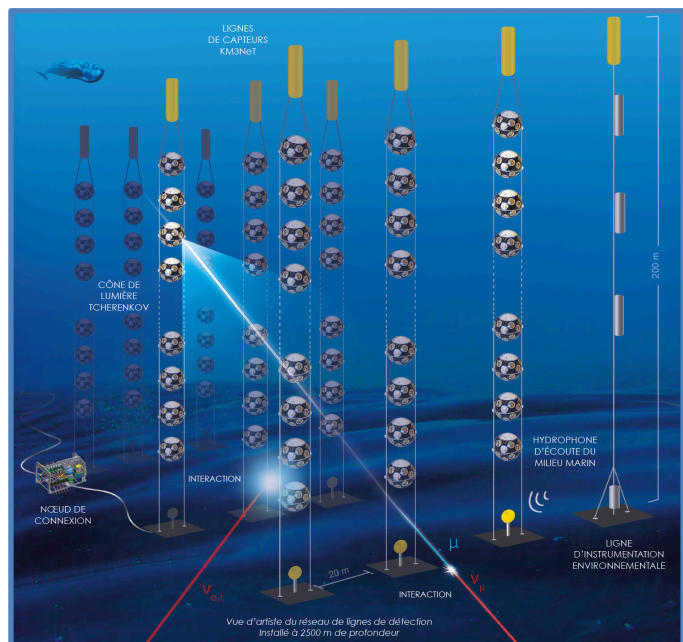
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The proposed PhD thesis will be performed in the framework of the european collaborations [ANTARES](#) and [KM3NeT](#), which use underwater « neutrino telescopes » in the Mediterranean Sea, to detect GeV to PeV atmospheric/cosmic neutrinos.

[ANTARES](#) has built a neutrino telescope dedicated to high-energy neutrino astronomy, in operation since 2008, 2500m underwater offshore Toulon (France). Its 12 detection lines host a total of nearly 1000 photomultiplier tubes, sensitive to the Cherenkov light induced by the passage of particles produced after the interaction of neutrinos in the Earth. The american experiment [IceCube has revealed in 2013](#) the existence of cosmic neutrinos, which yield precious information on the origin of cosmic radiation. The aim of ANTARES, in operation until late 2018, is the study of these astrophysical high-energy neutrinos.

Circa 2020, next-generation neutrino telescopes built by the KM3NeT collaboration will begin their data taking, with more than 300 lines on 2 sites. The Toulon KM3NeT-FR site will be dedicated to low energy GeV neutrinos, to determine the unknown neutrino mass hierarchy, with [ORCA](#) (Oscillation Research with Cosmics in the Abyss) : it will use the oscillation of atmospheric neutrinos to possibly determine the Neutrino Mass Hierarchy in 3 years. Its deployment has started, with the [first line deployed in September 2017](#). The italian KM3NeT-IT site, in Sicily, will host [ARCA](#) (Astroparticle Research with Cosmics in the Abyss), dedicated, like ANTARES, to TeV-PeV neutrino astronomy. ARCA could confirm the IceCube signal in less than 1 year, and will have the required sensitivity/resolution to study in details its astrophysical origin.



The IPHC Neutrino group has a long standing experience in both the study of neutrino oscillation parameters (with Double Chooz, JUNO), and multi-messenger astronomy in ANTARES, through in particular the GWHEN program, devoted to the search for Gravitational Waves - High Energy Neutrinos correlation. The PhD student will take an active part in the data analysis of the final data set of ANTARES, possibly concomitant with the O3 data taking period of the GW detectors LIGO/Virgo from 2019. He/She will devote part of the PhD to the preparation of multi-messenger analyses that will be performed with the KM3NeT telescopes, in particular the combination of ORCA/ARCA results for the search for GeV-PeV neutrinos from, e.g., gamma-ray bursts, or other potential GW emitters, in coincidence with GW data. He/She will also contribute to the calibration of the telescope(s) in their early data taking phases.