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Towards a hybrid optical-acoustic deep-sea neutrino detector

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Nowadays, deep-sea neutrino telescopes, e.g. KM3NeT, are based on the detection of the Cherenkov light produced after a neutrino interaction by a large 3D array of optical sensors. These detectors also have an acoustic system associated for monitoring the position of optical sensors. In this paper, we discuss the possibility of using the acoustic sensors of the positioning system for the detection of the thermo-acoustic pulse produced after the interaction of an ultra-high energy neutrino, to explore the possibility of having a hybrid optical-acoustic detector. This has become even more relevant after the observation of a very high-energy neutrino in KM3NeT/ARCA detector. We consider that the main limitation for the hybrid detector comes in the difficulty of triggering interesting acoustic events, which is due to the characteristics of the signature: a very weak and short bipolar pulse and of the large separation between acoustic sensors. To overcome these difficulties, we are working in two research topics. Firstly, we are developing an acoustic antenna formed by an array of 4 close hydrophones that complements the hydrophones of the telescope. Secondly, we are working on the deep-sea acoustic monitoring and data analysis, proposing a new triggering method based on spectrogram analysis. As it will be presented, this method is more appropriate for finding the weak short signal than the cross-correlation method used for acoustic positioning.

Abstract

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