

Prospectes on CCSN neutrino detection with KM3NeT

Core Collapse Supernovae (CCSN) are explosive phenomena that may occur at the end of the life of massive stars, releasing over 99% of the energy through emission of neutrinos with energies on the 10 MeV scale. While the explosion mechanics is not fully understood, neutrinos are believed to play an important role in it. The only detection as of today, marking the beginning of extrasolar neutrino astronomy, are the 24 neutrinos from supernova SN1987A. The observation of the next Galactic CCSN will provide an unprecedented potential for the study of these phenomena, and lead to important breakthroughs across the fields of astrophysics, nuclear and particle physics.

For a Galactic CCSN, the KM3NeT ORCA and ARCA detectors in the Mediterranean will observe a significant number of neutrinos via the detection of Cherenkov light, mostly induced from inverse beta decay interactions over a large instrumented seawater volume. The selection of photons in coincidence between the 31 photomultipliers of the KM3NeT optical modules allows to separate the signal from the optical background sources (K40 decays, bioluminescence and atmospheric muons).

The KM3NeT sensitivity for the detection of a Galactic CCSN and the potential to resolve the neutrino time profile have been estimated exploiting detailed MC simulations covering the event generation and the detector response. The directional information of the 31 PMTs, covering a large angular range on the sky, is also used to study the capability of the KM3NeT optical modules to infer the direction of the source. Specific criteria are proposed for the online triggering and the participation in the SNEWS global alert network.

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