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Constraining the contribution to Gamma-Ray Bursts to the high-energy diffuse neutrino flux with 10 years of ANTARES data

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Addressing the origin of the observed diffuse astrophysical neutrino flux is one of the main challenges in the context of the neutrino astronomy nowadays. Among several astrophysical sources, Gamma-Ray Bursts (GRBs) are considered interesting candidates to be explored. Indeed, being the most powerful explosions observable in the Universe, they are potentially able to achieve the energetics required to reproduce the neutrino flux and, thus, they are expected to give at least some contribution to the astrophysical neutrino flux. Within the framework of the fireball model, mesons can be produced during photo-hadronic interactions occurring in the internal shocks between shells emitted by the central engine; from their decays, high-energy gamma rays and neutrinos are expected to be generated. Within this context, the results of a stacked search for muon astrophysical neutrinos performed in coincidence with 784 GRBs in the period 2007-2017 using ANTARES data are presented. The neutrino flux expectation from each GRB detectable in ANTARES was calculated in the framework of the classical internal shock model. Given the absence of coincident neutrinos, the contribution of the detected GRB population to the neutrino diffuse flux is constrained to be less than 10% around 100 TeV. In addition, the systematic uncertainties are computed on the diffuse flux, propagating the uncertainties on the not well characterized GRB parameters of each individual burst to the stacked limit.

Keywords

GRB; astrophysical neutrinos; neutrino detection; neutrino telescopes; ANTARES; multi-messenger astrophysics; astroparticle physics

Collaboration

Antares

other Collaboration

Subcategory

Experimental Results

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