Multimessenger astronomy to study the origin of the very-high-energy astrophysical neutrinos

Yoann Gatelet
Université de Paris, CNRS, Astroparticule et Cosmologie,
F-75013 Paris, France

January 31, 2020

Abstract

The IceCube and Antares neutrino telescopes observed a few events with very high energies ($E \gtrsim 10$ TeV) during the last decade. Those observations, together with the recent measurement of the gravitational waves, contribute to the fast development of the "multimessenger astronomy". The combination of signals with different natures provides more information than the analysis of these signals separately. Here, we'll discuss about a way to combine the electromagnetic and neutrino signals to better understand the origin of the very-high-energy (VHE) neutrinos. Previous searches show that there might be a Galactic component in this VHE neutrino flux but the statistical significance remains too low to claim a discovery.

In this search, we'd like to find out if such energetic neutrinos could be emitted by the Galaxy. Since the neutrinos and the γ-rays are produced by the same astrophysical processes, we can study the most energetic photons observed in the Galaxy to create a VHE neutrino emission model. The combined observation of Antares and IceCube high energy neutrinos will be compared to the counterpart predicted by the γ-ray emission of the Galaxy using a likelihood maximization method, fitting both angular distribution and energy spectrum. If a correlation is found with a sufficiently high statistical significance, it would be the evidence of a galactic component of the VHE neutrino emission, and it might indicate the presence of a PeVatron in the Galaxy.

Keywords: High energy astrophysics, Neutrino