The IceCube Detector

IceCube is a high-energy neutrino observatory currently under construction at the geographic South Pole. The full detector will be composed of 86 strings of 60 Digital Optical Modules (DOMs) each, deployed between 1500 and 2500m below the glacier surface. A six string Deep Core with higher quantum efficiency photomultipliers and closer DOM spacing in the lower detector will enhance sensitivity to low energy neutrinos. Muons passing through the detector emit Cherenkov light allowing reconstruction with <1° angular resolution in the full detector.

Point Source Search with the 40 String Configuration Detector

The discovery of a source of high-energy astrophysical neutrinos would be evidence of hadronic acceleration, and give insight on the origins of cosmic rays. To this end we have unblinded six months of 40-string data (July to December 2008) unblinded. The event selection has been pushed to a high-energy sample in the southern hemisphere, where the background for astrophysical neutrinos is from down-going atmospheric muons, as opposed to the north where the background is from atmospheric neutrinos. We find a spot with equal or greater significance than the most significant spot on this skymap in 61% of trials with scrambled light ascension 3].

We also tested a list of 39 a priori sources including the hottest neutrino flare candidates from the northern hemisphere. The black line marks the Galactic Plane.

Time-Dependent Point Source Search with Fermi LAT Lightcurves

We are interested in using a multi-messenger approach to search for neutrino sources. Fermi data are interesting for IceCube because neutrino and gamma emissions can be correlated. If protons interact on matter or electromagnetic photons in sources, neutral and charged pions would be produced that decay in gamma and neutrinos. If Fermi observes a flare from a source there could be an enhanced state also in the neutrino emission. We look for neutrino emissions in coincidence with photon flares, which can help the potential for source discovery and over a time-integrated search. Candidate sources such as blazars exhibit variability on the timescale of hours, and the comprehensive sky coverage of Fermi opens up new approaches for our analyses. Blazars flares are interesting since they may be clumps of material moving into the jet, possibly meaning more interactions.

We have developed a likelihood ratio based method that uses multi-messenger information, such as the Fermi-LAT light curves. We use these as photon distribution functions and reconstruct them using the Maximum Likelihood Block Method [4][5] that accounts for statistical errors of each time bin. We keep open the possibility that the neutrino emission has a time lag with respect to the gamma one and that this emission happens above a certain threshold during the flaring state while the baseline flux of the source is supposed to be mainly due to electromagnetic processes. This allows us to simultaneously with respect to the gamma one and that this emission happens above a certain threshold during the flaring state while the baseline flux of the source is supposed to be mainly due to electromagnetic processes. This allows us to simultaneously

References


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