

Systematic MeerKAT Survey of Astrophysical Neutrinos

Abstract

Identifying electromagnetic counterparts to very high energy (VHE) astrophysical neutrinos will help answer questions with clear implications for the high energy Universe: what are the environments and physical mechanisms that accelerate the highest energy cosmic rays and neutrinos; and how are some of the highest energy photons in the Universe (TeV gamma-rays) generated. However, to date, very few VHE neutrinos have been confidently associated with an astrophysical counterpart. Thus, astronomers must shift to a more systematic followup approach to identify the counterparts to VHE neutrinos. Radio observations can play a critical role given the relative paucity of radio transients. Here we propose the beginning of a multi-year MeerKAT survey of the containment regions for the highest-quality newly-announced candidate astrophysical neutrinos. We will perform multi-year target of opportunity monitoring of up to 5 neutrino events with 11 epochs of mosaic imaging at L- and S-band for each event. With no more than 3 triggers per year over a 2-year triggering period, each containment region will be monitored for ~300 days (for a total program length of 3 years). By monitoring the entire 90% containment region for intensity and spectral variability, we will identify candidate VHE neutrino counterparts, while mitigating the biases associated with the strictly targeted follow-up of known sources.