

Study of Very High Energy (VHE) gamma-ray sources

Abstract: The gamma-ray astronomy is very young branch of astronomy which studies the gamma-ray of cosmic origin. The high gamma-ray spanning the energy range of MeV-GeV are detected using satellite based experiment like Large Area Telescope on board Fermi satellite. While, the very high energy (VHE) gamma-ray spans the energy range from about few 10's of GeV to about 100 TeV, are detected by ground based telescope using Atmospheric Cherenkov Technique (ACT). The telescopes used in the detection of VHE gamma-ray using imaging ACT consist of large reflector and cluster of photo-detectors, called as pixelated imaging camera, at the focal plane. The conventional imaging camera uses the cluster photo-multiplier tubes (PMTs) as photo-detector. These PMT-based telescopes are not operated during moon light conditions due to safety of PMTs. While, Geiger-mode Avalanche Photo-Diode/Silicon Photo-multiplier (G-APD/SiPM) based telescopes can be safely operated during moon light, which increases the duty cycle of these telescopes. One such 4 m class telescopes is currently operational in La-Palma at an altitude of 2 km above sea level. The Tata Institute of Fundamental Research, Mumbai is also developing G-APD based camera for 4 m class telescope, which is planed to be operated in Hanle, India at an altitude of about 4.3 km above sea level. The technical details and the performance parameters of this G-APD based telescopes will be discussed along with its importance in multi-messenger era. One of the primary goals of this telescopes is the monitoring of bright Active Galactic Nuclei (AGN). The study of two AGNs, which are extra-galactic sources of VHE gamma-ray, will be discussed. These sources are BL Lacerate 1ES 1959+650 ($z=0.047$) and flat spectrum radio quasar Ton 599 ($z=0.725$). The modelling of broadband spectral energy distributions of 1ES 1959+650 suggested the multi-zone emission model as the origin of broadband emissions from the source. While the observation of a bunch of high energy photons from Ton 599 constrained the location of gamma-ray emission region in this source near outer edge of outside the broad line region during the high flux state occurred in November 2017. The studies carried out for these two sources will be discussed in detail.