

Exploring the Multi-Messenger Universe with VERITAS

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The promise of multi-messenger astrophysics was clearly shown through coordinated observation campaigns of TXS 0506+056 and GW170817 in 2017. These led to the detection of a flaring gamma-ray blazar that was potentially associated with a high-energy neutrino event, and the first detection of gravitational waves from a neutron star merger by LIGO/Virgo. The multi-messenger group in VERITAS has been using real-time and archival data to search and study potential very-high-energy gamma-ray counterparts of various transients, including GRBs, AGN flares, high-energy neutrinos and gravitational wave events. In this talk, we will present target-of-opportunity observations of the blazars PKS 0735+178, PKS 0446+11, and B3 2247+381 with VERITAS and NuSTAR. We will discuss implications for leptonic and hadronic models of emission in blazars based on the constraints from hard X-ray and TeV gamma-ray observations. We will show VERITAS as a critical component in the global network for a joint study of IceCube neutrino events by combining all four major imaging atmospheric Cherenkov telescopes. We will discuss the prompt search for very-high-energy gamma-ray signals from the LIGO-Virgo-KAGRA O4 run, as well as the investigation of low-significance gravitational wave events using VERITAS archival data.

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