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Particle Accelerators in Space: Recent News from VERITAS

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Our universe carries a small but important population of highly energetic denizens: supernova remnants with fast shocks, pulsars with powerful winds, intensely-interacting binary systems built from a compact object and a massive star, relativistic jets launched by supermassive black holes. All of these environments conspire to generate populations of nonthermal particles, and observations of the very high energy (VHE; E > 100 GeV) gamma rays produced by these particles are gradually revealing the methods by which Nature accelerates cosmic rays, as well as the ways in which those cosmic rays escape and diffuse into the interstellar medium. These observations include studies of cosmic-ray acceleration in the supernova remnants Cassiopeia A and IC 443, follow-up of unidentified HAWC sources, and the remarkable Fall 2017 periastron passage of VER J2032+4127, the 50-year-period binary system containing PSR J2032+4127 and a Be star. Fast TeV gamma-ray flares coincidental with the emergence of superluminal radio knots from the blazar BL Lac can be interpreted in terms of a coherent scenario of jet particle flow and radiation. The recent TeV gamma-ray discovery of the radio galaxy 3C 264 adds a new member to the small population of off-axis jets available for study. Meanwhile, the direct detection for the first time of gravitational wave (GW) transients by Advanced LIGO has motivated searches for their electromagnetic counterparts at all wavelengths. Neutrino astronomy is an emerging area of study in high-energy astrophysics, and astrophysical neutrinos are natural cousins of VHE gamma rays. The VERITAS gamma-ray observatory has an active program of follow-up observations in the directions of potentially astrophysical high-energy neutrinos detected by IceCube, as well as in the direction of GW transients. In this talk, we discuss recent results from the VERITAS Galactic, Extragalactic, and Multi-Messenger Follow-up programs.

Primary author: HUMENSKY, Brian (Columbia University)

Presenter: HUMENSKY, Brian (Columbia University)

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