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NuSTAR broad-band X-ray observation campaign of energetic pulsar wind nebulae in synergy with VERITAS, HAWC and Fermi gamma-ray telescopes

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We will report recent progress on the on-going NuSTAR observation campaign of 8 TeV-detected pulsar wind nebulae (PWNe). This campaign (to be completed by June 2021) constitutes a major part of our NuSTAR study of some of the most energetic TeV sources in our galaxy detected by VERITAS and HAWC. NuSTAR is the only focusing X-ray telescope operating above 10 keV in space with sub-arcminute angular resolution. Broad-band X-ray morphology and spectroscopy data, obtained by NuSTAR, allow us to probe sub-PeV electron populations through detecting synchrotron X-ray radiation. Our targets include PeVatron candidates detected by HAWC, the Boomerang nebula, PWNe crushed by supernova remnant shocks (or else relic PWNe) and G0.9+0.1 in the Galactic Center. Combined with our Fermi-LAT data analysis and available TeV data, we aim to provide a complete, multi-wavelength view of a diverse class of middle-aged (~10-100 kyrs old) PWNe. Our NuSTAR analysis detected hard X-ray emission from the Eel and Boomerang PWNe and characterized their broad-band X-ray spectra most accurately. We plan to apply both time-evolution and multi-zone PWNe models to multi-wavelength spectral energy distribution (SED) data over the radio, X-ray, GeV and TeV bands. In this presentation, we will review our observation campaign and discuss the results for several PWNe in more detail.

Keywords

pulsar wind nebulae; multi-wavelength observations; NuSTAR X-ray telescope; VERITAS; HAWC; Fermi; PeVatron

Collaboration

other Collaboration

Subcategory

Experimental Results

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