“Understanding Nature's Particle Accelerators Using High Energy Gamma-ray Survey Instruments”

Nature's particle accelerators, such as Pulsars, Pulsar Wind Nebulae, Active Galactic Nuclei and Supernova Remnants accelerate charged particles to very high energies that then produce high energy photons. The particle acceleration mechanisms and the high energy photon emission mechanisms are poorly understood phenomena. These mechanisms can be understood either by studying individual sources in detail or, alternatively, using the collective properties of a sample of sources. Recent development of GeV survey instruments, such as Fermi-LAT, and TeV survey instruments, such as Milagro and HAWC, provides a large sample of high energy gamma-ray flux measurements from galactic and extra-galactic sources. In this talk, I will present a new multi-wavelength technique, developed to study the collective properties of a given GeV pulsar sample, using the GeV-TeV correlation between pulsars and their associated pulsar wind nebulae. This method is able to measure the beaming factor vs. pulsar spin-down luminosity distribution of a Fermi-LAT GeV pulsar sample. Interestingly, it appears that pulsar acceleration model simulations may be distinguishable by their beaming factor predictions. I will also compare the simulated beaming factor vs. pulsar spin-down luminosity distributions with the experiential results and present the future phase of this technique.

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