

Are you living inside a bubble? The answer from nearby pulsars

Cosmic-ray positrons are charged antiparticles that strike Earth's atmosphere isotropically. At energies below several GeV they are produced by cosmic-ray protons interacting with nearby interstellar matter. At higher energies, an unexpected and unexplained excess above the proton-induced background has been detected by several satellites. Due to energy losses in interstellar magnetic and radiation fields, the highest-energy positrons observed must be originated in our immediate Galactic neighborhood. This excess has been theorized to be originated from nearby astrophysical sources such as pulsars, dark matter, or new modes of cosmic-ray secondary production. Despite significant investigation on these hypotheses, the origin of the positron excess remains unknown. In this presentation I'll report on the observations by the HAWC observatory of multi-TeV gamma rays from the region surrounding Geminga and PSR B0656+14, two very nearby and middle-age pulsars which have long been obvious candidate sources for the high-energy positrons observed at Earth. Using the latest results from the HAWC observatory we are able to measure the diffusion coefficient for electrons injected by these sources and determine whether they are the responsible for the bubble of positrons that is producing the local positron excess.