Testing the PWN Interpretative for the TeV Emission from HESS J1640-465

Abstract

Galactic very high energy (VHE) gamma-ray sources are often coincident with PWNe powered by the spin-down luminosity of the associated pulsar. How pulsars produce such luminous VHE sources is poorly understood. Gamma-ray luminosity depends on the properties of the pulsar, total rotational energy and the evolutionary stage of the system. The best way to determine these properties is by using an evolutionary model of a PWN inside an SNR to fit the observed SED and dynamical properties of the system. HESS J1640-465 is a powerful source of VHE gamma-rays, possibly the most luminous TeV source in our galaxy . It is also associated with the first rotation-powered X-ray pulsar measured to have a braking index > 3. If the gamma-rays originate from the PWN, this neutron star must have been born spinning very rapidly and lost its initial rotational energy very quickly. However, there are considerable uncertainties in these parameters due to the current radio non-detection of the PWN. Previous analysis predicts this PWN should have an 800 MHz \& 1300 MHz flux density of ~100 mJy & ~80 mJy respectively . Detecting the radio PWN will help in verifying this prediction, which in turn will determine the initial rotation of the pulsar, its initial and current spin-down power. Not only will this allow us to determine the nature of the very high energy (VHE) gamma-ray source, but will also provide insight into the luminous galactic formation of neutron stars.