

Probing the age of 3C58 via multiwavelength observations

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ABSTRACT: The Northern sky pulsar wind nebula 3C58 has been regarded as the remnant of the SN1181, although radio expansion rate and optical filaments velocity measurements suggest a larger age for this nebula. We present a 1D model for 3C58 to solve the transport equation of particles in a convective wind, which employs proper boundary conditions, to explain the measured radio velocity, the synchrotron nebular emission in terms of photon index vs radius, synchrotron surface brightness and terminating energy dependent size, as well as the inverse Compton γ -ray flux. With this procedure we derive a nebular field strength around $10 \mu G$, which is well below the equipartition value of $80 \mu G$, with the strongest argument in favor of such a weak field strength coming from a constraint on the cooling of the highest energy electrons from the pulsar wind shock to allow X-ray emitting electrons to survive to the edge of the pulsar wind nebula. We predict the inverse Compton γ -ray flux from 3C58 as a function of the system age, which according to this model, can be used by GLAST and ground-based VHE gamma-ray observations in the northern hemisphere, such as MAGIC and VERITAS, to shed light on the age problem.