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Pulsar Wind Nebulae

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Pulsar wind nebulae (PWNe) are multi-wavelength bright sources produced by the interaction of the relativistic, magnetized and cold plasma emanating from the neutron star with the surrounding material, either the ejecta of the supernova explosion or the interstellar medium, depending on their phase of evolution.

They will constitute the widest class of Galactic gamma-ray sources of future surveys, with around 300 new detections expected in the first Galactic Plane Survey of the Cherenkov Telescope Array.

Moreover PWNe are known to be efficient particle accelerators, with the class prototype, the Crab nebula, the unique firmly identified leptonic PeVatron of the Galaxy.

Last years observations at X-rays and gamma-rays have proved they efficiently release particles in the ambient medium in their late evolutionary phases, being connected to the formation of elongated X-ray jets and extended TeV halos.

Almost all the LHAASO's recently detected PeVatrons have a pulsar in their surroundings, leaving open the possibility that all of them are actually illuminated by a pulsar or a pulsar wind nebula that is not resolved by LHAASO.

Being able to model and identify these sources through their different evolutionary stages is then extremely important for the interpretation of future gamma-ray data. Here I will discuss where we are in this respect.

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