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Generation of Cosmic Rays in Pulsar Wind Nebulae

The overall observations of plerions from radio to the very high energy gamma-rays could provide information about the evolution of PWN from the young Crab-like stage to the older plerion stages. Geminga is a nearby (250 pc) and middle-aged pulsar of 3.4×10^5 years. The Geminga pulsar wind nebula was detected in X-rays, and the detailed studies reveal the morphological and spectral variability, which may raise a high energy emission. The extended MeV-TeV emission from Geminga in SHALON, Milagro, HAWC observations, and Fermi-LAT detection and upper limits could arise from the PWN associated with the Geminga SNR. 3C 58 is similar to the Crab Nebula (explosion of the 1054 year) on many parameters, but these two objects differ significantly in luminosity and size at X-rays and radio-emission. The 3C 58 estimated age varies from ~ 800 to $(5 - 7) \times 10^3$ years. MeV-GeV The gamma-ray emission from the nebula has been detected by Fermi-LAT. The gamma-ray source associated with the 3C 58 was detected above 800 GeV for the first time by SHALON in observations of 2011 year and systematically studied since then. The overall spectral energy distribution and information about the extension of PWN from radio to GeV-TeV energies can contribute to particle transport models and also to the understanding of the mechanisms of PWN expansion, which is, in turn, can shed light on the age of 3C 58 and the history of progenitor SN explosion.

Author: SINITSYNA, Vera Georgievna

Co-author: Dr SINITSYNA, Vera Yu. (P.N. Lebedev Physical Institute)

Presenter: SINITSYNA, Vera Georgievna