Fermi-LAT observation of Shell-type Supernova remnants and Pulsar Wind Nebulae

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Abstract. **The last few years have brought significant advances in the understanding of particle acceleration in both shell-type and plerionic Supernova remnants. These advances have been made possible by combining X-ray with TeV gamma-ray observations. A missing link in the understanding of these objects have been sensitive observations in the GeV gamma-ray band which are now made possible through the launch of the Fermi Gamma-ray Space Telescope operating in the band between 20 MeV and 300 GeV. I will present first results of studies of Galactic gamma-ray emitters such as Supernova remnants and Pulsar Wind Nebulae with the Fermi-LAT.**

***Keywords*:**

I. Shell-type Supernova remnants

Supernova remnants, through shocks in their expanding shells, have long been thought to accelerate charged particles to ultra-relativistic energies [1], [2]. These charged particles can subsequently emit radio, X-rays or gamma-rays through interactions with magnetic fields and surrounding material. In spite of recent detailed studies of Supernova remnants in particular with VHE gamma-rays [3], [4], the nature of the parent population responsible for the gamma-ray emission remains elusive. It is not yet evident, whether the bulk of the gamma-rays are produced by Bremsstrahlung or Inverse Compton (IC) scattering of electrons, or by hadronic interactions and subsequent π^0-decay. If in the future a hadronic origin of the gamma-ray emission can be established, this would represent a great step towards the final proof that shell-type SNRs are the long sought source of cosmic rays in the Galaxy. In the GeV band EGRET data showed a statistical associations of gamma-ray emission with radio SNRs (and related sources) [5], however, no individual shell-type SNR could unambiguously be identified. The Fermi-LAT instrument, however, has the spectral and angular resolution to perform first detailed study of these object between 20 MeV and 300 GeV. Several shell-type Supernova remnants are coincident with LAT sources from the LAT bright source list [7]. While these are intriguing positional correlations, an firm counterpart association needs a detailed study of the region, taking into account source properties and multi-frequency data. The study of Supernova remnants and Pulsar Wind Nebulae is complicated by the prevalence of Gamma-ray pulsars in the GeV sky and by the intense Galactic diffuse emission and therefore first results will be presented at the conference.

II. Pulsar Wind Nebulae

EGRET found a number of bright variable Galactic objects that are potentially associated with Pulsar Wind Nebulae (PWN). Recent advances in VHE gamma-rays above 100 GeV by H.E.S.S. have shown that there are at least 8 PWN emitting at gamma-ray energies detected in a survey of the southern Galactic plane [6]. Fermi-LAT might be able to determine morphologies and energy spectra for a number of PWN and allow for population studies. Because of the near continuous coverage and stable high sensitivity of the Fermi-LAT, it is expected that slow (mo.nth-year) variability of the PWN synchrotron component from the wind termination shock should be measurable in some cases providing a new probe of PWN dynamics. The Crab Nebula has been detected by the EGRET instrument and as such will present a test-case for the study of Pulsar Wind Nebulae with the LAT. As in the case of shell-type Supernova remnants, a critical aspect of the analysis is the exact understanding of potential pulsar contribution to the gamma-ray emission in a LAT PWN.

References

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