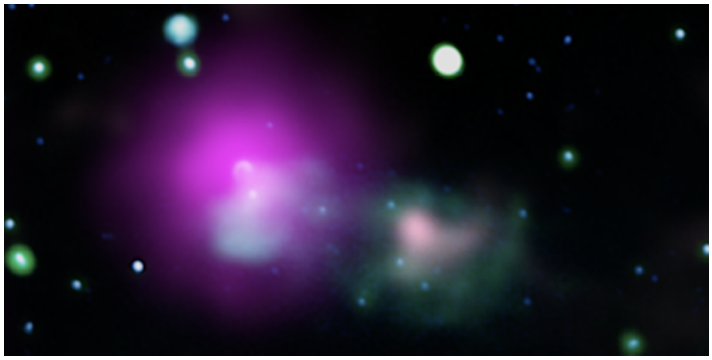
Identifying a Galactic Particle Accelerator

An analysis of 12 years of gamma-ray observations has allowed researchers to pinpoint a Galactic source of high-energy cosmic rays.

By **Marric Stephens**

Cosmic rays constantly bombard Earth from all directions. The energy spectrum of these particles—which are mostly protons and other atomic nuclei—roughly follows a power law. Most of the particles having energies of a few GeV or less, but a spectral feature at around 1 PeV hints at a fraction of particles accelerated to much higher energies. These high-energy cosmic rays are thought to originate from within our Galaxy, but the identity of the accelerators, or "PeVatrons," that produce them remains a mystery (see **Viewpoint: Signs of PeVatrons in Gamma-Ray Haze**). Now, after analyzing 12 years of data taken by the Fermi Large Area Telescope (Fermi-LAT), researchers point to a supernova remnant (SNR) as a potential source [**1**].

The precise origin of cosmic rays is difficult to pin down because the trajectories of these charged particles are perturbed by interstellar magnetic fields. Astronomers map cosmic-ray sources indirectly by observing the gamma radiation created when cosmic rays interact with interstellar material near to where astronomers think the particles were created. But the very-high-energy radiation that might signpost a PeVatron can also be generated by other processes, such as inverse Compton scattering of cosmic background radiation by relativistic electrons.



Credit: J. English/University of Manitoba; NASA/Fermi/K. Fang *et al.* [**1**]; Canadian Galactic Plane Survey/DRAO

Ke Fang, at the University of Wisconsin-Madison, and colleagues studied G106.3 + 2.7, an SNR about 2600 light years away, seeking a mechanism that could fit both the gamma radiation detected from it by Fermi-LAT and the x rays and radio waves measured by other observatories. They found that the data strongly support the SNR being a PeVatron, while being incompatible with an inverse-Compton-scattering origin for the radiation. Fang says that she hopes that G106.3 + 2.7 will be the first of many galactic PeVatrons to be discovered.

Marric Stephens is a Corresponding Editor for *Physics Magazine* based in Bristol, UK.

REFERENCES

1. K. Fang *et al.*, "Evidence for PeV proton acceleration from Fermi-LAT observations of SNR G106.3 + 2.7," **Phys. Rev. Lett. 129, 071101 (2022).**