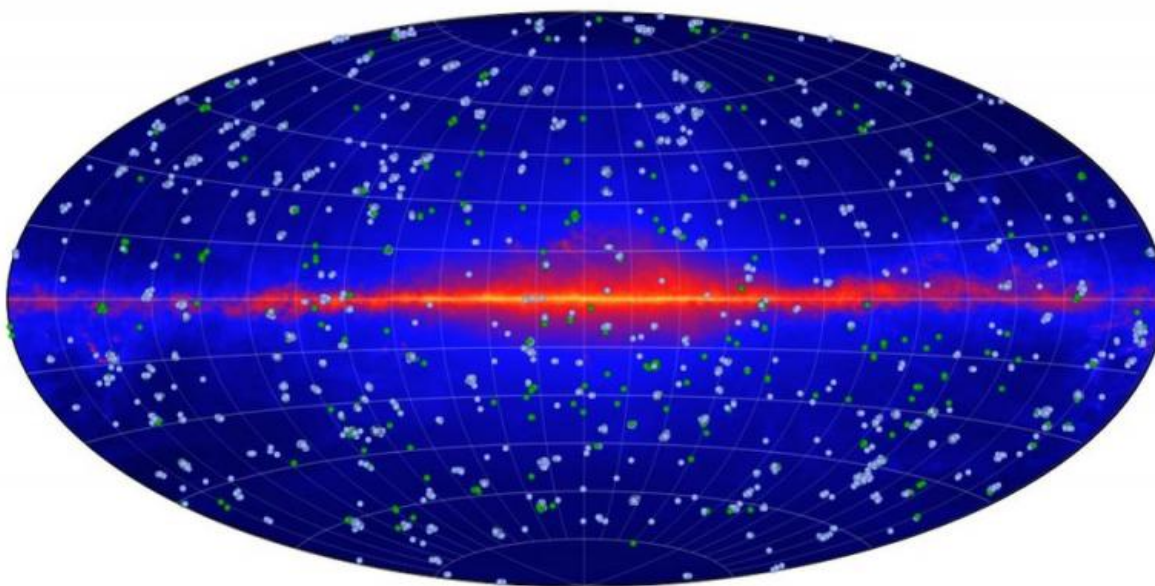


Analysis reveals dozens of unknown gamma-ray sources in the universe

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The gamma-ray sky as seen by 'Fermi'. Each spot represents a localised gamma-ray flare. Credit: Fermi All-Sky Variability Analysis

Researchers at DESY have compiled an extensive catalogue of variable sources of cosmic gamma radiation. For his doctoral thesis, Matteo Giomi, working at DESY in Zeuthen, analysed almost 7.5 years of observational data from NASA's "Fermi" space telescope. Over that period, the "Large Area Telescope" (LAT) on board the satellite registered a total of 4547 bursts of gamma radiation, known as flares.

Thanks to improved analytical methods, Giomi was able to assign these flares to 518 variable sources. The "Fermi All-Sky Variability Analysis" (FAVA) also lists 77 unknown sources, whose identity has not yet been determined. The "Fermi" scientists are presenting their catalogue in the *Astrophysical Journal*.

"The catalogue comprises a wide range of [gamma-ray sources](#)," explains Giomi. "Most of the sources in the catalogue are eruptions in extremely distant, so-called active galactic nuclei, but we are also seeing [binary star systems](#) involving white dwarfs and black holes, neutron stars and other remnants of stellar explosions." In all cases, the recorded gamma rays are produced by subatomic particles, which are accelerated to extremely high energies by a range of mechanisms. The catalogue will make it easier for astroparticle physicists to figure out precisely how the different cosmic particle accelerators work.

"We are looking at the particles while they are in the process of being accelerated, so to speak," says DESY's Rolf Bühler, who supervised the thesis. "In steadily radiating galaxies, the acceleration can take thousands of years. In the variable sources, by contrast, the acceleration must be taking place on roughly the same timescale as the flare. This gives us some clues about the acceleration process. For example, an accelerator cannot be larger than the distance travelled by light over the duration of the flare."

The analysis pays special attention to the 77 as yet unidentified sources. "In most cases, these will probably be [active galactic nuclei](#) as well, but they could also include representatives of entirely new classes of gamma-ray sources, which we have not come across before," says Bühler, who compiled an earlier catalogue of variable gamma-ray sources with some of his colleagues, based on just under four years of "Fermi" observations and listing 215 sources. To facilitate access to the two catalogues, as well as the latest data from "Fermi", Daniel Kocevski of NASA's Goddard

Space Flight Center has written a web interface, through which research scientists can retrieve the latest [observational data](#) on variable sources: [fermi.gsfc.nasa.gov/ssc/data/access/lat/FAVA/"](#)
[fermi.gsfc.nasa.gov/ssc/data/access/lat/FAVA/"](#)
`target="_blank">`[fermi.gsfc.nasa.gov/ssc/data/access/lat/FAVA/](#)

More information: S. Abdollahi et al. The Second Catalog of Flaring Gamma-Ray Sources from the Fermi All-sky Variability Analysis, *Astrophysical Journal* (2017). [DOI: 10.3847/1538-4357/aa8092](#)

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