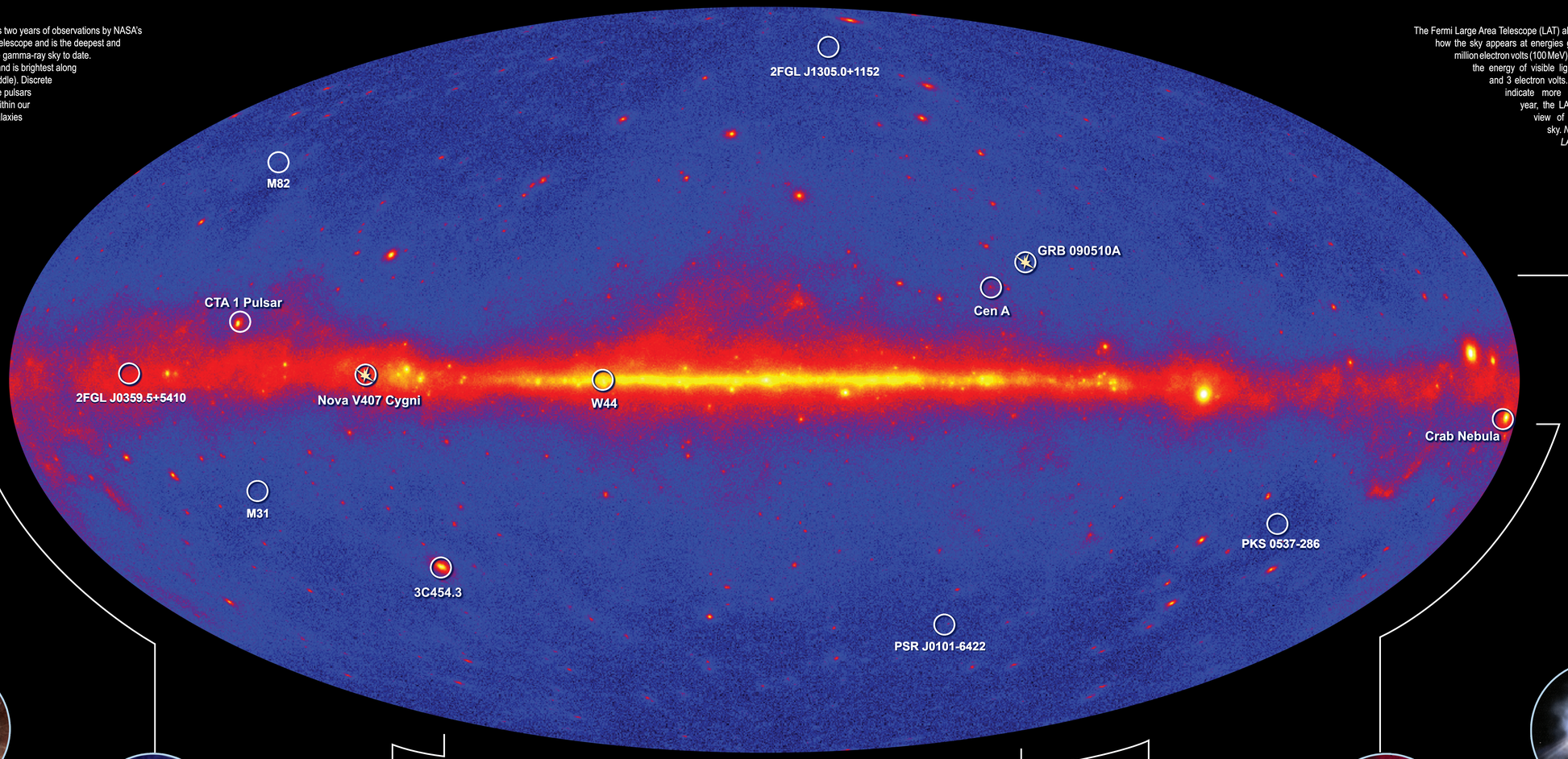
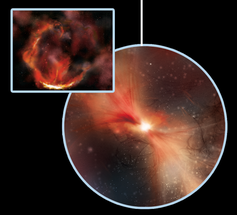
National Aeronautics and Space Administration

The Fermi LAT Gamma-ray Sky

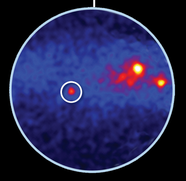
This all-sky view represents two years of observations by NASA's Fermi Gamma-ray Space Telescope and is the deepest and best-resolved portrait of the gamma-ray sky to date. A diffuse glow fills the sky and is brightest along the plane of our galaxy (middle). Discrete gamma-ray sources include pulsars and supernova remnants within our galaxy as well as distant galaxies powered by supermassive black holes.

The Fermi Large Area Telescope (LAT) all-sky map shows how the sky appears at energies greater than 100 million electron volts (100 MeV). For comparison, the energy of visible light is between 2 and 3 electron volts. Brighter shades indicate more emission. Each year, the LAT builds on this view of the gamma-ray sky. *NASA/DOE/Fermi LAT collaboration.*

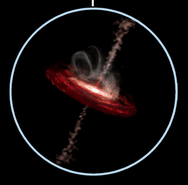




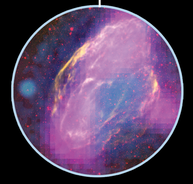
CTA 1 Pulsar: The first of many pulsars discovered by LAT scientists using only gamma-ray data was the one in supernova remnant CTA 1. A pulsar is a neutron star whose rapid rotation powers beams of radio, X-ray and gamma radiation. Although 10,000 years old, the CTA 1 pulsar still emits a thousand times more energy than our sun. *Illustration: NASA SSU E/PO, Simonnet.*



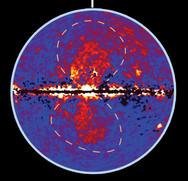
Nova V407 Cygni: Fermi LAT scientists were surprised and delighted in March 2010 when gamma rays from a nova were detected for the first time. These stellar eruptions were not expected to be strong enough to produce gamma rays, the highest-energy form of light. *NASA/DOE/ Fermi LAT collaboration.*



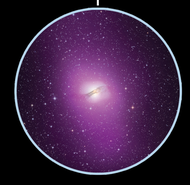
3C454.3: In 2009 and 2010, Fermi's LAT recorded a series of flares from the blazar 3C 454.3. The flare in November 2010 was larger than the 2009 flares, and 3C454.3 briefly was the brightest object in the gamma-ray sky. The source is a particle jet powered by the galaxy's supermassive black hole. The blazar is 7 billion light-years away, but is especially bright because its jet is directed toward Earth. *Illustration: NASA SSU E/PO, Simonnet.*



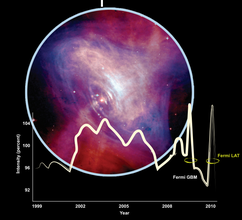
W44: Fermi's LAT has resolved GeV gamma rays (magenta) in the supernova remnant W44. The features clearly align with structures detectable in X-rays (blue) from the German ROSAT mission, infrared (red) from NASA's Spitzer Space Telescope, and radio (orange) from the Very Large Array near Socorro, N.M. *CXC/SAO/JPL-Caltech/Steward/O. Krause et al., and NRAO/AUI.*



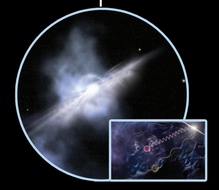
Giant Gamma-ray Bubbles: Another Fermi surprise: In late 2010, scientists uncovered a giant gamma-ray-emitting structure (dashed lines) extending 25,000 light-years north and south of the Milky Way's central plane. These gamma-ray "bubbles" may have formed from a past eruption of our galaxy's supermassive black hole. *NASA/DOE/Fermi LAT/D. Finkbeiner et al.*



Cen A: Fermi's LAT resolved high-energy gamma rays from an extended region around the active galaxy Centaurus A. The emission corresponds to million-light-year-wide radio-emitting gas thrown out by the galaxy's supersized black hole. The gamma rays (purple) surround the optical image (white) of the galaxy. *NASA/DOE/Fermi LAT Collaboration, Capella Observatory.*



Crab Nebula: Fermi observations of the Crab Nebula, a young supernova remnant containing a pulsar, reveal gamma-ray flares set off by the most energetic particles ever traced to a specific astronomical object. To account for the days-long flares, scientists say that electrons near the pulsar must be accelerated to energies a thousand trillion (10^{15}) times greater than that of visible light. Above is a composite of the nebula in visible light and X-rays. *NASA/CXC/HST/ASU/J. Hester et al.*



GRB 090510A: On May 10, 2009, gamma rays of very different energies struck Fermi. They arrived less than one second apart during a gamma-ray burst that exploded 7.3 billion light-years away. According to Einstein, all photons should travel at the speed of light, but some new theories of gravity predicted otherwise. Yet over this vast distance, the photons traveled at the same speed with an error of one part in 100 million billion. Einstein still rules. *Illustration: NASA SSU E/PO, Simonnet.*

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