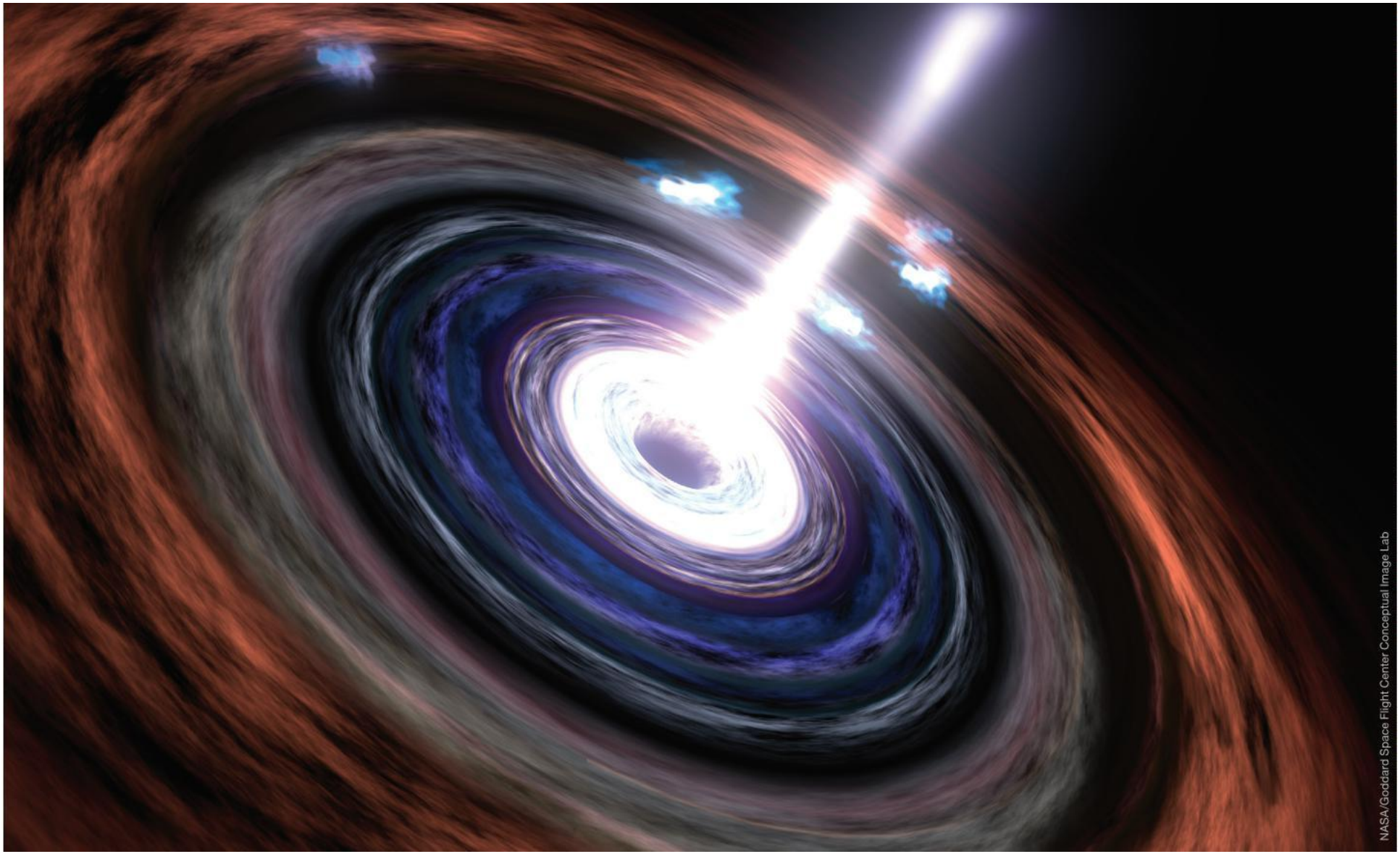
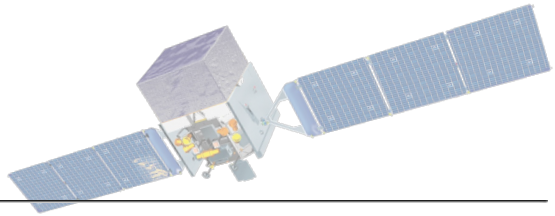
National Aeronautics and Space Administration



Active Galactic Nuclei. For more information visit http://fermi.gsfc.nasa.gov/

Active Galactic Nuclei (AGN)



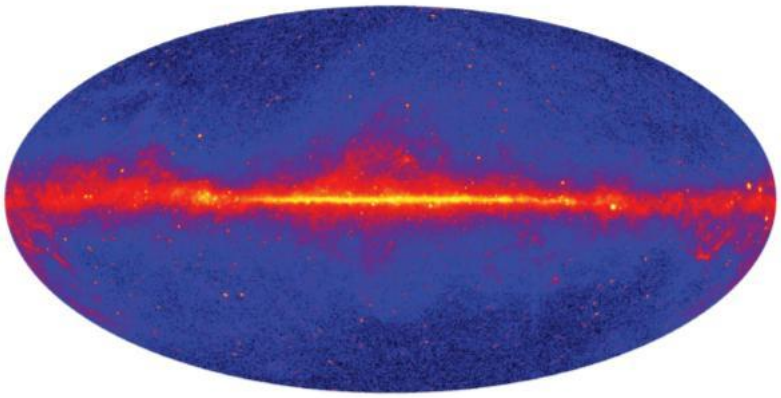
New Insights into AGN Physics from Fermi LAT

Active Galactic Nuclei (AGN) are compact regions, powered by supermassive black holes, at the centers of some galaxies. A fraction of AGN accelerate particle jets that can stretch up to hundreds of kpc outside the host galaxies to velocities near the speed of light. AGN that happen to have their jets pointed to Earth are known as blazars. Blazars are one of the most extreme astronomical sources in the Universe. They are characterized by being rapidly variable and very luminous across the whole electromagnetic spectrum.

AGNs detected with the LAT

The Large Area Telescope (LAT) on board the Fermi Gamma Ray Space Telescope observes gamma rays in the 30 MeV – 300 GeV energy band. Fifty-eight percent of the sources Fermi-LAT has detected, and almost all the gamma-ray sources from outside the Milky Way, are AGN.

The Fourth Fermi LAT AGN Catalog (4LAC) contains over 3407 gamma-ray sources associated with AGN. This is the largest catalog of gamma-ray-detected AGN ever made. The 4LAC catalog contains different AGN types: blazars (the majority), misaligned blazars (or radio galaxies), narrow-line Seyfert 1s, and starburst galaxies.

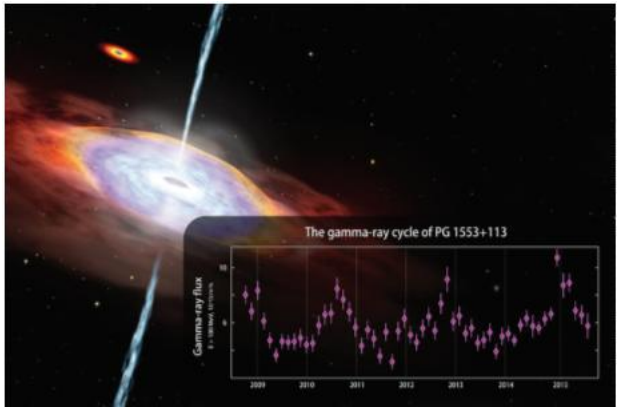


LAT 9-year all-sky map (Pass 8). Most sources outside of the Milky Way are blazars

Blazars are highly variable sources on timescales as short as minutes. In fact, the gamma-ray sky never looks the same two days in a row. This makes the all-sky coverage of the LAT a valuable tool for studying AGN. Therefor, the LAT has monitoring programs that search for flaring episodes on the sky.

The Most Extreme Blazars Yet

Fermi has identified the most distant gamma-ray blazars, revealing light that began its journey to us when the universe was only 1.4 billion years old (about 10% of its present age). This discovery triggers the question of how these huge black holes could have formed in such a young universe. The question is particularly intriguing because these new gamma-ray blazars are likely just the tip of the iceberg, the first examples of a previously undetected galaxy population.



LEFT: Do supermassive black holes come in pairs?
Fermi data suggests possible years-long cyclic changes in gamma-ray emission from the blazar PG 1553+113: This graph shows Fermi LAT data from August 2008 to July 2015 for gamma rays with energies >100 MeV. This cycle may be caused by oscillations of the jet produced by the gravitational pull of a second massive black hole.

RIGHT: The Record Flare from Blazar 3C 279
3C 279 is a famous blazar. On 2015 June 14, a pulse of high-energy light produced by a great disturbance near the monster black hole at the center of 3C 279 set off detectors aboard Fermi and other satellites. This flare was the most dynamic outburst Fermi has seen, becoming 10x brighter overnight. It conveyed information about the size of the emitting region, which cannot be larger than the distance light can travel during the flare.