



Dark Matter in the Galactic Center!

Why are we searching for dark matter in the galactic center?

Because this is expected to provide the brightest signal from dark matter annihilation! This is due to two reasons: (1) the density of dark matter increases towards the centers of galaxies and (2) the center of our own galaxy is relatively close to us.

What are we searching for in the galactic center? - In order to take advantage of the brightness of the galactic center, we need to look for a signal that provides directional information - such as gamma-rays, neutrinos, or potentially radio signals. In this case, we will search primarily with gamma-rays, and use instruments like the Fermi-LAT satellite.

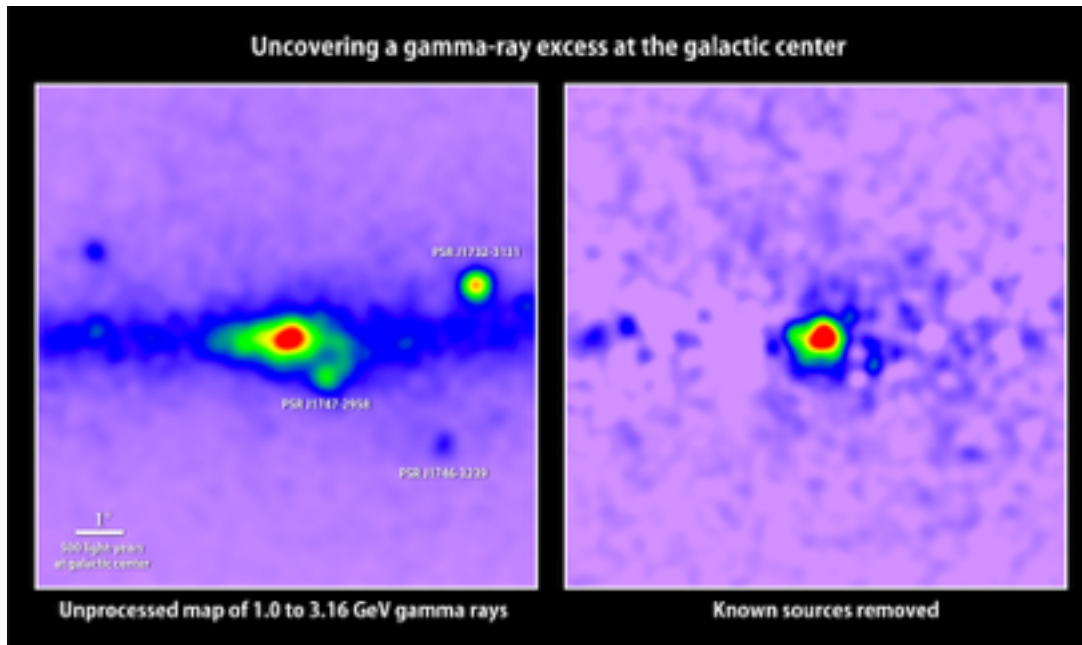
The Fermi-LAT telescope, pictured here, is among the most sensitive detectors for dark matter annihilation events.



Launched in 2008, the Fermi-LAT looks for gamma-rays (light with energies 30 million to one trillion times as energetic as the visible light in this room). It has a large field of view, which allows it to see the entire sky every few hours. The Fermi-LAT produces high resolution maps of these events, and can use the morphology, spectrum, and

timing of these events to look for hints of dark matter annihilation.

What Have We Found - A signal! After subtracting models for the gamma-ray emission from known astrophysical sources near the galactic center (things like supernovae, pulsars, high energy cosmic-rays that hit gas), we are left with some excess emission.



Why do we think this excess might be dark matter? - It has a lot of the properties that we would expect from a dark matter signal. It is spherical (not flattened along the plane of the galaxy), it falls off sharply with increasing distance from the center of our galaxy. It produces many gamma-rays at an energy of approximately 1 GeV (1 billion times the energy of the light in this room) - more than are expected from most astrophysical mechanisms.

What else could it be? - There are many theories out there. Some include large populations of dim pulsating neutron stars in order to explain the signal. Others argue for a recent outburst of high energy protons from the black hole at the center of our galaxy. The status of this excess, and our search for dark matter, continues!