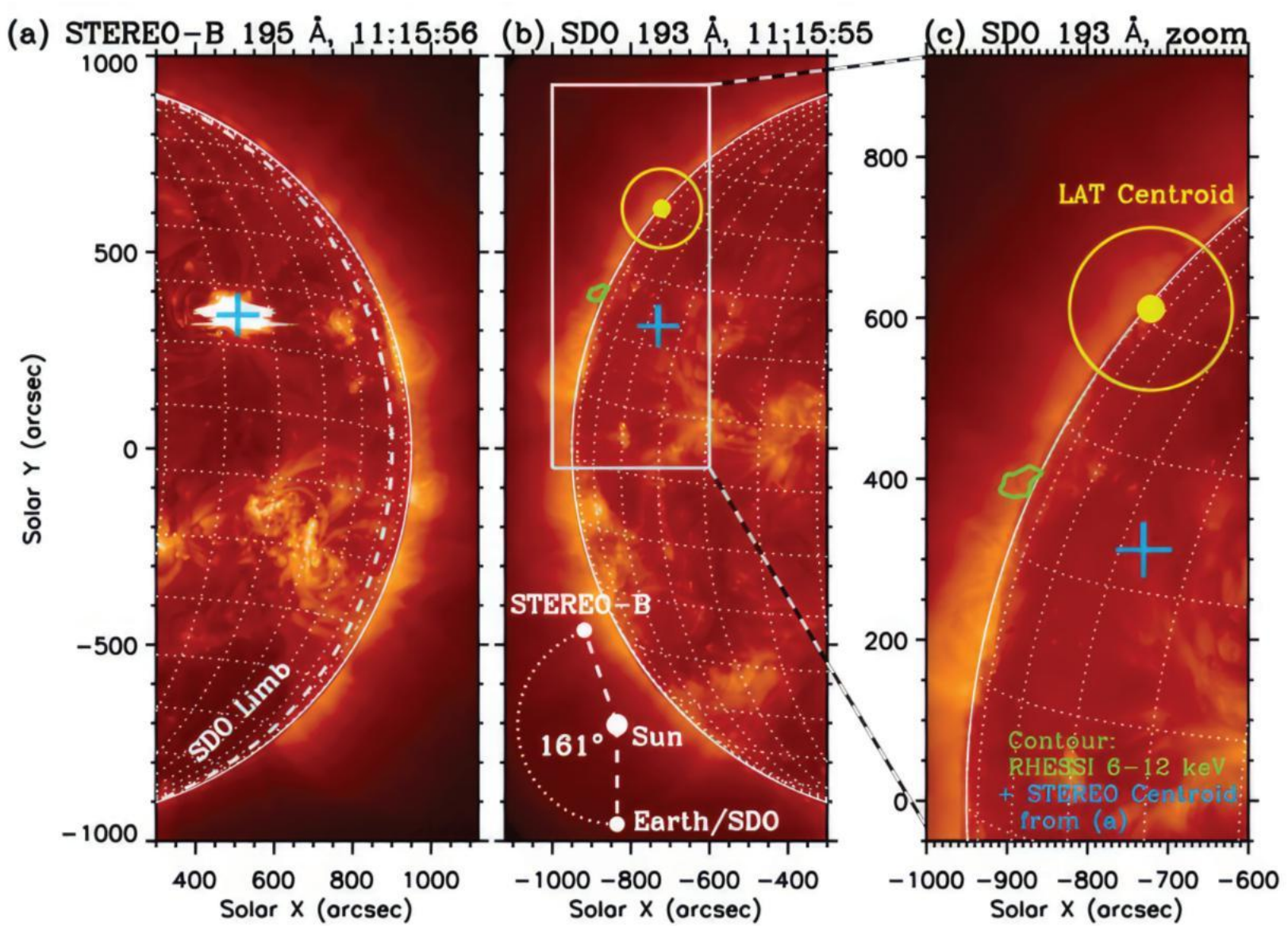
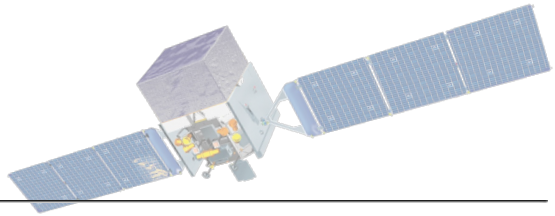


M. Ackermann et al 2017 ApJ 835 219

Solar Flares. For more information visit http://fermi.gsfc.nasa.gov/

Gamma-Ray Solar Flares

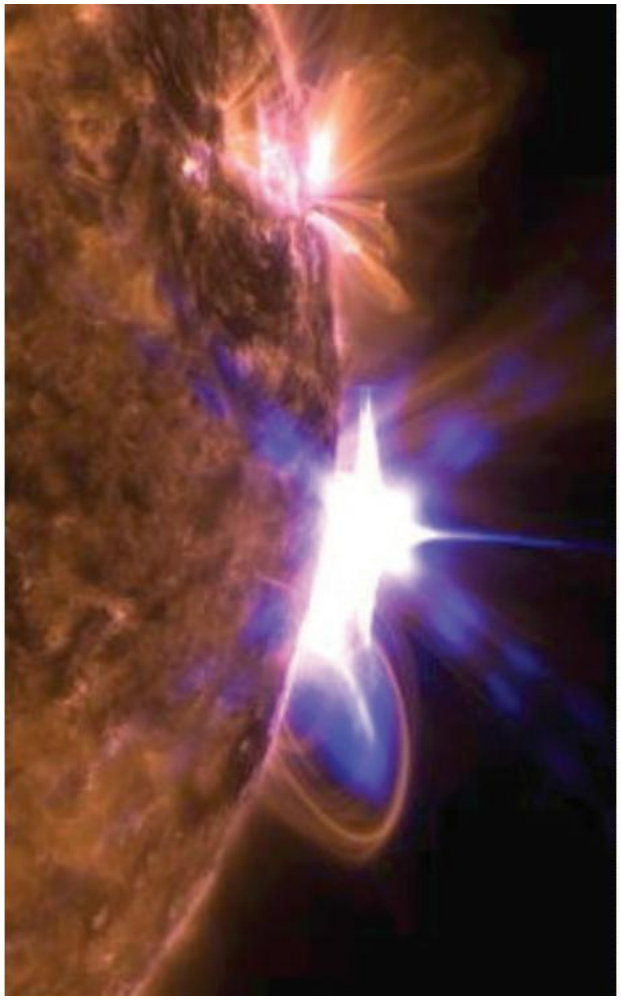


Fermi-LAT unveils the violent side of the flaring Sun

Solar flares typically produce gamma rays over time periods of seconds to several minutes and are commonly tied to the X-ray activity of the flare. The highest energy gamma rays are caused by protons colliding. These collisions create particles called pions that quickly decay into gamma rays. The Large Area Telescope (LAT) on board the Fermi Gamma-ray Space Telescope is so sensitive that we now see ten times more gamma-ray solar flares than before Fermi. We have learned that hour long high-energy gamma-ray emission is fairly common, even from moderately bright flares. In fact, more than 10 of the 40 gamma-ray solar flares detected by the LAT have continued producing gamma rays for at least 5 hours. In one instance, on March 7, 2012, the LAT observed continued gamma-ray emission for more than 20 hours! This record-setting flare was not only long-lived, but it also produced the highest-energy light ever detected during or immediately after a solar flare.

Fermi detects GeV emission from occulted flares for the first time

Fermi-LAT has even detected high-energy gamma rays from solar flares erupting on the far side of the Sun (not visible from the Earth). Some of the flares were near the edge of the Sun's visible disk (called the "limb" of the Sun), but others were much farther away, up to 40 degrees from the limb. Gamma-ray detections of "Behind the Limb" (BTL) flares implies that the energetic particles must be traveling very fast, up to 300,000 miles in just a few minutes. In fact, BTL observations strongly support the existence of a large component in solar flares that must travel far away from the active region in order to interact with the visible portion of the solar disk.



Localizing the >100 MeV emission from solar flares

For the brightest flares, the LAT is able to provide information on the region from which the emission originated. In the case of the March 7, 2012, flare the emission lasted so long that it was possible to make time-resolved localization, illustrating that the emission centroid moved across the solar disk (away from the active region) as time progressed.

Astronomy Picture of the Day March 15, 2012

Fermi-LAT observations of the March 7, 2012, solar flare. During this flare the Sun became nearly 100 times brighter than the Vela Pulsar, the brightest persistent gamma-ray source at these wavelengths.