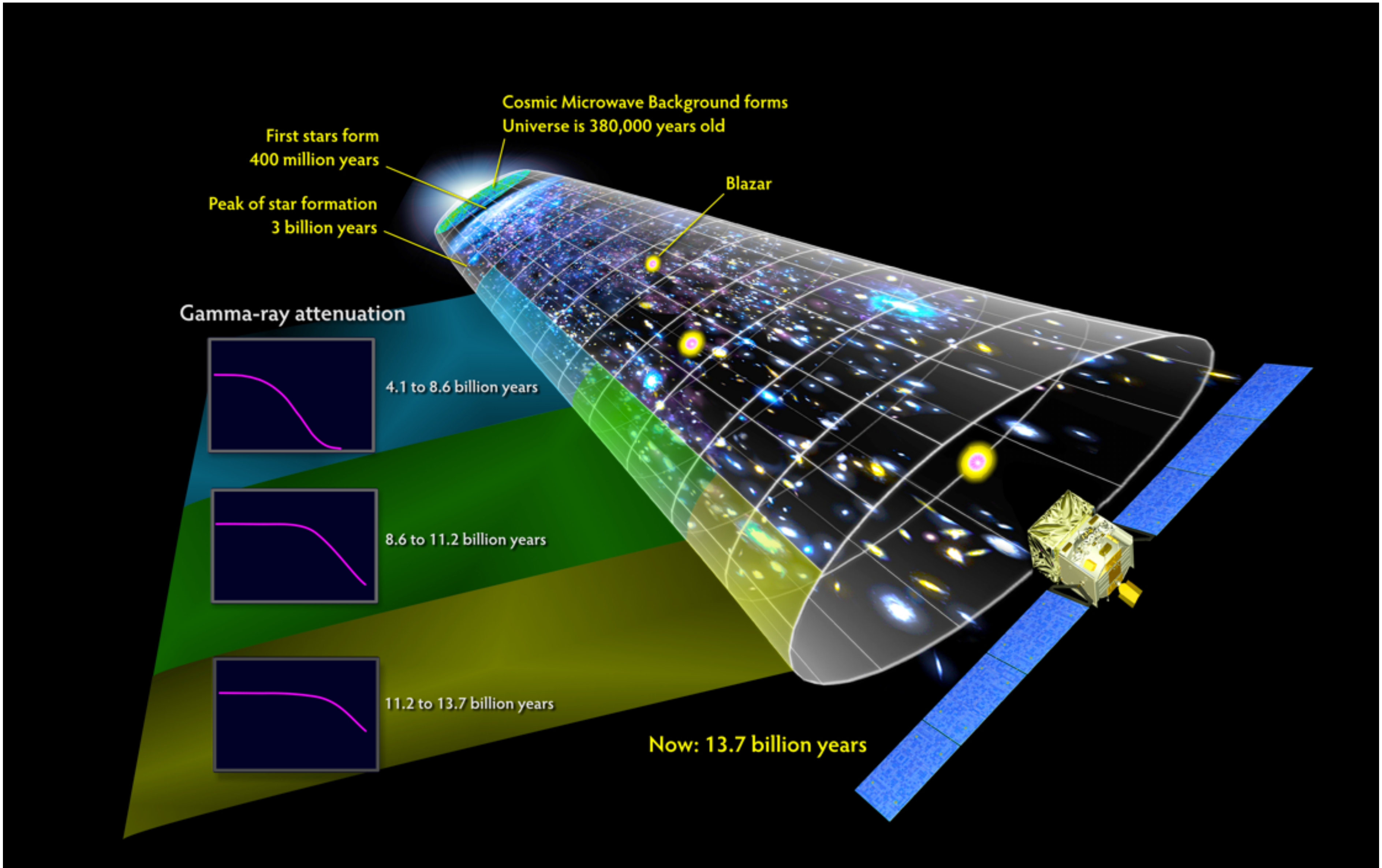
EXTRAGALACTIC BACKGROUND LIGHT

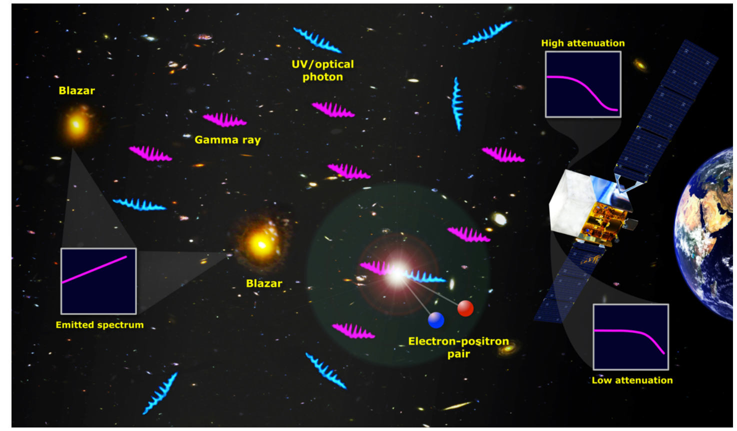


Credit: NASA's Goddard Space Flight Center

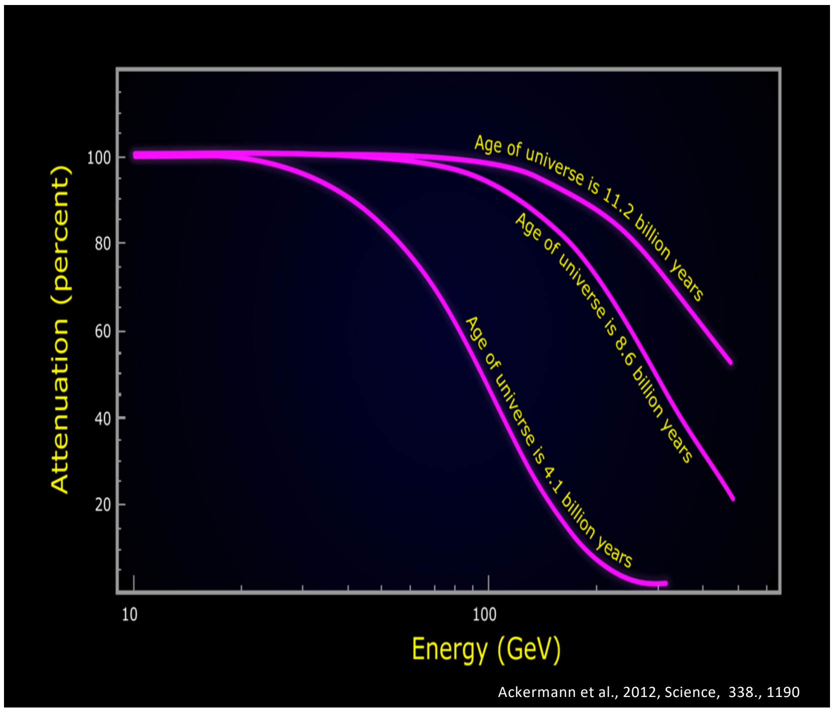
Studying The Extragalactic Background Light with *Fermi*

The Extragalactic Background Light (EBL), extending from the infrared through the optical and into the ultraviolet, is the total light from all of the stars (and to a lesser extent, active galactic nuclei) that have ever existed in the observable universe. Knowledge of the EBL is important for understanding the **evolution of our Universe** and the formation of stars and galaxies. Bright foreground sources from the Milky Way and solar system make direct measurements of the EBL challenging.

However, **gamma-ray astronomy provides a powerful tool** for measuring the EBL; gamma rays emitted by distant sources such as active galactic nuclei (AGNs) and gamma-ray bursts (GRBs) may interact with EBL photons, creating electron-positron pairs, effectively absorbing the gamma rays. The EBL leaves a distinct imprint in the gamma-ray spectra of cosmic sources, an attenuation that increases with the distance of the source from us.



High-energy gamma rays emitted by distant AGN interact with the EBL creating electron-positron pairs



Effect of the absorption due to the EBL in the spectra of sources at three different distances from us.

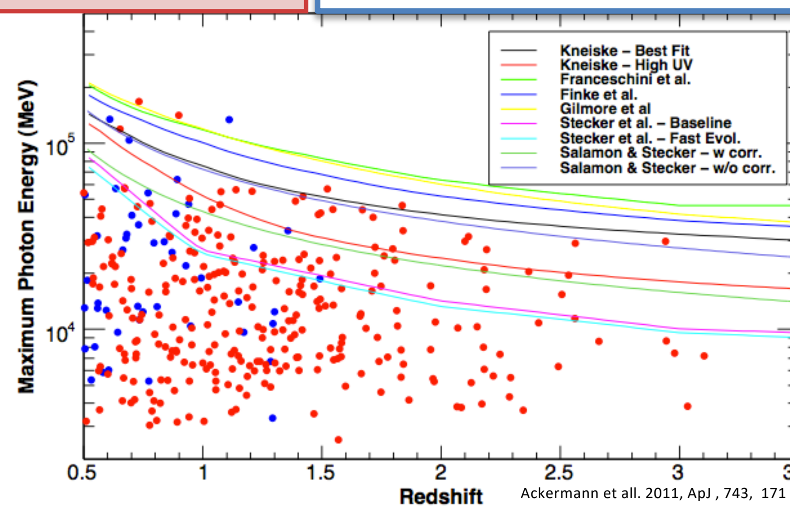
EBL Science with the LAT

The Large Area Telescope (LAT) on board Fermi measured the amount of gamma-ray absorption in blazar spectra produced by ultraviolet and visible starlight at three different epochs in the history of the Universe. The measurement (see left panel) shows clearly that the amount of absorption at higher redshifts **dramatically increases** for gamma rays emitted when the universe was younger. This is mostly due to the increase in the star formation activity of the Universe.

EBL Science with the LAT

The EBL suppresses most of the flux of distant gamma-ray sources. The **cosmic gamma-ray horizon** refers to that distance at which only ~30% of the source flux arrives at Earth for a given energy.

The detection of the highest energy photons (below) from distant sources allows *Fermi*-LAT scientists to probe the horizon from very low to very high redshift. This has important consequences for measuring cosmological parameters, such as **the expansion rate of the Universe.**



Observations of the highest energy photons received from sources located at various redshifts are used to test models of the EBL.

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

NASA's Fermi mission is an astrophysics and particle physics partnership managed by NASA's Goddard Space Flight Center in Greenbelt, Md., and developed in collaboration with the U.S. Department of Energy, with important contributions from academic institutions and partners in France, Germany, Italy, Japan, Sweden and the United States.

Fermi
Gamma-ray Space Telescope