Gamma Ray Bursts

The brightest and most powerful events in the universe

Luke Bender
Johns Hopkins University
25 July 2014

Abstract

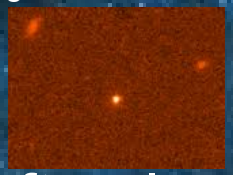
The purpose of this research was to learn as much as possible about the history, cause and effects of gamma ray bursts as well as what they could tell us about the universe. With NASA's Swift satellite and telescopes around the world, much data has been collected and analyzed to help us understand this bizarre event we accidentally discovered 50 years ago.

Early History

In the 70s and 80s, scientists could detect GRBs but could not find their location. In 1997, the observatory VLA detected faint radio wave signals from the area with a burst found by the satellite BeppoSAX. Later that year they determined the first distance of a GRB, a few billion light years.

Continuing Research

I would like to see if there is any data or proof of a possible third cause of GRBs that is much rarer, as not all GRBs found perfectly fit in either category. I would also like to understand how GRBs cause shockwaves in the universe and their effects.



Afterglow

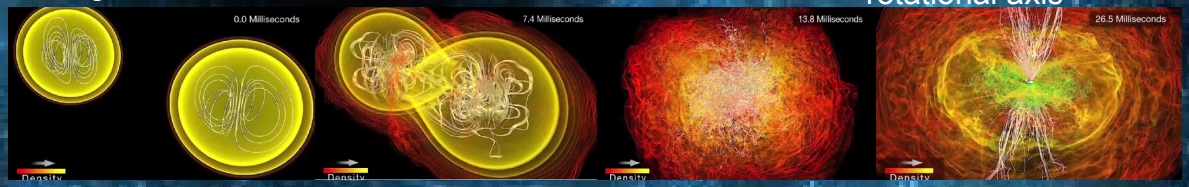
Faint, but lasts longer and occurs in much longer wavelengths, so it helps scientists locate it and use redshift to determine its distance from Earth. It was used in earlier times to find GRBs since it was easier to detect the other wavelengths.

Long GRBs

- Death of a Supermassive star
- Lasts >2 sec
- about 70% of all GRBs
- Produces black hole with accretion disk around it
- Energy jets out at poles

Short GRBs

- Collision of 2 neutron stars revolving around each other
- Lasts <2 sec
- About 30% of all GRBs
- Also produces jets at rotational axis



The white lines in the pictures are magnetic field lines. In the collision they are chaotic and jumbled, but they end up orderly and creating jets, proving that colliding neutron stars do cause short GRBs

Most GRBs are billions of light years away, but if one were to be within 1000 light years and pointed at Earth, then it could end humanity

Bibliography

Dunbar, Brian. "Magnetic Power Revealed in Gamma-Ray Burst Jet." *NASA*. NASA, 9 Dec. 2009. Web. 16 July 2014.

Dunbar, Brian. "NASA's Swift Finds Most Distant Gamma-ray Burst Yet." *NASA*. NASA, 27 May 2011. Web. 9 July 2014.

"Gamma-ray Bursts." *Gamma-ray bursts*. NASA, n.d. Web. 8 July 2014.

Harrington, J.D.. "Hubble Finds 'Smoking Gun' After Gamma-Ray Blast." *HubbleSite*. NASA, 3 Aug. 2013. Web. 16 July 2014.

Perley, D.. "Gamma-Ray Bursts." *Gamma-Ray Bursts*. University of California, Berkeley, n.d. Web. 7 July 2014.

Rothstein, Dave. "Why are accretion disks flat?." *Ask an Astronomer*. Cornell University, 28 Apr 2005. Web. 17 Jul 2014.