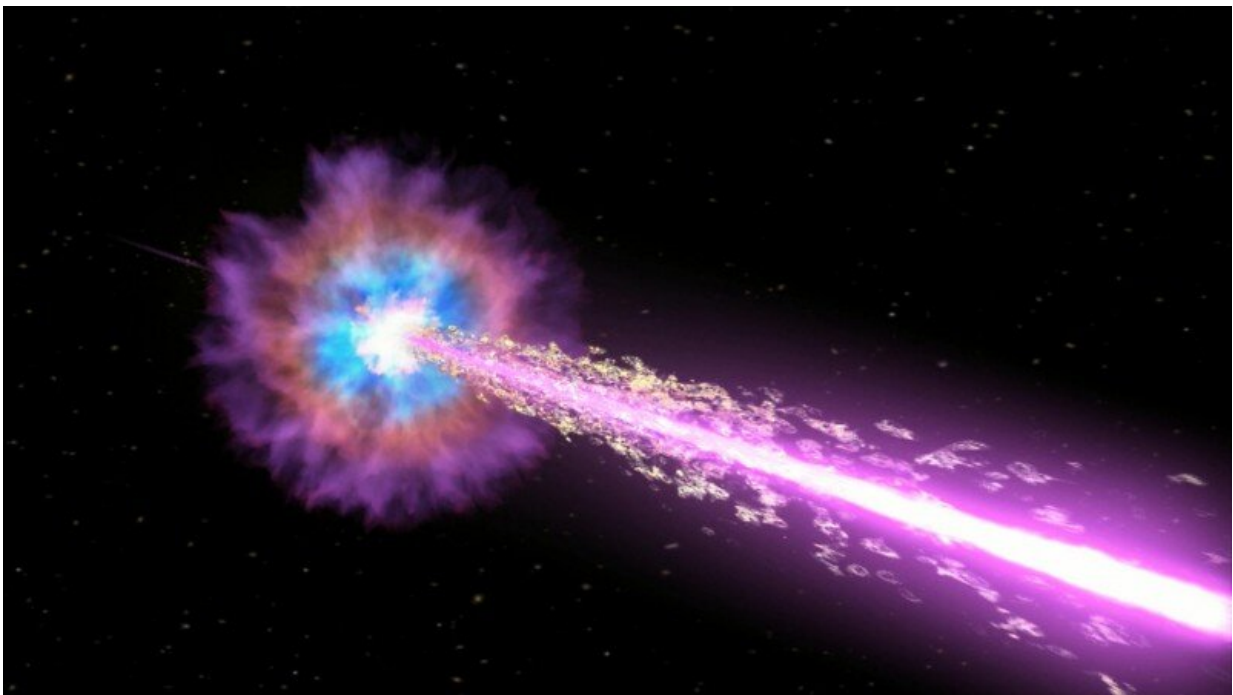


# Researchers operating Gamma-ray Burst Monitor discover brightest gamma-ray burst ever detected

July 18 2023, by Russ Nelson

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Astronomers believe Gamma-Ray Burst 221009A represents the birth of a new black hole formed within the heart of a collapsing star. In this illustration, the black hole drives powerful jets of particles traveling near the speed of light. The jets pierce through the star, emitting X-rays and gamma rays as they stream into space. Gamma-ray bursts are the most powerful explosions in the universe. They emit most of their energy in gamma rays, light which is many times more energetic than the visible light we can see with our eyes. Credit: NASA

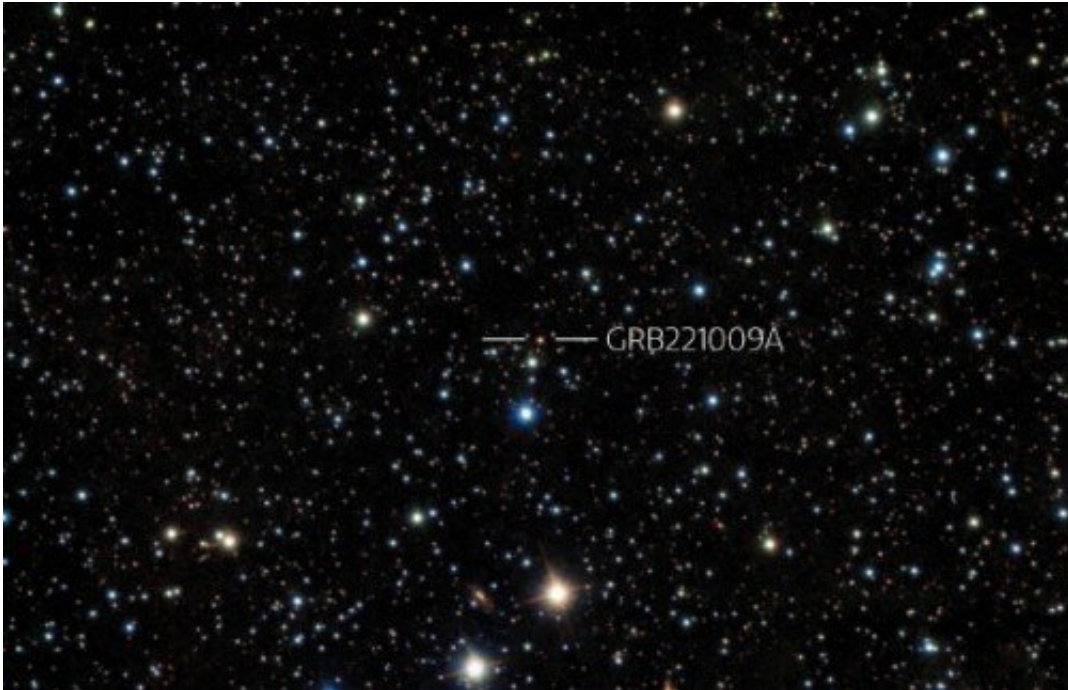
The University of Alabama in Huntsville (UAH) has announced that three researchers associated with the UAH Center for Space Plasma and Aeronomic Research (CSPAR) have discovered a gamma-ray burst (GRB) approximately 2.4 billion light-years away in the constellation Sagitta that ranks as the brightest ever observed. Believed to have been triggered by collapse of a massive star, it is accompanied by a supernova explosion, giving birth to a black hole.

Dr. Peter Veres, an assistant professor with CSPAR, Dr. Michael S. Briggs, CSPAR principal research scientist and assistant director, and Stephen Lesage, a UAH graduate research assistant, collaborated on the discovery and analysis of the [gamma-ray burst](#). The researchers operate the Gamma-ray Burst Monitor (GBM) at UAH, a part of the University of Alabama System.

The GBM is an instrument in low-Earth orbit aboard the Fermi Gamma-ray Space Telescope that can see the entire [gamma-ray](#) sky not blocked by the Earth and hunts for GRBs as part of its main program.

The development of the GBM and analysis of its data is a collaborative effort between the National Space Science and Technology Center in the U.S. and the Max Planck Institute for Extraterrestrial Physics in Germany. The instrument is managed at NASA's Marshall Space Flight Center in Huntsville, AL.

"This gamma-ray burst was extremely bright. We expect to see one like this only every 10,000 years or so," says Dr. Veres. "We routinely detect GRBs at a rate of about five per week and keep an eye out if any of the GRBs are special in some way. This one was so bright, the instrument couldn't keep up with the large number of incoming photons. Most of the work, led by Stephen Lesage, was to figure out how to reconstruct the lost counts."



Gamma-Ray Burst 221009A occurred approximately 2.4 billion light-years away in the direction of the constellation Sagitta. Credit: Courtesy International Gemini Observatory

Gamma-ray bursts come from random directions of the sky, so the GBM must watch as much of the sky as possible at all times. The GBM consists of 12 detectors made of sodium iodide for catching X-rays and low-energy [gamma rays](#) and two detectors made of bismuth germanate for high-energy gamma rays.

When the gamma rays enter these detectors, they interact with crystals in the instrument. The more energetic the gamma ray, the more light is produced. By seeing which crystals light up, the GBM can tell the direction of the bursts. In all, the Fermi instrument has discovered over 3,500 GRBs, and 221009A is by far the brightest ever detected.

"During a GRB, we see the death of a massive star, approximately 30 times more massive than the sun, and the formation of a black hole," Dr. Veres explains.

"The black hole launches a very fast jet close to the speed of light, and the jet will produce the gamma-ray burst. At later times, GRBs are visible at other wavelengths as well, from radio, or optical through very [high-energy gamma-rays](#), which is called the afterglow of the GRB. This GRB was so bright, the afterglow showed up in the Gamma-ray Burst Monitor, which is very uncommon, and we could follow it for almost three hours."

GRB 221009A is also one of the nearest and possibly most energetic GRBs ever found, as detailed in a paper on the *arXiv* preprint server, which has been accepted for publication in *The Astrophysical Journal Letters*.

**More information:** S. Lesage et al, Fermi-GBM Discovery of GRB 221009A: An Extraordinarily Bright GRB from Onset to Afterglow, *arXiv* (2023). [DOI: 10.48550/arxiv.2303.14172](https://doi.org/10.48550/arxiv.2303.14172)

Provided by University of Alabama in Huntsville

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