Brightest gamma-ray burst was aimed at Earth

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Astronomers think they know what caused the brightest ever gamma-ray burst, which was observed in March: a tightly beamed jet of matter that happened to be aimed almost directly at Earth.

Gamma-rays bursts are thought to be caused when massive, spinning stars collapse to form black holes and spew out jets of gas at nearly the speed of light. These send gamma rays our way, along with visible light produced where the jet heats up surrounding gas.

On 19 March, astronomers nabbed a view of the brightest such burst ever to be seen in visible light.

The blast, dubbed GRB 080319B, came from 7.5 billion light years away, more than halfway across the universe. Despite the immense distance, it would have been visible with the naked eye at dark sites on Earth for 40 seconds.

Collapsing stars may produce gamma-ray bursts by blasting out jets with two components: a narrow, super-fast jet, as well as a wider one. Narrow beams will only rarely point at Earth (Illustration: NASA/Swift/Mary Pat Hrybyk-Keith/John Jones)

Combining information from more than a dozen different telescopes, an international team found GRB 080319B contains what appears to be a particularly tightly focused jet, surrounded by a dimmer one. The find could explain why most other bursts seen are not nearly as luminous – only rarely does the narrow beam point at Earth.

This is the first time astronomers have been able to discern the cross-section of a gamma-ray burst jet, says Jonathan Grindlay of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, who was not involved with the study. "It starts to give us a hint as to what these jets really look like."

Two components

To discern the structure of the jet, researchers attempted to fit the signature of visible light and X-rays to a 'fireball' model, which describes the shape that a single jet cone is supposed to take.

But the model did not fit, says David Burrows of Penn State University in University Park.

Instead, a better model suggests the gamma-ray burst may have released light in two components. First, it shot out a tightly focused beam of light roughly 1% the width of the Full Moon on the sky. A dimmer beam that was 20 times wider eventually followed.

Most of the gamma-ray bursts we observe might actually have this same jet structure, the astronomers say. Most of the time, we only see the dimmer jet, but every 10 years or so, a narrow jet might be pointed in the right direction for us to catch it.

More common

If all gamma-ray bursts have this structure, they could be 10 to 100 times more common than previous estimates, Grindlay says. A number of far-off ones would evade detection because they would be too dim for current telescopes to find them, unless the primary jet was pointed directly at Earth.

Future telescopes, like the Energetic X-ray Imaging Survey Telescope, which is currently under consideration by NASA, might be able to detect such bursts at very early times in the universe's history.

Gamma-ray bursts could potentially act as backlights for the intervening universe, allowing astronomers to discern the composition of intergalactic gas and galactic halos.

Because the accelerating expansion of space is also causing time to dilate, gamma-ray bursts that occurred a few hundred million years after the big bang would be seen to last 10 or more times longer, making observations even easier, Grindlay says.

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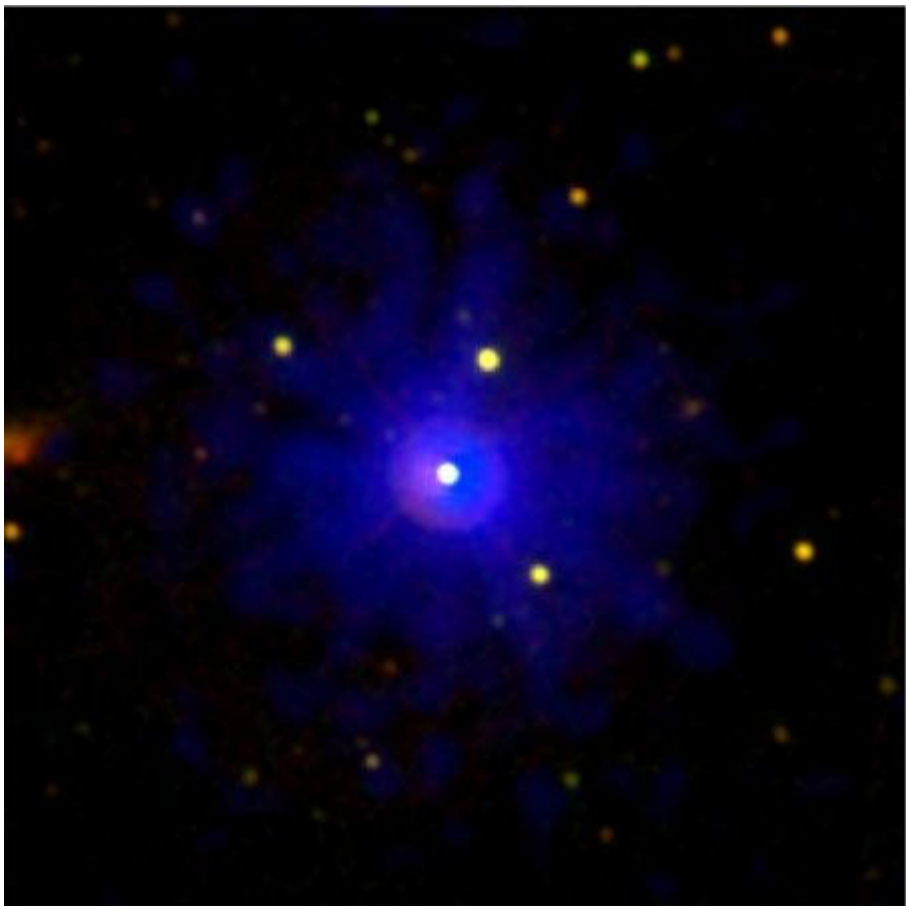

The NASA Swift satellite caught this glimpse of gamma-ray burst 080319B with its ultraviolet and X-ray telescopes (Image: J Racusin)