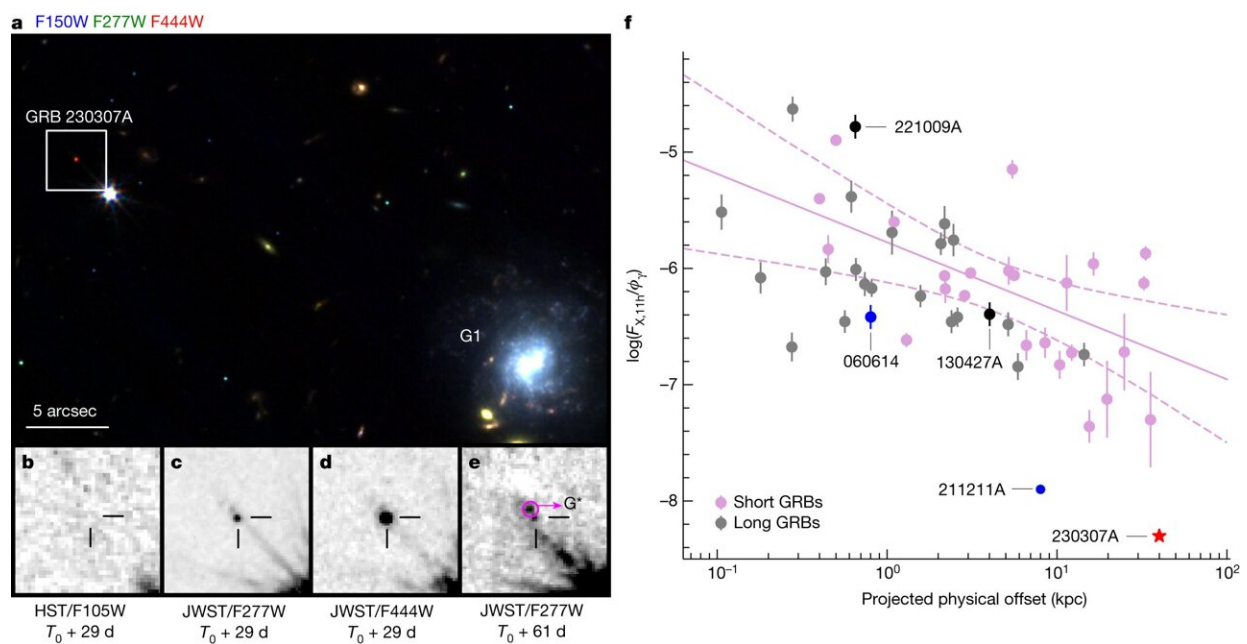


# Further study of bright gamma-ray burst GRB 230307A shows it was caused by neutron stars merging

February 26 2024, by Bob Yirka



The environment of GRB 230307A. **a**, False-color image combining three filters from JWST (F150W, F277W and F444W). The bright galaxy labeled by G1 is the most likely host galaxy at an offset of 40 kpc. **b–e**, Zoom-in on the transient location, corresponding to the white box in **a**. The high-redshift galaxy G\* is marked in the magenta circle in **e**. **f**, Ratio of 0.3–10 keV X-ray flux at 11 h ( $F_{X,11h}$ ) to the 15–150 keV gamma-ray fluence ( $\phi_\gamma$ ) versus the projected physical offset from the GRB host galaxy. The purple and gray data points represent short and long GRBs, respectively. Credit: *Nature* (2024). DOI: 10.1038/s41586-023-06979-5

An international team of astronomers and astrophysicists has found evidence that the bright gamma-ray burst GRB 230307A [observed last year](#) was caused by two neutron stars merging, not from a collapsing massive star. In their study, [published](#) in the journal *Nature*, the group analyzed data from both the Hubble Space Telescope and the James Webb Space Telescope.

Prior research has shown that the strongest occasional flashes of light in the night sky are made by gamma-ray bursts. There are two basic kinds of GRBs: those that last longer than two seconds and those that are shorter. Study of these bursts has shown that the shorter bursts are typically the result of merging [neutron stars](#). Longer bursts, on the other hand, were believed to occur when a massive star collapses.

Neutron stars are created when massive supergiant stars collapse during a supernova. Once created, they can wander aimlessly alone through space. Sometimes, though, they travel close to another neutron star, forming a neutron binary system. As they orbit one another, they release [gravitational waves](#), which can be measured here on Earth.

As they spiral, they are also pulled more tightly to one another until they eventually merge, emitting a massive burst of gamma rays, which on Earth looks like a bright burst of light—such bursts are called kilonovae. In studying GRB 230307A, researchers found that not only had it had been the source of the second-largest gamma-ray burst ever recorded, but it was also due to a kilonova, confounding theories regarding how GRBs are created.

As part of their research, the team studied the events leading up to the [merger](#), the merger itself, and the material left after the collision—the first study of its kind. In focusing on the [atomic nuclei](#) left behind after the [collision](#), the researchers found evidence of the creation of several heavy elements, including gold and silver. Further study of how such

elements were formed, they suggest, could help to better understand how the universe as a whole was formed.

**More information:** Yu-Han Yang et al, A lanthanide-rich kilonova in the aftermath of a long gamma-ray burst, *Nature* (2024). [DOI: 10.1038/s41586-023-06979-5](https://doi.org/10.1038/s41586-023-06979-5)

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