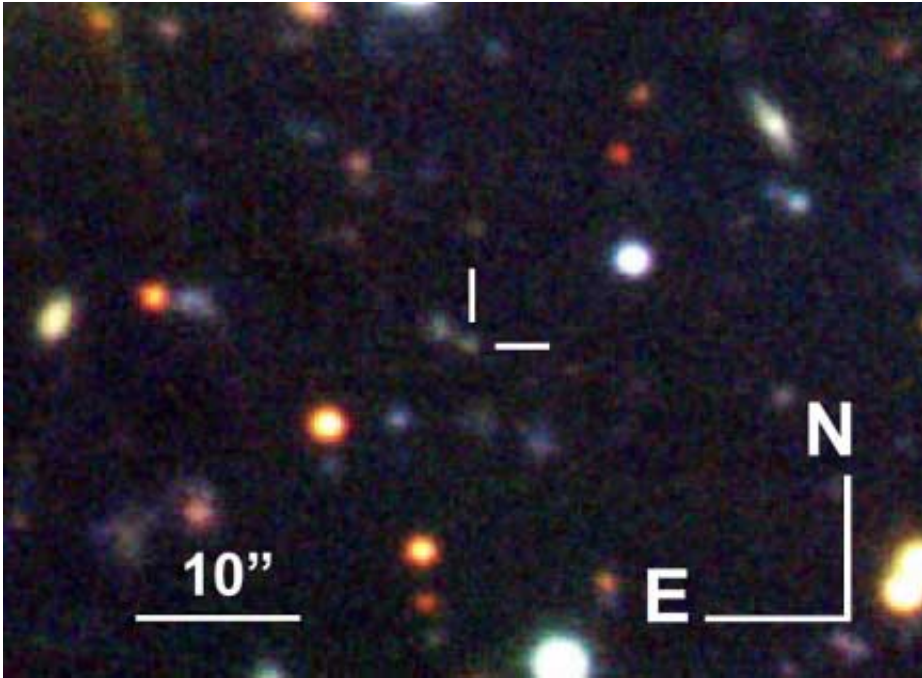


# Shocks in a distant gamma-ray burst

September 14 2015

---



An optical image of the sky at the location of a faint galaxy (marked with the cross-hairs) where a gamma-ray burst (GRB) was seen last year. Followup studies of the burst and its afterglow find that it originated in a supernova - the death of a massive star - yet also shows signs of shocks more typically originating in GRBs from merging binary stars. Credit: Cano et al.

Gamma ray bursts (GRBs)—flashes of high-energy light occur about once a day, randomly, from around the sky—are the brightest events in the known universe. While a burst is underway, it is many millions of times brighter than an entire galaxy. Astronomers are anxious to decipher their nature not only because of their dramatic energetics, but

also because their tremendous brightness enables them to be seen across cosmological distances and times, providing windows into the young universe.

There appear to be two general types of GRBs: those associated with the deaths of [massive stars](#), and ones believed to originate from the coalescence of two extreme objects (neutron stars or black holes) that had been orbiting each other in a binary system. In general the two types can be distinguished by the lengths of their bursts, the former lasting longer than a few seconds, while the latter are briefer. Astronomers think that, despite the differences, both kinds of GRBs have hot discs accreting material leading to the production of bipolar jets of charged particles moving at relativistic speeds. In the standard model, shocks internal to the fireball produce the gamma-rays in the first (longer duration) case, while shocks from the jets' interactions with the external medium produce the initial burst of gamma-rays in the second case. Many details are similar in both scenarios, however, while some others vary according to the type, and astronomers have been trying to constrain these various parameters so that they can trace the origin of each GRB more precisely.

CfA astronomer Raffaella Margutti and her colleagues used several ground-based telescopes to follow-up a GRB event that went off in June of 2014, examining the afterglow from about three days after the detection to about one hundred and twenty days later. They conclude that the burst is associated with a massive star's death (a supernova), but find that some of its emission apparently results from shocks external to the fireball as are seen in the less luminous class of GRBs. The results are consistent with the predictions of supernova modeling, but the fact that this object spans both classes highlights the complexity of the sometimes-overlapping physical processes at work and the importance of observations at multiple wavelengths.

**More information:** "GRB 140606B/iPTF14bfu: Detection of shock-breakout emission from a cosmological  $\gamma$  -ray burst?" *MNRAS* 452, 1535, 2015. [DOI: 10.1093/mnras/stv1327](https://doi.org/10.1093/mnras/stv1327)

Provided by Harvard-Smithsonian Center for Astrophysics

Citation: Shocks in a distant gamma-ray burst (2015, September 14) retrieved 10 April 2024 from <https://phys.org/news/2015-09-distant-gamma-ray.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.