

Determining the direction of a gamma-ray burst's jet in its host galaxy

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Abstract

Background

A gamma-ray burst (GRB) launches a jet towards the observer. However, it is not clear what the orientation of the GRB jet is with respect to the host galaxy.

New information

We suggest the direction can be obtained from the morphology of the host galaxy. If the host galaxies are mostly face-on, that means the GRB jets are perpendicular to the galaxy disk.

Keywords

GRB, relativistic jet, galaxy

Overview and background

Gamma-ray bursts (GRBs) are the most violent explosion in the universe (Piran 2005). They eject the highest speed jet with a bulk Lorentz factor in the order of hundreds. Their host galaxies have been extensively studied (Fruchter et al. 2006, Savaglio et al. 2009). The GRBs are mainly located in the field galaxies with a related high star formation rate.

Objectives

Determine the direction of a GRB jet in its host galaxy

The jets are believed to be aligned with the spin axis of the central engine, whose spin has in turn been preserved from the progenitor. For long GRBs, the progenitors are massive stars. It is not clear how the spin of the star relates to the spin of the galaxy.

Here, we suggest to use the morphology to determine the direction of the GRB jets. Under extreme conditions, if all the jets are aligned with the host galaxy spin, we should see the host galaxies all face-on. In reality, the morphology should be diverse and may have some tendency like more face-on galaxies than edge-on ones.

Therefore, it is possible to measure the morphology of the host galaxies, to determine the distribution of the GRB jet direction.

Impact

This could show the connection of star formation and galaxy formation. If the GRB jets are aligned with the spin of the host galaxy, the probability that they would destroy possible life decreases.

Conflicts of interest

No

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