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# Understanding GRB progenitors from their environment

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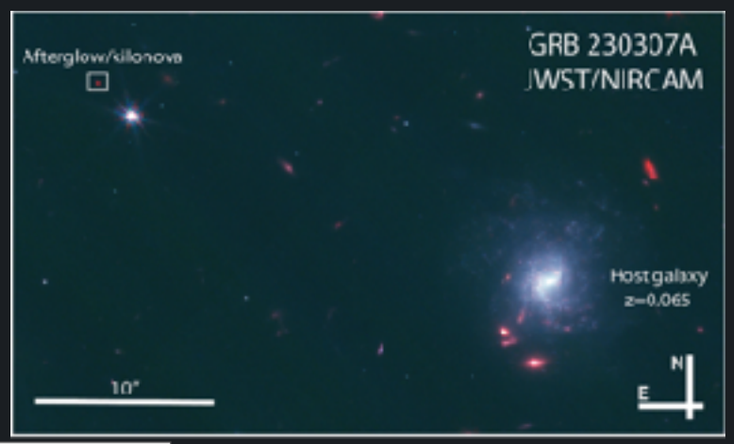
## Traditional diagnostics are insufficient

GRBs are divided into two categories:

- Long → Collapsar (type II)
- Short → Merger (type I)

Traditionally based on duration (T90) and hardness ratio of the prompt emission
But recent discoveries are challenging this (GRB 211211A, GRB 230307A)




Levan et al. 2024, Nature

## Use the environment as a probe of the progenitor

Collapsar and mergers have different requirements for production which are reflected in their hosting environments:

- Collapsar: massive rapidly rotating star → Usually young, star-forming, low-metallicity galaxy
- Merger: binary compact system → Diversity hosts but generally more evolved

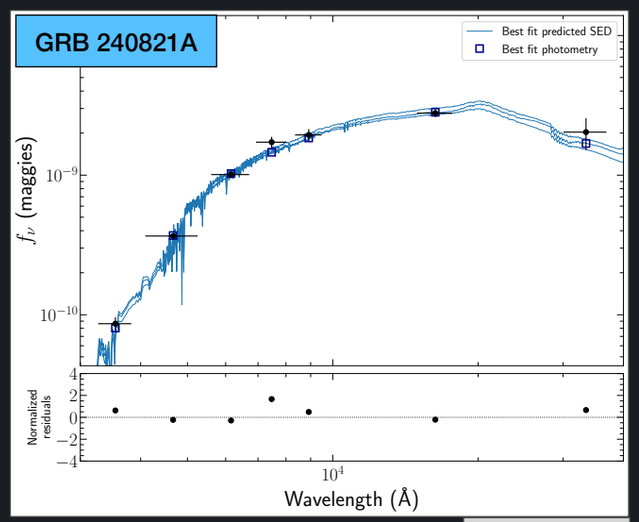
Some sub-categories of GRBs are particularly hard to classify:

- Short GRBs with extended emission (SGRB+EE)

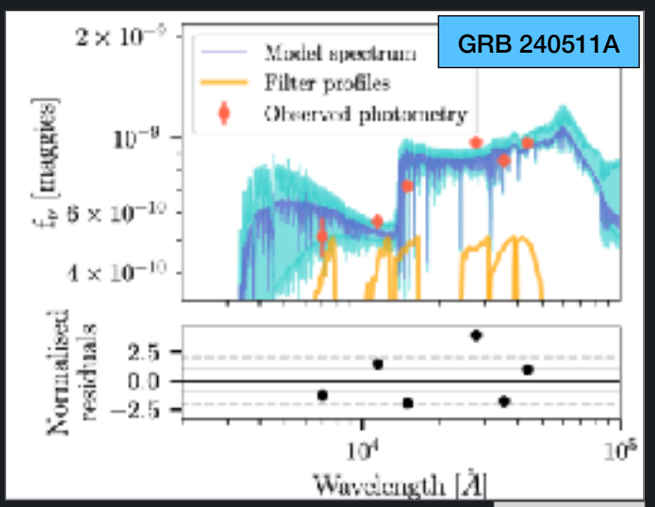
⇒ Real merger or just a collapsar dimmed by the "tip of the iceberg" effect?

Two recent examples where spectrophotometric observations of host galaxy helped:

- GRB 240511A: host galaxy properties are similar to the expectation from collapsar
- GRB 240821A: host galaxy properties strongly disfavor a collapsar progenitor but rather point towards a merger progenitor




Daigne et al. in prep




Dimple et al. 2025

**Take home message:**

Constraining the **properties of the host galaxy** can help infer the **nature of the progenitor**