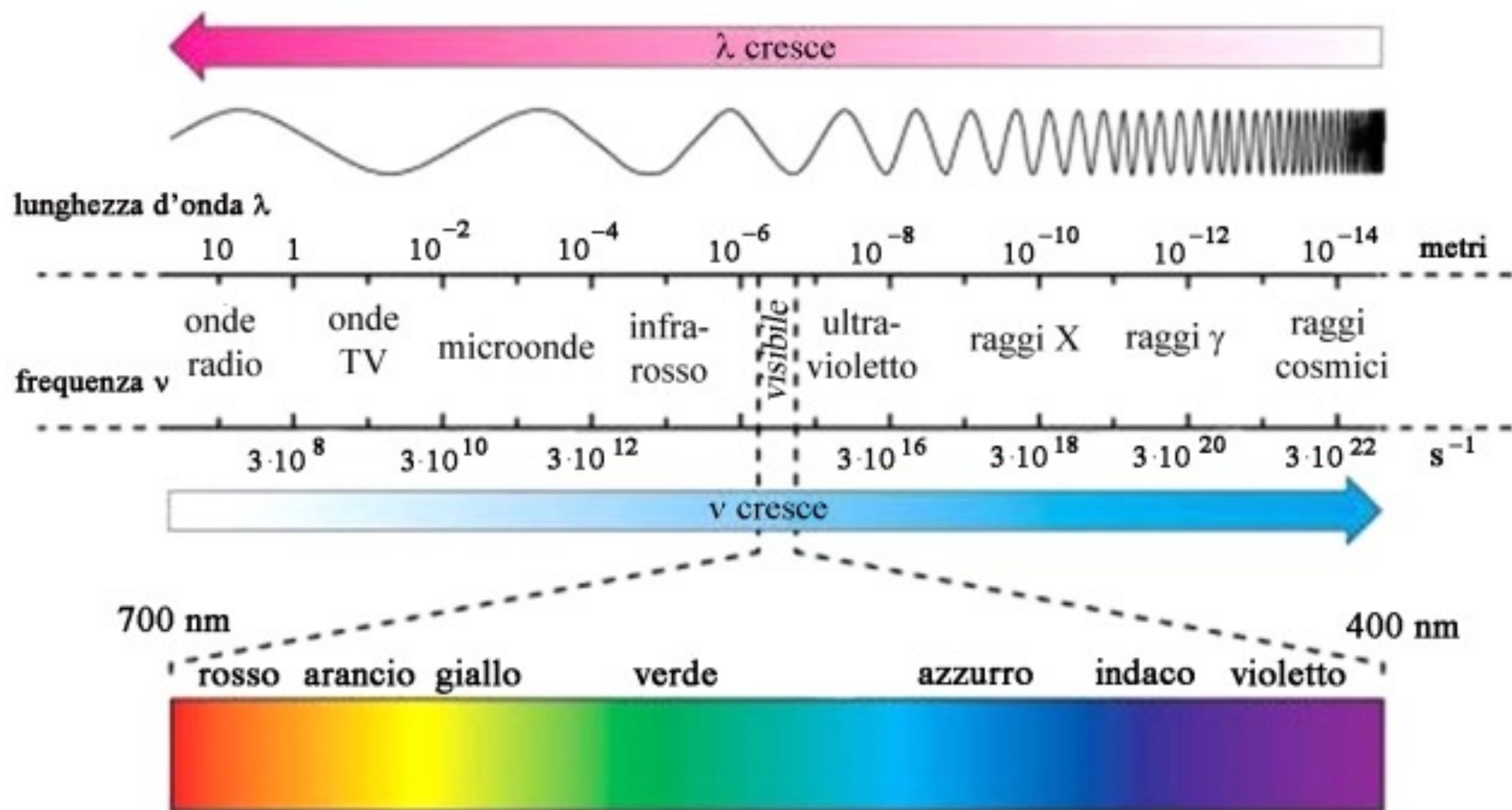


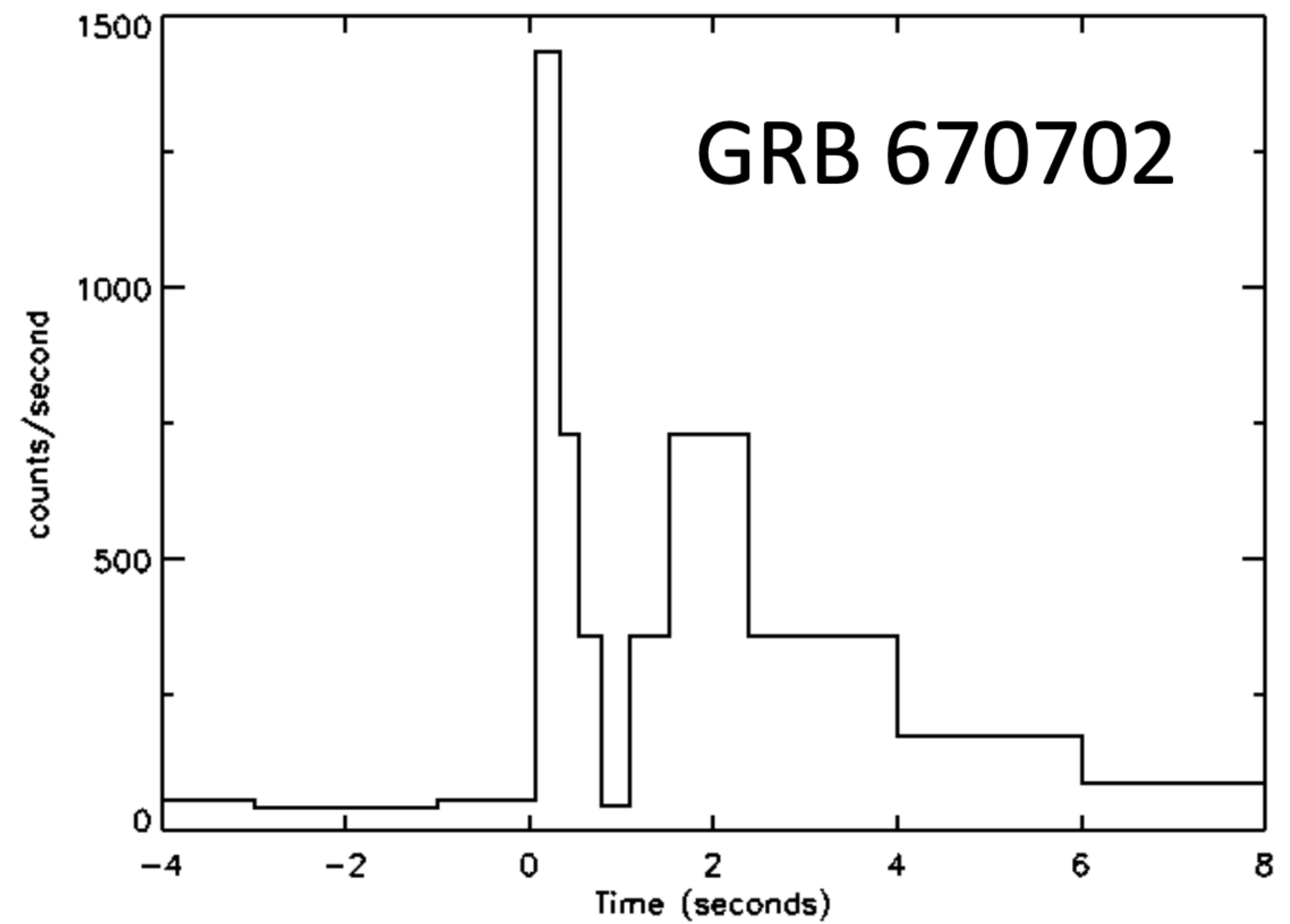
Gamma-ray bursts



Spettro Elettromagnetico: dove sono i raggi gamma?



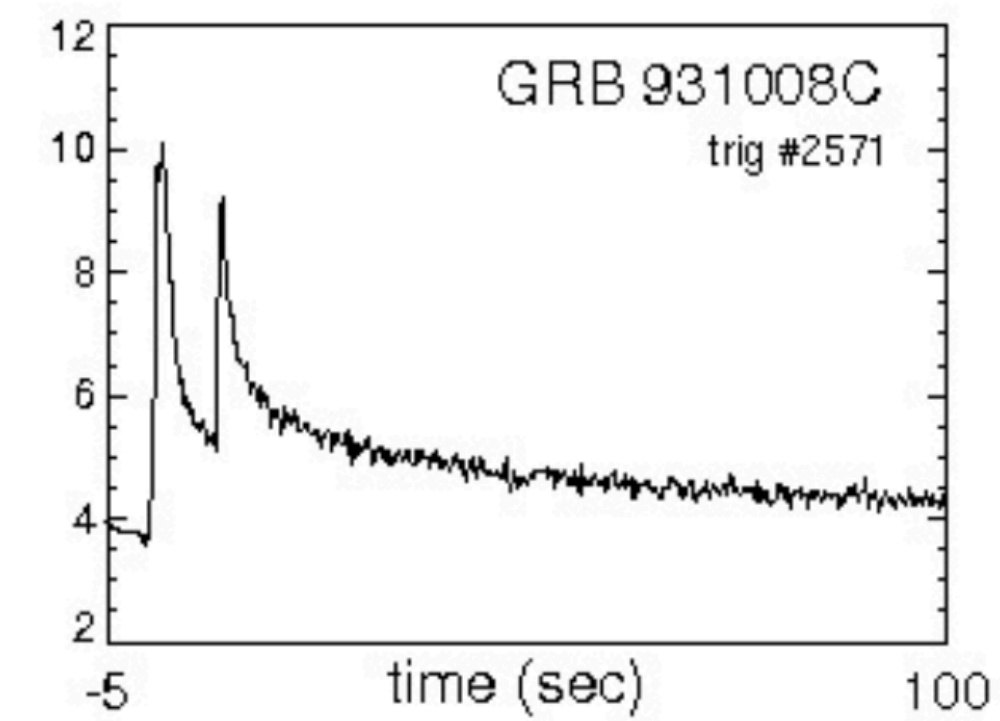
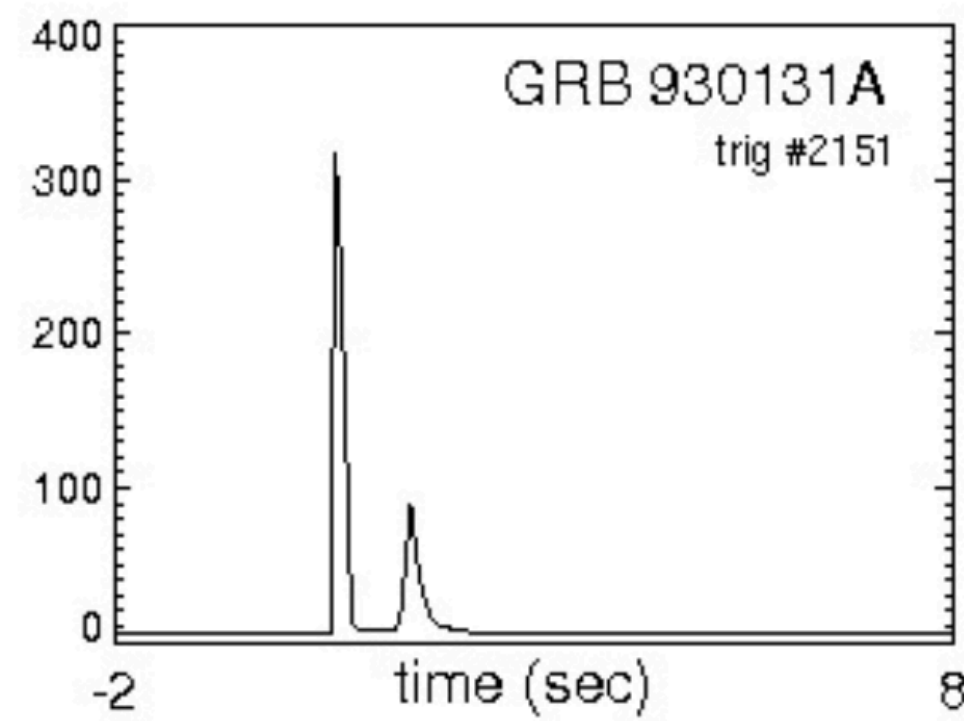
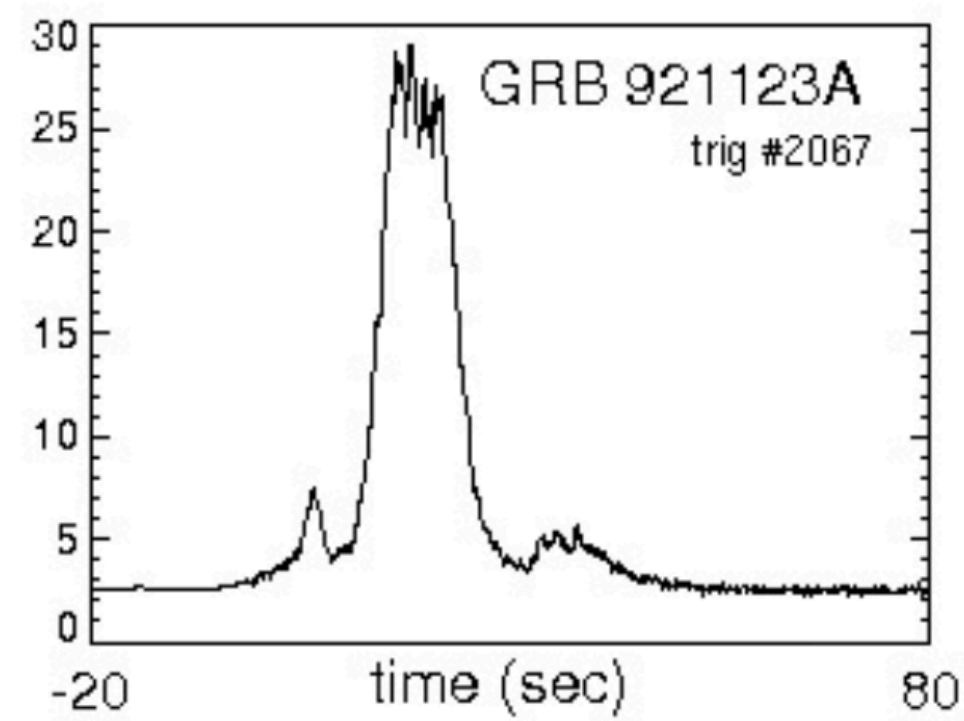
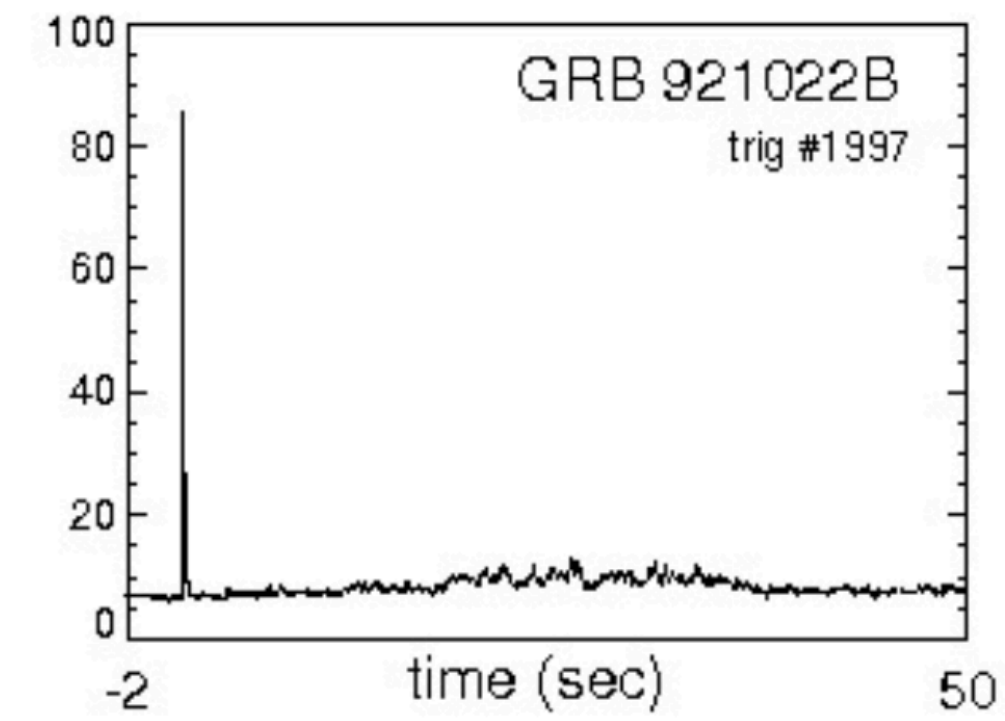
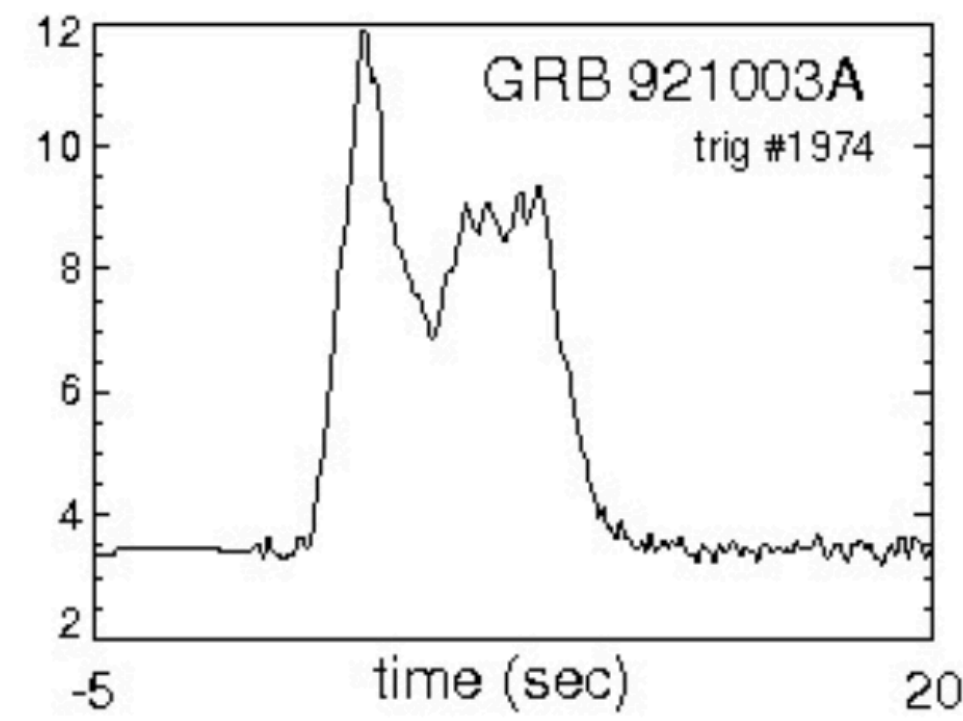
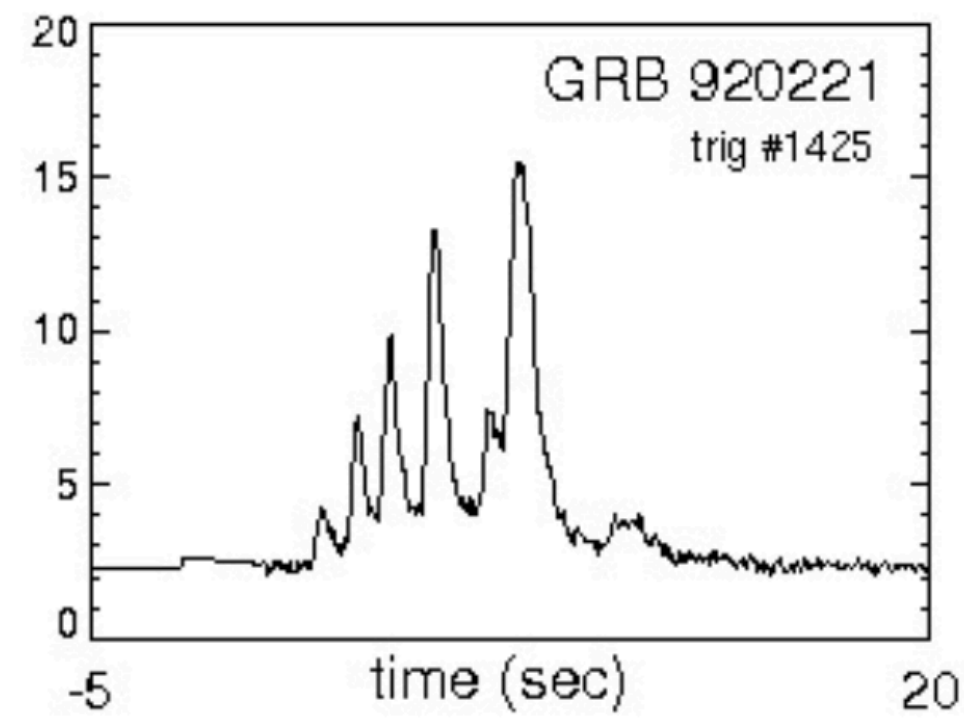
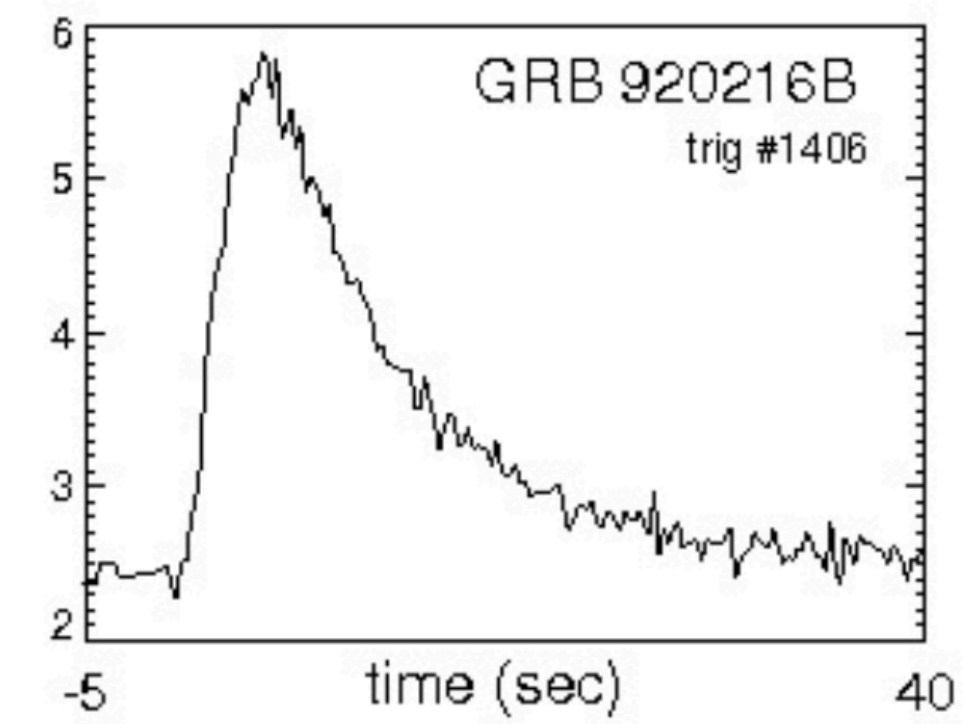
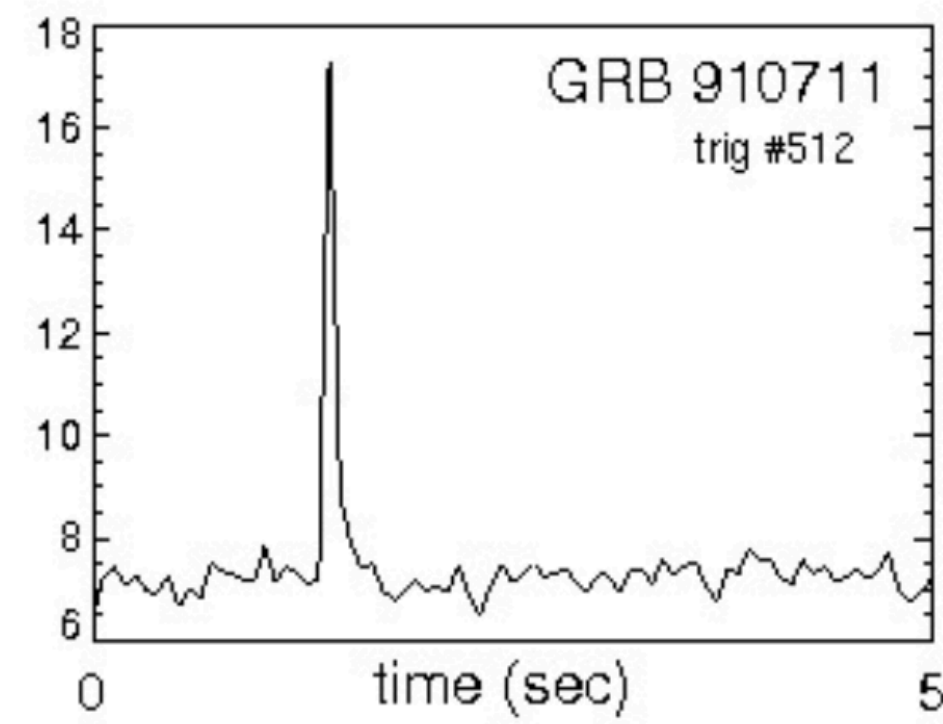
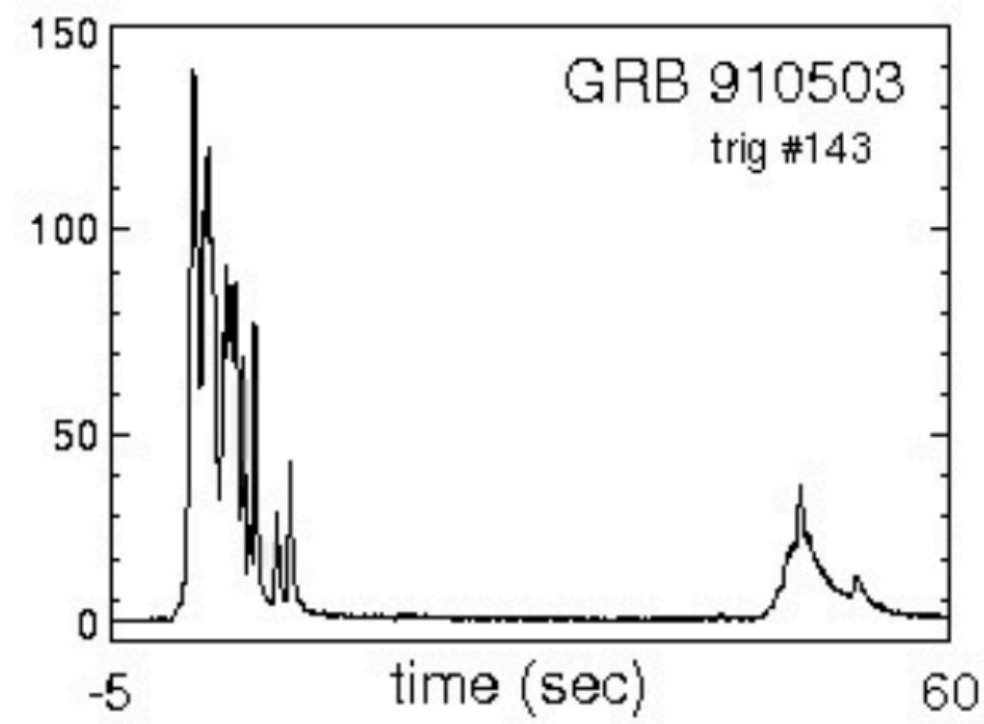
La scoperta



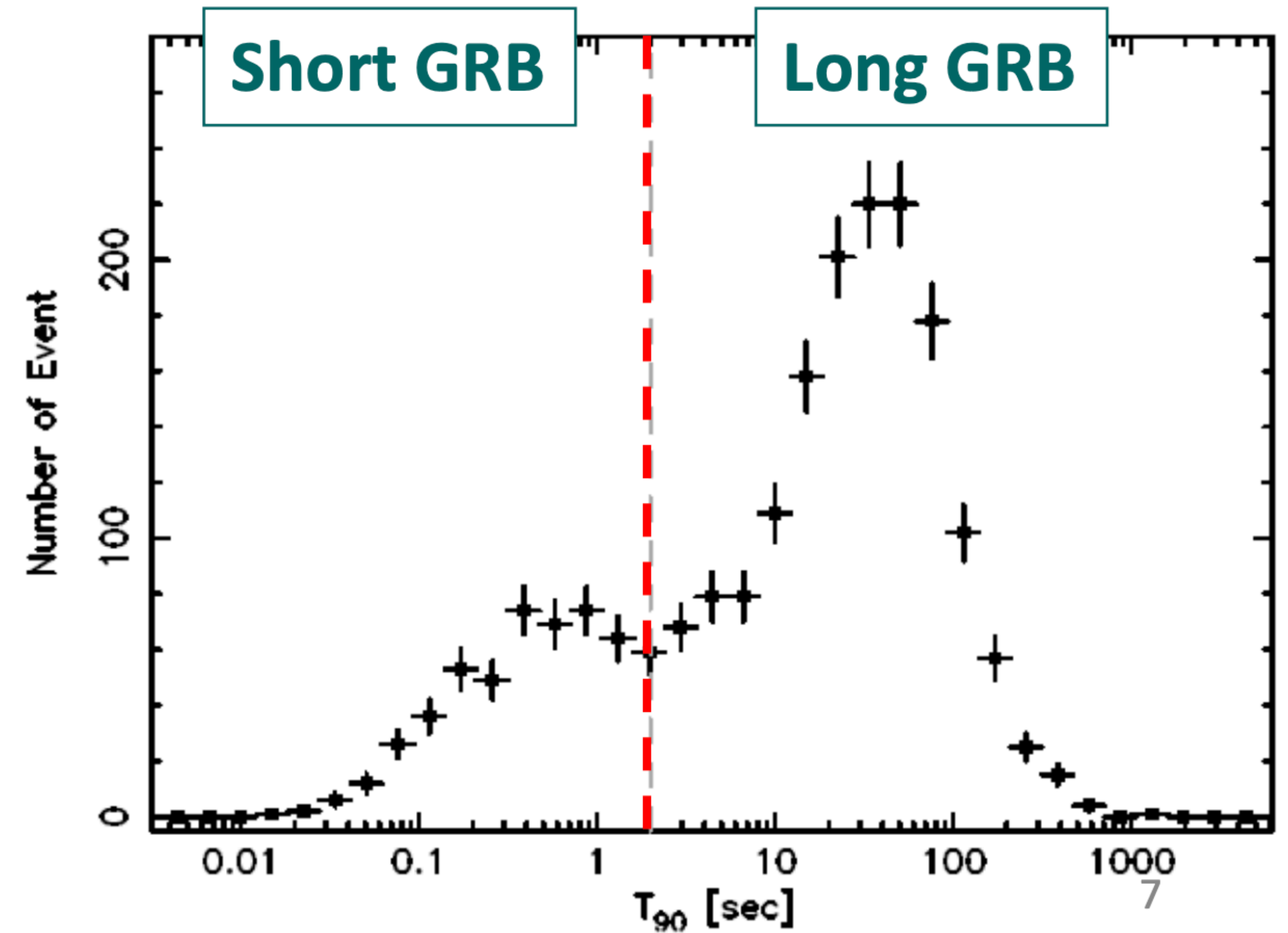
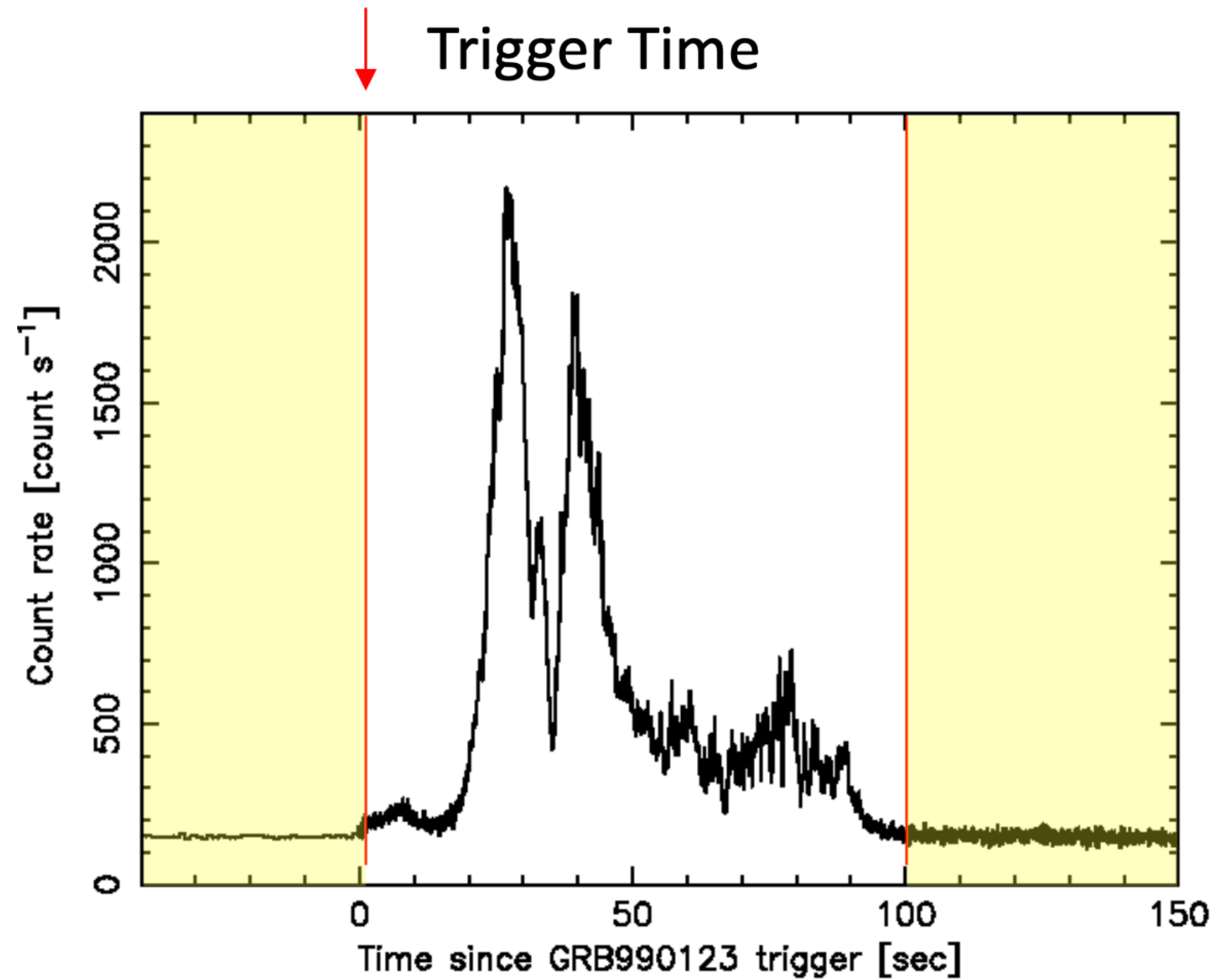
Le 6 ere della storia dei GRBs

- 1) **"Dark" era (1973-1991): discovery**
Klebesadel, Strong & Olson's discovery (1973);
- 2) **BATSE era (1992-1996): spatial distribution**
Meegan & Fishman's discovery (1992),
detection rate: ~ 1 to 3 /day, ~ 3000 bursts;
- 3) **BeppoSAX era (1997-2000): afterglows**
van Paradijs, Costa, Frail's discoveries (1997);
- 4) **HETE-2 era (2001-2004): origin of long bursts**
Observations on GRB030329/SN2003dh
- 5) **Swift era (2005-): very early afterglows, short-GRB afterglow, GRB subclasses? GRB cosmology?**
- 6) **Fermi era (2008-): High energy emission component, GW counterparts! – origin of short GRB**
- 7) **VHE era (2019-): VHE emission component from GRB!**

Curve di Luce



Lungo o corto??? ... due classi di GRBs

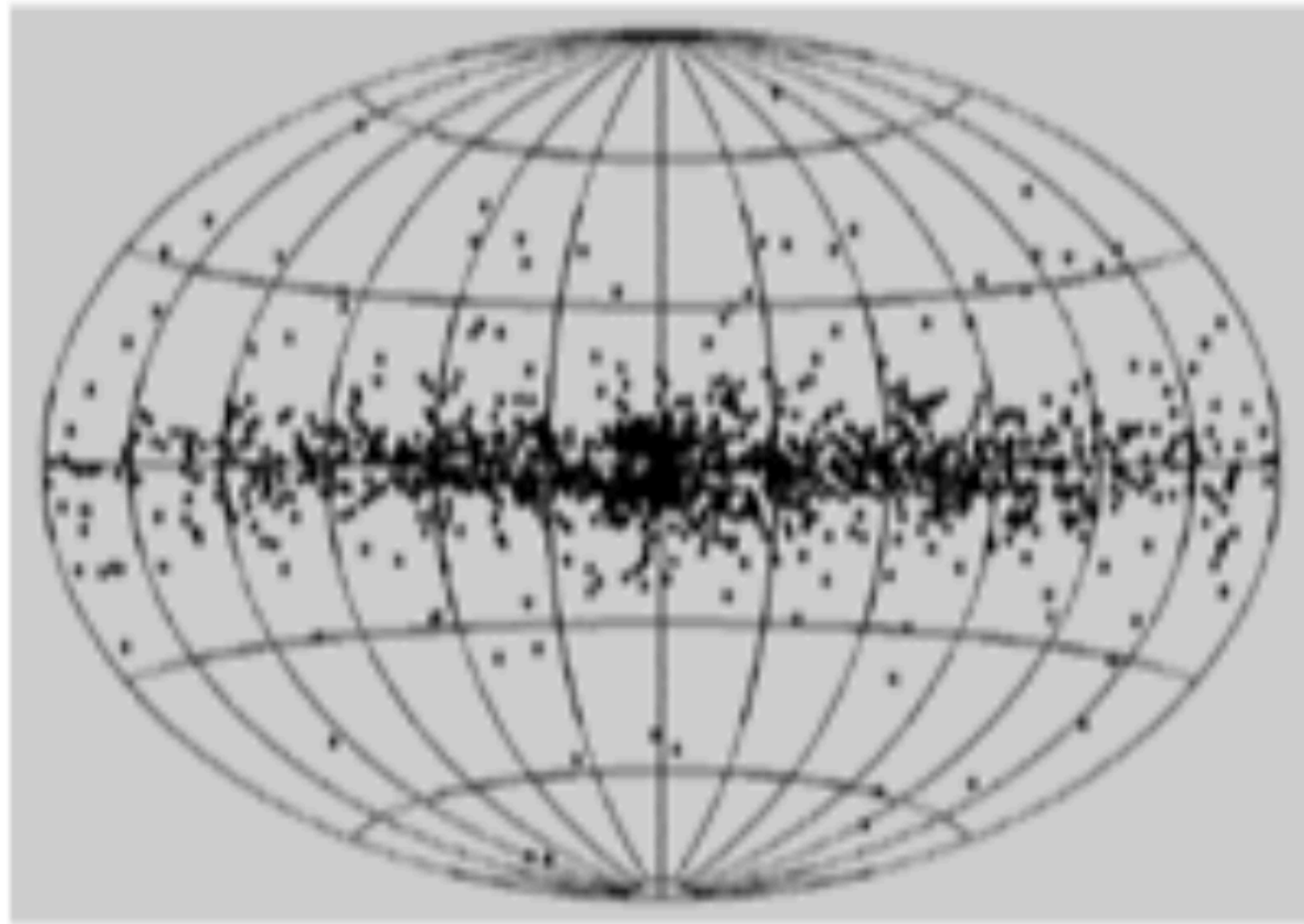


Il grande dibattito

The great debate (1995)

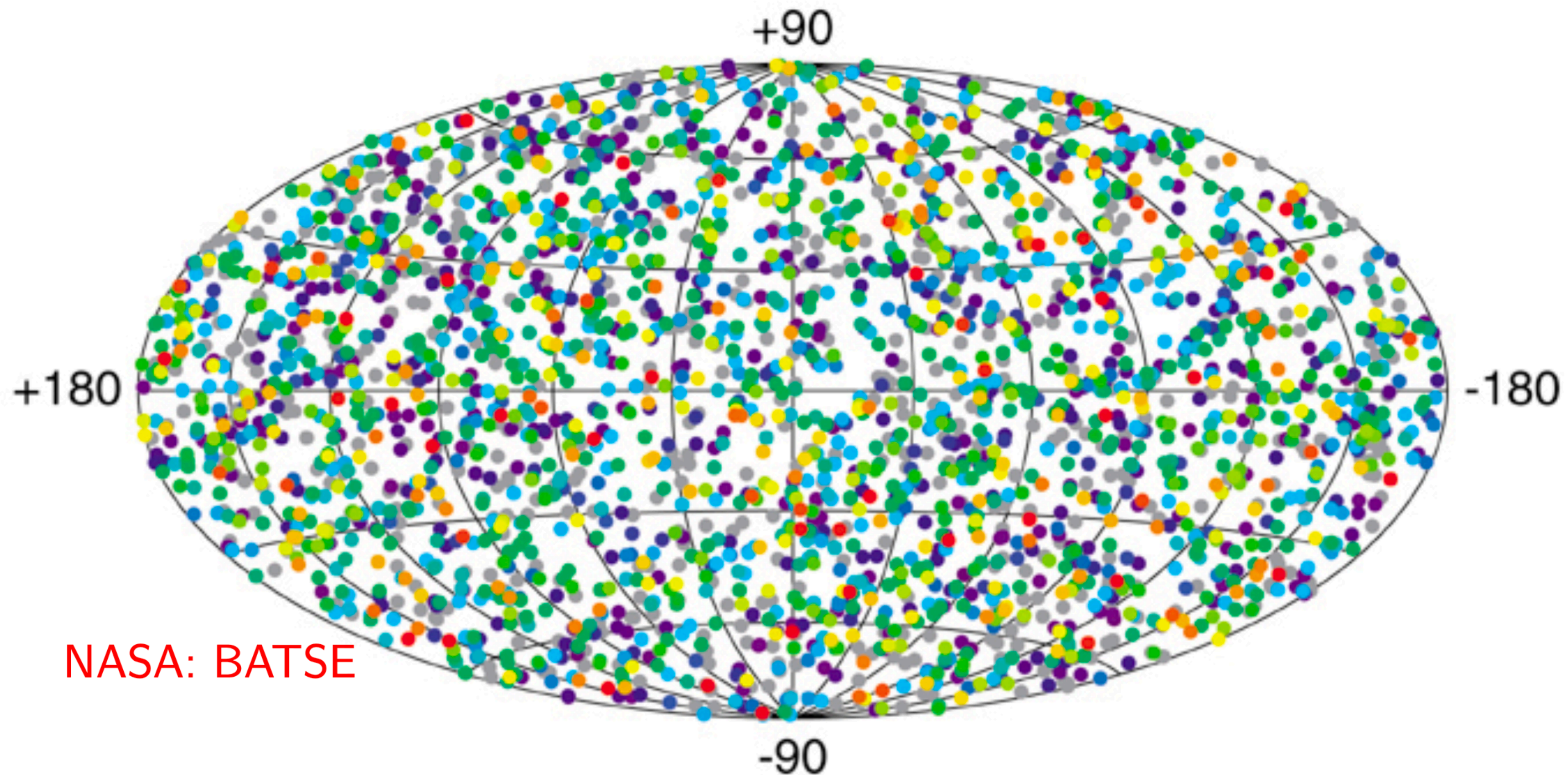


L'arrivo del CGRO e di BATSE ... quello che ci aspettavamo



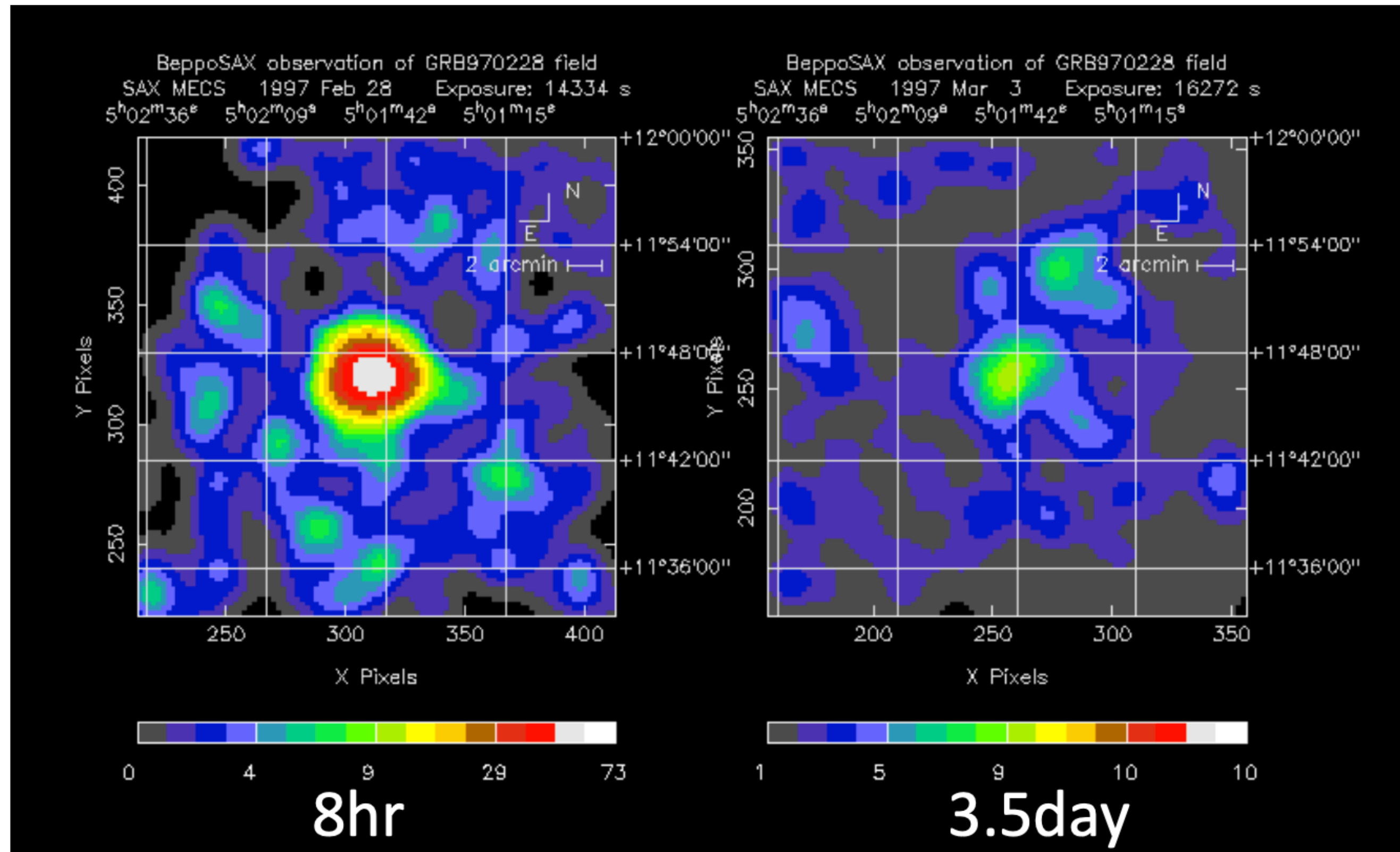
L'arrivo del CGRO e di BATSE ...
quello che abbiamo visto

2704 BATSE Gamma-Ray Bursts

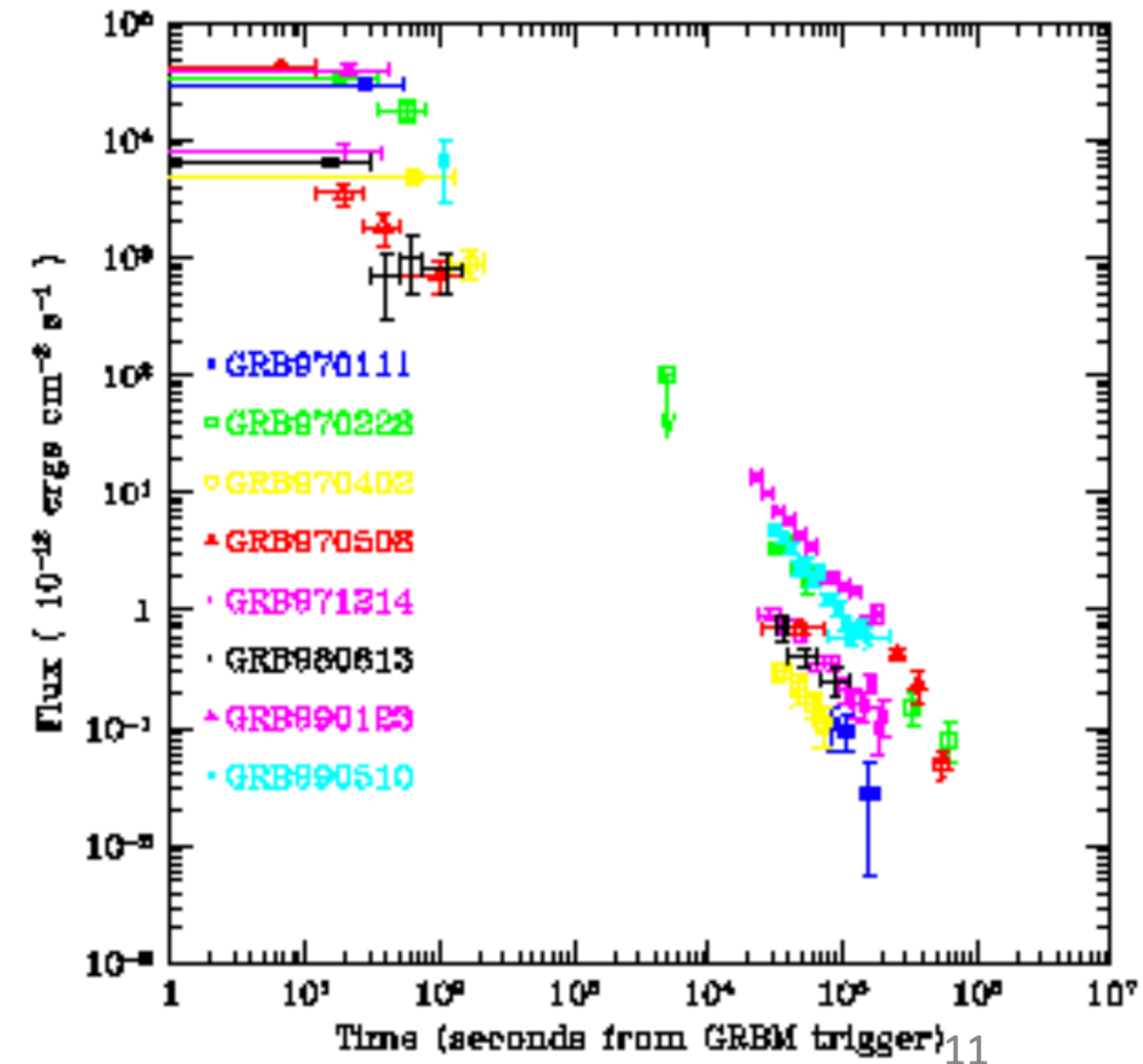


Una seconda scoperta ... tutta italiana

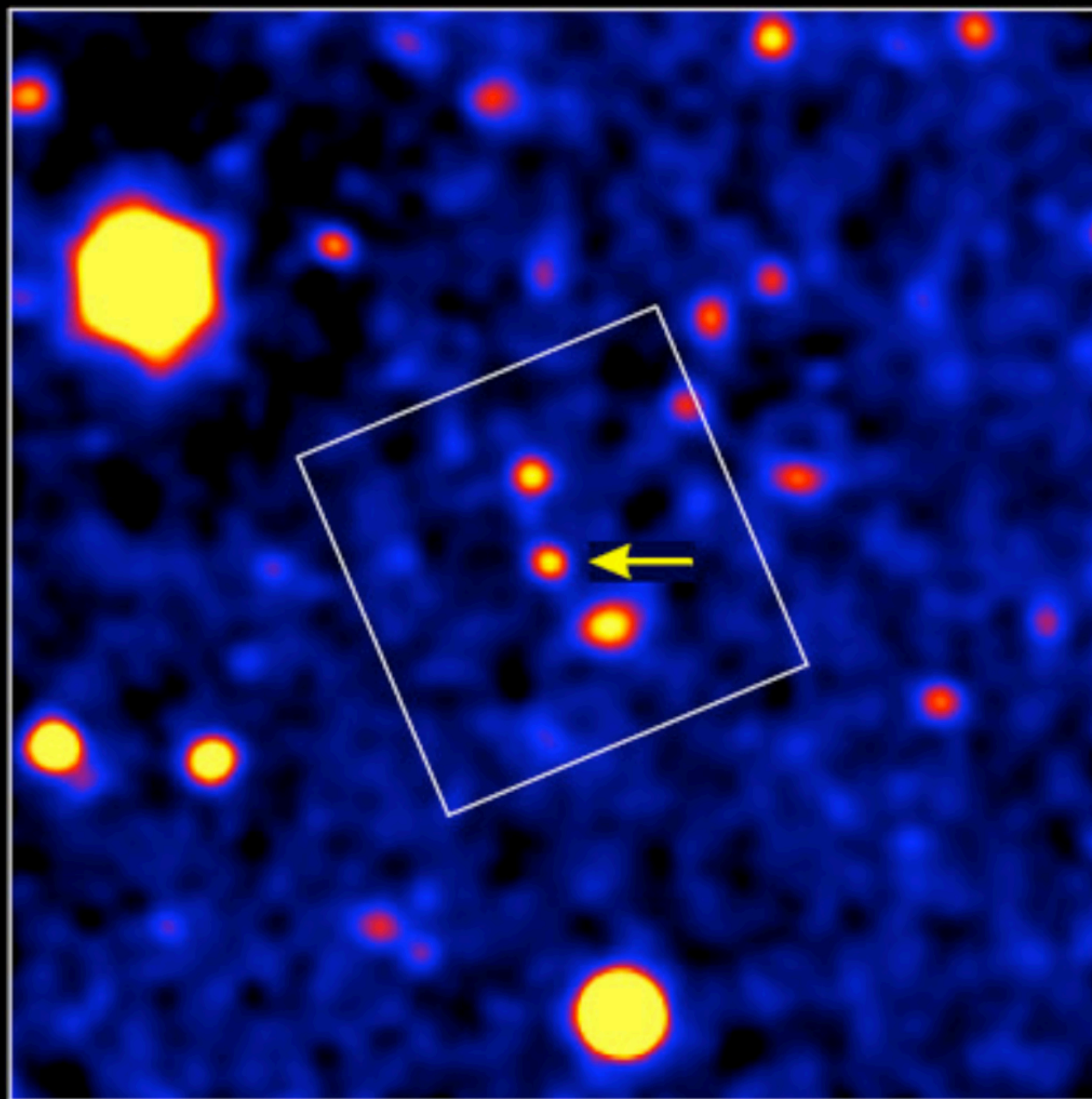
GRB970228



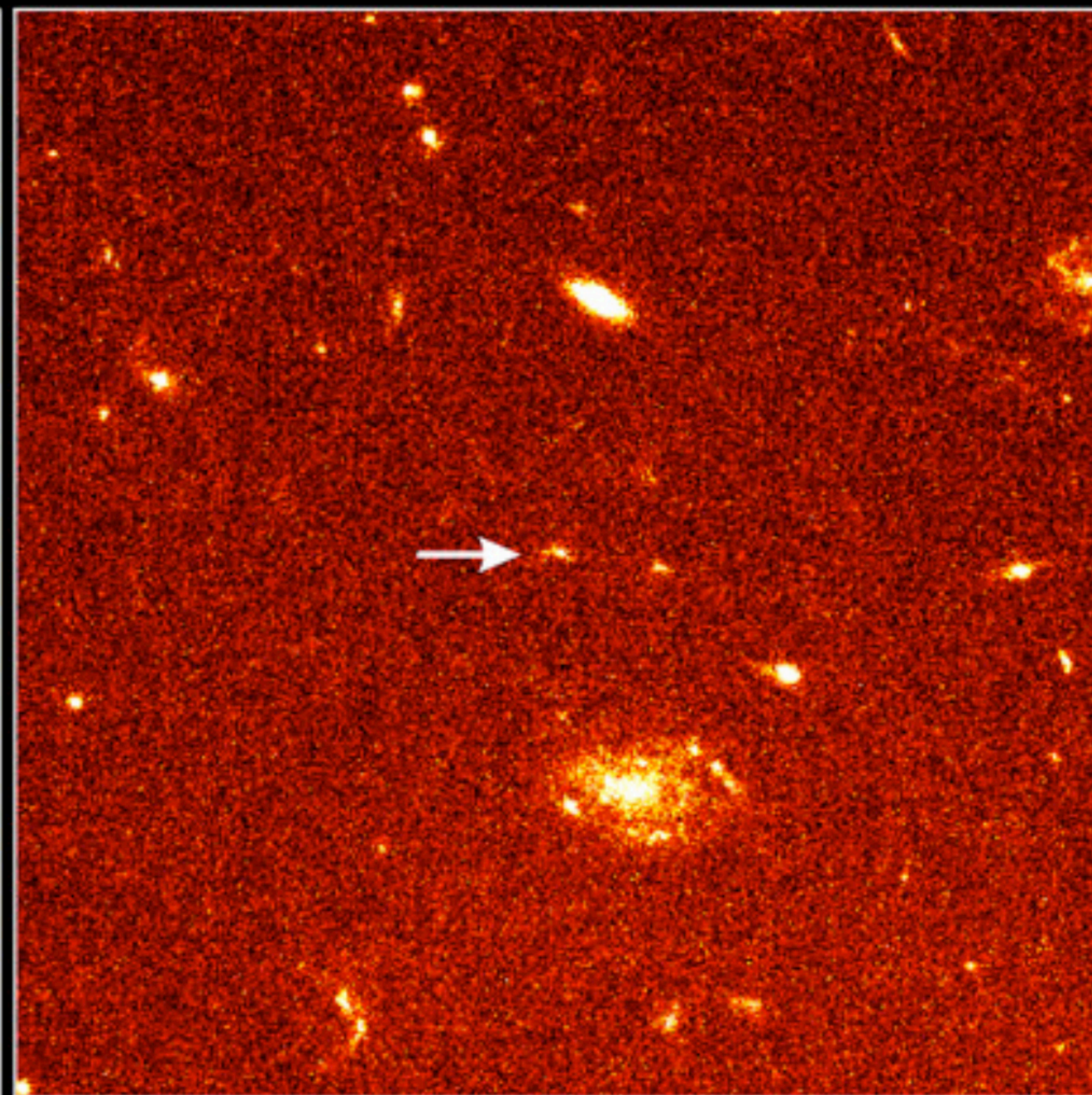
Costa et al. 1997



Gamma Ray Burst 971214



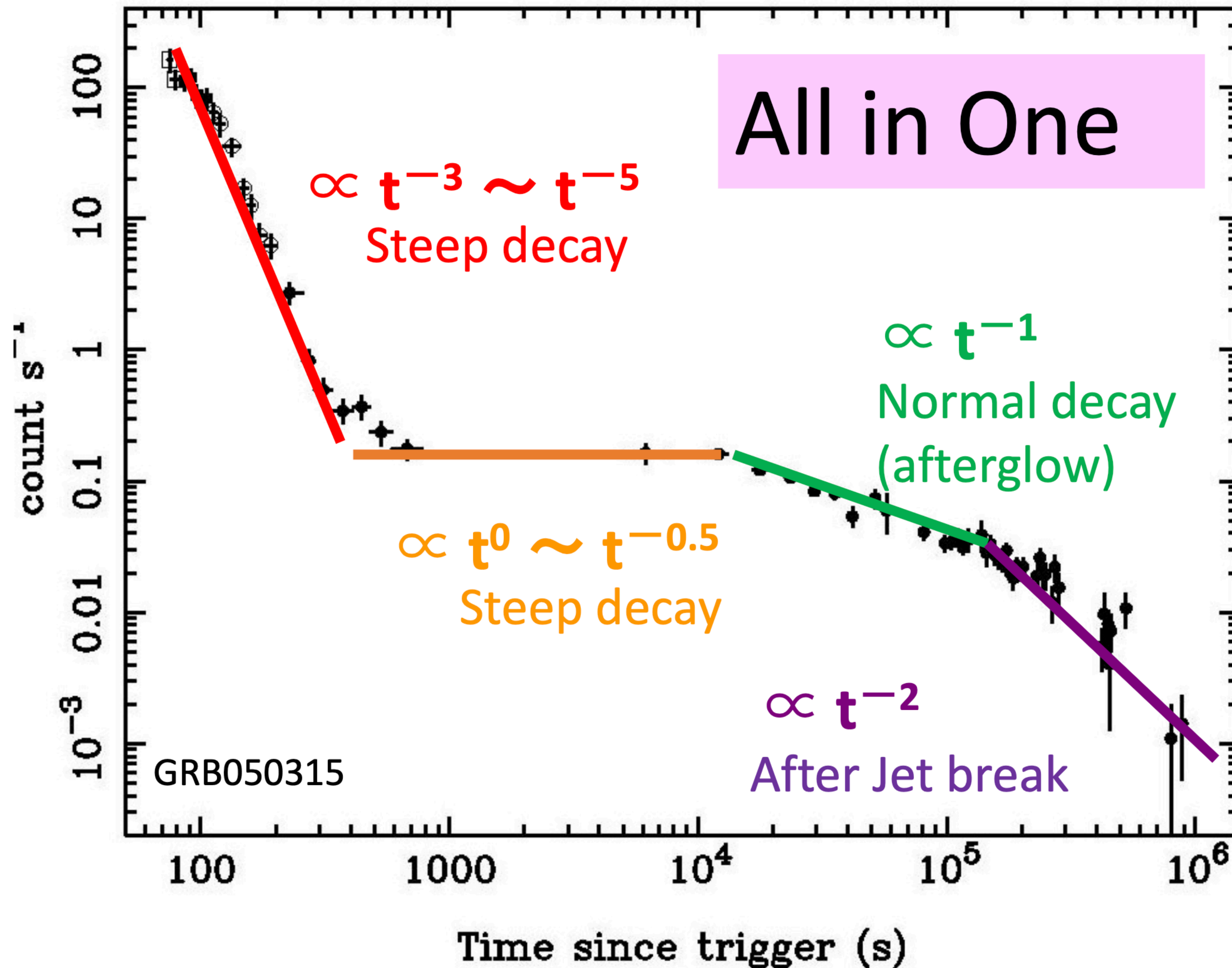
Keck • December 1997



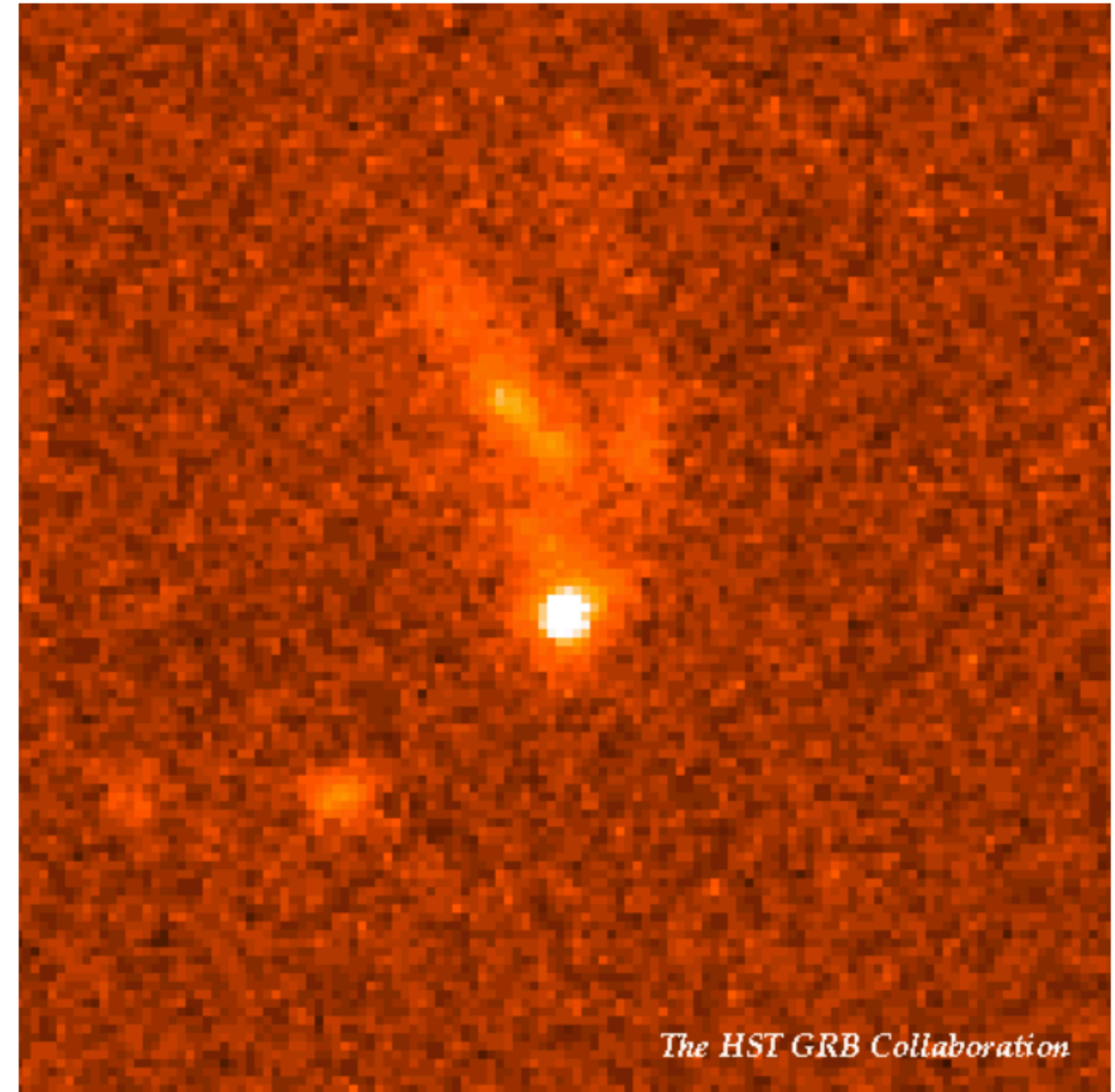
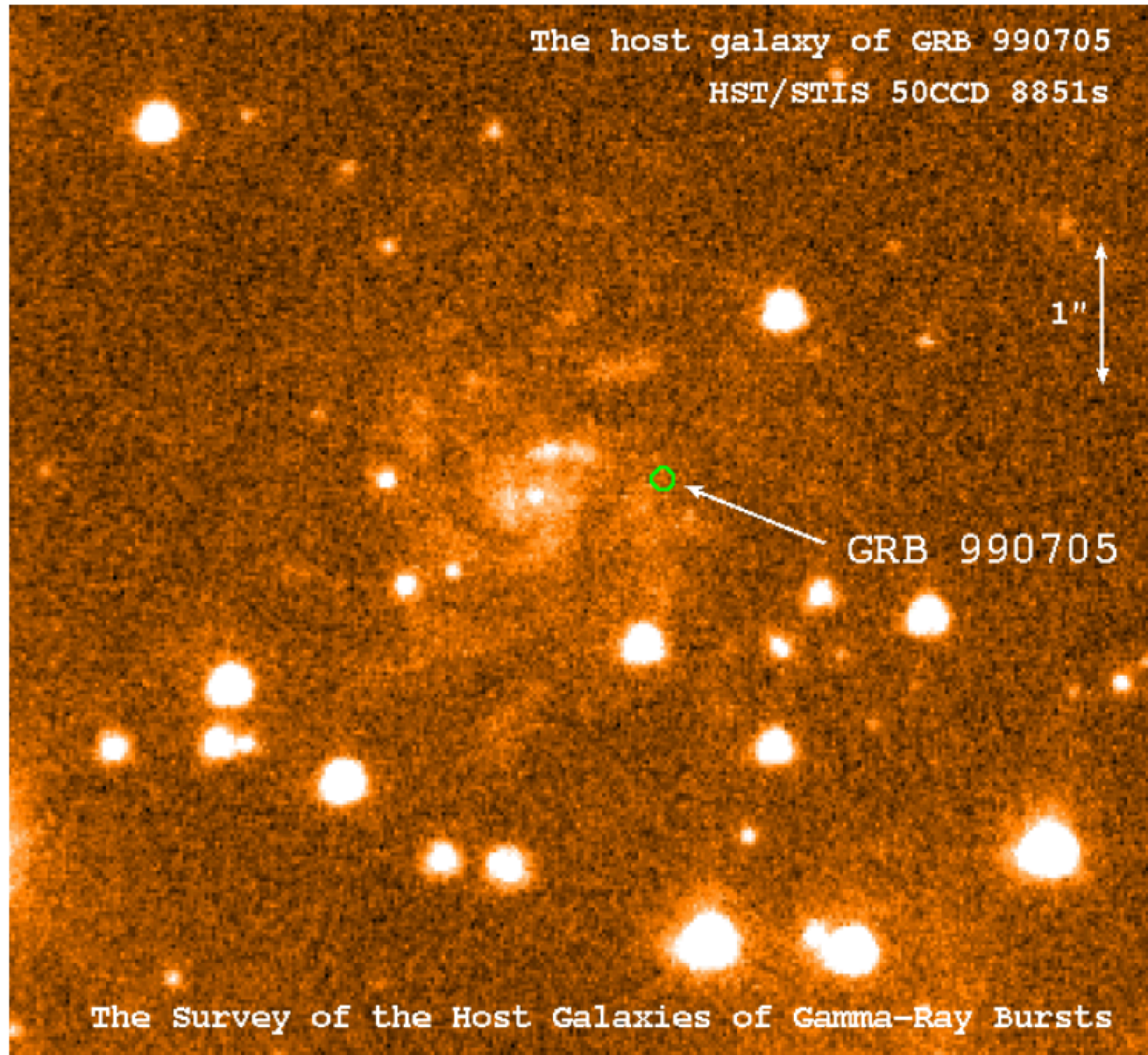
HST/STIS • February 1998

PRC98-17c • May 7, 1998 • ST ScI OPO
S. G. Djorgovski and S. R. Kulkarni (Caltech), the Caltech GRB Team,
W. M. Keck Observatory and NASA

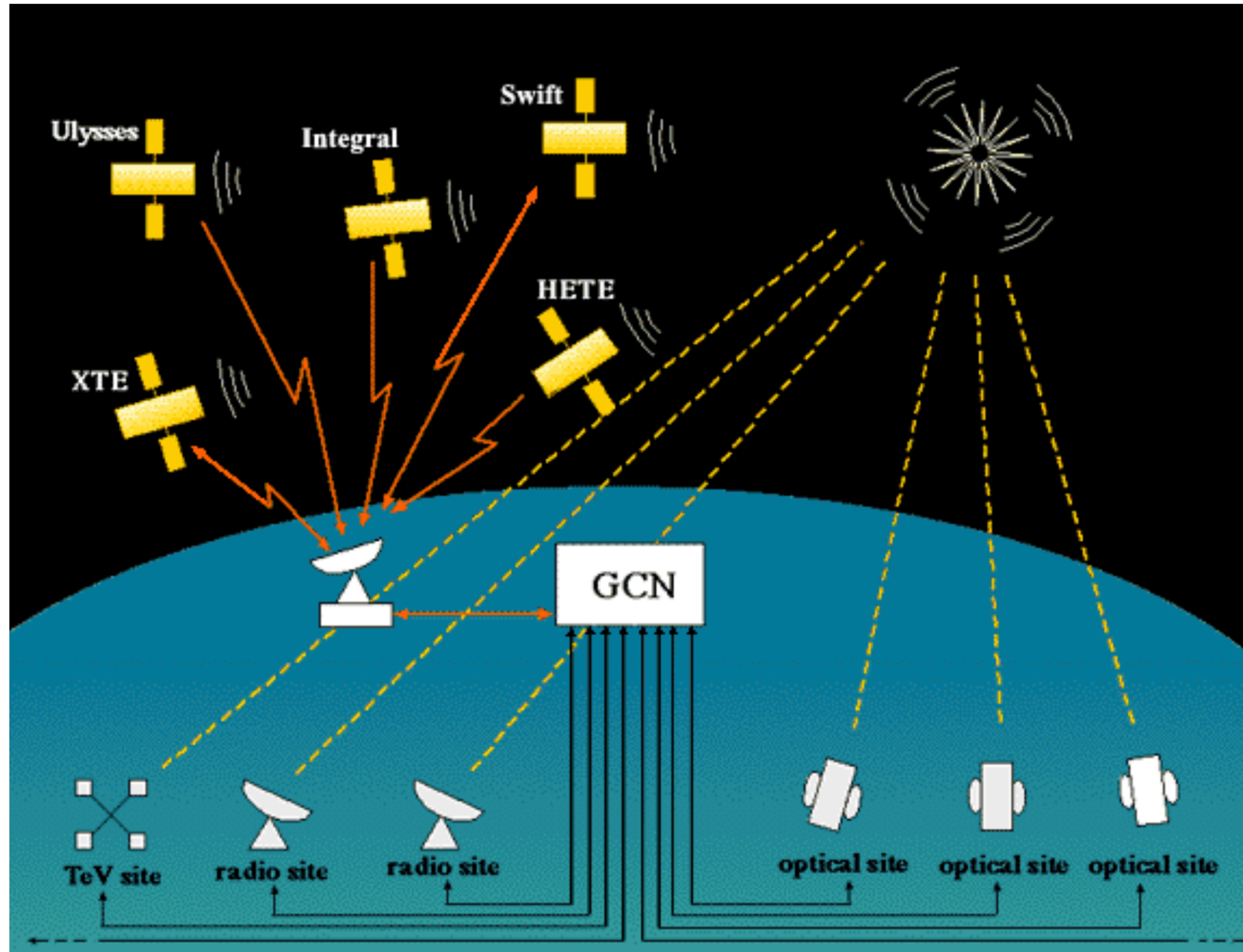
Curve di Luce ... ma della pistola fumante



Dove scoppiano?



The GRB coordinates network



Cosa sono?

Comments on Astrophysics: in press

A Century of Gamma Ray Burst Models

More than 100 gamma-ray burst progenitor models have now been published in refereed journals. A list of the models published before the end of 1992 is presented and briefly discussed. The consensus of the present astronomical community remains that no specific model is particularly favored for cosmic bursts. Its make most of these models untenable in their present form, opening up the field to another era of speculative papers. Is speculation in this area becoming valueless? Alternatively, one may argue that the new data makes many of the old models untenable, and simply adapting old models may not be sufficient. With this in mind, three relatively unexplored “toy” paradigms are suggested from which more detailed models for the progenitors of gamma-ray bursts may be made.

Key Words: *gamma-ray bursts*

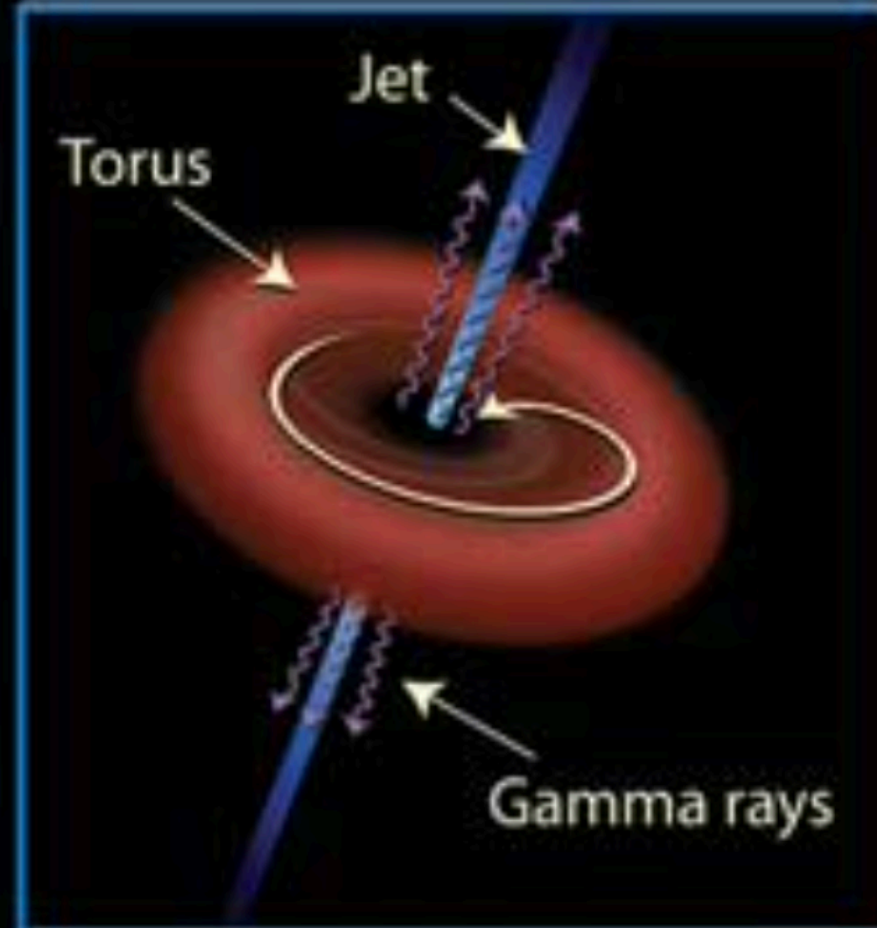
“For theorists who may wish to enter this broad and growing field, I should point out that there are a considerable number of combinations, for example, comets of antimatter falling onto white holes, not yet claimed.”

- M. Ruderman¹

Cosa sono?

Gamma-Ray Bursts (GRBs): The Long and Short of It

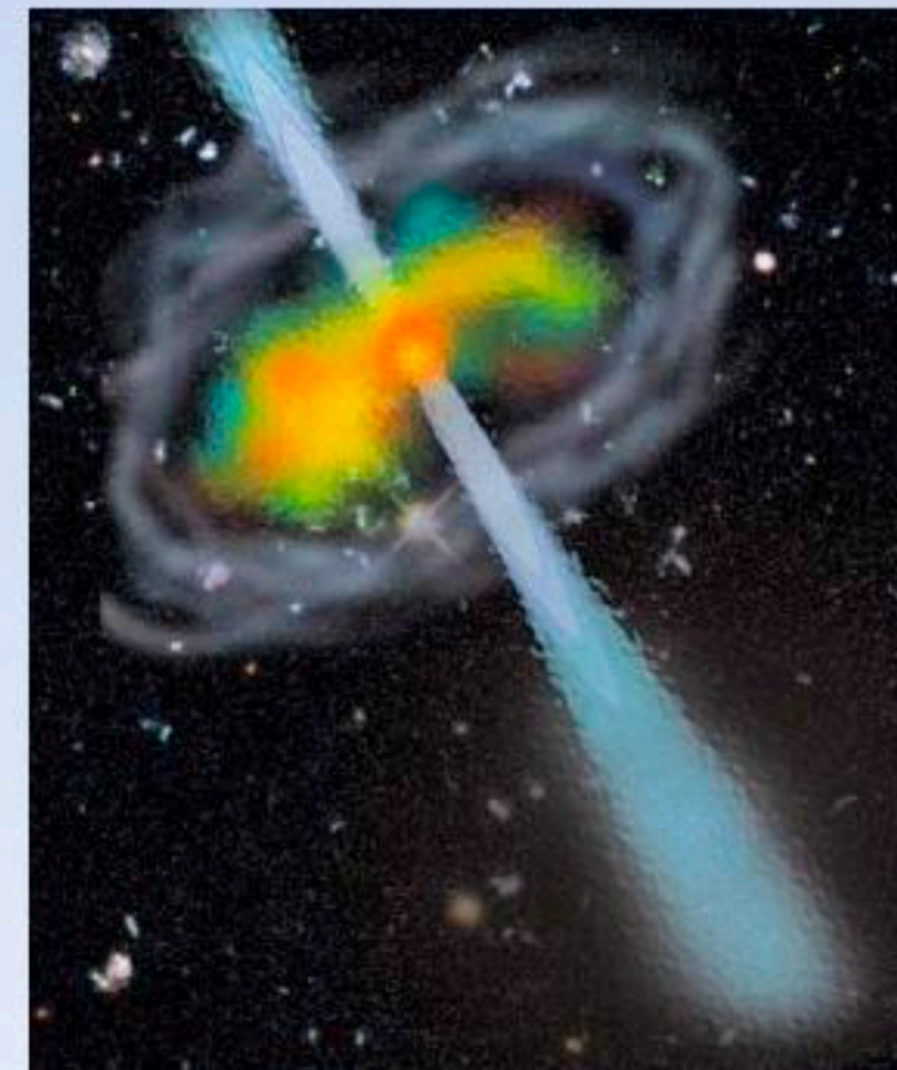
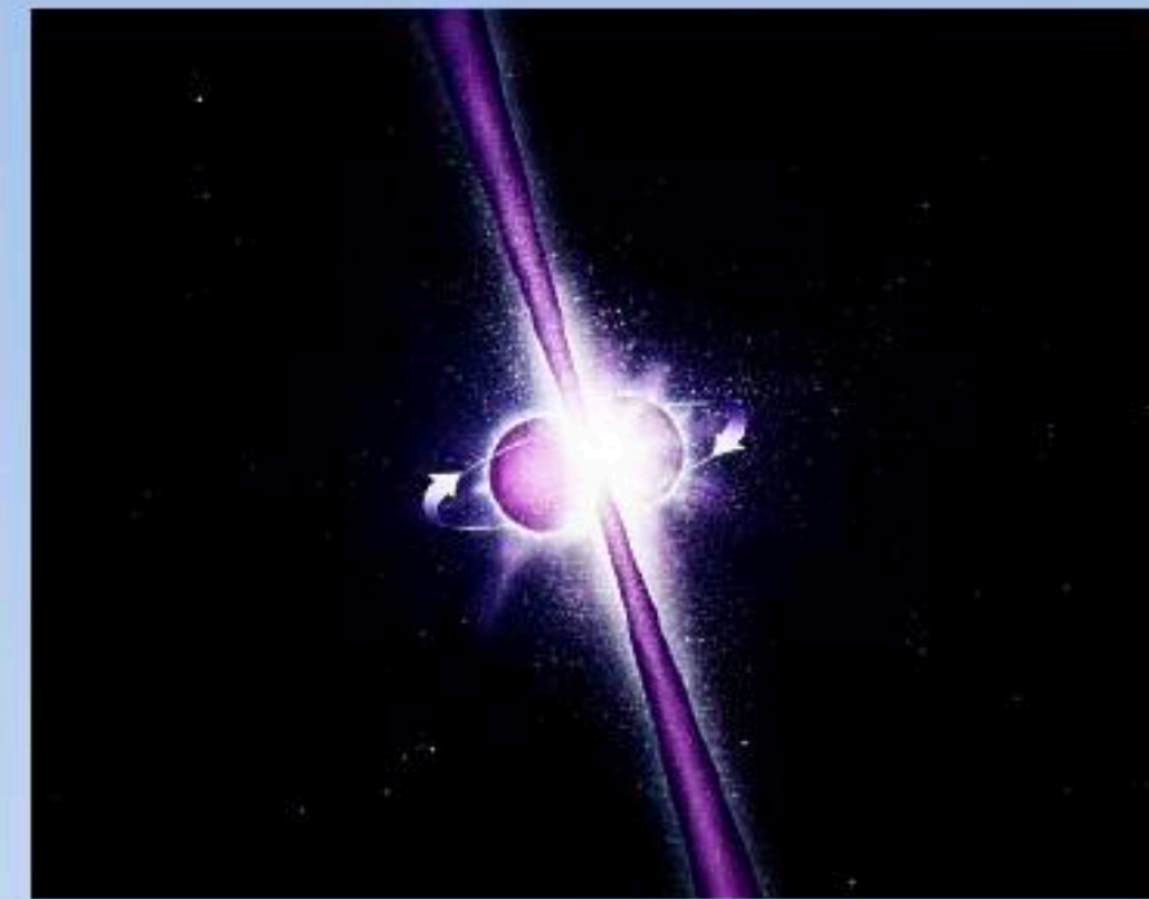
Long gamma-ray burst (>2 seconds' duration)



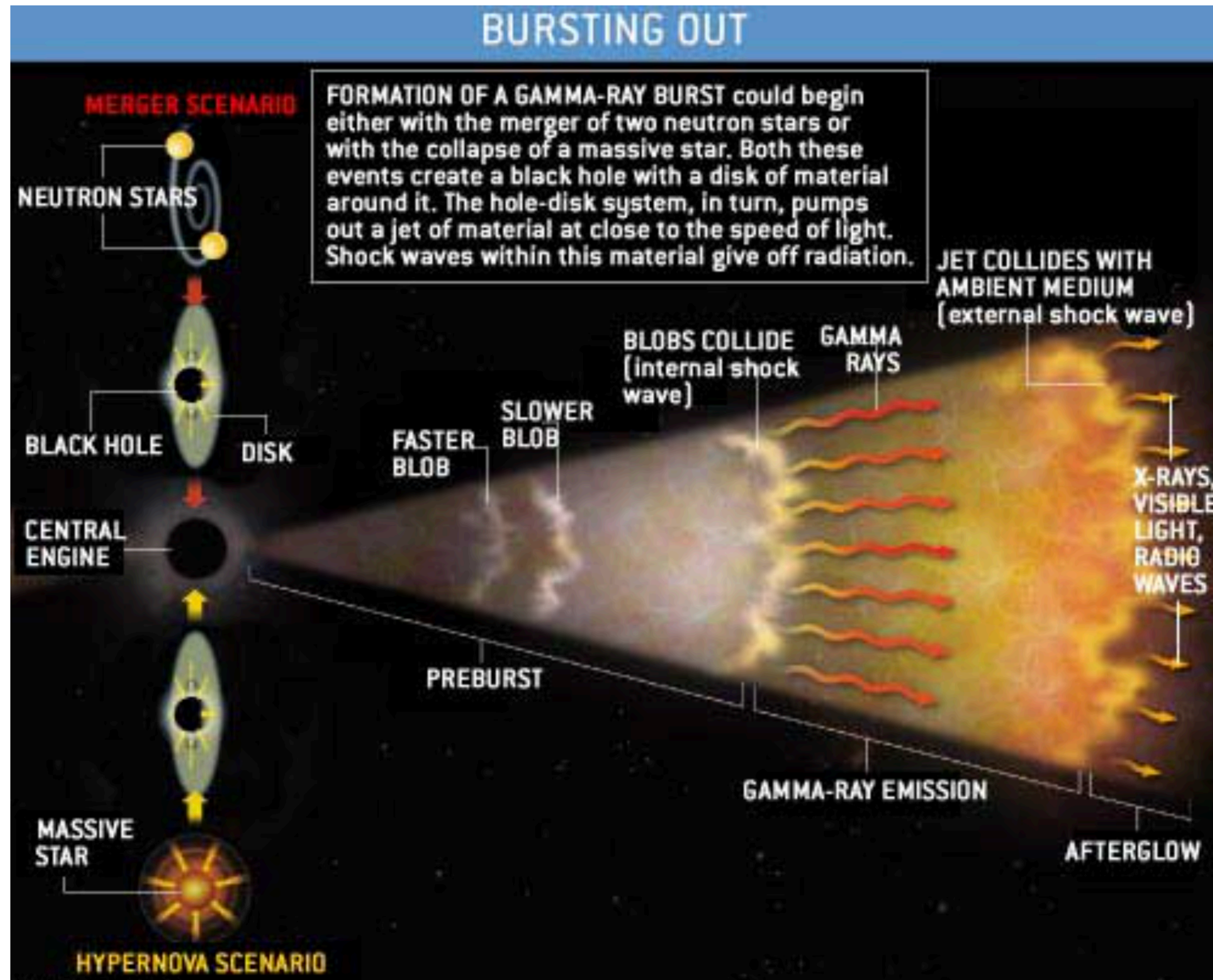
Short gamma-ray burst (<2 seconds' duration)

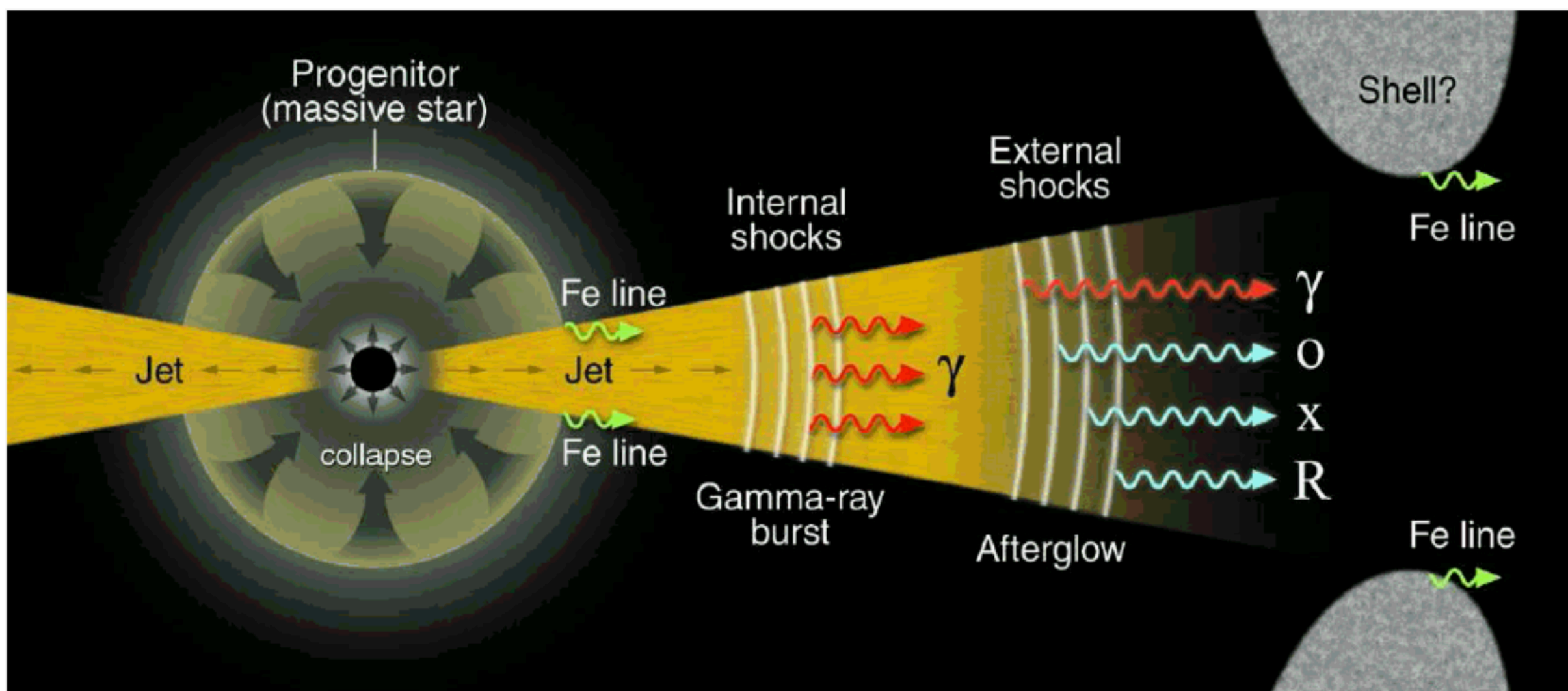


*Possibly neutron stars.

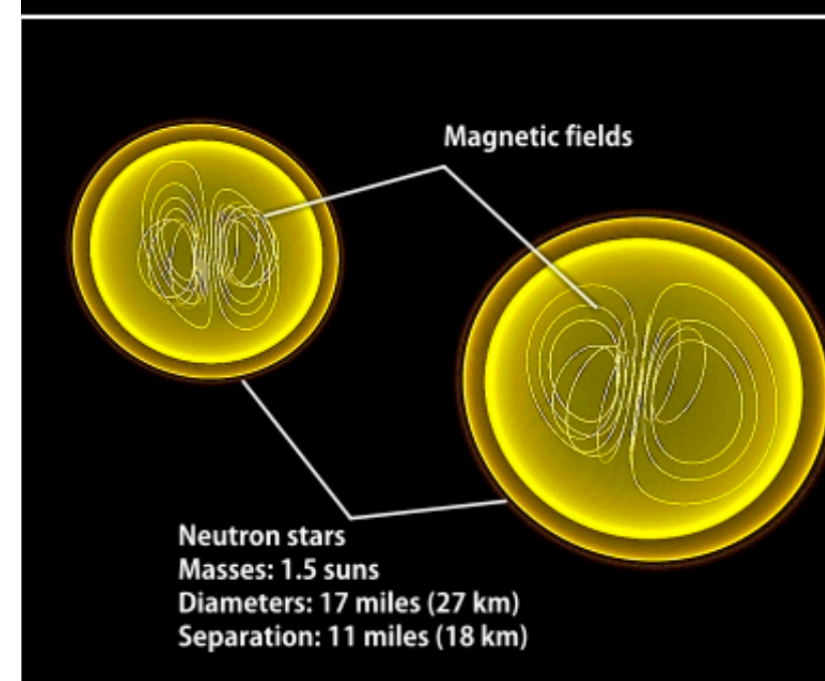


And great balls of fire

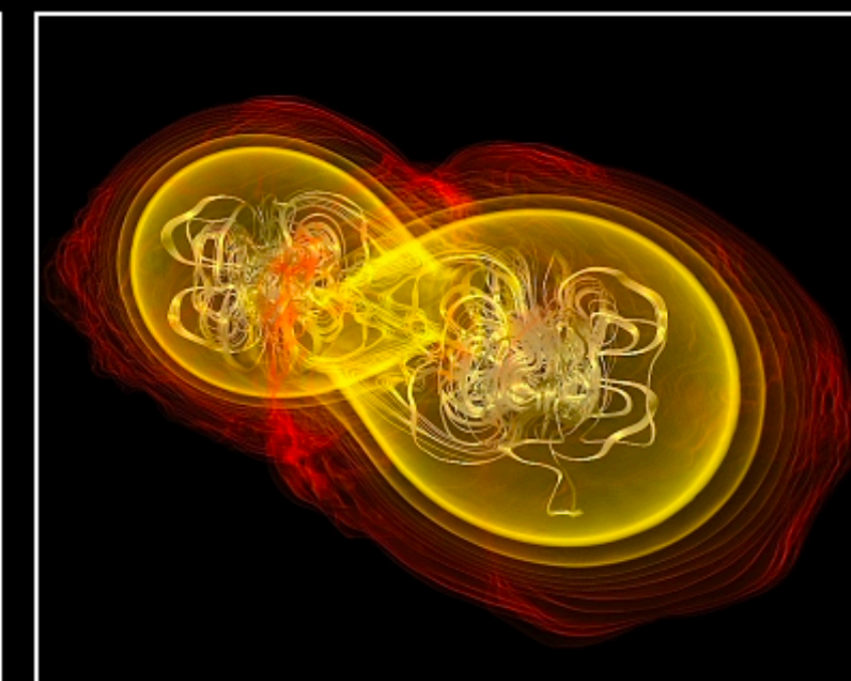




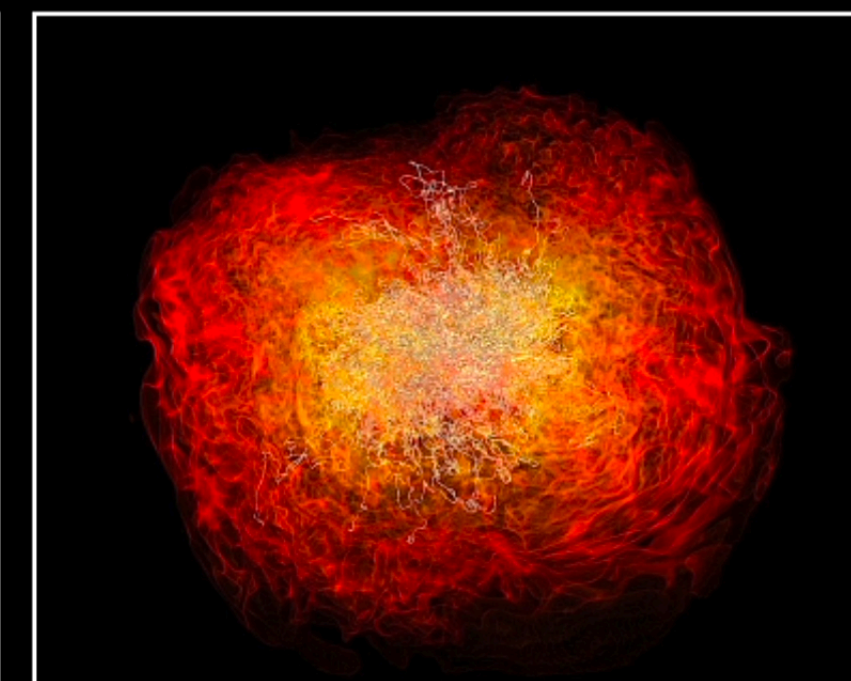
Crashing neutron stars can make gamma-ray burst jets



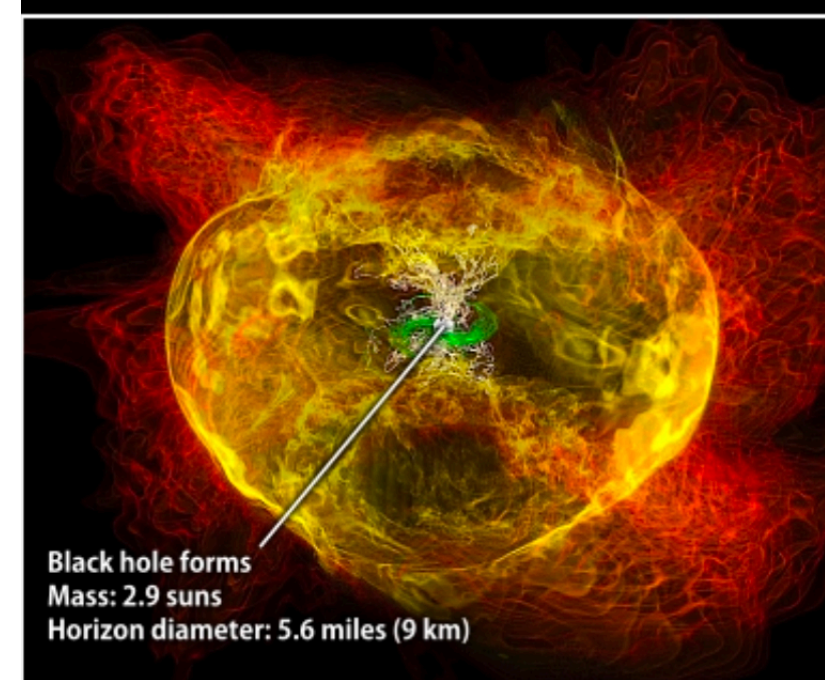
Simulation begins



7.4 milliseconds



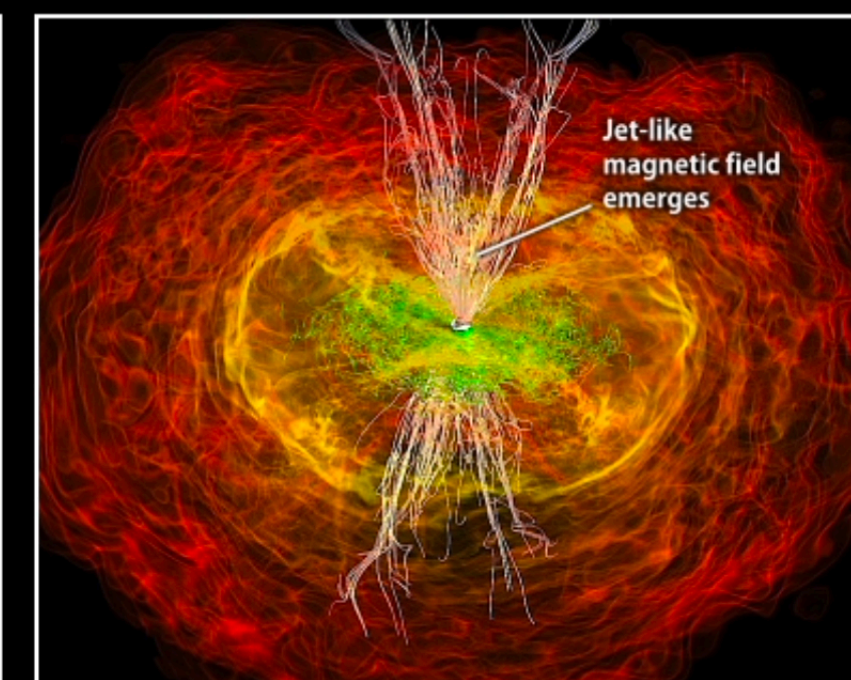
13.8 milliseconds



15.3 milliseconds



21.2 milliseconds



26.5 milliseconds

Biological Hazards of Gamma-Ray Bursts

Distance (kpc)	Events /10 by	Megatons	Results
10	100 – 1000	200	Some ozone damage, EMP acid rain
1	1 – 10	20,000	Ozone gone, acid rain, blindness 2 nd and 3 rd degree burns*
0.1	0.01 – 0.1	two million	Shock waves, flash incineration, tidal waves, radioactivity (¹⁴ C) End of life as we know it.

* Depends on uncertain efficiency for conversion of energetic electrons to optical light

Dove sono tutti?

Se civiltà tecnologicamente avanzate hanno abitato la nostra Galassia per per tempi dell'ordine un miliardo di anni, e alcune di queste hanno intrapreso viaggi e colonizzazioni interstellari, allora perché non abbiamo mai visto alcuna prova delle loro visite?

Non risulta che Fermi abbia mai pubblicato una sola parola riguardo all'esistenza di vita extraterrestre. Si sa che egli ha chiesto "Dove sono tutti?" durante un ricevimento a Los Alamos nel 1950 in cui si stava parlando di viaggi interstellari. Ogni altra versione delle sue parole è fuorviante.

Il Paradosso di Fermi

L'Universo ha oltre 10 miliardi di anni. La Via Lattea è circa 100.000 anni luce in dimensione (D). La distanza tra una stella e l'altra è circa 1 anno luce.

Una civiltà avanzata impiegherebbe 10.000 anni per viaggiare tra due stelle se viaggiasse con la stessa velocità v con cui la Terra orbita intorno al Sole o magari anche 100 anni se viaggiasse a $0.01c$

Il tempo per colonizzare la galassia sarebbe dell'ordine di D/v **100.000.000** di anni circa.

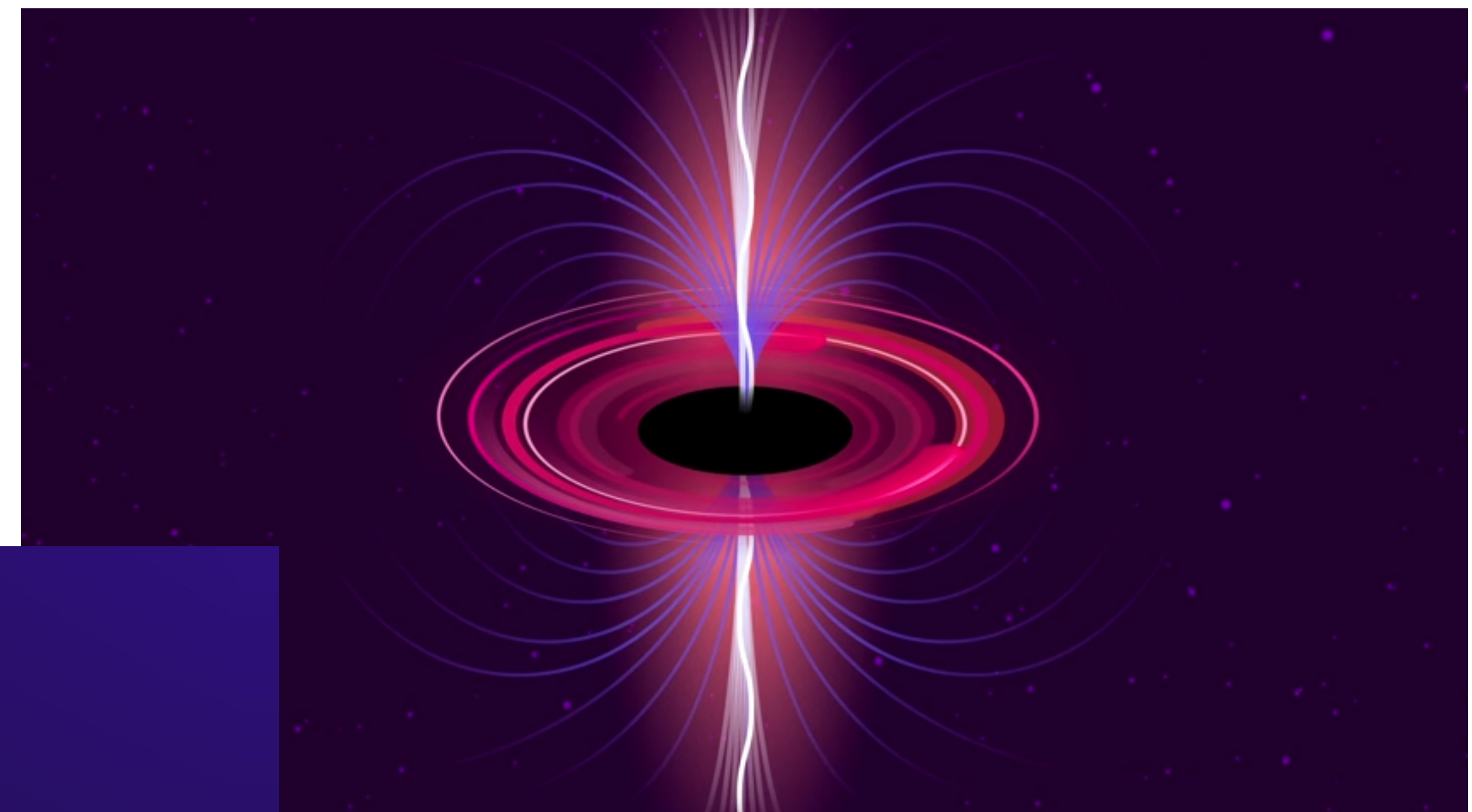
Il paradosso di Fermi è proprio la differenza tra il tempo scala in cui si può colonizzare la galassia e la sua età.

Il Paradosso di Fermi .. ed i GRBs

C'è un GRB ogni 1.000.000 di anni nella nostra Galassia ma in passato il loro tasso era più grande. Circa l'1% aveva un getto che puntava nella direzione dove si trova la Terra.

Assumendo che ogni GRB che punta verso di noi possa causare l'estinzione ... ed assumendo di poterci aspettare una estinzione ogni 1.000.000 di anni e se moltiplichiamo per la probabilità che il getto punti verso di noi...una estinzione sulla Terra ogni **100.000.000** anni.

La vita nel mare potrebbe considerarsi più "protetta" ... e la vita sulla terra ferma è arrivata circa **100.000.000** di anni fa ... curioso no?.



The BOAT GRB in Context

