Afterglows of the intermediate group of gamma-ray bursts

Workshop of Young Researchers in Astronomy and Astrophysics

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3-6. September, 2012

The third group

- 2 classes $\longrightarrow$ 1993 : C. Kouveliotou et al. (T_{90})
- 3 classes $\longrightarrow$ 1998 : I. Horváth, S. Mukherjee et al. (T_{90})

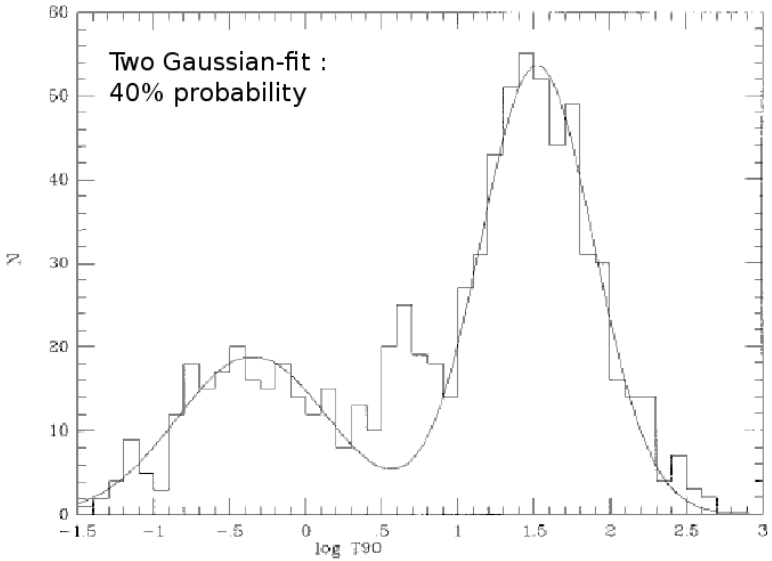


FIG. 1.—Distribution of log T_{90} for 797 bursts from the 3B catalog. The solid line represents a fit of two lognormal Gaussians using 6 parameters and 52 bins. The best fit $\chi^2 = 46.8$, which implies a 40% probability.

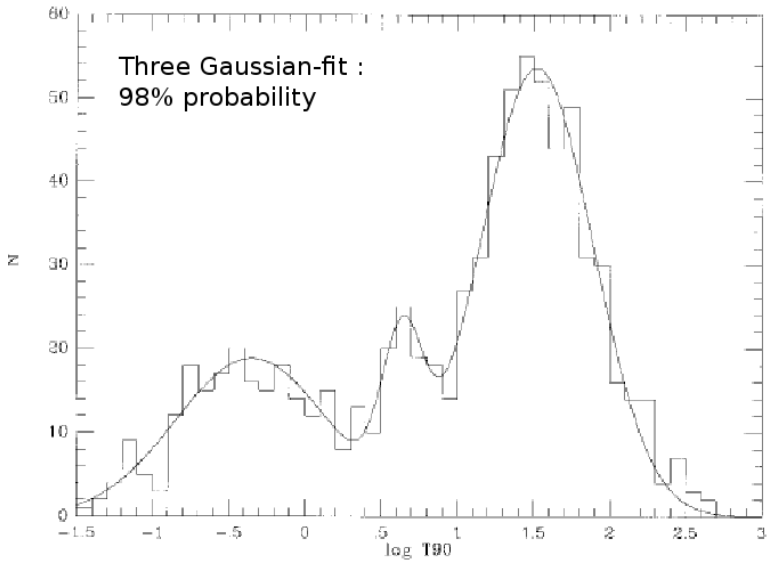
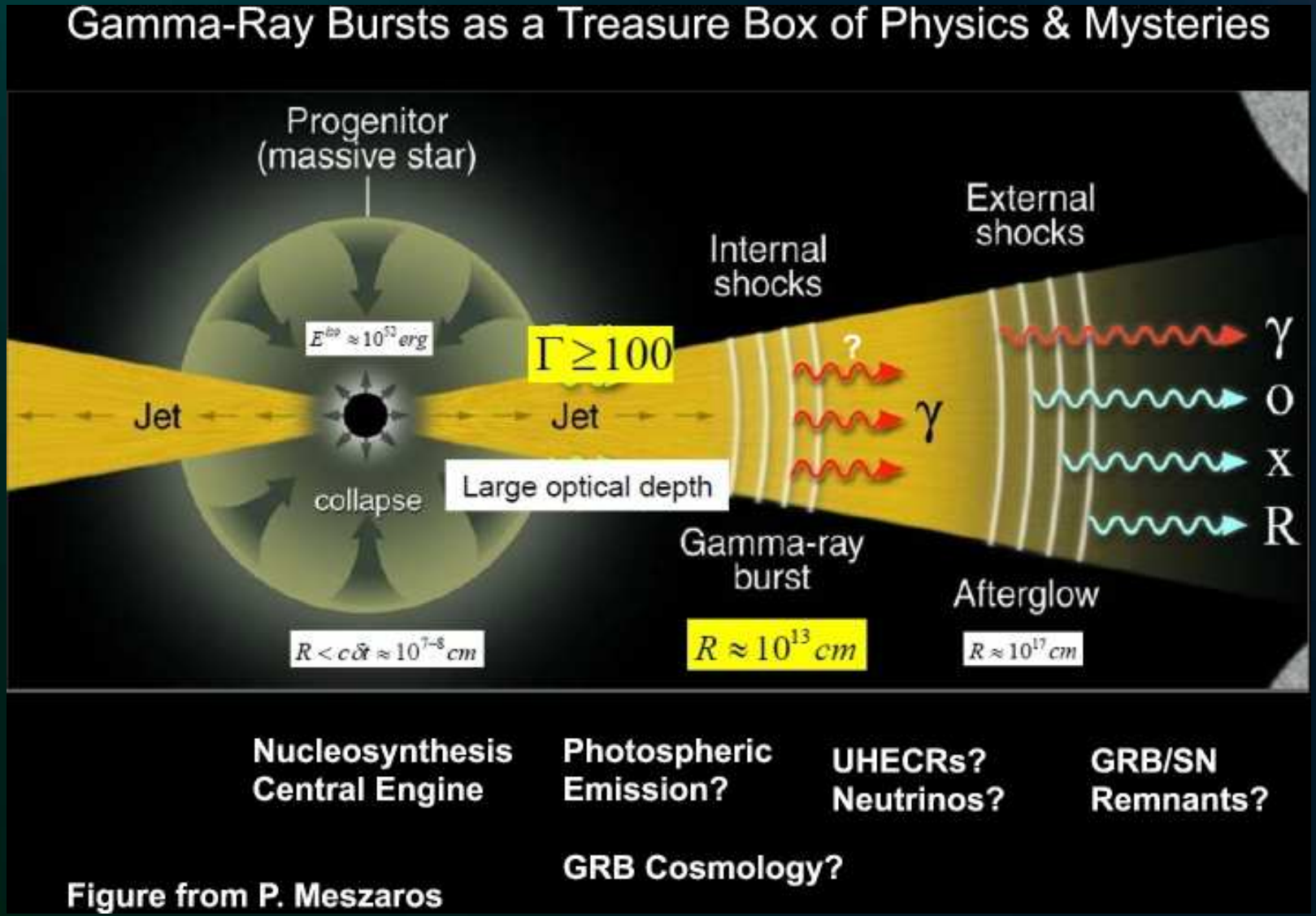


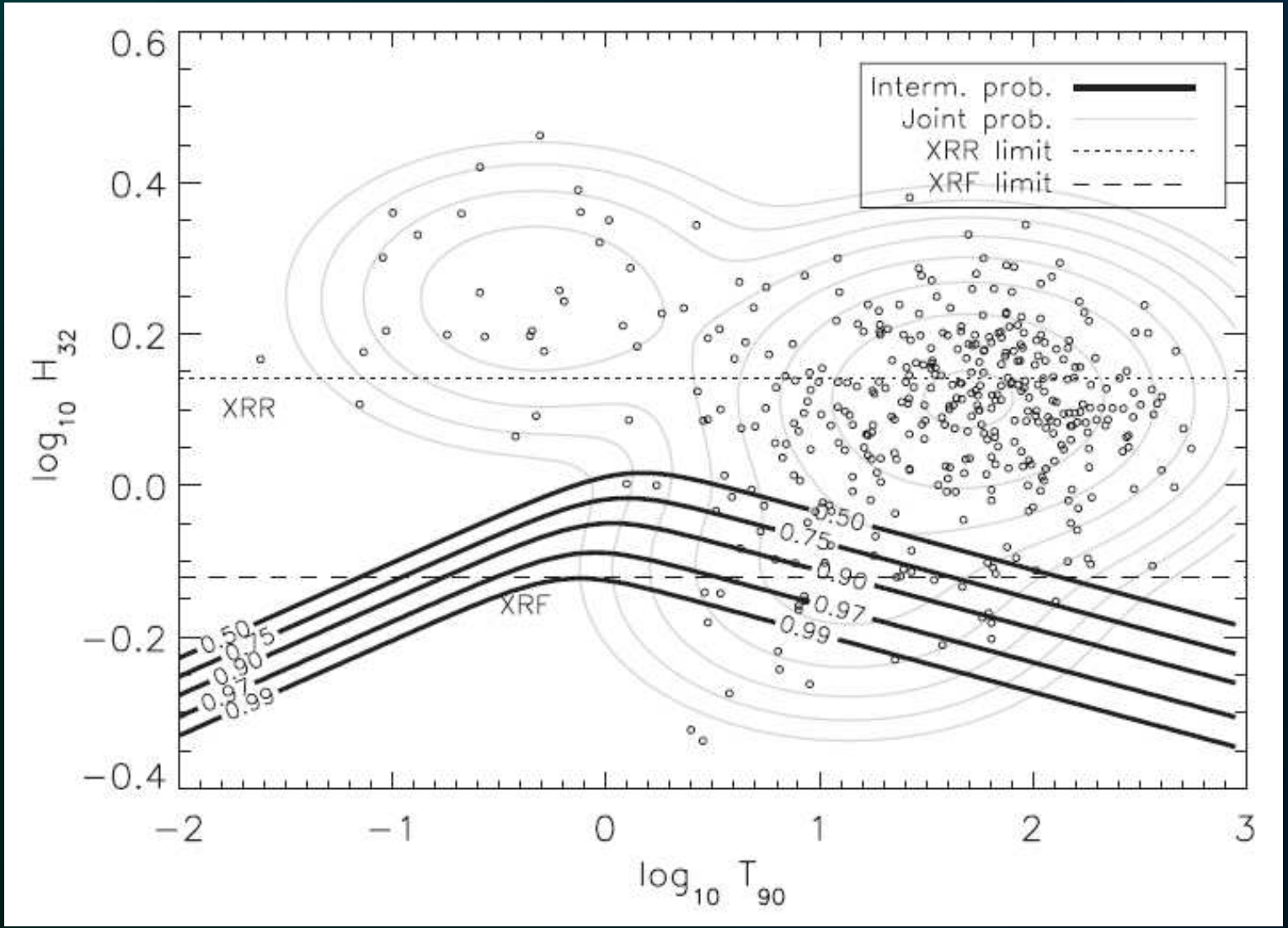
FIG. 3.—log T_{90} distribution. The solid line represents a fit of three lognormal Gaussians. The χ^2 value implies a probability of 98%.

Figure from: I. Horváth, *ApJ*, **508**, 1998

Basic theory



Why are they interesting? - P. Veres et al.



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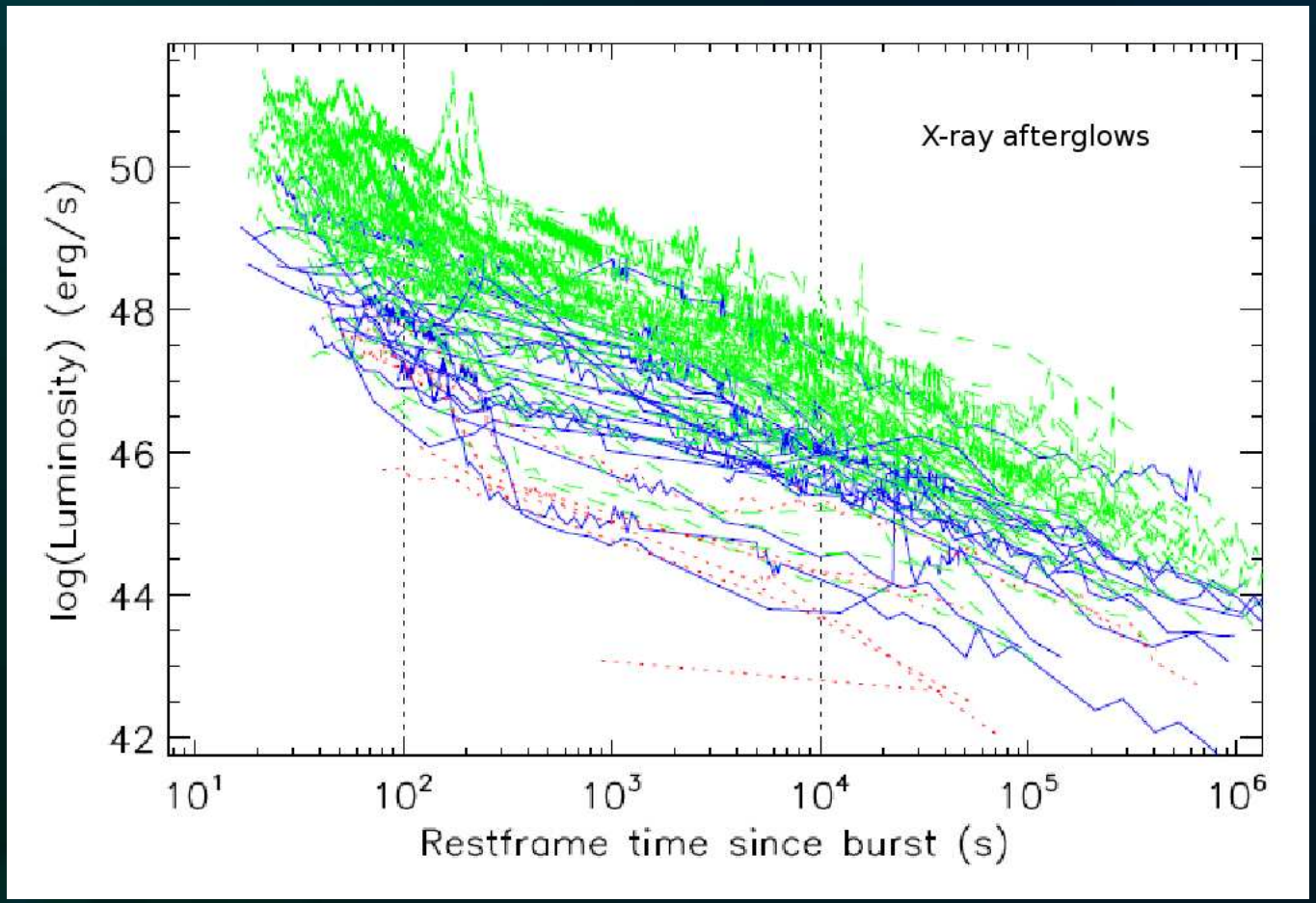

- Kolmogorov-Smirnov test : same population hypothesis $\rightarrow$ 0.005%

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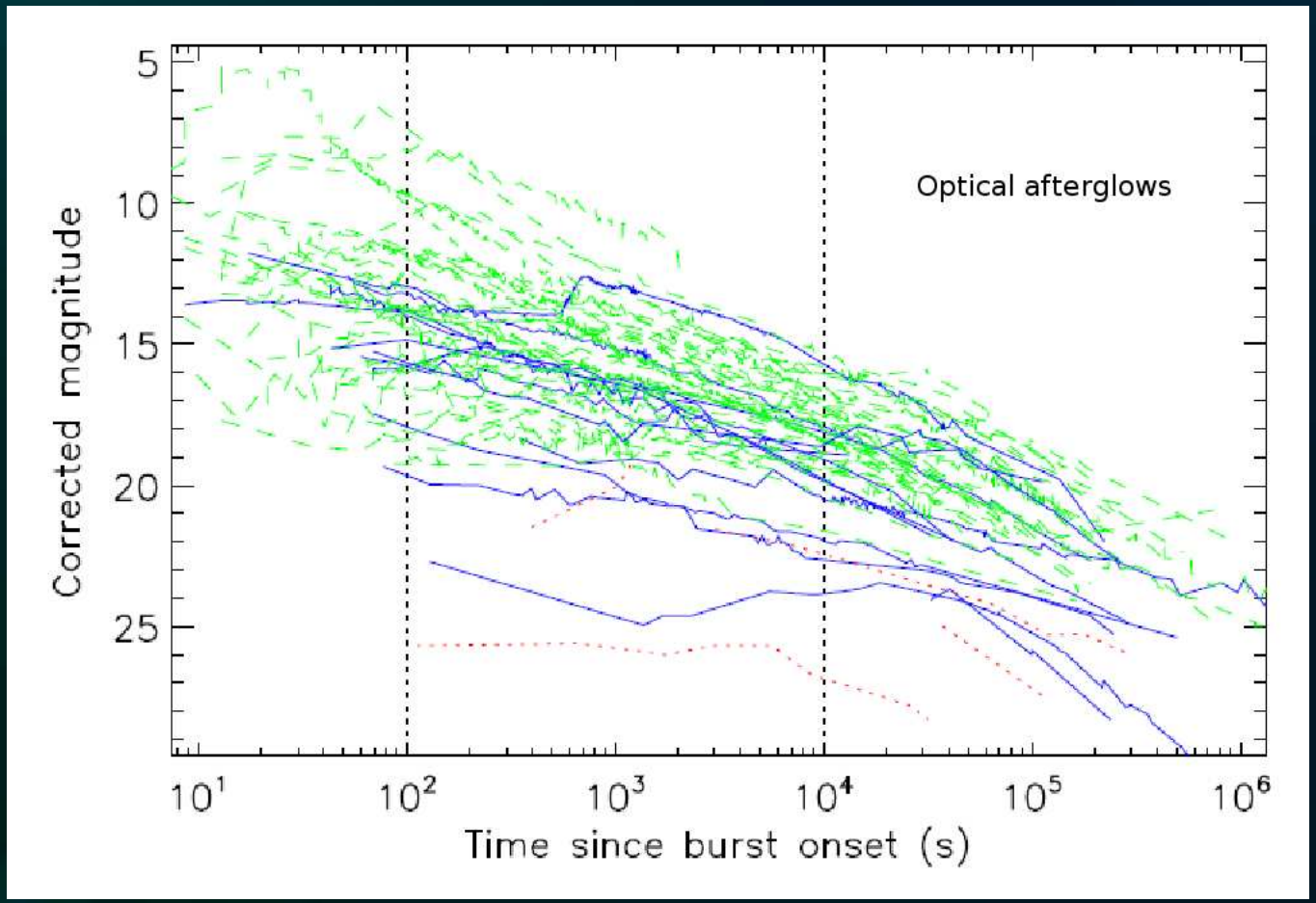
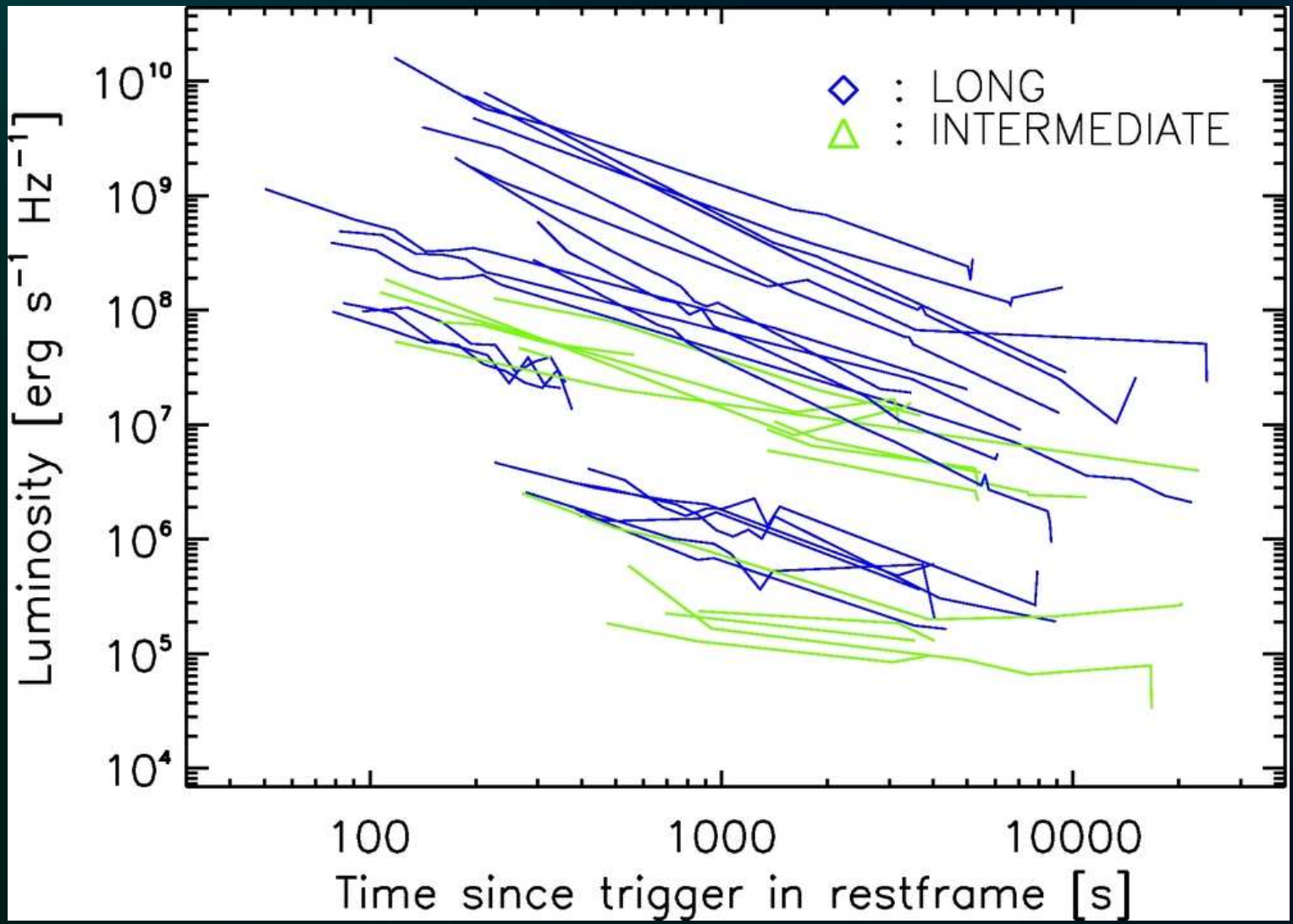


- Kolmogorov-Smirnov test : same population hypothesis $\rightarrow$ 11%

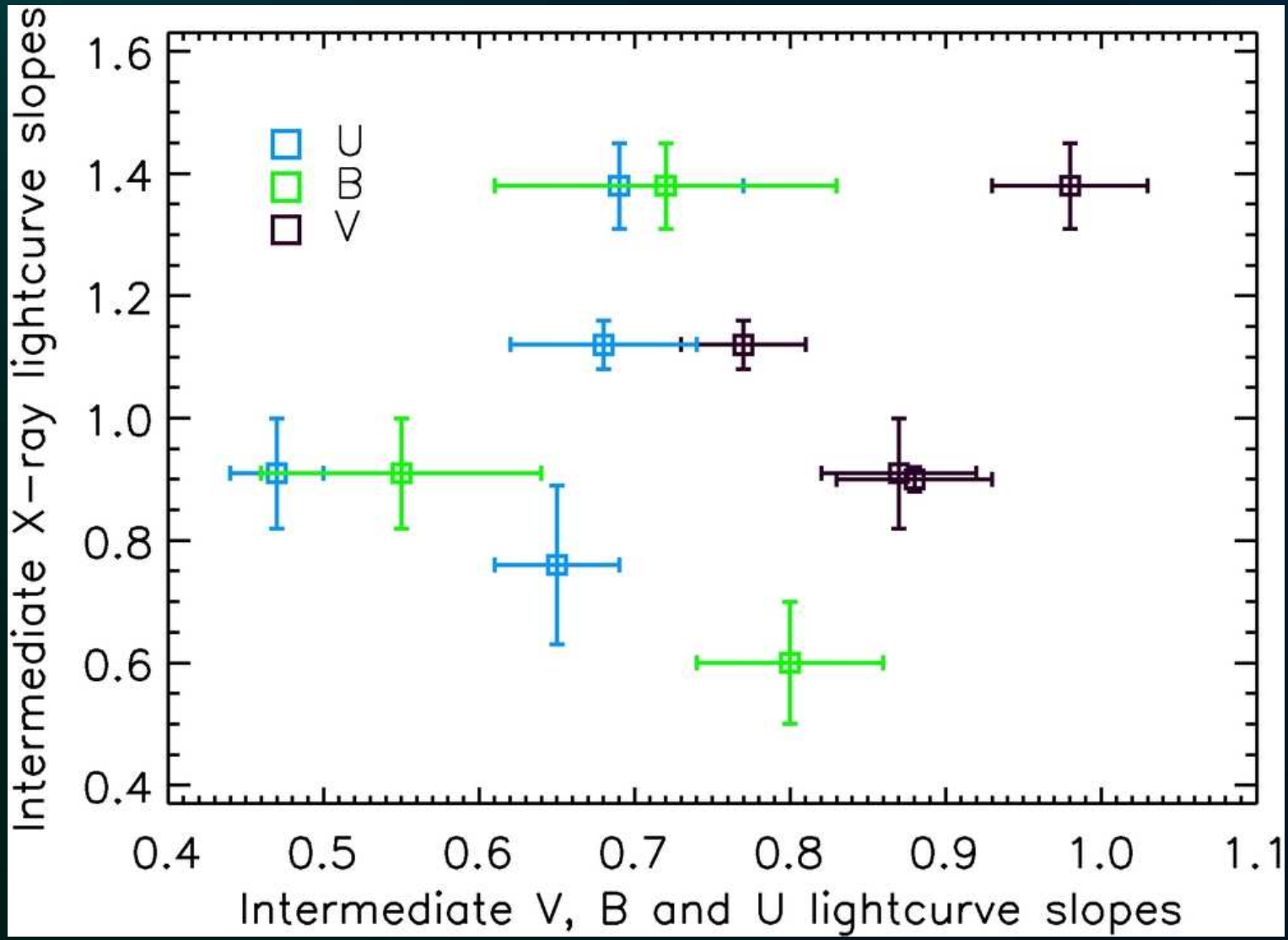
Sample and data reduction

- P. Veres et al., ApJ, Volume 725, Issue 2, pp. 1955-1964 (2010)
  $\longrightarrow$ model based clustering (Bayesian Information Criterion method)
  $\longrightarrow$ 46 intermediate, 15 have UVOT (SWIFT) observations, 9 bright enough
  $\longrightarrow$ 331 long, many of them has UVOT observations...
- redshift distributions are the same

Results - luminosity lightcurves



Results - X-ray slopes vs. optical slopes (F $\propto t^{-\alpha}$)



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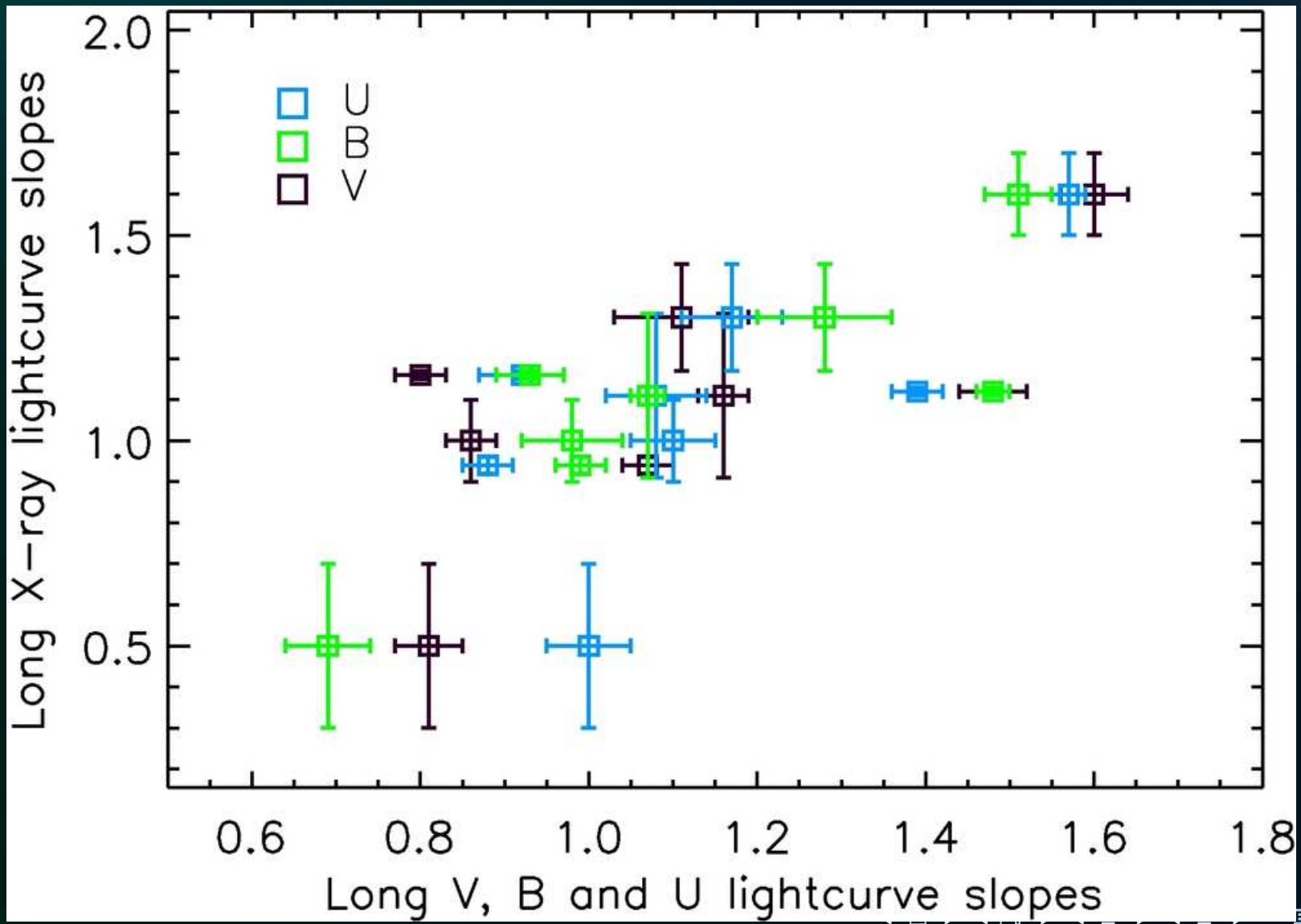

Temporal and spectral properties (F $\propto t^{-\alpha}$, F $\propto \nu^{-\beta}$)

Long	β	β	Int.
060512	1.78	0.72	050801
070518	1.8	1.28	050922C
070810A	1.69	2.16	061007
080330	0.54	3.19	080721
080520	3.95	2.13	080916A
081007A	1.53	2.26	081203A
090426	1.9	1.89	090426

$\overline{\alpha}_{filter}$	Long	Int.
$\overline{\alpha}_V$	1.10±0.02	0.87±0.02
$\overline{\alpha}_B$	1.11±0.02	0.69±0.05
$\overline{\alpha}_U$	1.12±0.02	0.62±0.16
$\overline{\alpha}_{W1}$	1.13±0.02	1.48±0.2
$\overline{\alpha}_{M2}$	1.50±0.07	2.21±0.18
$\overline{\alpha}_{W2}$	1.27±0.07	-

Future plans

- Afterglow database from Gamma Ray Burst Coordinates Network circulars
- Distribution of the afterglow parameters
- Third group - are they distinct or are they just a subgroup?

Thank you for Your attention!

Optical slopes vs. redshifts