

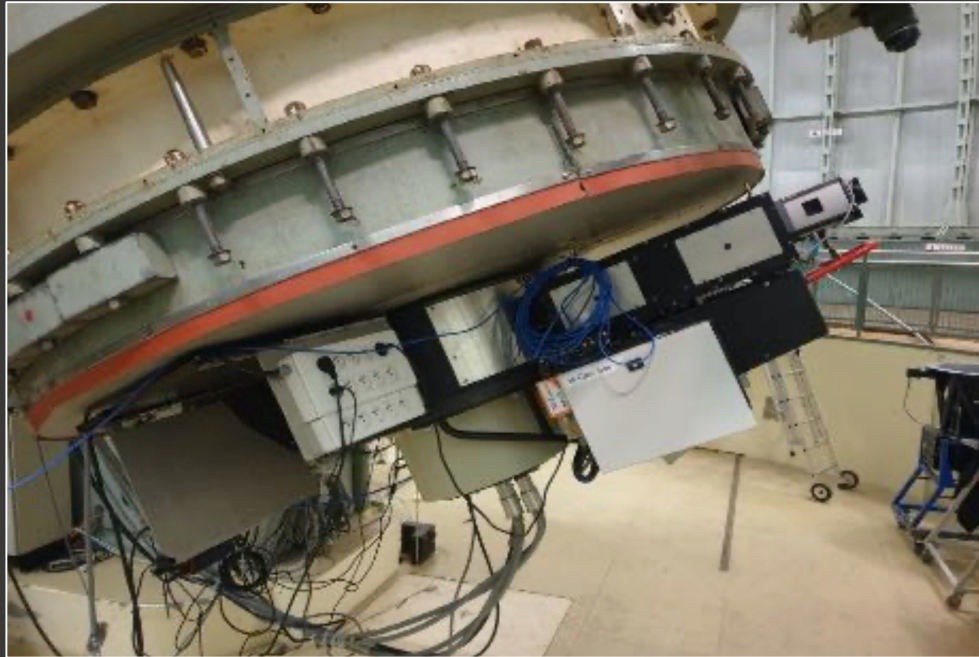


Spectroscopic optical follow-up of GRB afterglows with MISTRAL

Emeric Le Floc'h (CEA/Dap - AIM)

... on behalf of the GRB MISTRAL collaboration

MISTRAL : a new spectrograph at the OHP 193cm



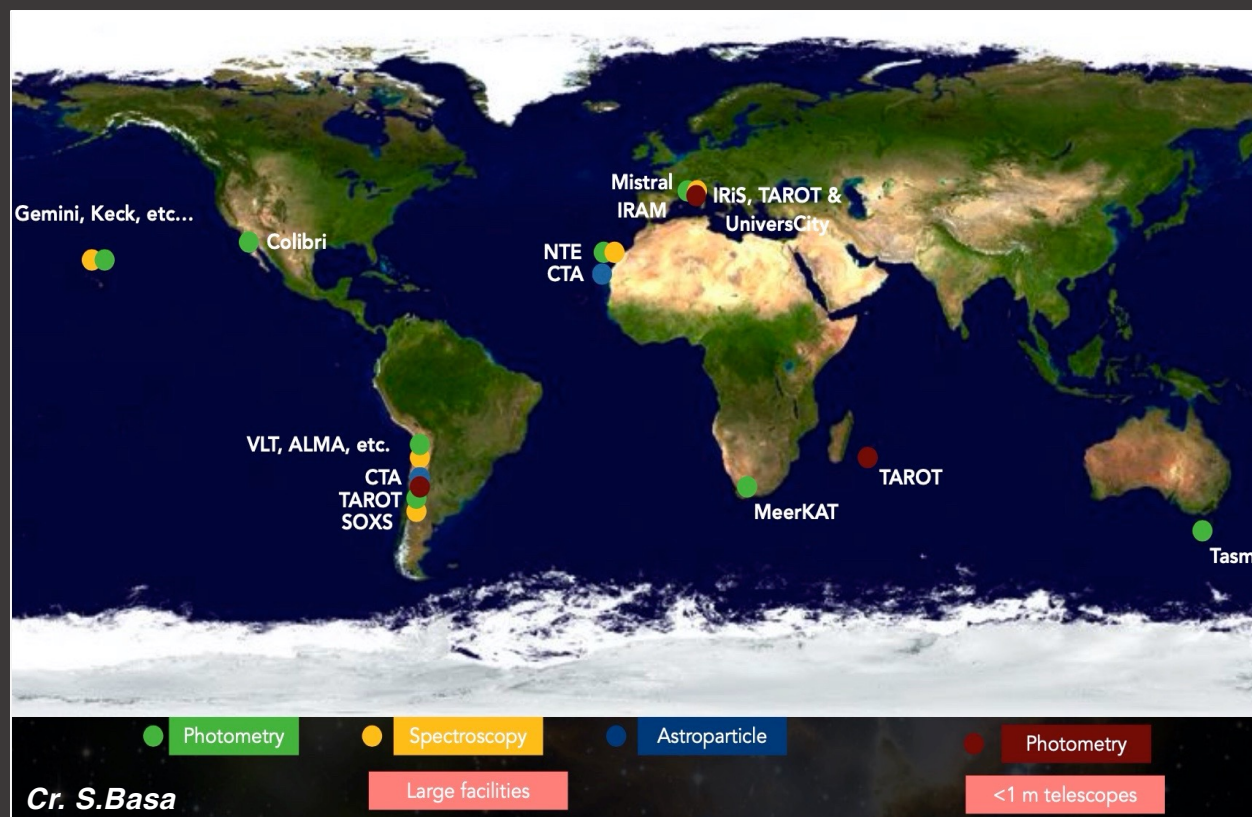
- Imaging: G' , r' , I' , z' , Y , $H\alpha$, [OIII], SII, $H\beta$
- FOV : 5.1 arcmin (full), ~ 9 arcmin (total)
- Wavelength range : $\sim 4200 - 10000$ Ang.
- Spect. : blue (4200 - 8200 Ang.)
red (5800- 9950 Ang.)
- Resolution : ~ 750 at 6000 Ang.
- Slit : 1.9"
- Sampling : 0.48 arcsec/px

→ MISTRAL "permanently" mounted (folded Cassegrain), close to SOPHIE

→ Offered in ToO mode since March 2022 through calls for INSU programs

→ ToO rules: 2h / night max, 1 ToO every 3 nights

MISTRAL : another opportunity for the SVOM follow-up program



OHP: strategic position between China (C-GFTs) and San Pedro Martir (Colibri)

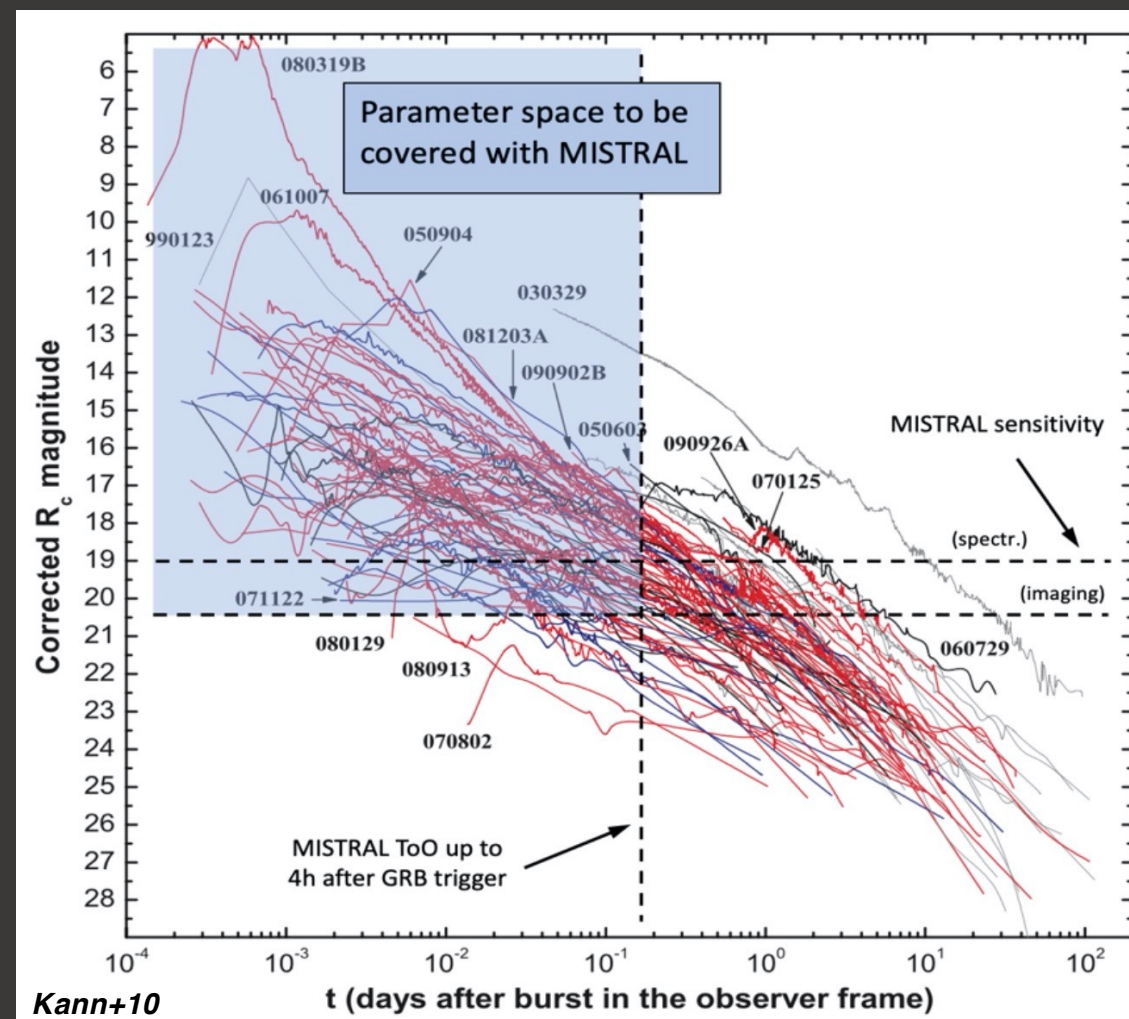
→ We applied last fall to initiate MISTRAL follow-up of Swift GRBs, mostly to get trained and be ready for the launch of SVOM

→ Awarded ~19h for 2022A semester (March-October)

Trigger criteria : no later than 4h post-burst, $A_v < 0.5\text{mag}$, $R < 19\text{mag}$ for spectroscopic mode

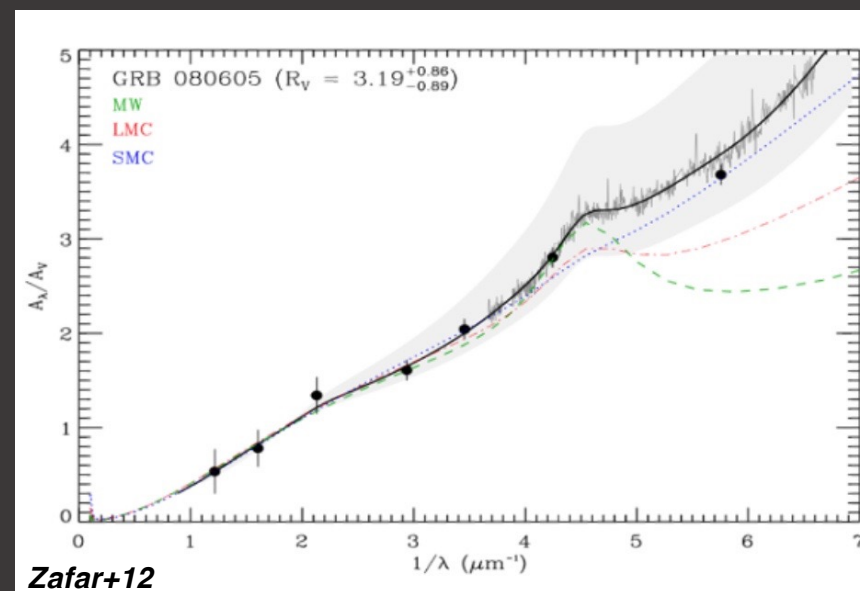
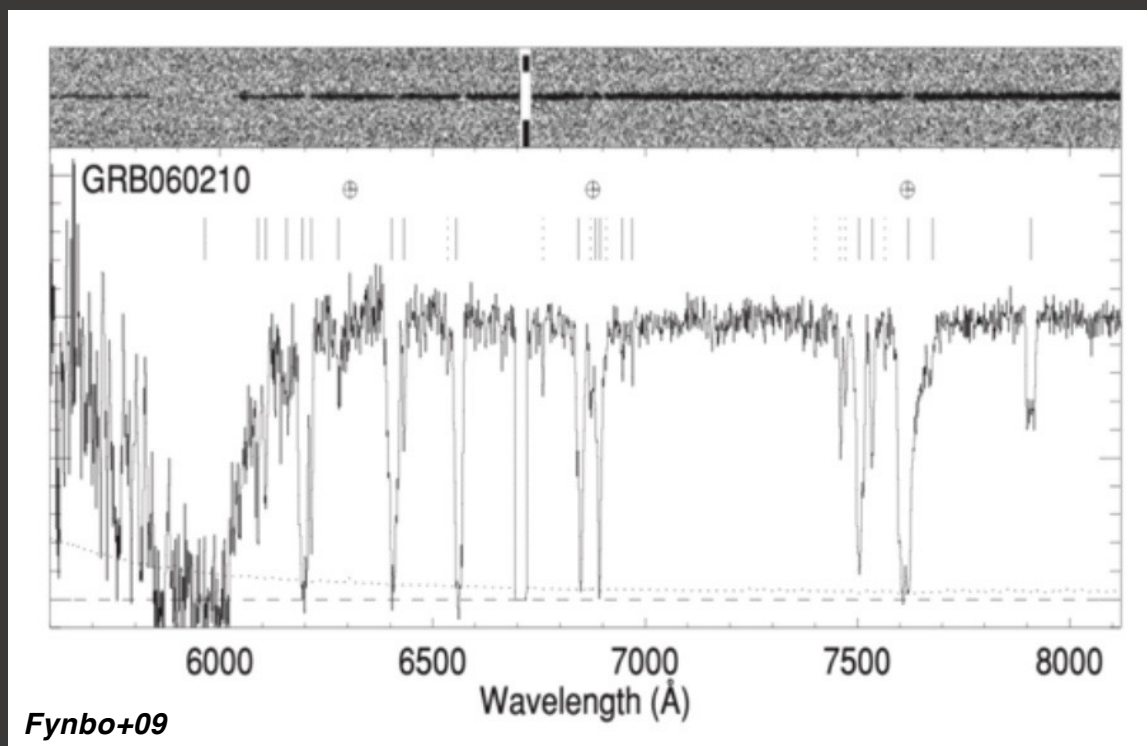
MISTRAL GRB program : science cases (i)

- Photometric properties and light-curves of GRB counterparts in the very early phase of afterglow emission
- Properties of the prompt emission in case of exceptional events
- Nature and diversity of stellar explosions
- Possible association of SN accompanying the afterglow emission



MISTRAL GRB program : science cases (ii)

- GRB redshift, constraints on metals along the GRB sight-line, information relative to abundances, HI column density in the host using Ly α ($z \sim 3$)



- Dust extinction curves
- Host galaxies (nearby)

MISTRAL GRB program : setup (i)

- Currently in a "discovery" phase (no previous experience with MISTRAL in ToO mode)
 - regular BA shift framework postponed to later time
- First follow-up to be carried out with volunteered contributions :
 - thanks to Benjamin S., Stephane B., Christophe A., Alix N.d.I.F., Michel D., Jesse P., Susanna V., Andrea S., Damien T., ...



The screenshot shows a web browser displaying a wiki page for the MISTRAL project. The page title is "GRB afterglow observations with MISTRAL". The content includes an introductory paragraph about the program's approval for the 2022A semester, a section on the organization of follow-up observations, and a list of rules to keep in mind regarding triggers. The page also features navigation tabs for Overview, Activity, Issues, Calendar, News, DMS, Documents, Wiki, Files, and Settings.

SVOM » GRB follow-up » MISTRAL

Search

+ Overview Activity Issues Calendar News DMS Documents Wiki Files Settings

Edit Watch ...

GRB afterglow observations with MISTRAL

This wiki page is dedicated to our on-going MISTRAL ToO program, approved for the 2022A semester (March–October 2022) at the OHP 193cm telescope. We were granted a total of 3.4 nights (18.7 hours) in ToO mode, which should allow us to perform follow-up observations for a number of ~10 alerts triggered by *Swift* GRBs. A copy of the proposal is accessible in the "Useful links" section at the bottom of the page.

Organization of the follow-up

For each alert received at OHP and satisfying our trigger criteria, the telescope operator takes (in principle) him/herself the decision to stop the on-going exposure and to point MISTRAL toward the location of the burst, so as to initiate a first exposure with the imaging mode. Nonetheless, it is also advised to rapidly get in touch with the operator and kindly ask whether the alert was properly received at OHP and if it is possible to trigger the MISTRAL follow-up.

All the interactions with the telescope operator will be done through the MISTRAL Slack workspace, using the "grb-follow-up" channel. On this workspace, the 193cm operator is identified as the "mistral.ohp" user, and it has been agreed that for each trigger, **only one person from our team will pursue the real-time interactions with OHP**. At the same time, the few of us willing to participate during the night to the follow-up so as to discuss the best strategy to follow will be able to exchange using a dedicated channel on the SVOM Slack workspace (to be confirmed by Stephane later, or modified).

The MISTRAL data will be accessible through a cloud hosted at OSU Pytheas : <https://nuage.osupytheas.fr/s/nprxLwY8waKtNsb>

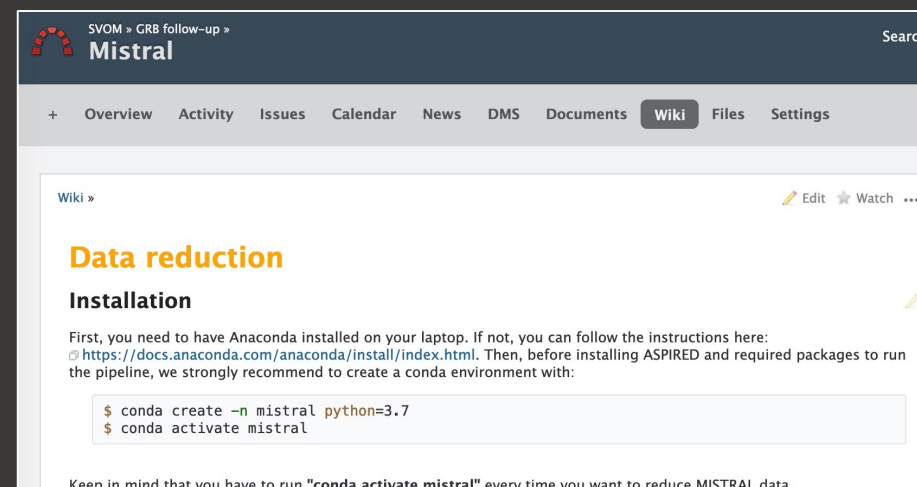
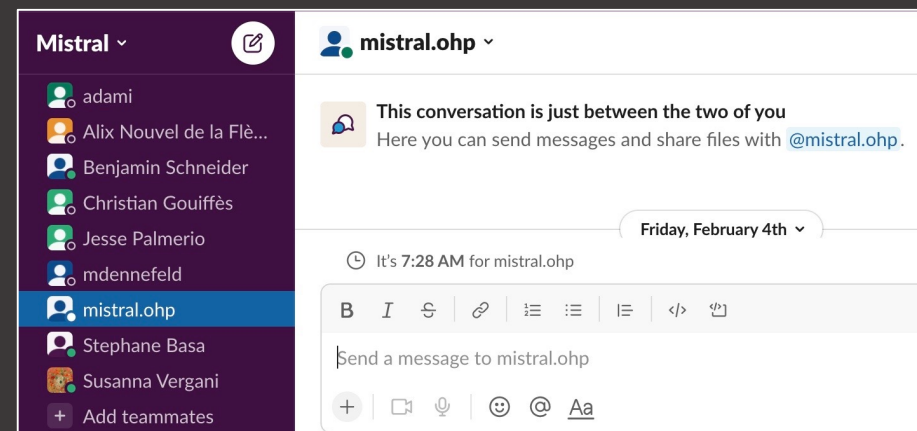
Rules to keep in mind regarding the triggers:

- The occurrence of MISTRAL ToOs is at most 1 every 3 nights.
- The duration of a given ToO can not exceed 2 hours (including overheads, and in particular the switch from one instrument to the other).

MISTRAL GRB program : setup (ii)

- VOEvent received at OHP, MISTRAL follow-up triggered automatically (in principle)
- ToO mode tested in the previous semester
- Communication with T193 night operator established through Slack
- Get ready on MISTRAL data reduction : python quick-look, use of ASPIRED, debugging (B.Schneider, C.Adami, ...)
- But expertise on spectra analysis missing for many of us

→ MISTRAL analysis hands-on !!



MISTRAL GRB program : current status

GRB	RA, Dec	Av	Comment
GRB220305	107.5974 -37.6809	1.26	high Av, MISTRAL not avail.
GRB220306	5.3870 +71.3632	1.72	high Av, MISTRAL not avail.
GRB220319	218.2247 +61.2938	0.03	bad weather
GRB220321			wrong trigger (known source)
GRB220325	269.4853 -7.0307	2.87	high Av
GRB220402	30.6924 -61.3764	0.11	BAT only, likely not a GRB
GRB220403B	191.4734 +89.1846	0.65	high Av, MISTRAL not available
GRB220404A	50.448 +10.005	1.37	high Av, BAT only

→ No luck so far...

GRB220403B : $r \sim 19$ mag UVOT afterglow, with fast decay.
Would we have triggered MISTRAL ?

MISTRAL GRB program : open questions

March 2022						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
21	22	23	24	25	26	27
		• Too test	• Too test 22:00	• Too test 02:00 • Too test 23:00		
28	1 Mar	2	3	4	5	6
					No ToO 17:00	ends 07:00
7	8	9	10	11	12	13
No ToO 17:00	ends 07:00		No ToO 17:00	ends 07:00	No ToO 17:00	
14	15	16	17	18	19	20
No ToO ends 07:00		No ToO 17:00	ends 07:00			
21	22	23	24	25	26	27
28	29	30	31	1 Apr	2	3
				No ToO 17:00	ends 07:00	No ToO 17:00
				No ToO 17:00	ends 07:00	

April 2022						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
28	29	30	31	1 Apr	2	3
				No ToO 17:00	ends 07:00	No ToO 17:00
				No ToO 17:00	ends 07:00	No ToO 17:00
4	5	6	7	8	9	10
No ToO ends 07:00	No ToO 17:00	ends 07:00	No ToO 17:00	ends 07:00		
No ToO 17:00		No ToO 17:00	ends 07:00			
11	12	13	14	15	16	17
18	19	20	21	22	23	24
	No ToO 17:00	ends 07:00				
25	26	27	28	29	30	1 May
2	3	4	5	6	7	8
No ToO 17:00	ends 07:00	No ToO 17:00	ends 07:00	No ToO 17:00	ends 07:00	No ToO 17:00
				No ToO 17:00	ends 07:00	

Accounting for (i) weather conditions, (ii) GRBs close to the Galactic plane ($A_V > 0.5 \text{ mag}$), (iii) nights when MISTRAL is not available: is our probability to trigger too small ????

Summary: - one month with no trigger (March 2022)
- but time for ~10-12 alerts for this semester...!

MISTRAL GRB program : open questions

Call for next semester (2022B) already opened, deadline end of April

It would be nice to illustrate some first afterglow spectra taken with MISTRAL...

Thanks for your attention