

# REM

The REM **robotic** telescope: an early pioneer on the frontier 20 years after.



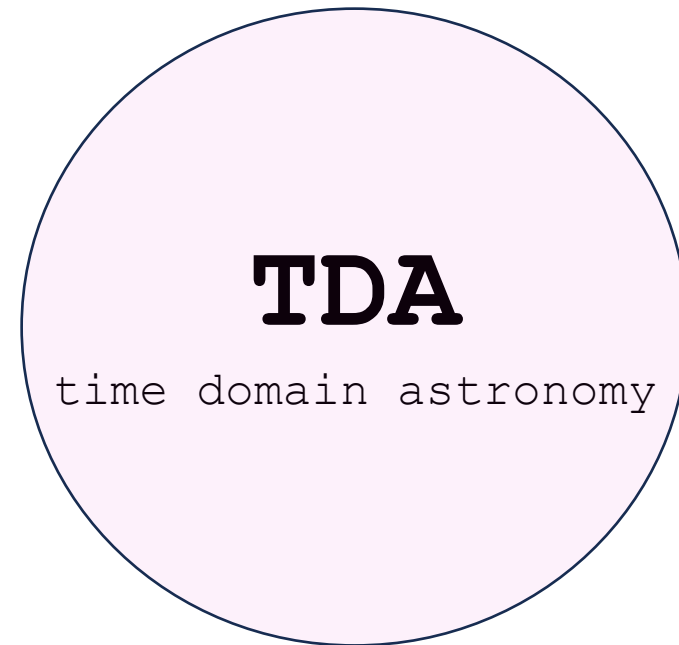
REM



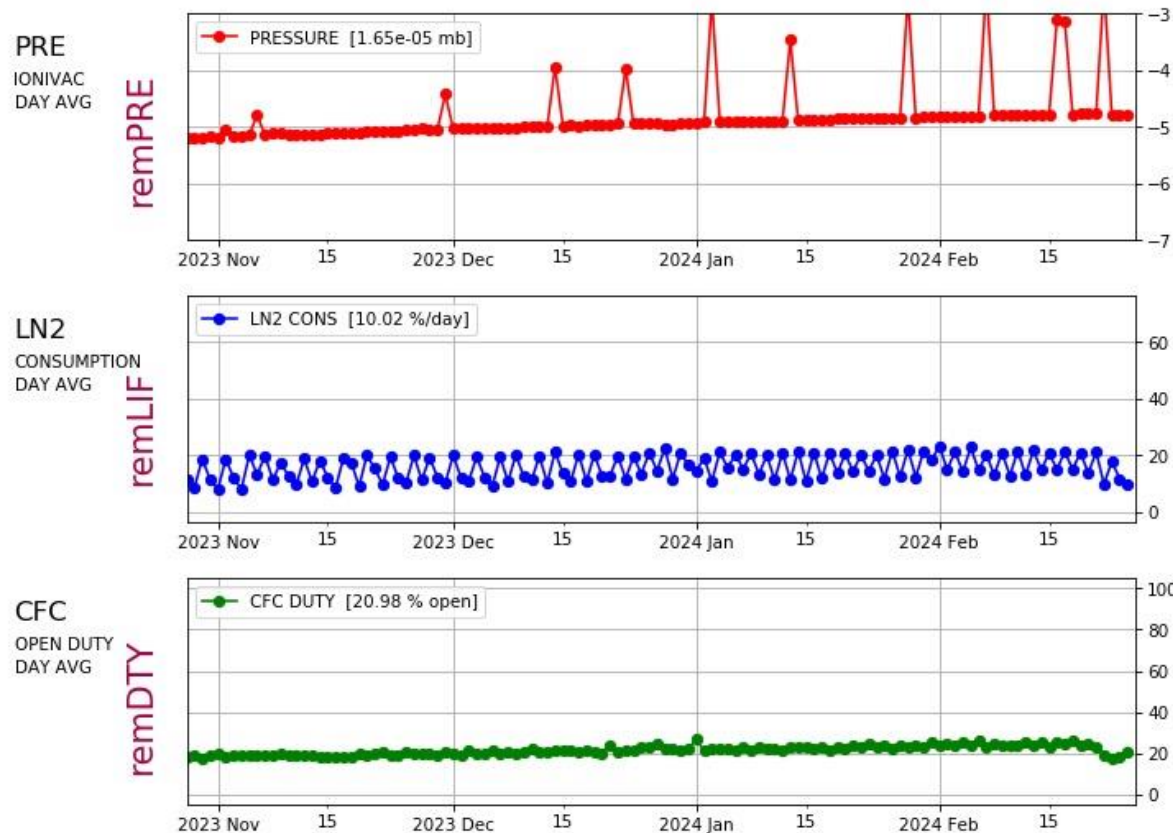
CHIANTITOPICS VI, Firenze, 2024  
Emilio Molinari, **INAF**, Osservatorio Astronomico di

# to be robotic: goals

- multimessenger astronomy
- comets
- occultation
- GRB
- SSA



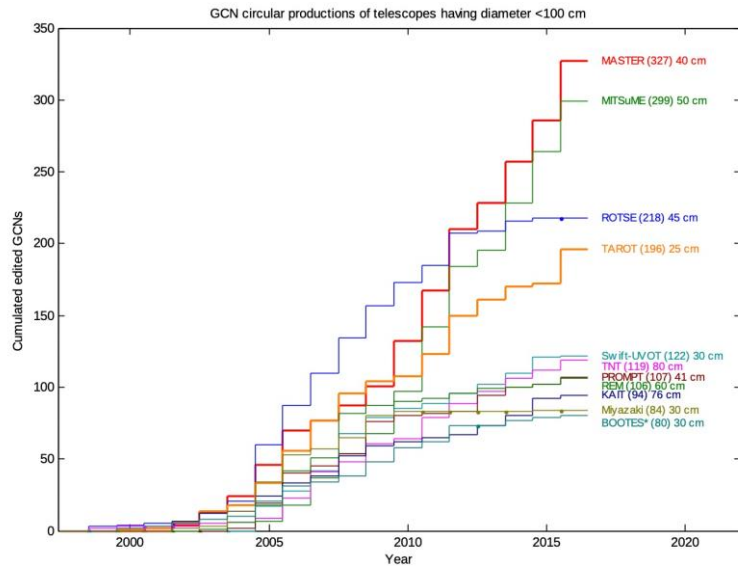
# to be robotic: tools



- **scheduler** (autonomous!, intelligent...)
- TCS (a good **control** of the telescope)
- **broker** ? (see e.g. BH-TOM, to be connected with a network)
- metrics (we need to control, intervene, be **accountable**)
- periodic reporting

# we are the robots

(never try to present a complete survey!)

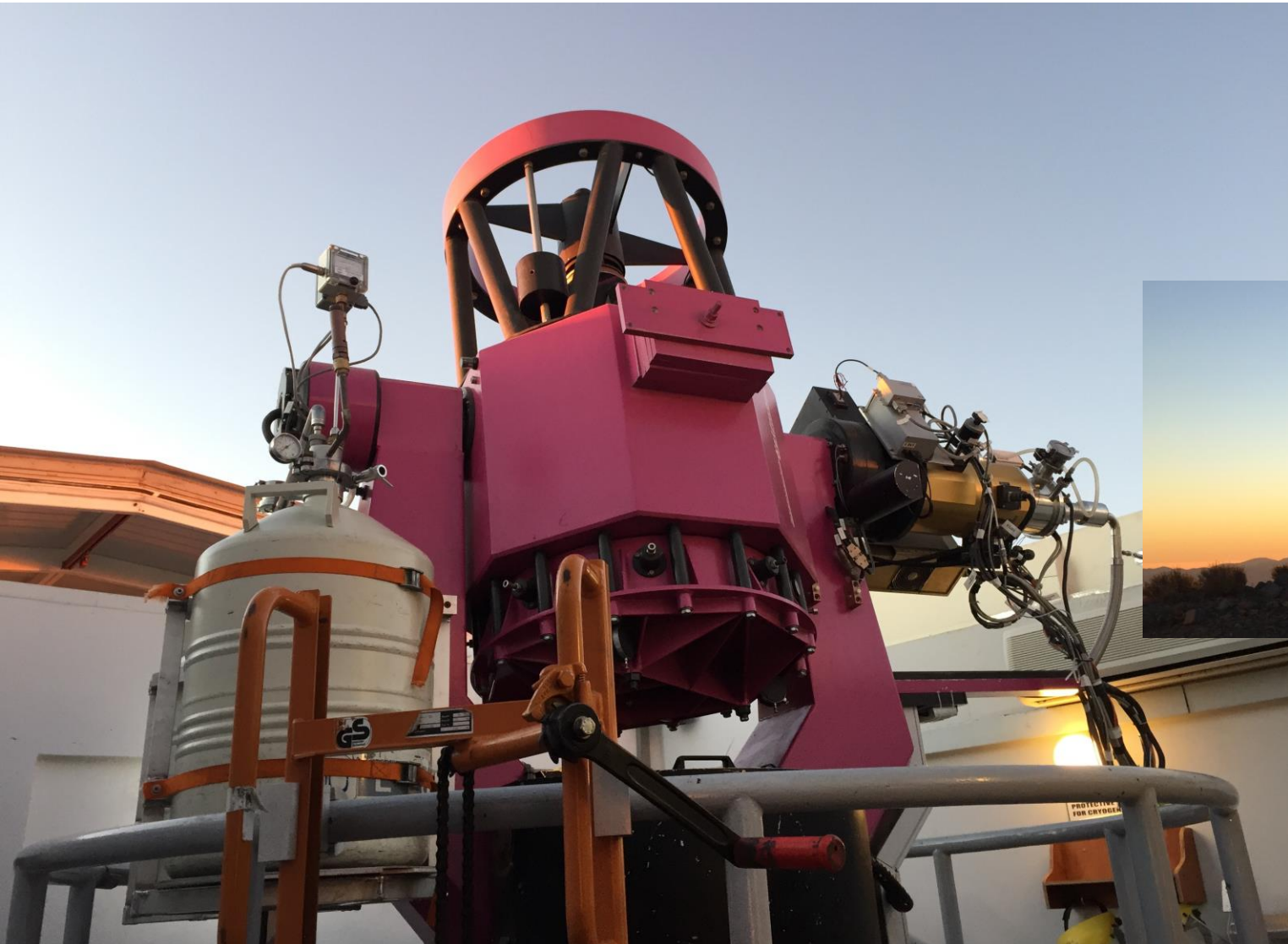


A. Klotz,





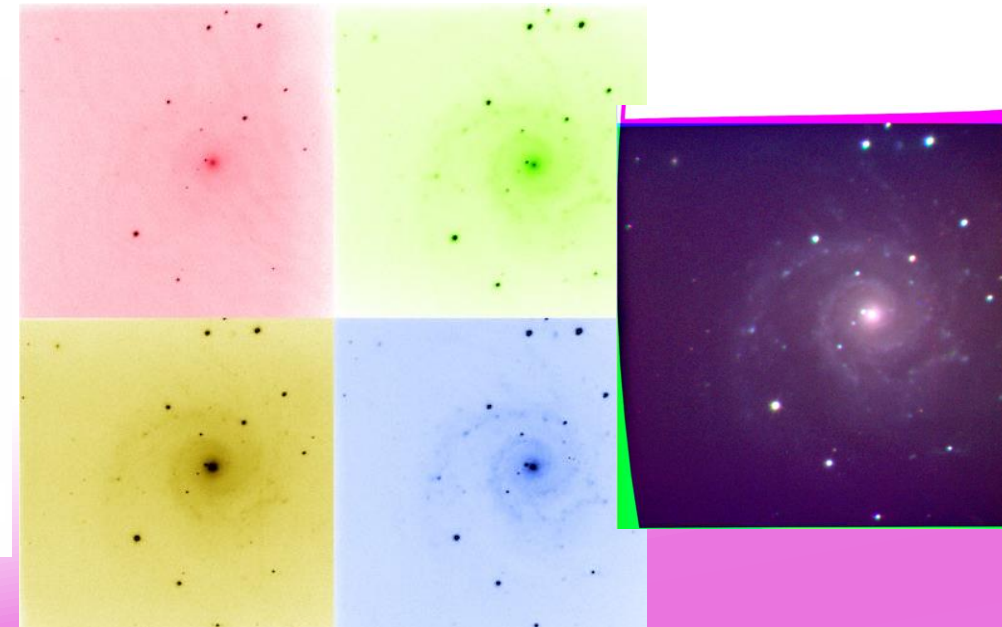
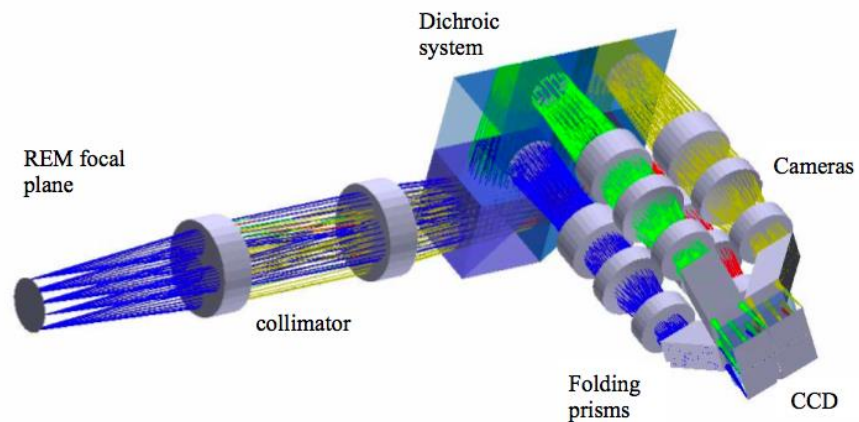
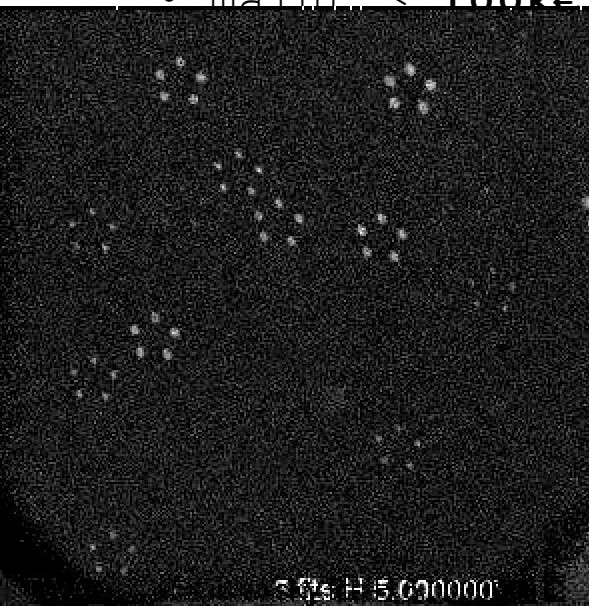
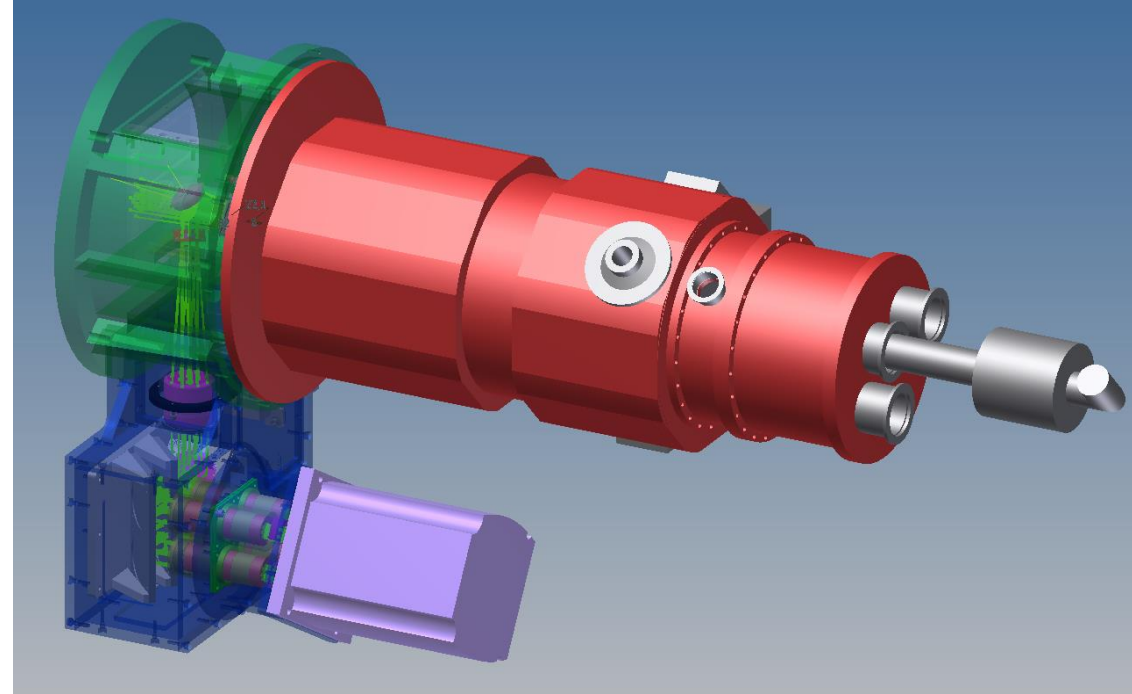
# Notre **Dome** de la Silla





# REM: quick facts

- 4\*VIS+1\*NIR, **dichroics**
- 9'x9' FoV
- IR **dither**, no autoguide
- **20 years** operating in La Silla, +3M-imgs (Feb 2024)
- **FAR, REMOTE, ALONE** (1-2 visits /yr)
- maint. < 100k€/y



# the d'REM team

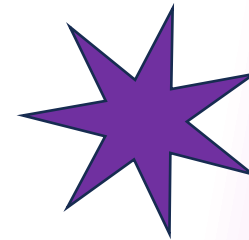
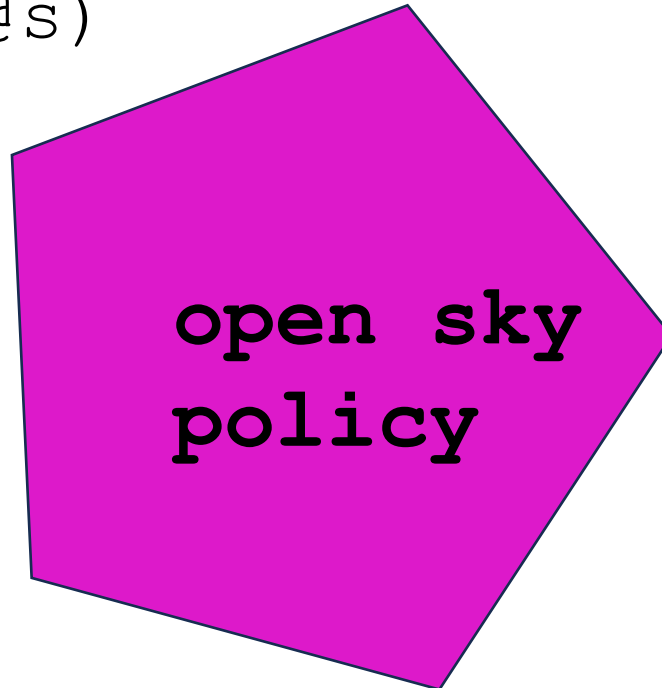
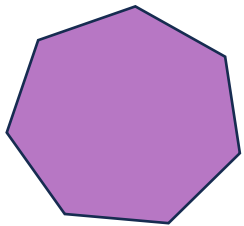
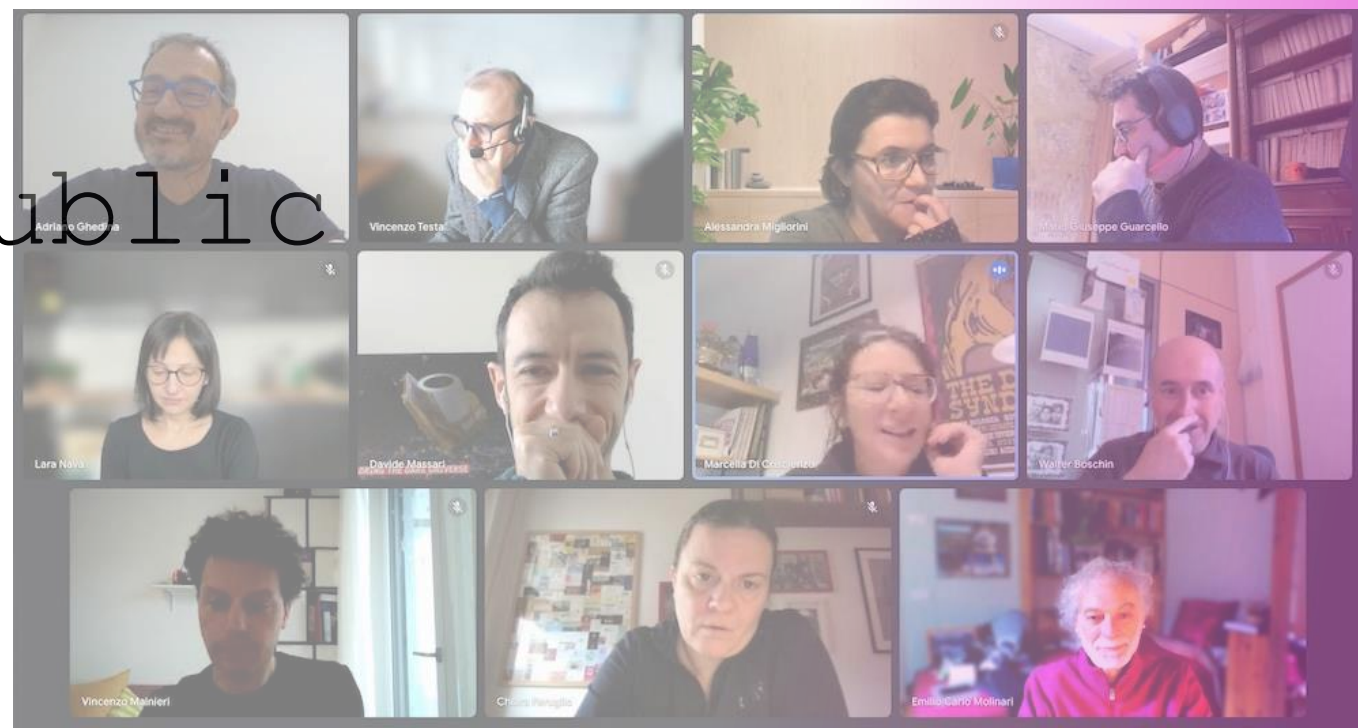
- **Stefano Covino**, Oss. Brera (Observing software)
- **Francesco D'Alessio**, Oss. Roma (Infrared Camera control software)
- **Dino Fugazza**, Oss. Brera (Observation Software, VIS data acquisition)
- **Giuseppe Malaspina**, Oss. Brera (IT System manager, network)
- **Emilio Molinari**, Oss. Cagliari (Director, Dome, Telescope)
- **Luciano Nicastro**, IASF Bologna (VIS+NIR archiving)
- **Chiara Righi**, Univ. Insubria Como (Observation software, calibrations)
- **Mauro Stefanon**, Leiden Observatory (Scheduling Software)
- **Vincenzo Testa**, Oss. Roma (Infrared Camera data acquisition and archiving)
- **Fabrizio Vitali**, Oss. Roma (Infrared Camera hardware)





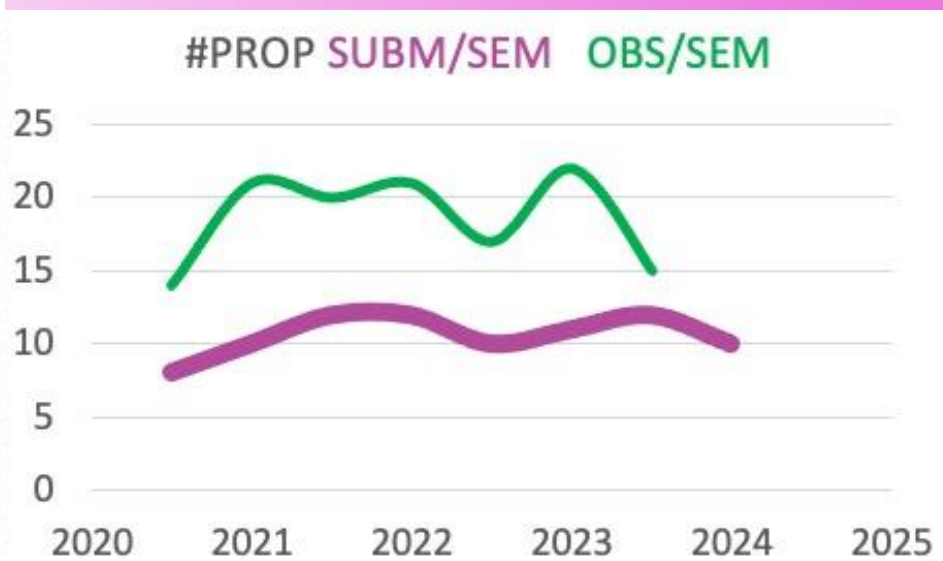
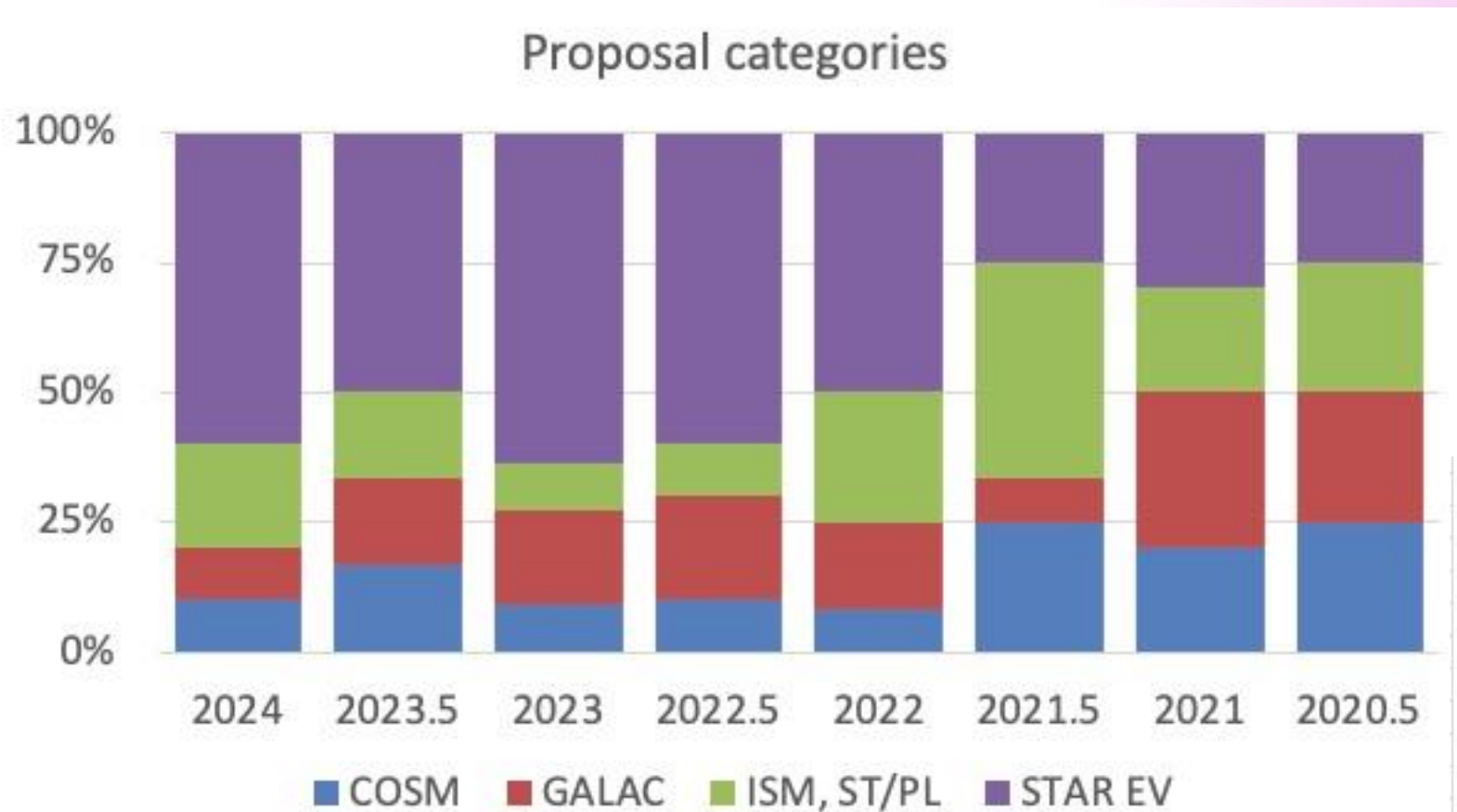
offer to the public

- TAC (INAF)
- CTAC (OPTICON/ORP)
- CNTAC (Chile)
- DDT (aficionad@s)



# fields of views

- **monitoring**
- trigger response
- alerts for TNG, VLT, spacecraft
- BH-TOM
- exoplanets
- active galaxies
- GW (GRAWITA)
- ...
- **TDA**, of course



# where all is kept

Select **REMIR but Std** WHERE **ImgNight** ≥ **2014-01-29** ≤ **2024-02-27**   More options  **REMIR**



3555054. **GSAT0104\_3\_5\_H (JS9 - AladinLite)**

Object: **GSAT0104** (GENSTAR) PI: **EmilioMolinari**  
RA: **21:54:59.50** Dec: **-21:48:43.6** Date: **2023-10-11** UT: **00:19:21**  
Gl: **30.563** Gb: **-49.701** MJD: **60228.01344**

Filter: **H** Exp.: 5 s  
ObsID: **275687** SubID: **3** DithID: **99** *Calibrated source catalogue is available: [retrieve - View \(?\)](#)*  
ObID: **288047** PropID: **5**

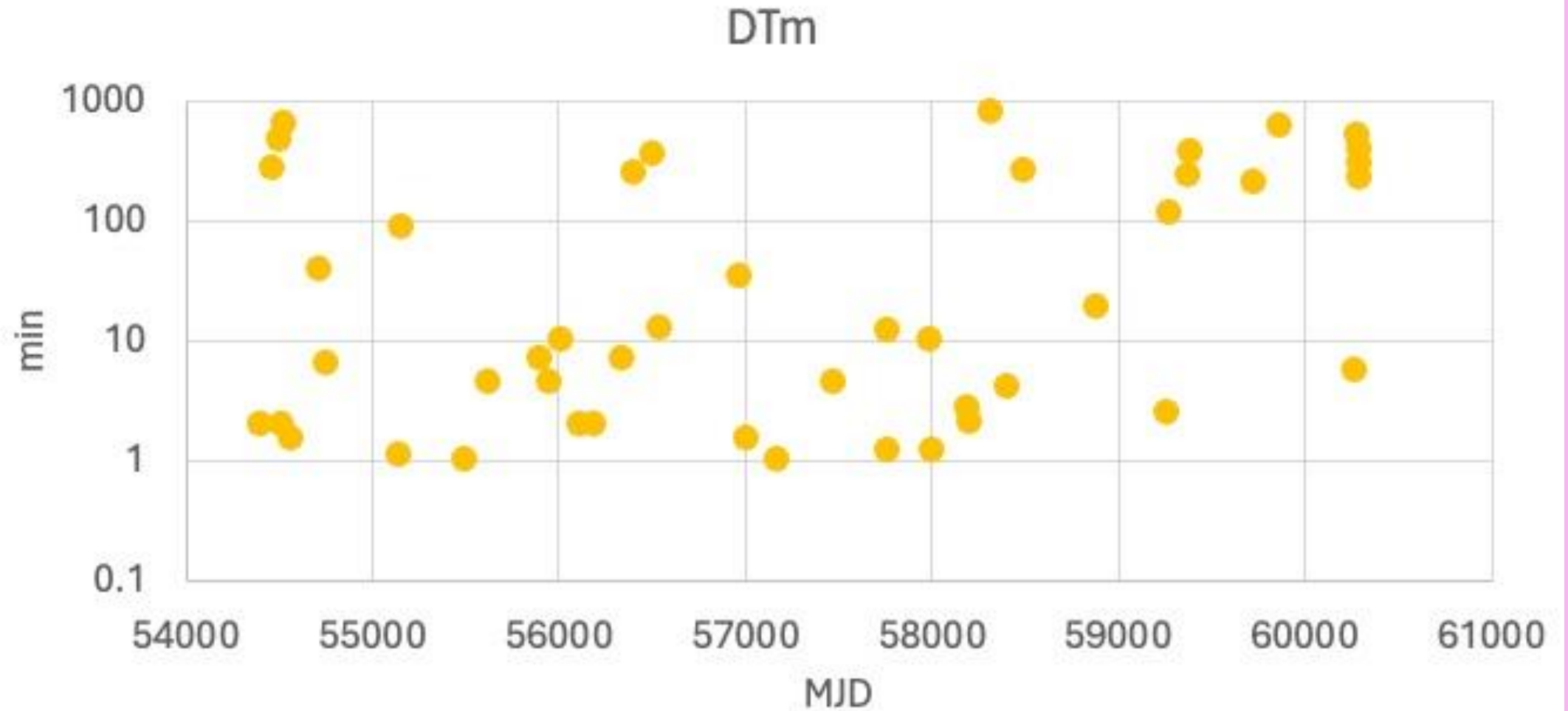
**REMIR Co-added image** Sky chart: [GSC-2.3](#), [USNO-B1.0](#), [2MASS](#), [Google Sky](#)  
Inserted on: 2023-10-11 03:24:35 UT. PI user name: **emolinari**

?	Filename	Object	RA	Dec	Date	Time	PI-CoI	Texp	Filter	ObsType	uniqueID	MJD
	GSAT0104_4_5_H_sky	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:20:27	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870498	60228.0
	GSAT0104_4_5_H_3	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:20:27	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870403	60228.0
	GSAT0104_4_5_H_2	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:20:14	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870402	60228.0
	GSAT0104_4_5_H_1	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:20:02	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870401	60228.0
	GSAT0104_3_5_H_5	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:45	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870305	60228.0
	GSAT0104_3_5_H_4	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:33	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870304	60228.0
	GSAT0104_3_5_H	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:21	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870399	60228.0
	GSAT0104_3_5_H_sky	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:21	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870398	60228.0
	GSAT0104_3_5_H_3	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:20	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870303	60228.0
	GSAT0104_3_5_H_2	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:19:08	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870302	60228.0
	GSAT0104_3_5_H_1	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:18:55	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870301	60228.0
	GSAT0104_2_5_H_5	<b>GSAT0104</b>	21:54:59.50	-21:48:43.6	2023-10-11	00:18:39	<b>EmilioMolinari</b>	<b>5</b>	<b>H</b>	GENSTAR	2756870205	60228.0

PI are noticed every Chilean morning

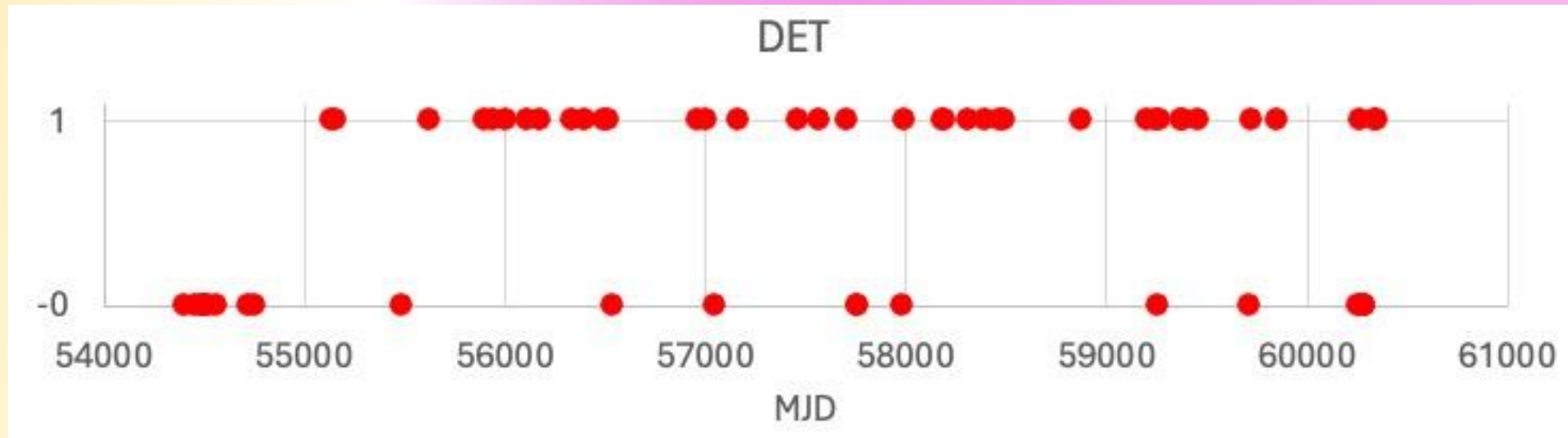
Frames available in minutes at IASFBO

GRB are fast, **robots** too

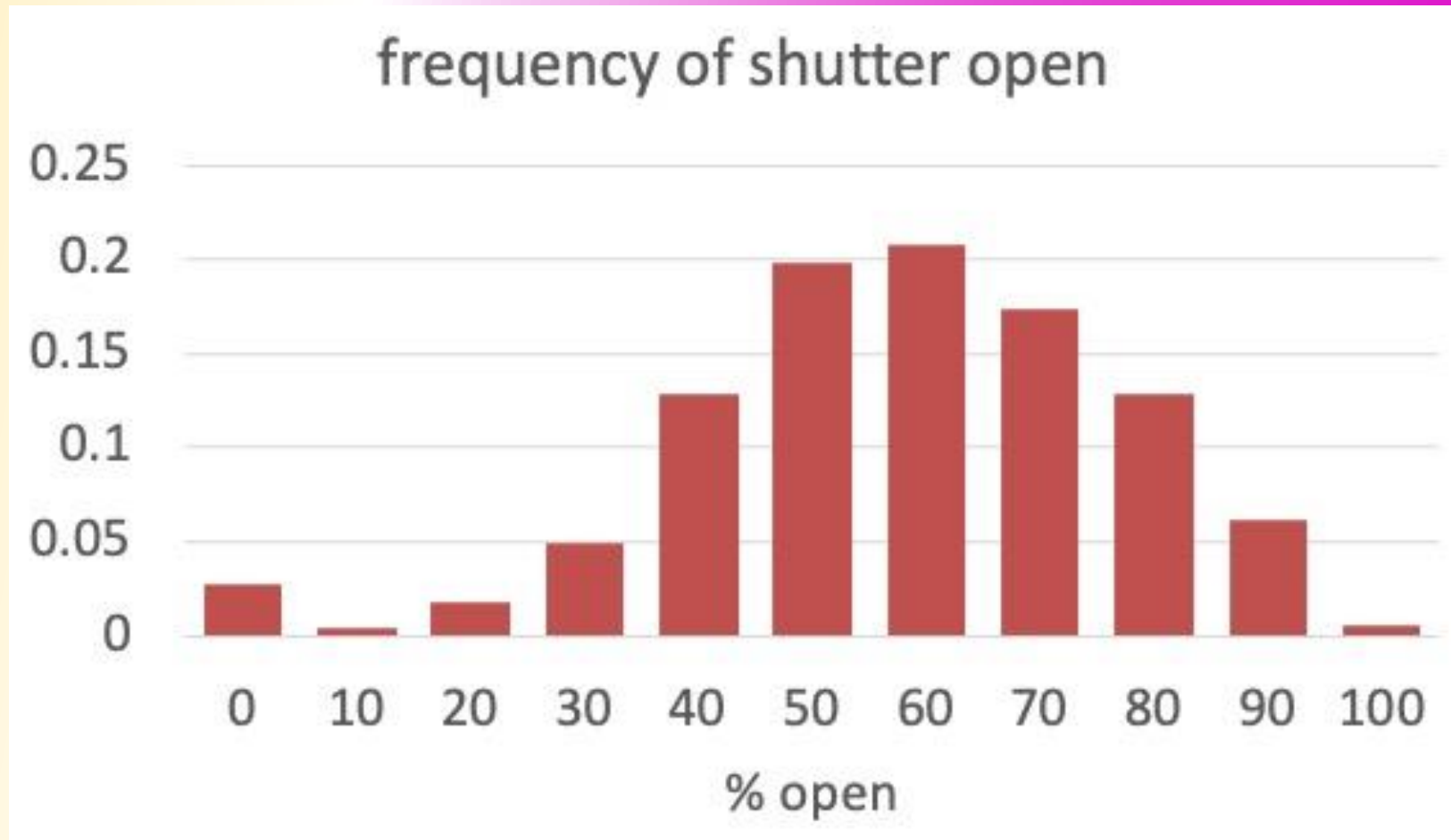




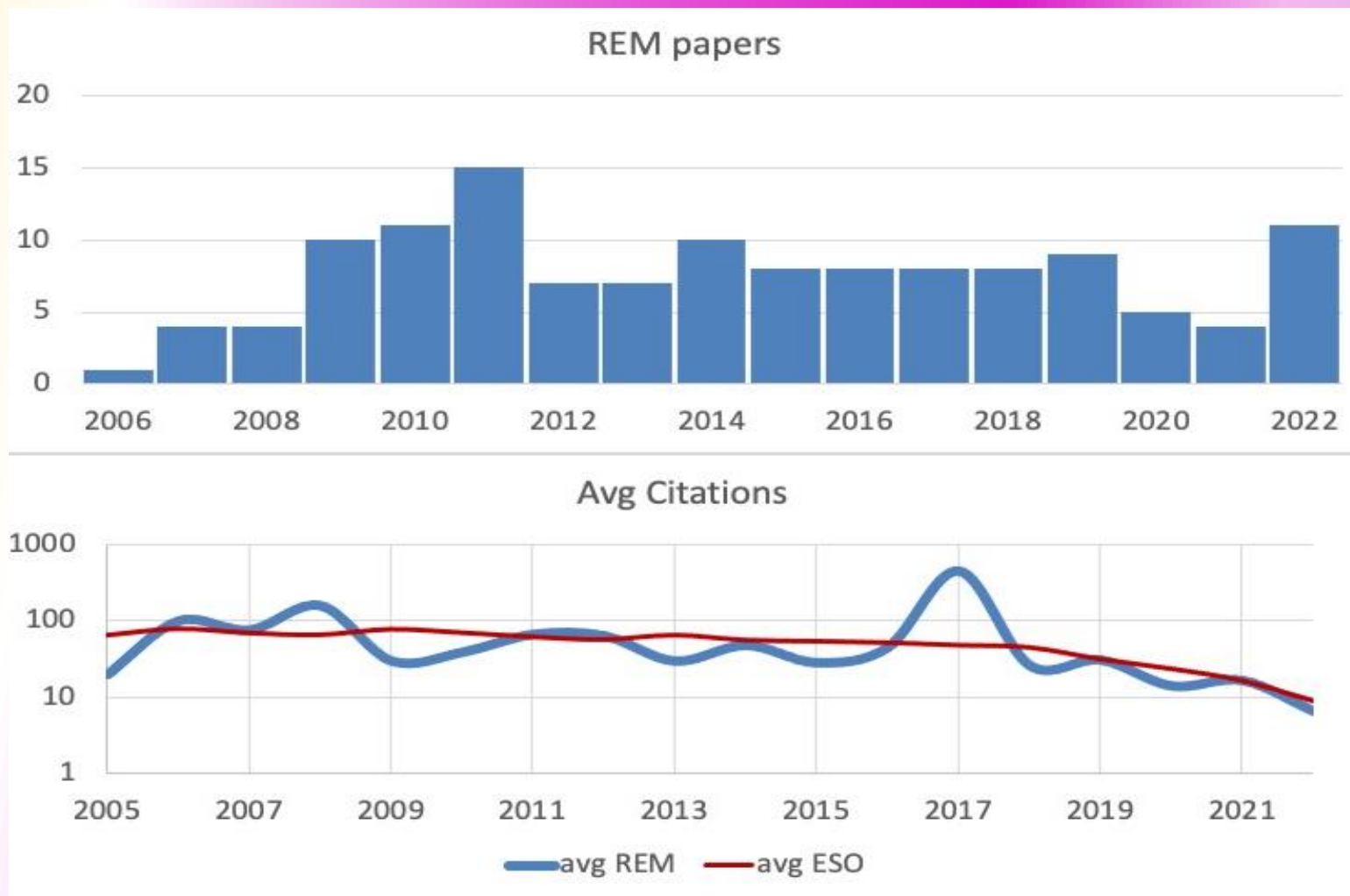
GRB are dim, 60 cm is not enough...



# Eyes Wide Open

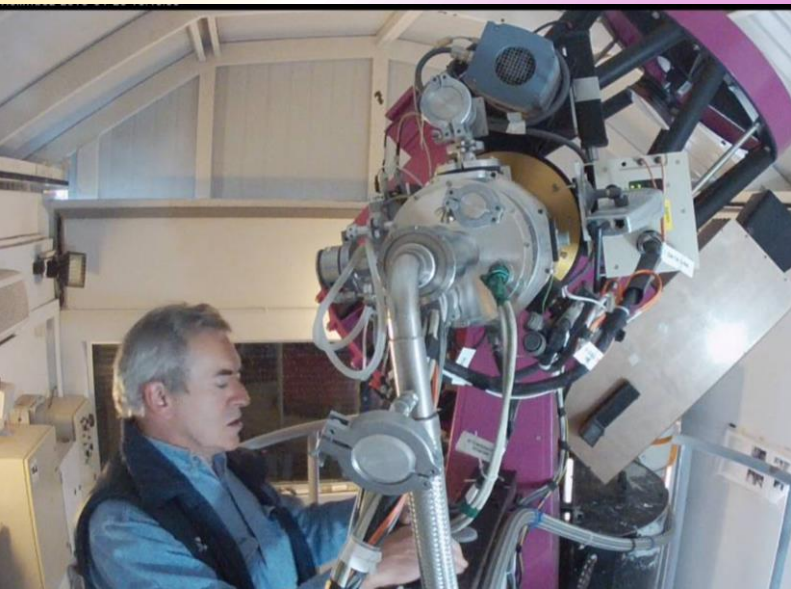


# black on white



problems?

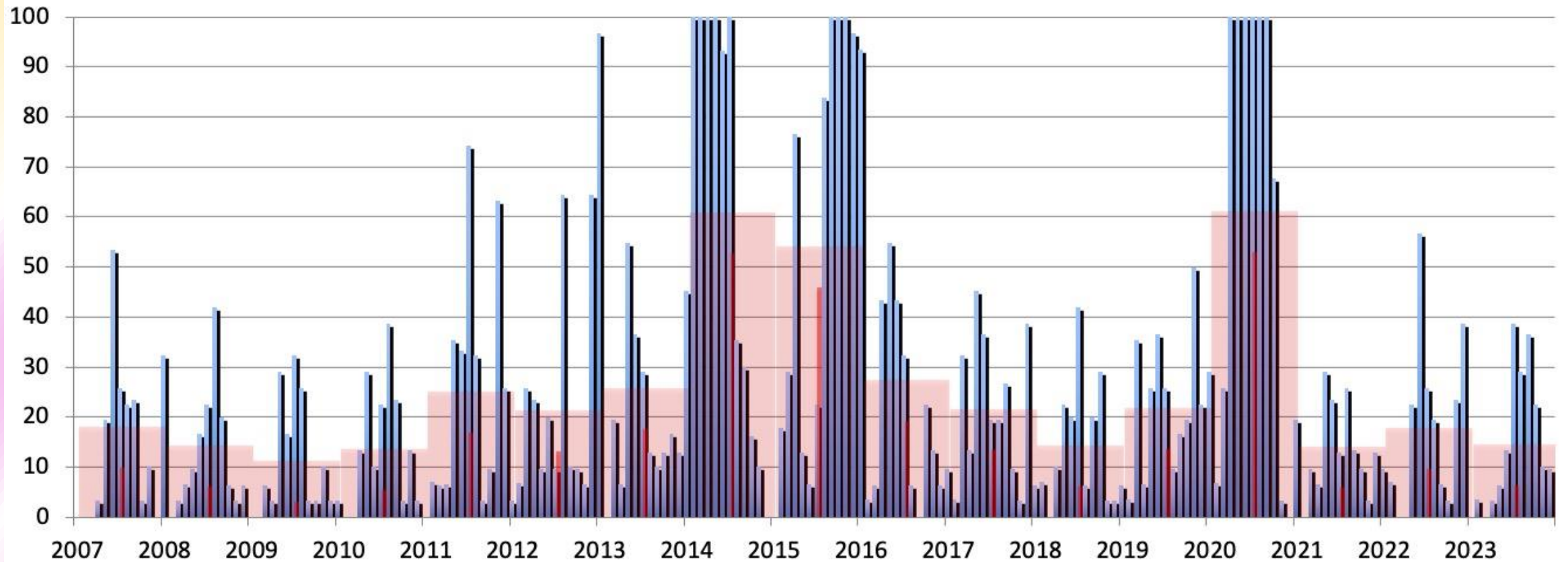
- solutions !





# Sleeping nights, no stars...

REM, La Silla,  
% lost nights

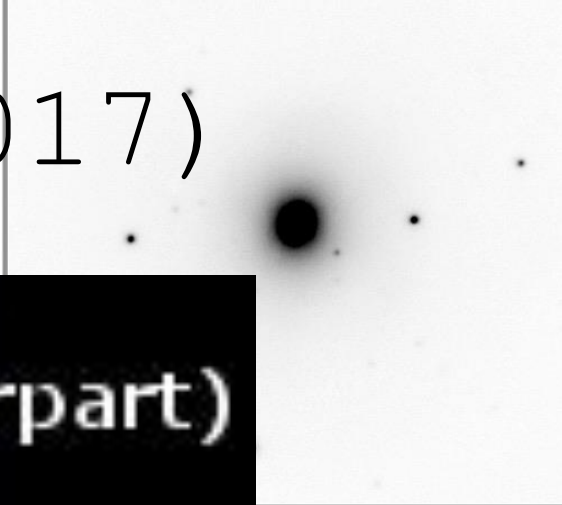


so, still worth  
while ?

( yes, of  
course )

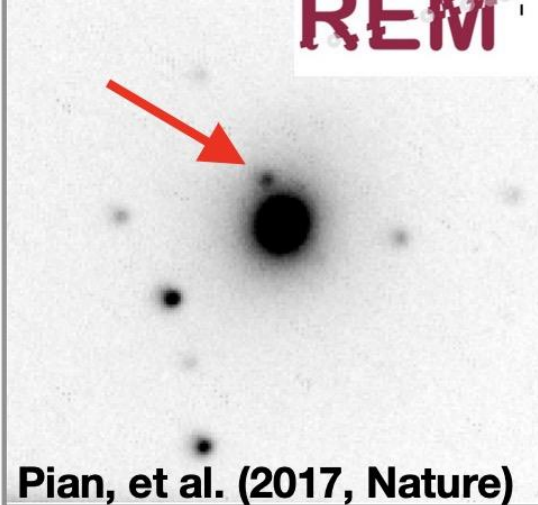
color kilonova (2017)

archival (Pan-STARRS)



T+12h44m

REM



Pian, et al. (2017, Nature)

AT2017gfo (GW170817 counterpart)



REM-ROS2

far away GRB (today)

# GCN Circular 35742 t0

**Subject** GRB 240218A: Swift detection of a burst  
**Date** 2024-02-18T02:17:56Z (5 days ago)  
**From** K.L. Page at U Leicester <klp5@leicester.ac.uk>

# GCN Circular 35743

**Subject** GRB240218A: VLT/X-shooter upper limits  
**Date** 2024-02-18T03:49:19Z (5 days ago)  
**From** Daniele B. Malesani at IMAPP / Radboud University <d.malesani@astro.ru.nl>

1.5 hr

**Hu**  
Youdong  
talk

# GCN Circular 35747 9 hr

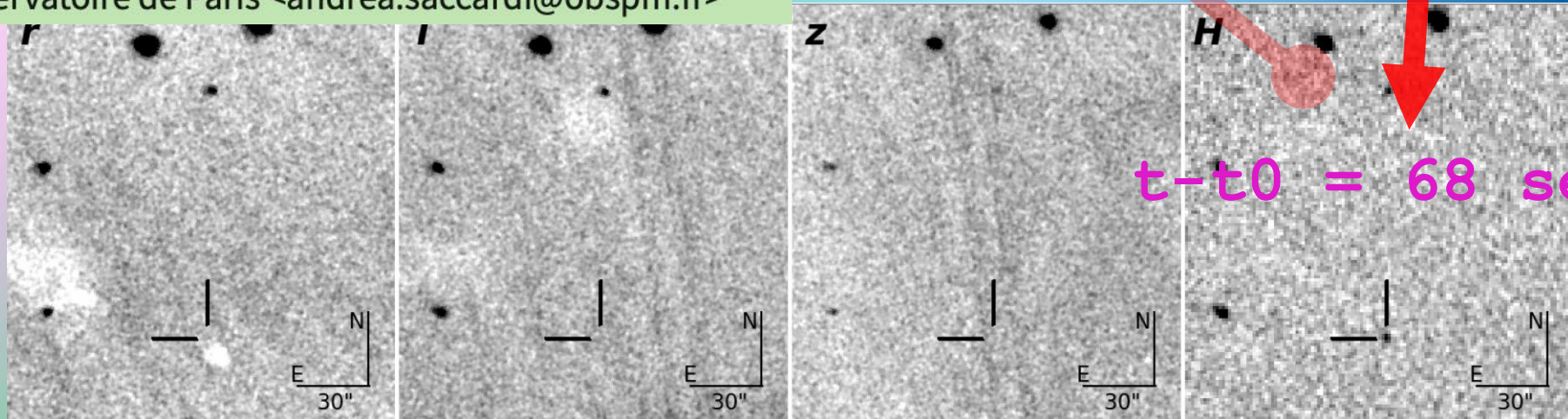
**Subject** GRB 240218A: REM detection of a NIR afterglow candidate  
**Date** 2024-02-18T11:08:05Z (5 days ago)  
**From** Paolo D'Avanzo at INAF-OAB <pda.davanzo@gmail.com>

# GCN Circular 35756

**Subject** GRB 240218A: VLT/X-shooter redshift of  $z = 6.782$   
**Date** 2024-02-19T11:21:15Z (4 days ago)  
**From** Andrea Saccardi at Observatoire de Paris <andrea.saccardi@obspm.fr>

9+ hr

$z = 6.782$





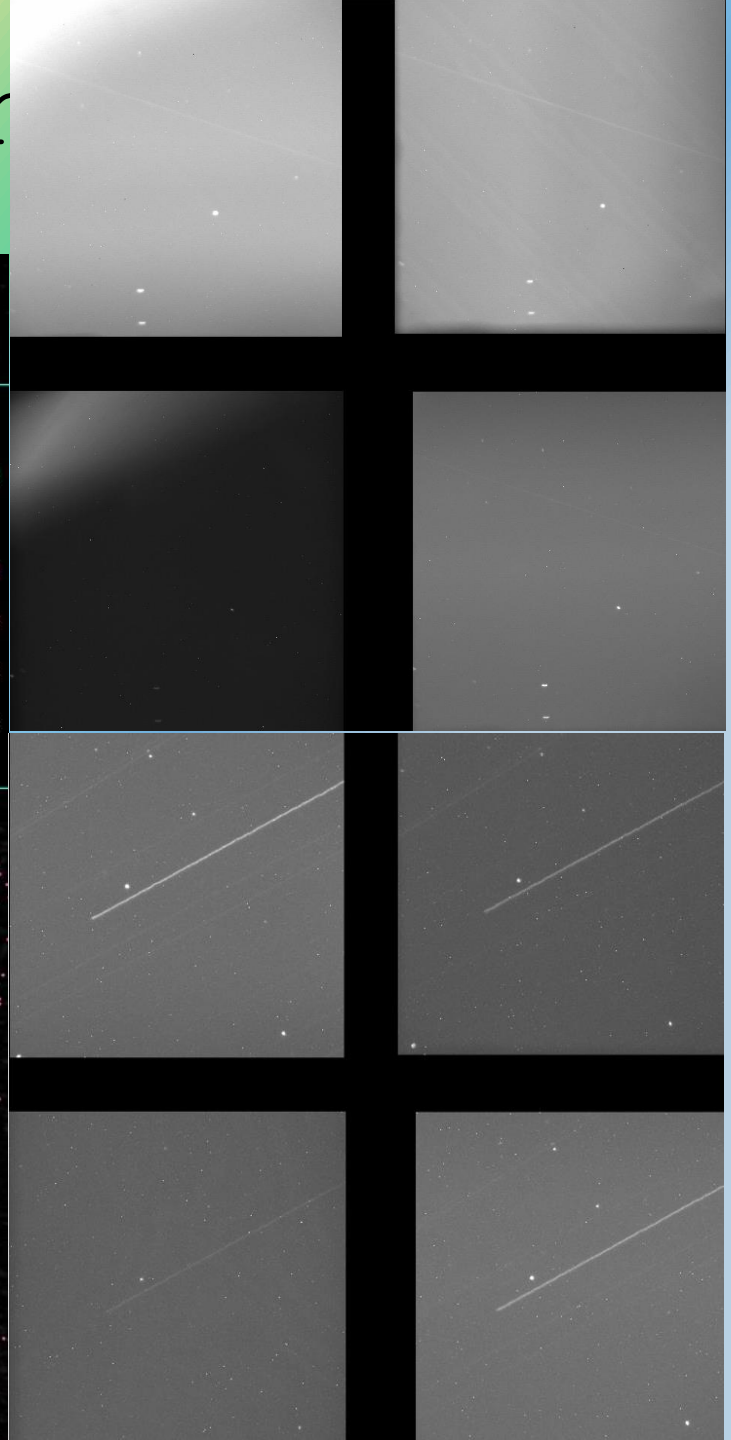
those bright **trails** in the  
sky

WAYFINDER



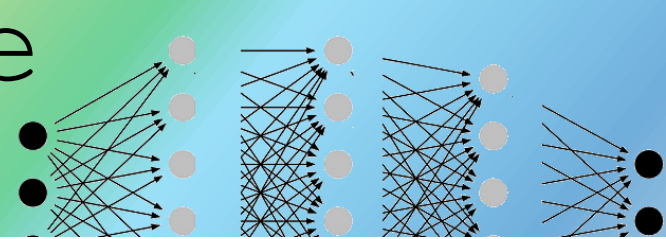
> LEGEND

- Active Satellite (9586)
- Inactive Satellite (2937)
- Uncategorized (9193)
- Rocket Body (2082)
- Debris (10318)



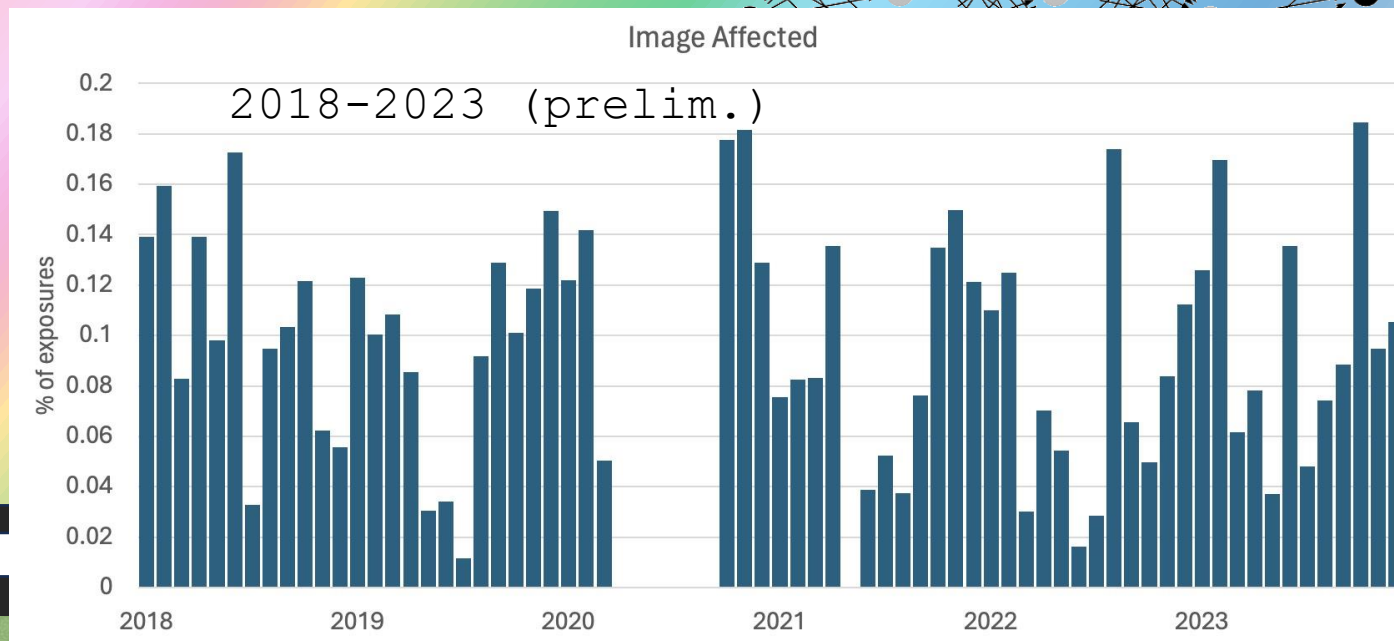


those bright **trails** in the sky...

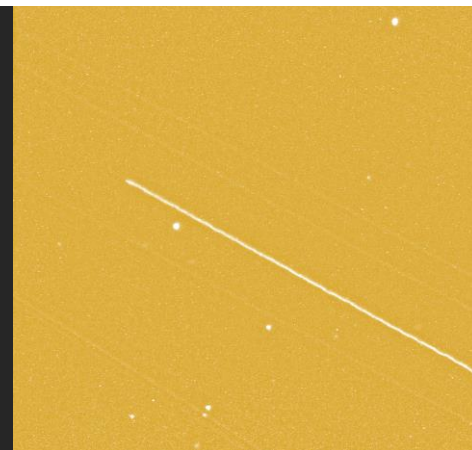
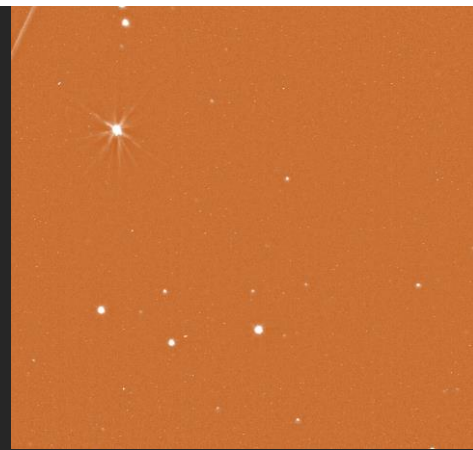
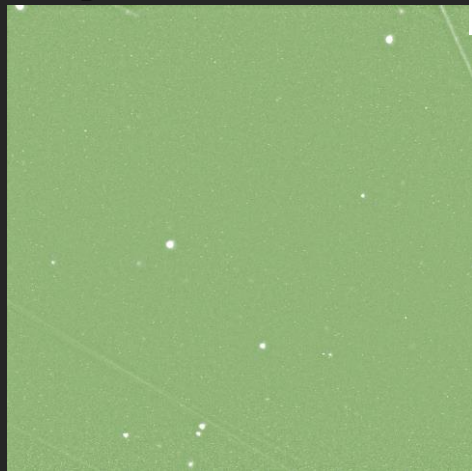
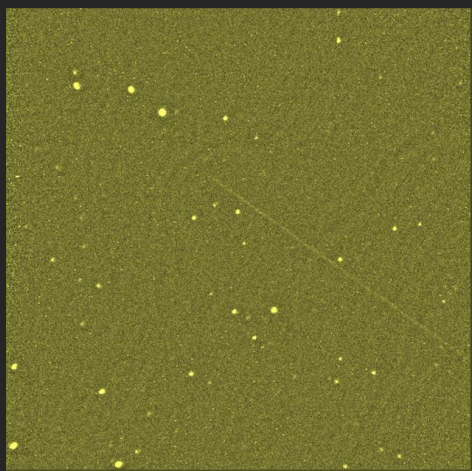


L. Rosseti thesis work

Neural Network (ResNet), input:  
FITS frame (cleaned), output  
Y/N  
goal: whole REM archive (20  
yrs)



NEXT: GalHassinGRT? Tijarafe  
LP?



TRAILS ON

[STARTREMOB]

[TARGET]

TargetCategory: Star

TargetName: GSAT0104

RA: 298.72950

DEC: -57.75270

Equinox: 2000.0

[ROSS]

OptFlag: 1

Exptime: 10

OptFocus: 0

OptNInt: 2

[REMIR]

IRFlag: 1

DIT: 5

IRFilter: H\_IRCam

# number of exposure DITx5 long

IRNInt: 15

[PI]

PIName: EmilioMolinari

PIInst: REM/INAF

PIEmail: [emilio.molinari@inaf.it](mailto:emilio.molinari@inaf.it)

[DATA]

PropId: 5

PassWd: REMObsPwd

MinJD: 0

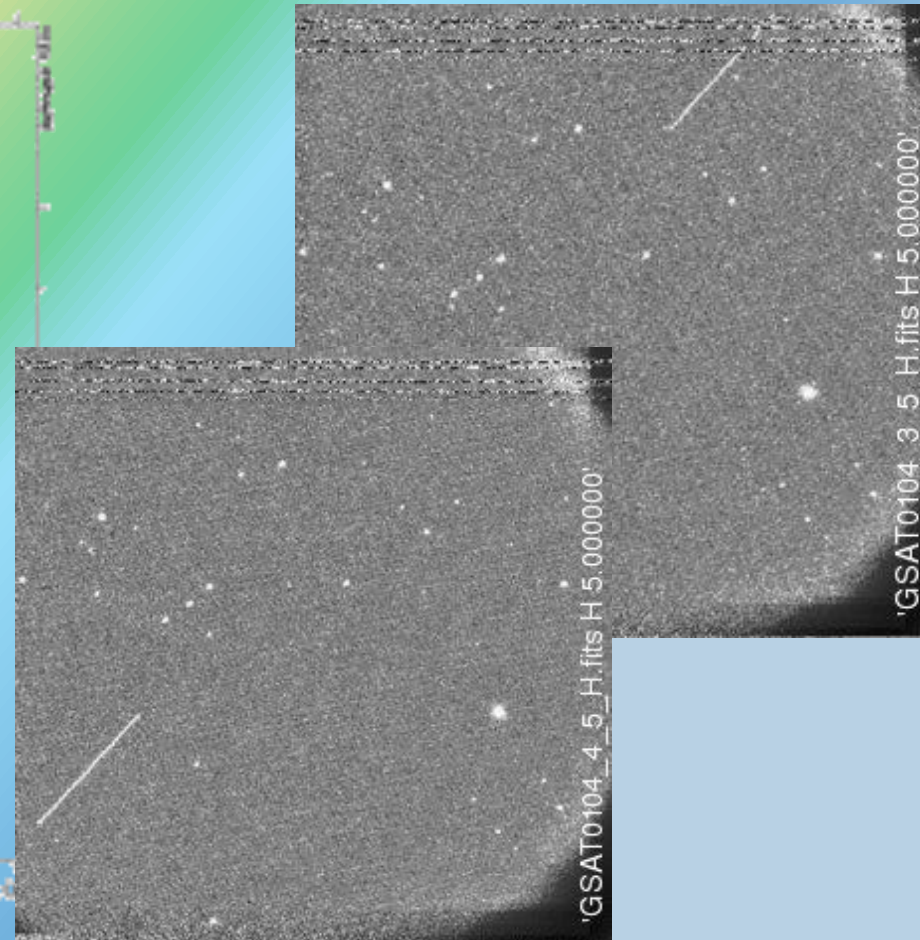
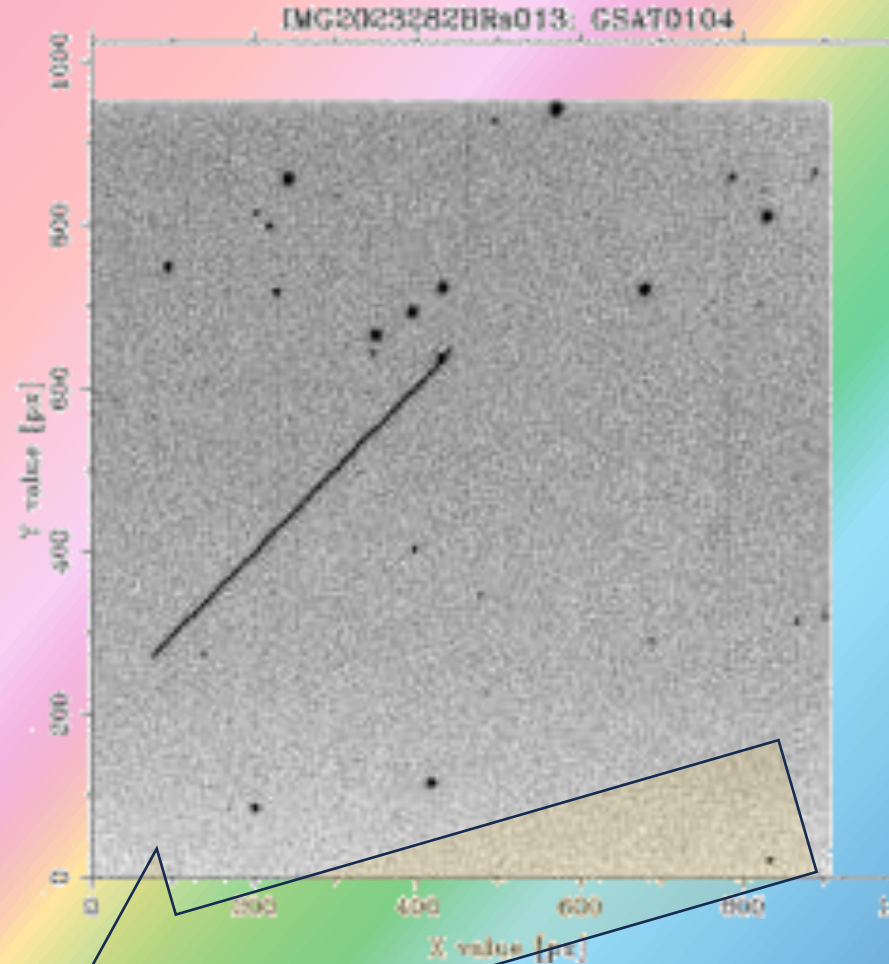
MaxJD: 0

StrictJD: 2460230.53125

# <https://sats.oas.inaf.it/>

Priority: 0

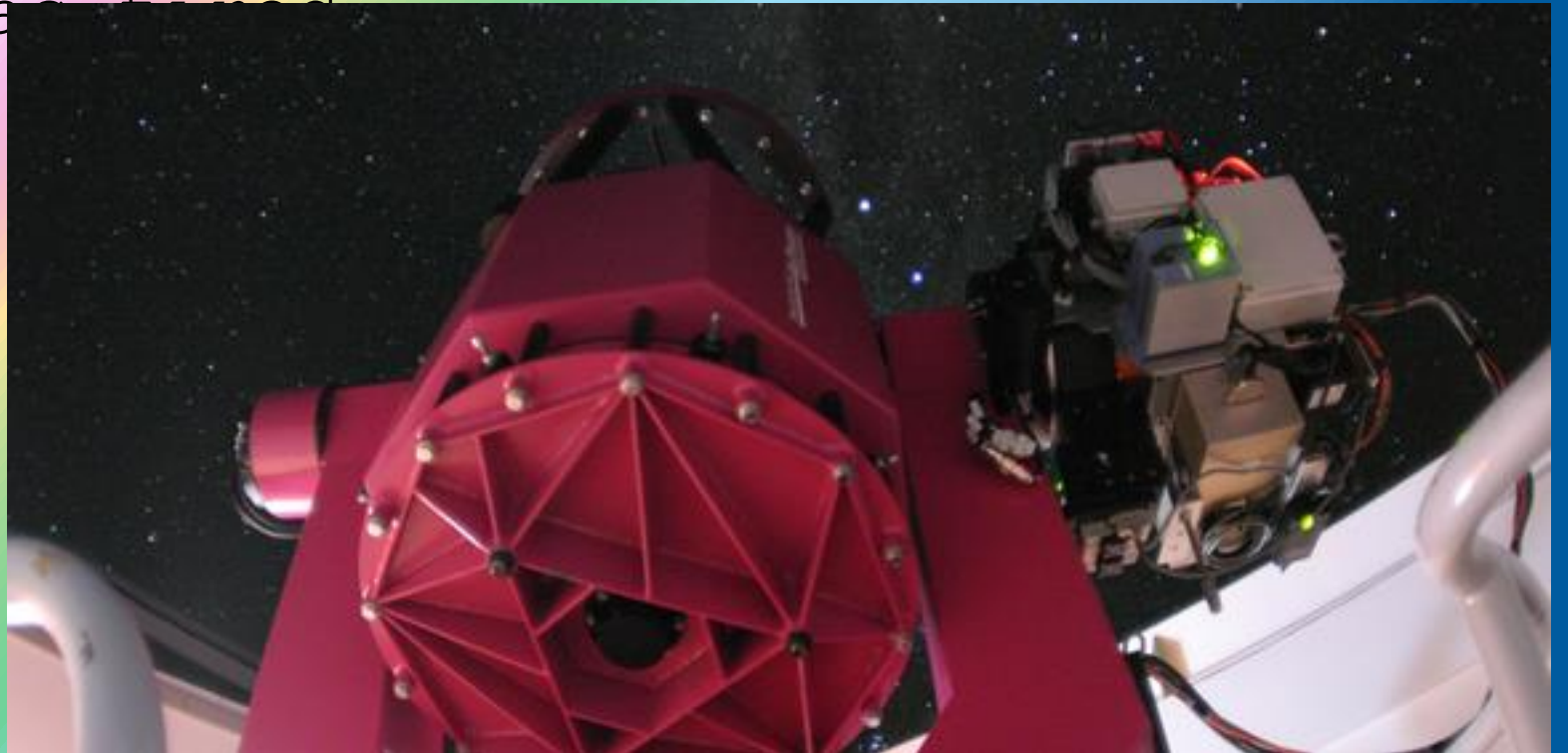
point and.. click





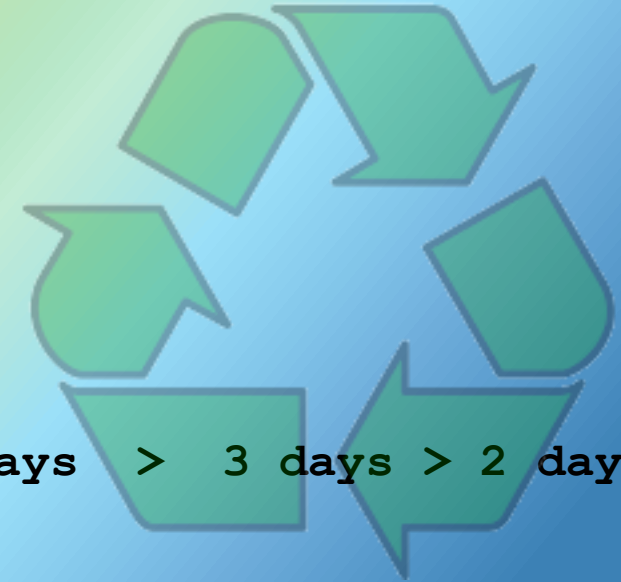
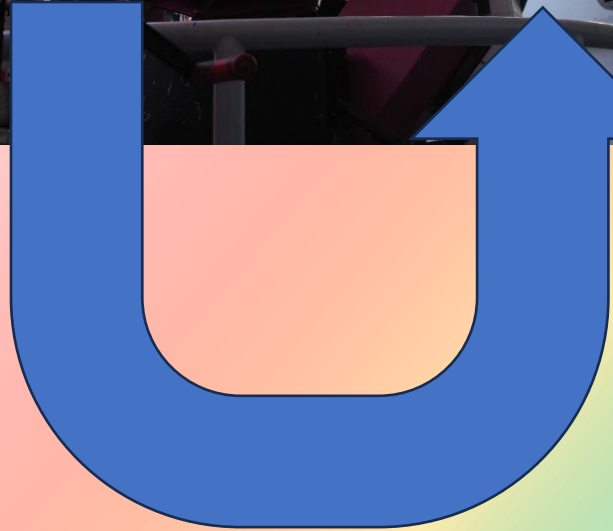
# back to the future !

- at the **beginning** there was a Stirling cryocooler.
- the derotator was ~~broken~~
- nice photos !
- it did not last

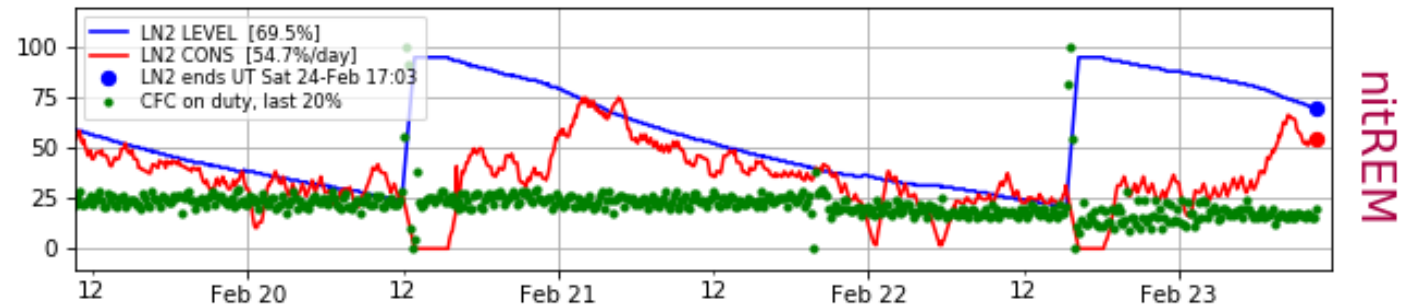




then came **JJL** with his **CFC**



every 4 days > 3 days > 2 days  
now...

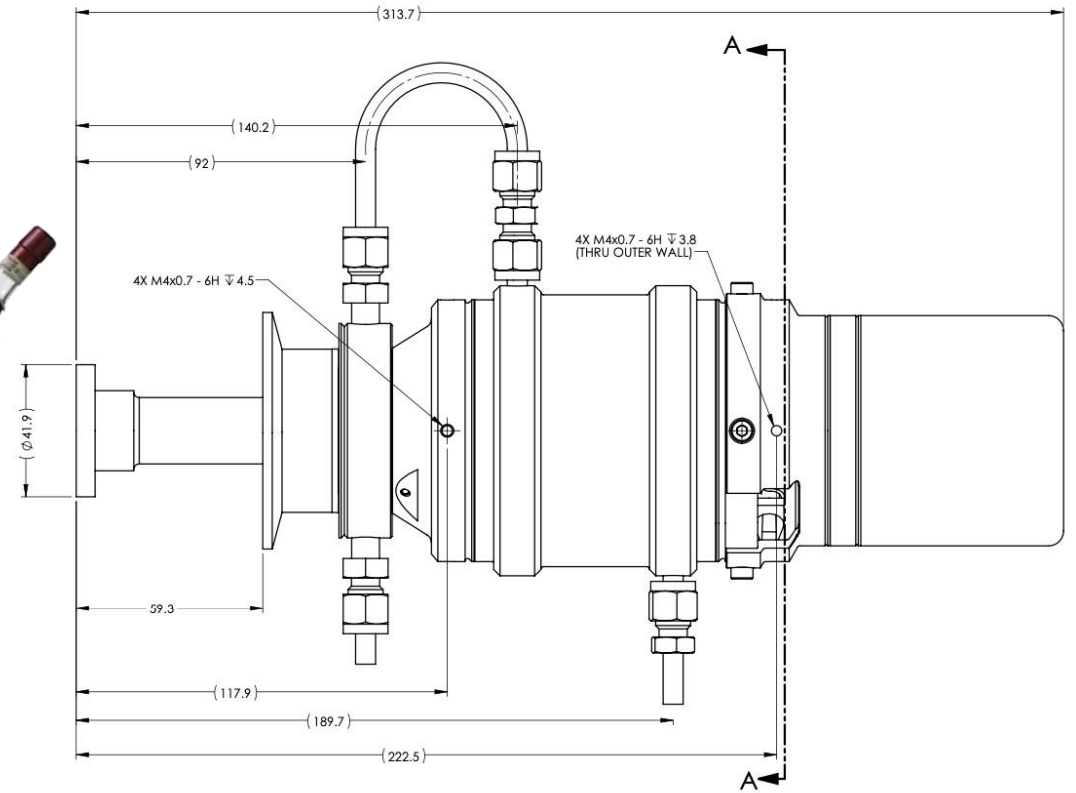


thanks to [www.rem.inaf.it](http://www.rem.inaf.it) ->

and now we experiment again  
(cool !)

# CryoTel<sup>®</sup> GT

Cryocooler & Gen II  
Controller

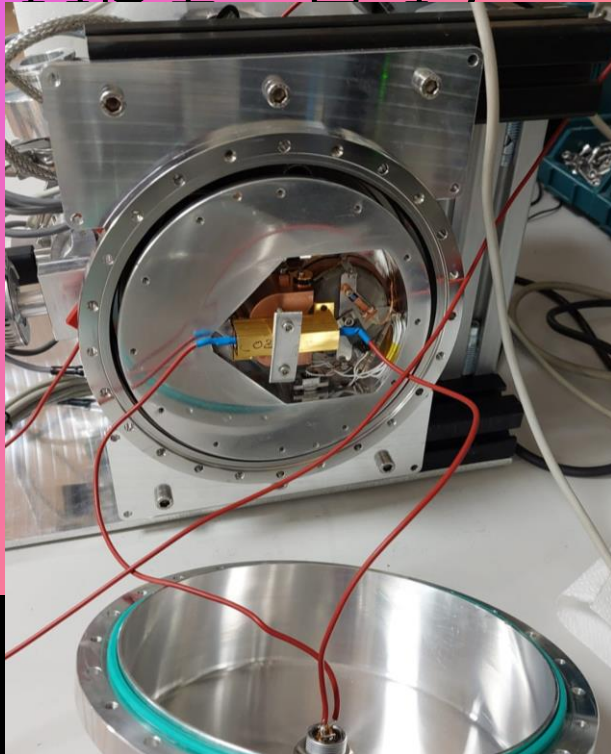


together  
with

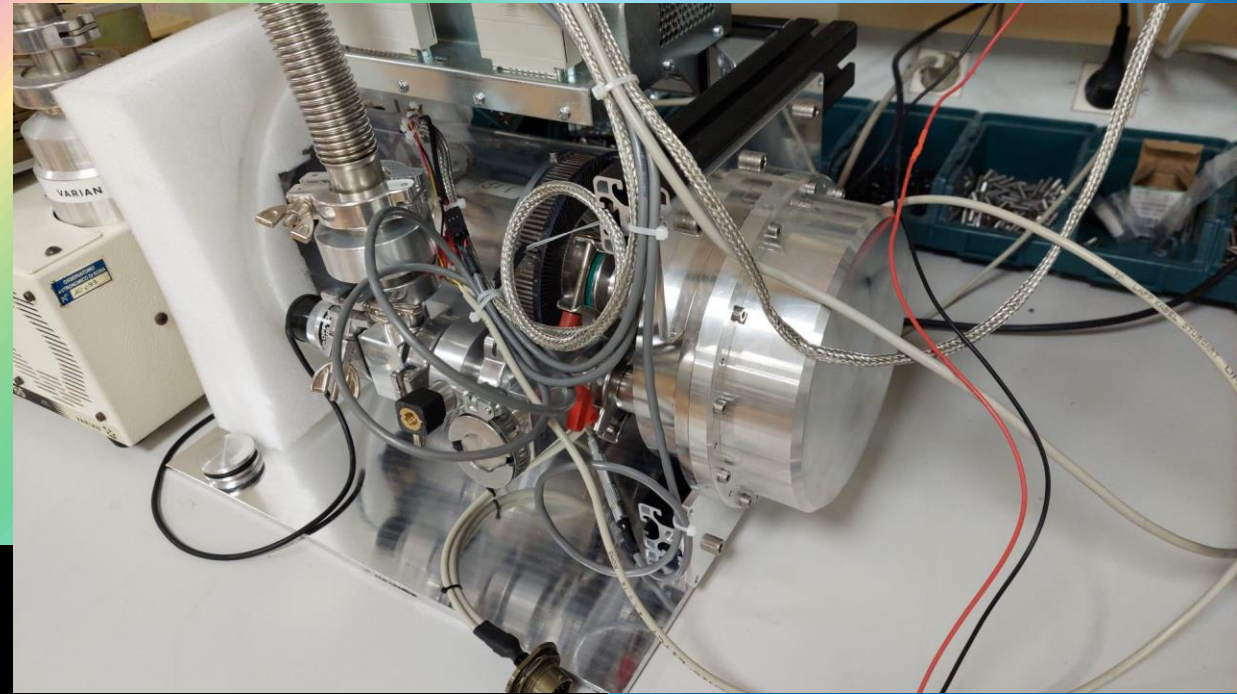




we are almost there (end  
Apr'24)



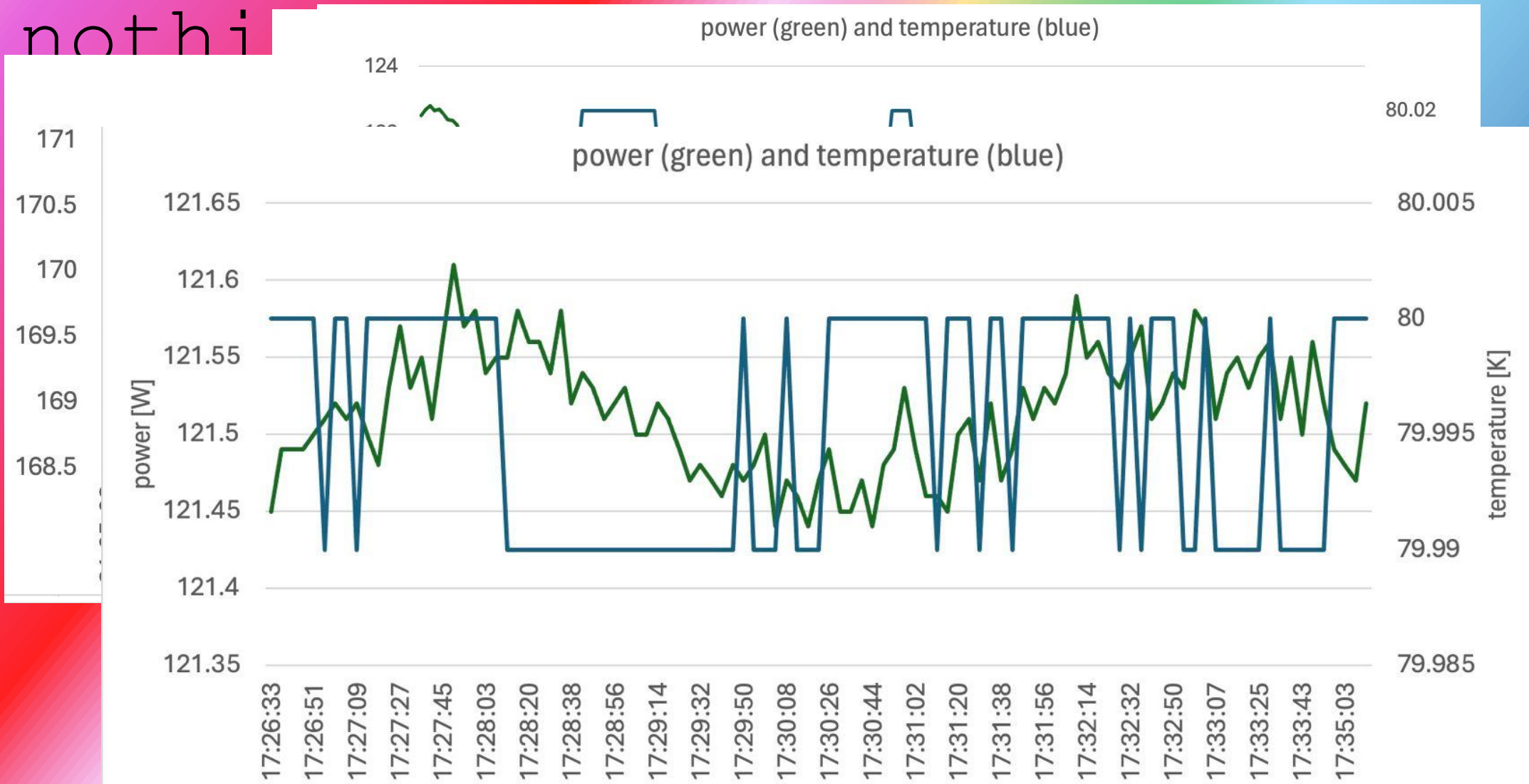
INAF-OA Roma ->



```
try:
    s = Serial(theport, baudrate=9600, bytesize=8, parity='N', stopbits=1,
timeout=1)
except:
    print(theport," not reachable\n")
    sys.exit("ITISCRY: could not connect.")

s.write ("STATUS\r") # read set point
```

power without **control** is  
nothing

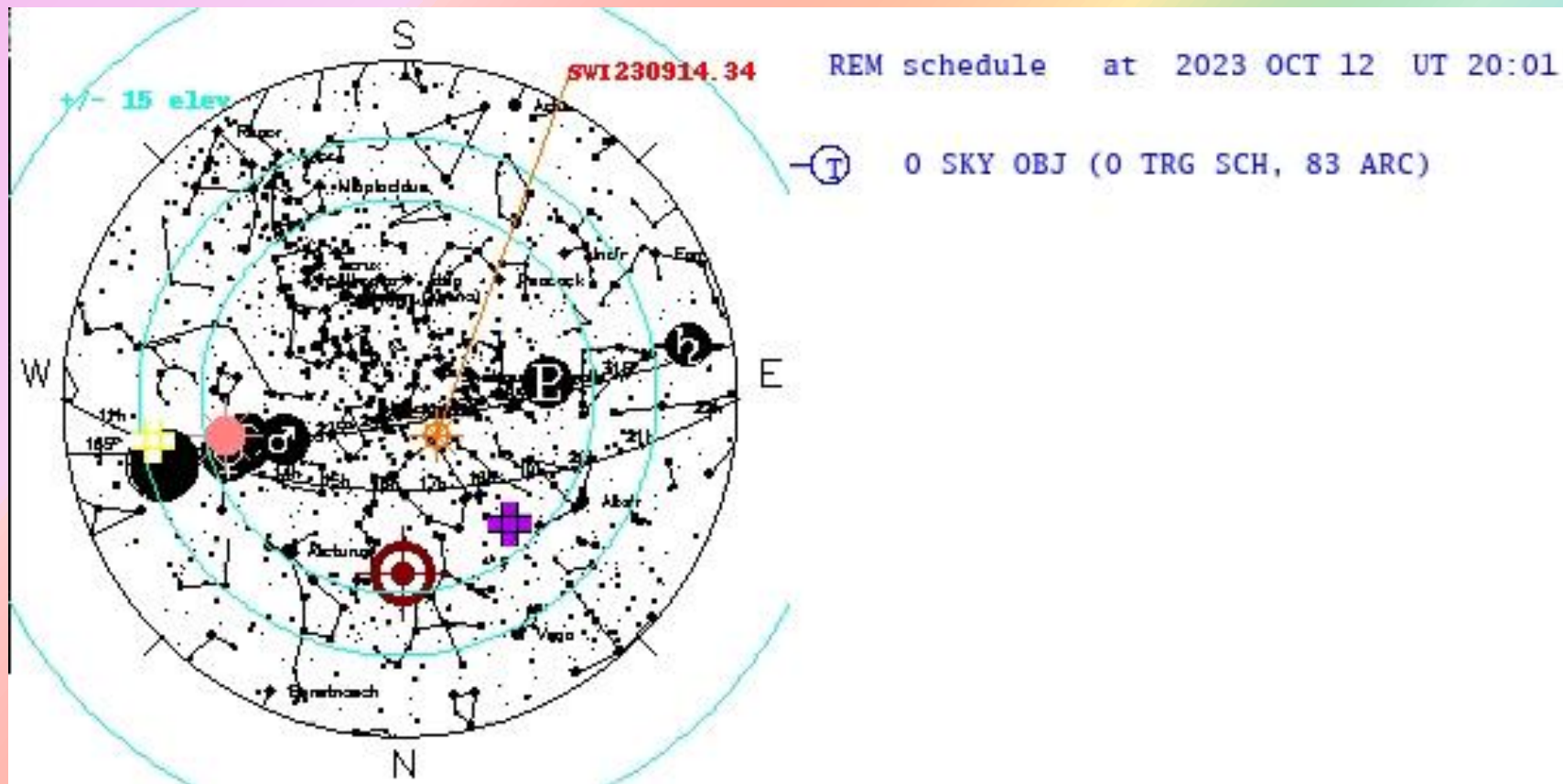




we keep having **fun** 😊



more info? **visit**  
[www.rem.inaf.it](http://www.rem.inaf.it)  
(or just **ask**)



quasi real time  
monitoring of  
REM health  
status and  
operations

the **tREMometer**



Chiant'you !



REM

[www.rem.inaf.it](http://www.rem.inaf.it)