

Multi-frequency Observations Using REM at la Silla

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On behalf of the REM/ROSS team



AGILE WorkShop, February 3, 2005



A fast moving telescope ...

- **Alt-az 60 cm f/8 RC silver-coated**
- **2 Nasmyth foci (one idle)**
- **60 deg 5 sec – to any α, δ in 60 sec**

REM



REM

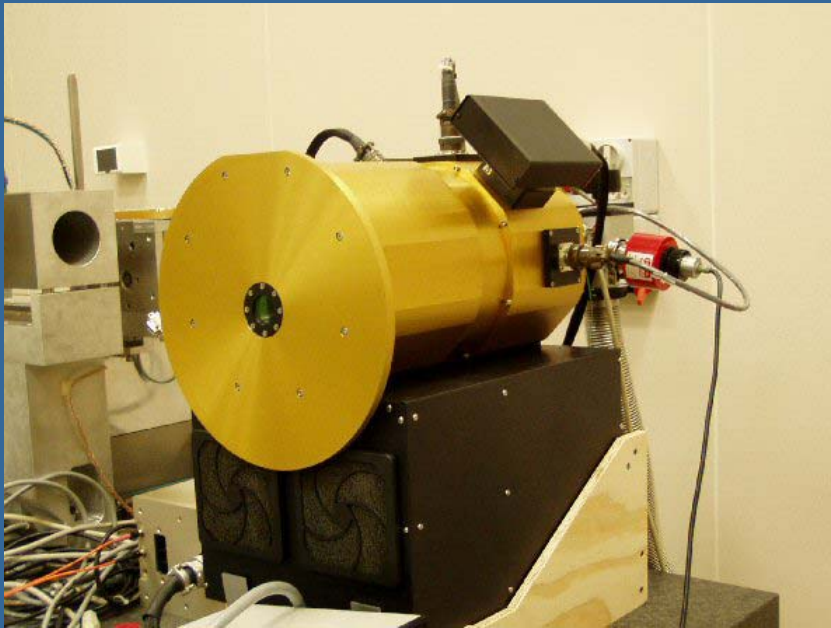
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REM

... with a high throughput NIR Camera...

- **10x10 am² FoV**
- **1.2 as pixel scale (diff.limited)**
- **0.9-2.3 microns (Z',J,H,Ks)**
- **512x512 HgCdTe chip @77 Kelvin**
- **Wobbling plate for dithering**



REM

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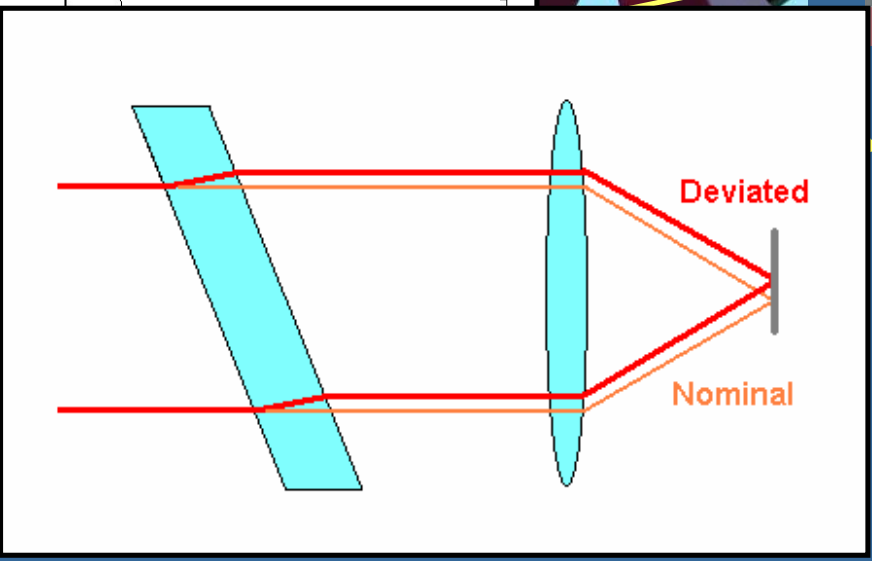
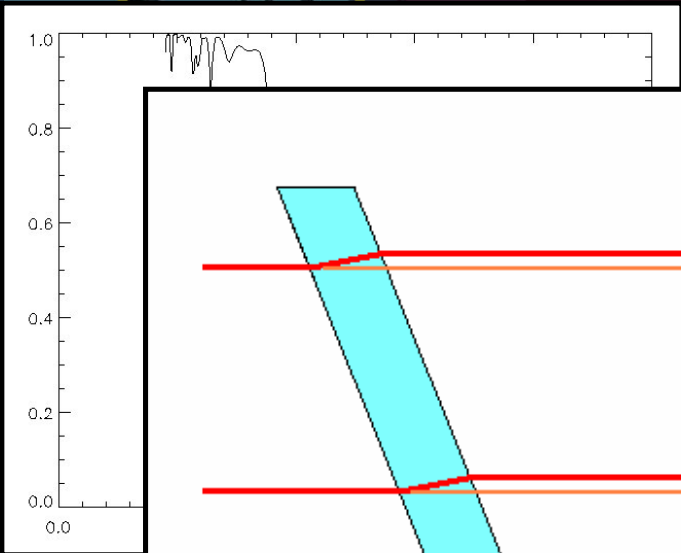
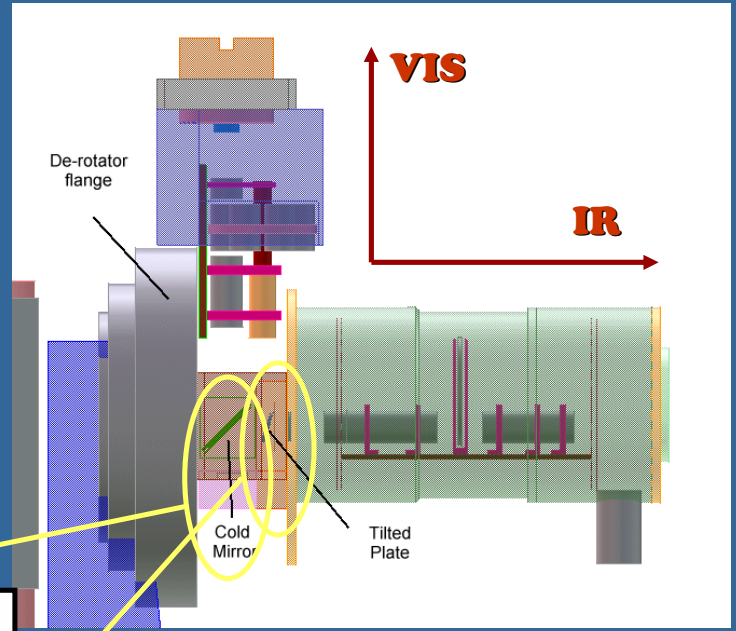
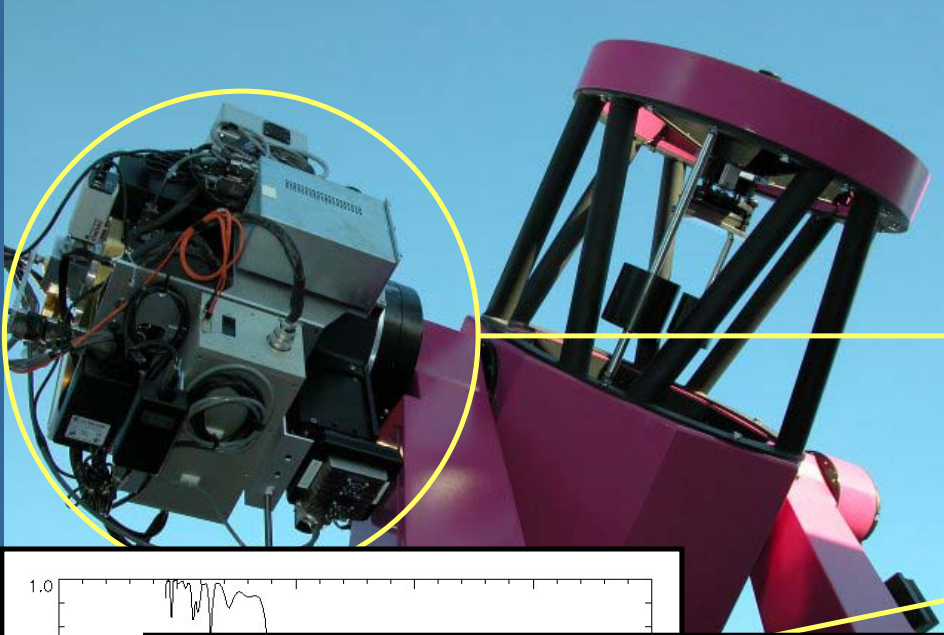


REM



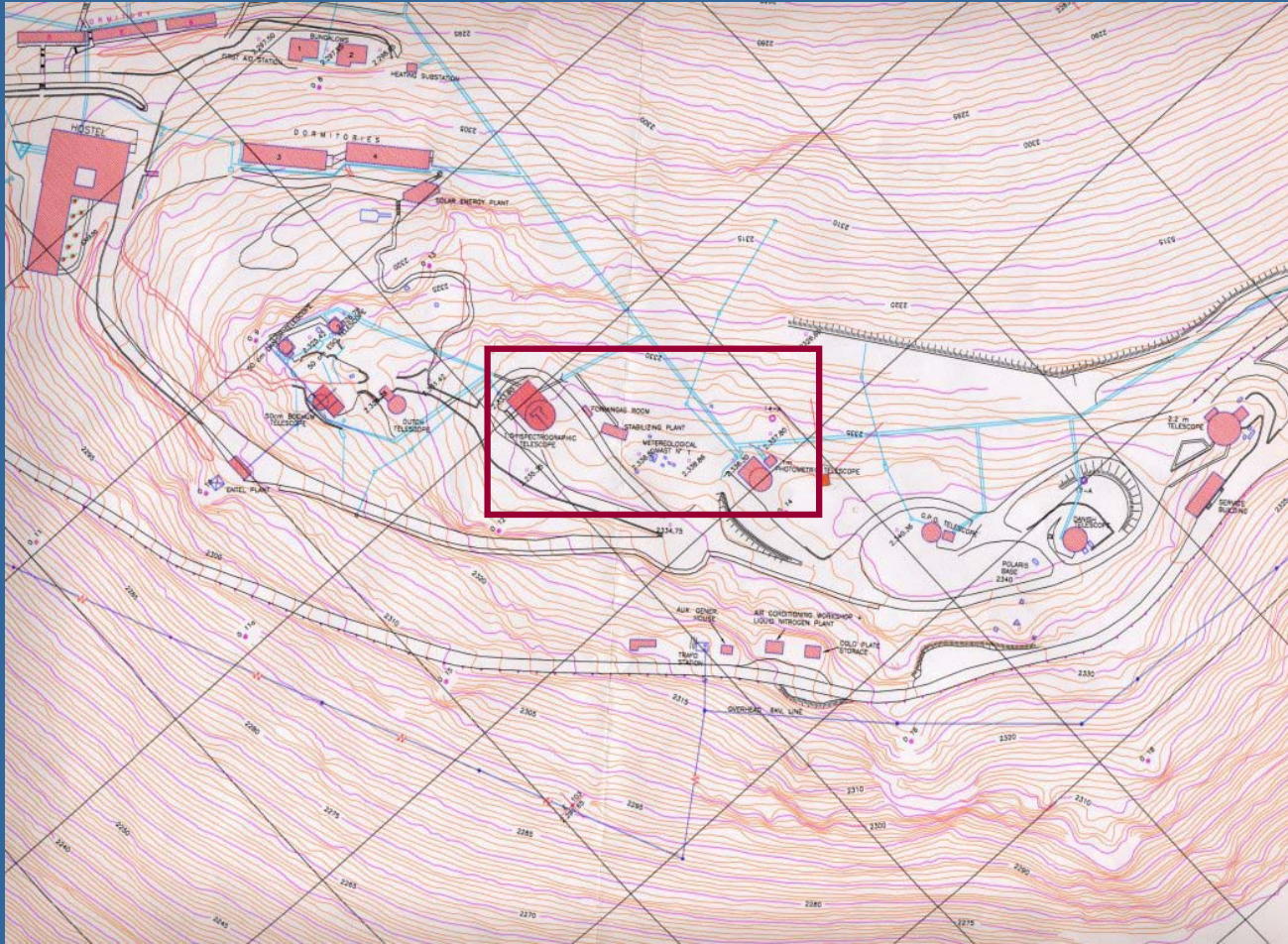
... and a Visible Imaging-Spectrograph

- **10x10 am² FoV**
- **0.55 arc as pixel scale**
- **30 bins between 0.45-0.9 μm (Amici Prism)**
- **1024x1024 Marconi CCD in Apogee head**

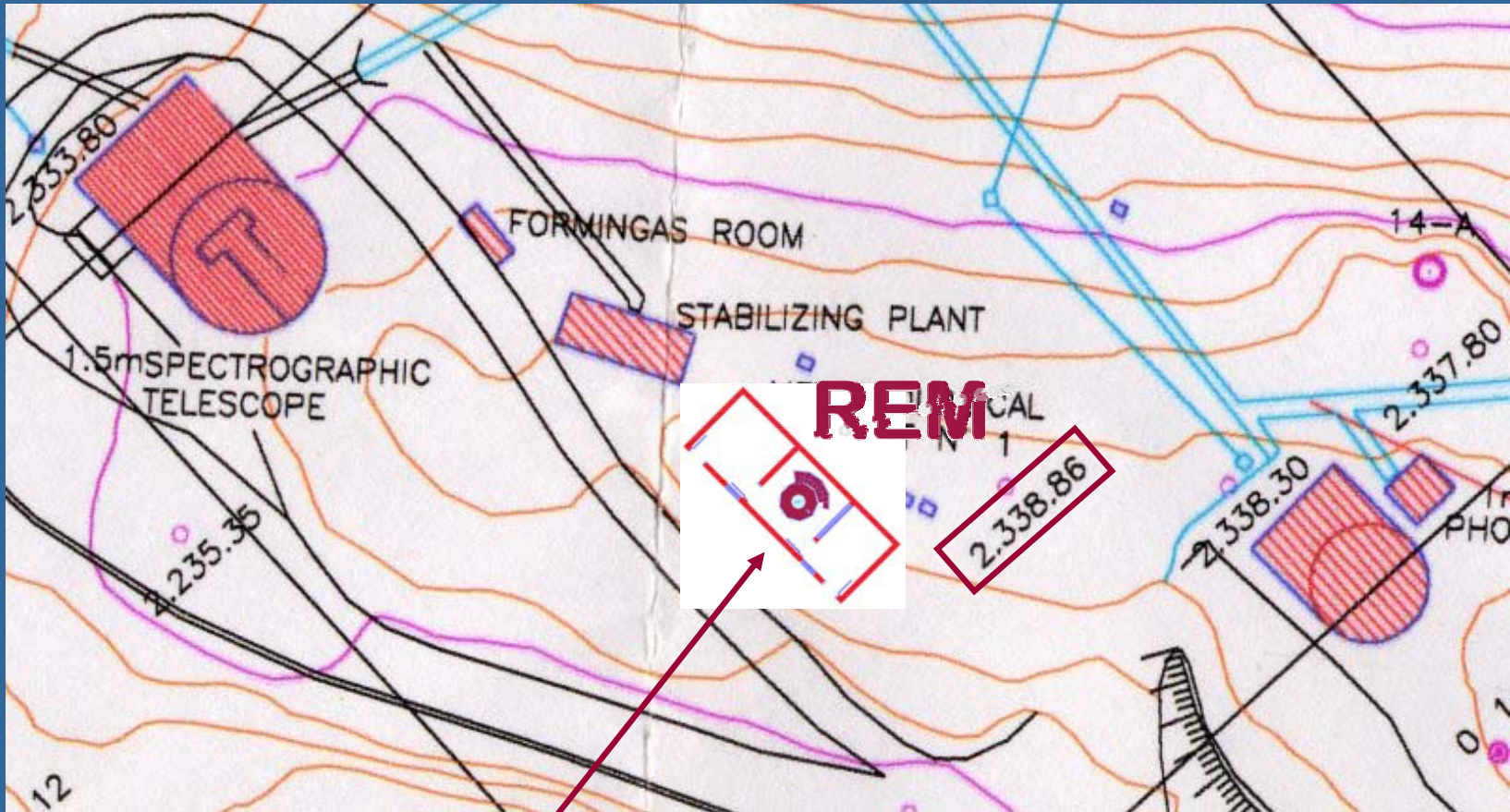


The Instrument Flange

Nôtre Dome de la Silla



Nôtre Dome de la Silla



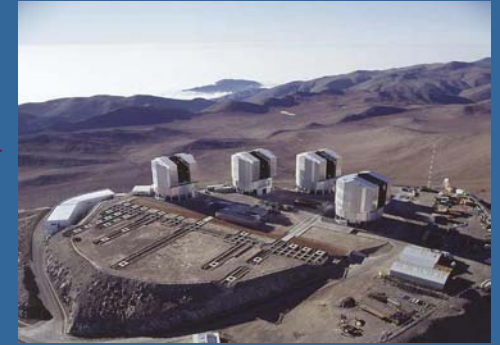
UTM (Zone 19) E 331,235 N 6,762,735

Nôtre Dome de la Silla



What is REM for ?

REM is conceived as a link between **transient phenomena** detected at high energy from space **AND** Large ground-based facilities on the ground → Gamma Ray Bursts



Such a link is needed for:

- **Transient Coordinate determination**

High Energy detections have large error-boxes

- **Pre-screen of transient characteristics**

Cases selection for further observations

In both Cases crucial are:

- a) **Coverage up to NIR**

- b) **Fast response**



What SWIFT gives us is

- **Position of the GRB - [15 sec] (4 am)**
- **Position of the XT [20-70 sec] (5 as)**
- **Position of the OT [100-300 sec] (1as) (if there)**
- **Color Information 0.15-0.65 μm [600 sec]**

What SWIFT does not give us

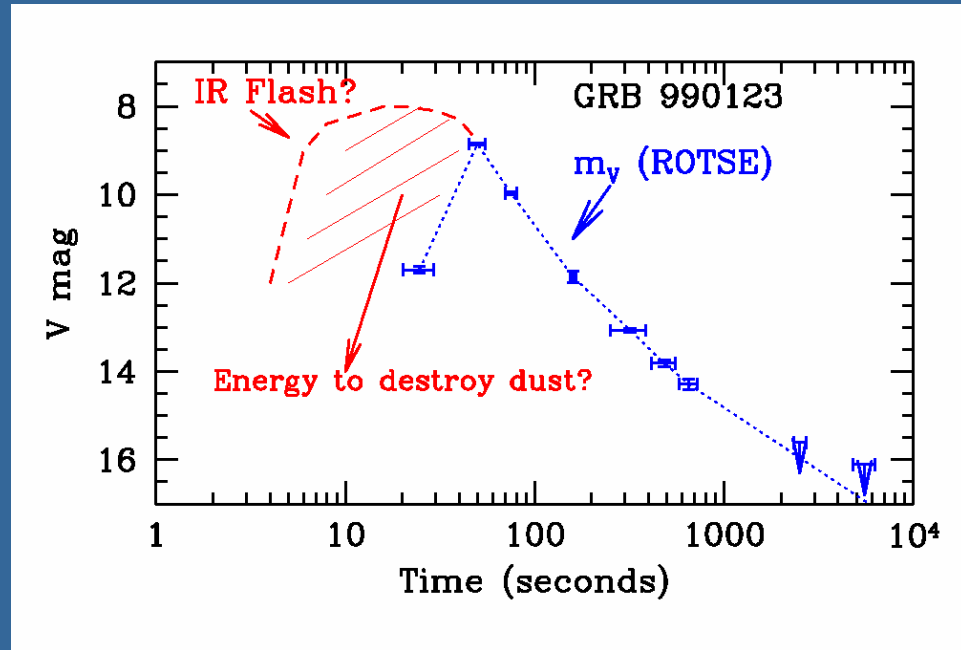
- **Position of the Red-T (above 0.65 μm) and NIR-T**

>150 trigger per year !

50% of the known GRB do not show an Optical AG.

It could be dust or it could be Ly- α if the GRB is high-z

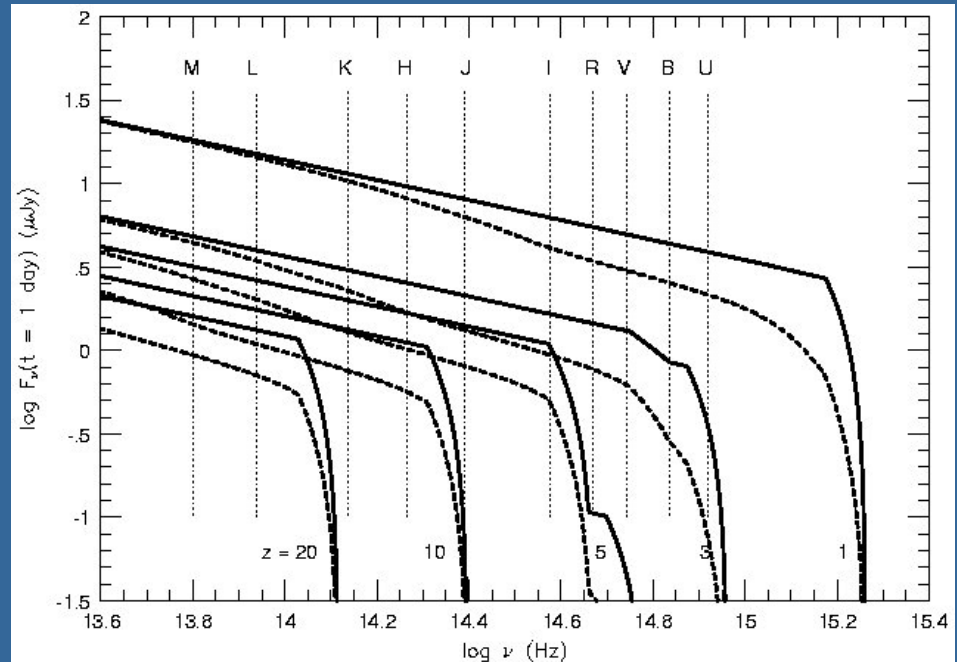
- **IF dust, K is much less absorbed: more chance to get α, δ AND have info on dust via Col/Col diagrams**
- **Dust should be destroyed by burst. IR photons penetrate while Higher energy photons do the job**



50% of the known GRB do not show an Optical AG.

It could be dust or it could be Ly- α if the GRB is high-z

**• IF Ly- α , we get α, δ
when still bright enough
to send trigger to large
T-scopes to collect
a spectrum at $z=14$!!**



ROSS acquires 30 simultaneous calibrated data points between 0.45 and 0.9 microns

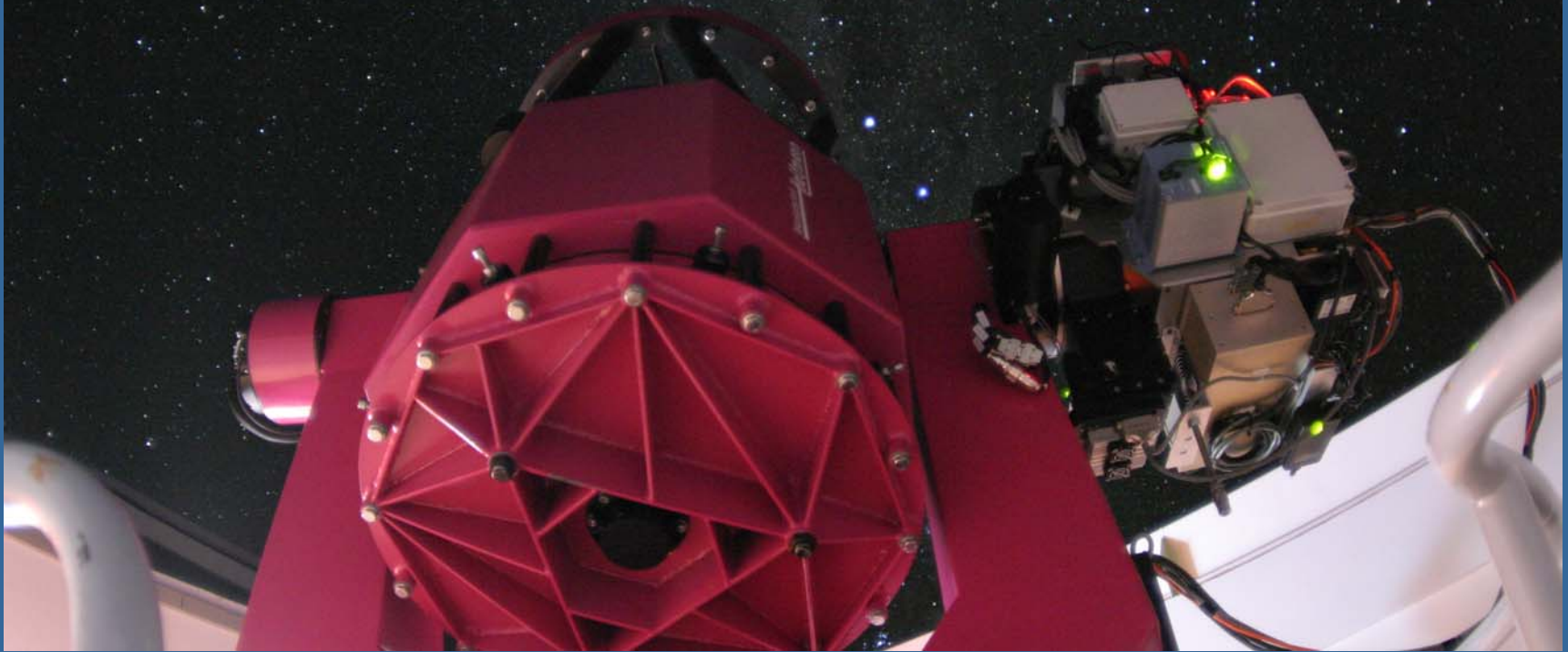
This allows to:

- **Correlate the time of the optical peaks with the distribution of Lorentz Factors in the original cataclysm.**
- **Detect the possible time dependent obscuration of optical transients associated with GRBs.**
- **Possibly detect the peak energy that goes from gamma to optical within few hours.**

Provide sub-as OT position in tens of seconds

Provide sub-as IR-T position in tens of seconds

Provide OT LR Slitless spectra in tens of seconds



Limits...

Band	lim mag(3σ)	lim mag(5σ)
J	15.5	15.0
H	15.4	14.9
Ks	14.1	13.5

**5 dithered images of 1 sec each
January, 16, 2005**



ROSS/photom.

Band	lim mag(3σ)
V	17.0
R	17.0
I	16.5

ROSS/Amici

V=14 5σ 1 sec exposure

1 sec exposures



Any possible optimization of the Space-borne trigger source will let free REM observing time

INTEGRAL-AGILE few bursts

SWIFT-HETE II more bursts but
latitude/longitude constraints

- **Housekeeping and calibration**
- **Other Observing programs**

Anywhere Rapid multi-frequency observations are needed

- 1. Multifrequency monitoring of AGNs**
- 2. Black Hole Candidates –X-ray Novae**
- 3. Flare Stars**

Other Programs Proposed by The community



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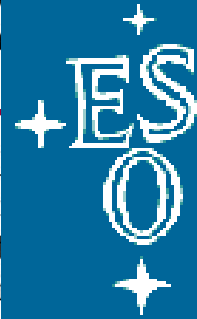




Intellectual property rules

DOC: REM-A_DOC_PO_2000_2.0_0002

Date: 25/05/2001 Rev 2.0



3.4 Secondary “individual projects “ results

A minor amount of telescope *idle time* will be dedicated to “individual projects” initiated by members of the REM team or other astronomers in the community. A call for proposal will be issued and a number of referees selected in the REM-ST will judge the proposal and allocate the time.

The Intellectual property of the data belongs to the whole REM-Team but the access to the data will be reserved to the proponent team until publication. The proponent team have the responsibility to analyze the data and publish the results in a correct and timely manner. After publication the data will be added to the REM data base of general astronomical data. The use of the REM data base is regulated as described in section 3.5 below.

As described in *Annex A*, the Consortium is fully responsible for the use and handling of idle time data and results. Such responsibility includes receiving proposals for the use of such idle time from the ESO community.

- **Key-Programs require agreement with ST**

- **Individual Programs needs only to be proposed**

Chiara Raiteri – OATo – MW of Blazars



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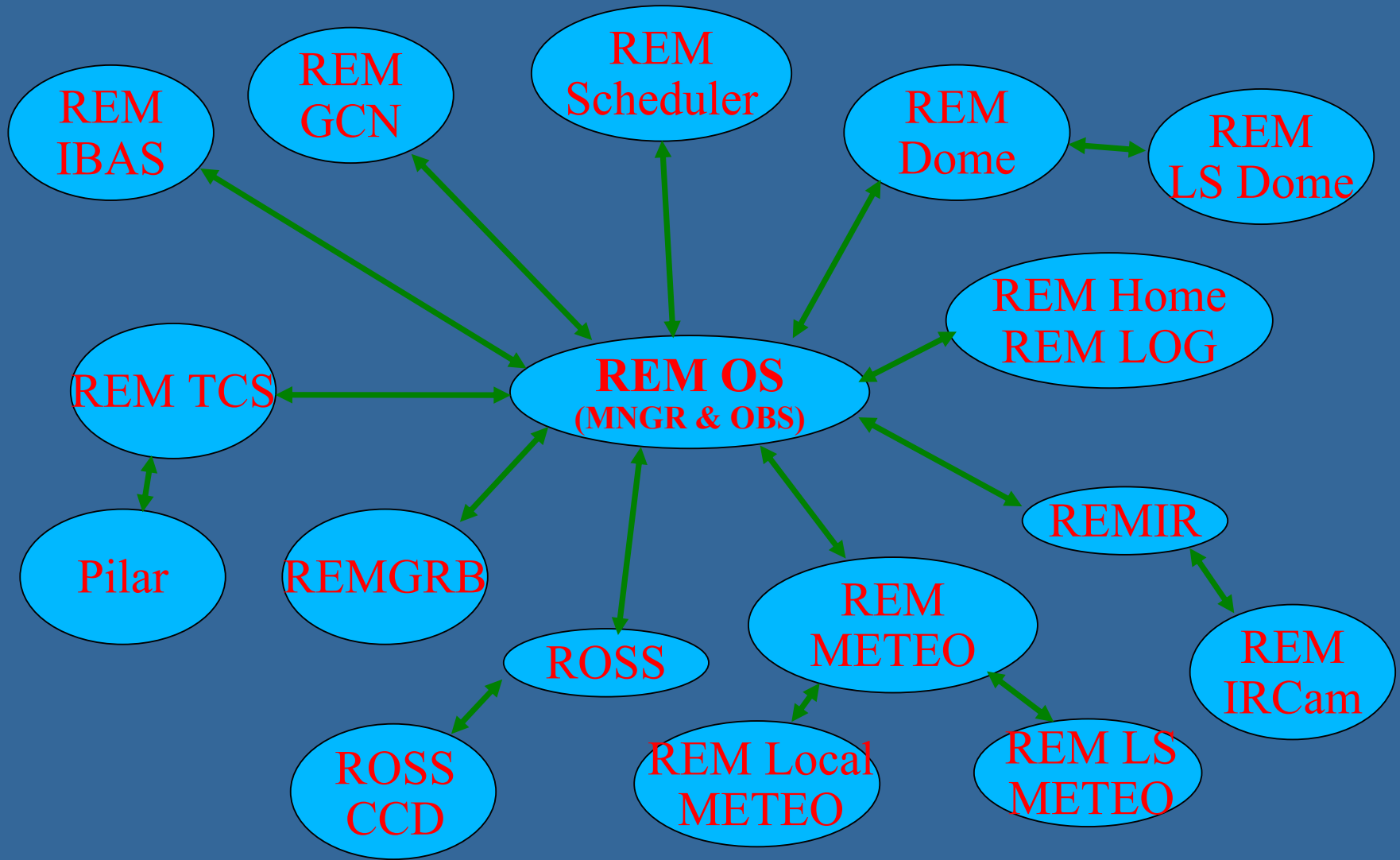


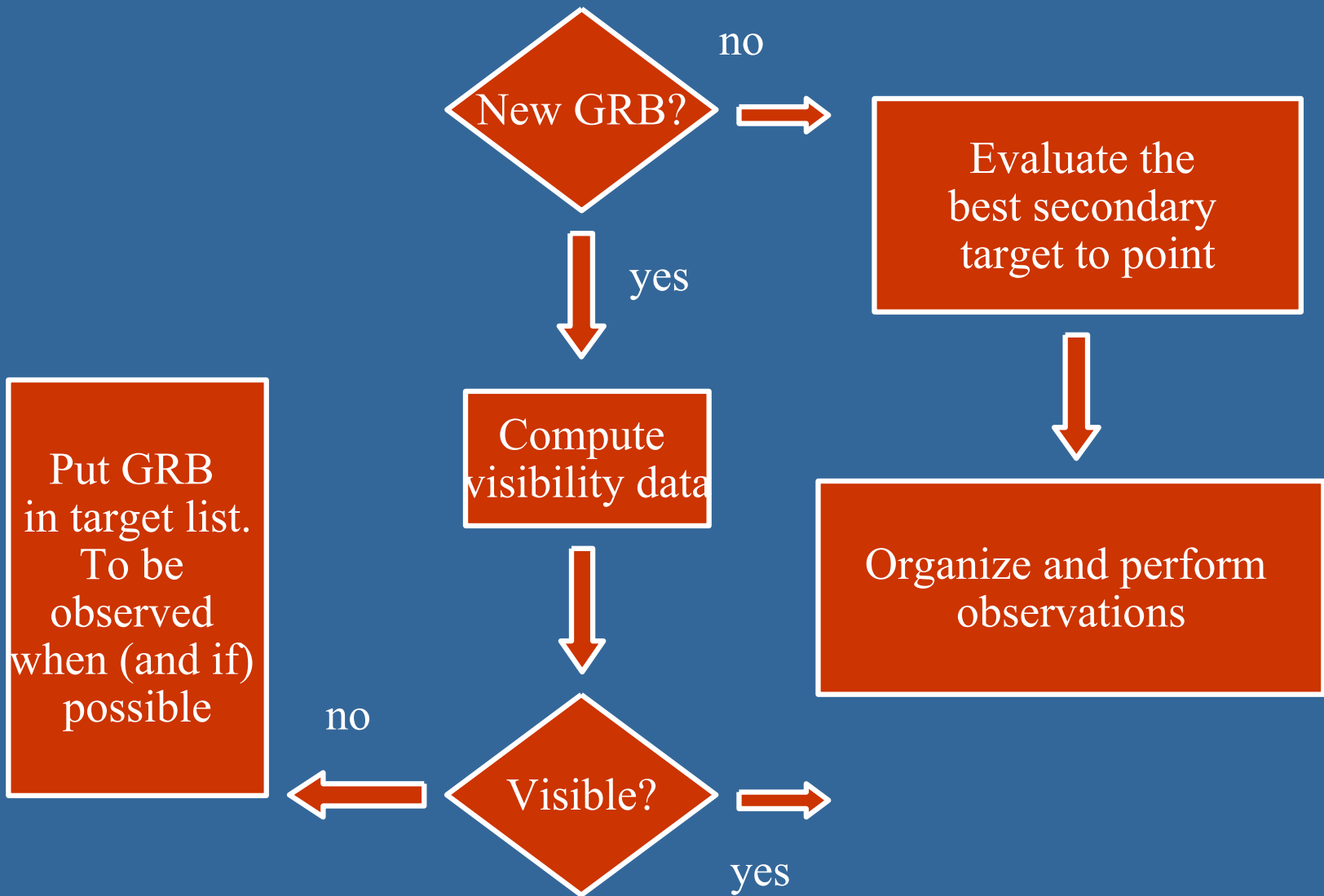


REM

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REMOS:

- Target acquisition
- Start observation

5-10 s up.tr.rec.

One Raw Image every 1.5 s

PREPROCESS:

Sky and Bias Subtraction
flat fielding and dithering reconstruction

5 images processed in 3.7 s

One Cleaned Image every 7.5 s

Quick-Look Scientific pipeline

- Transient detection (SEXtractor) [.2 s]
- Coordinates determination [2 s]
- Photometry (Z'JHK) (any object in the frame above a S/N threshold) [6 s]

Coordinates

Web >15 s



RRM

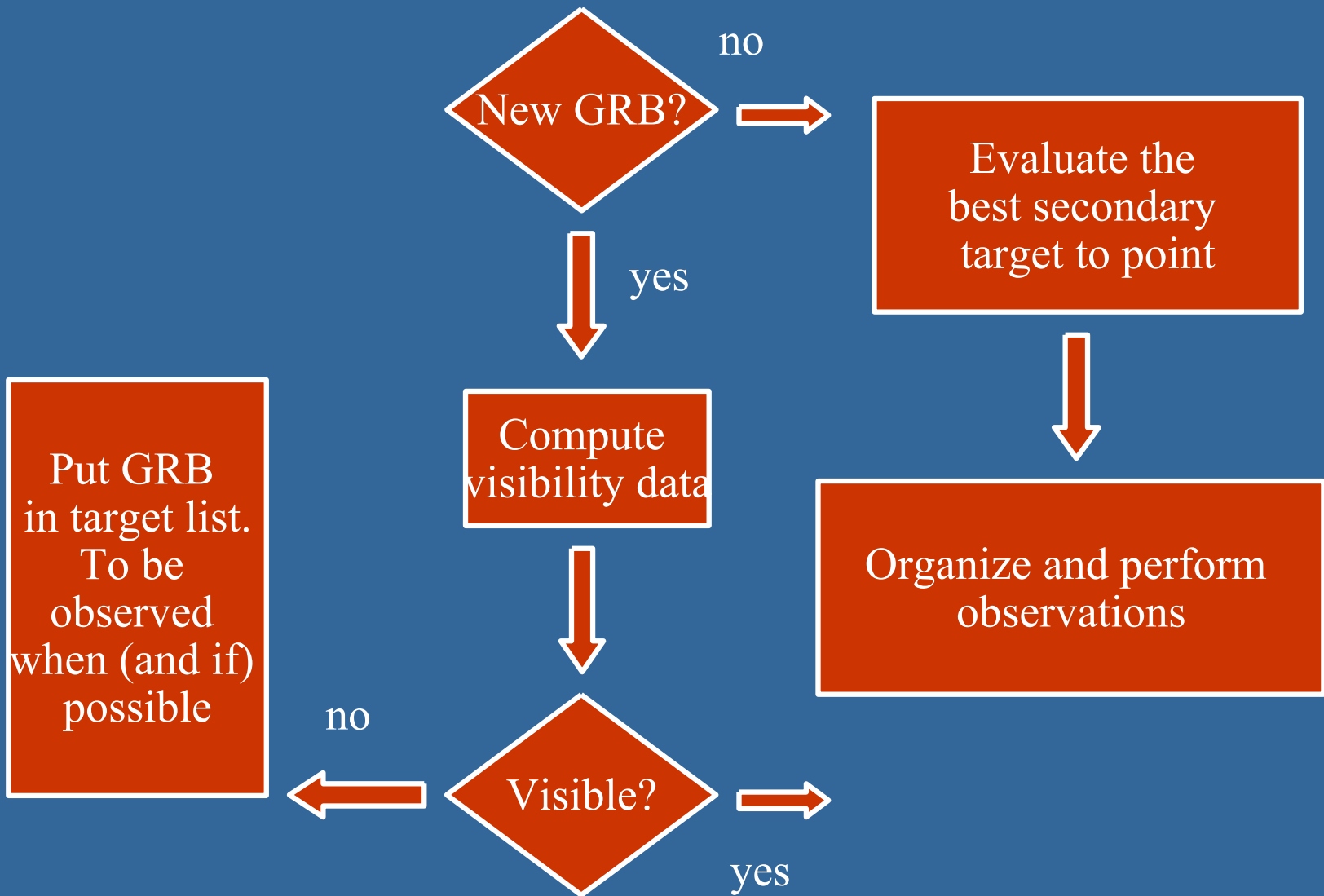
UVOT

ROSS

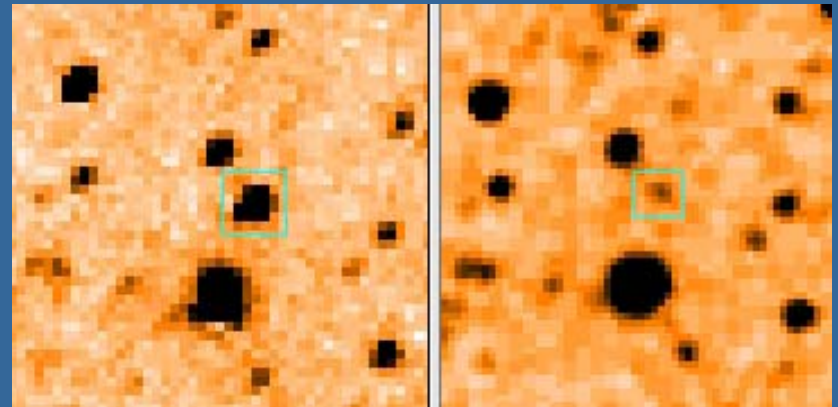
Tarot-S

DECISION routine

Redshift



GX339-4 :
a BH candidate

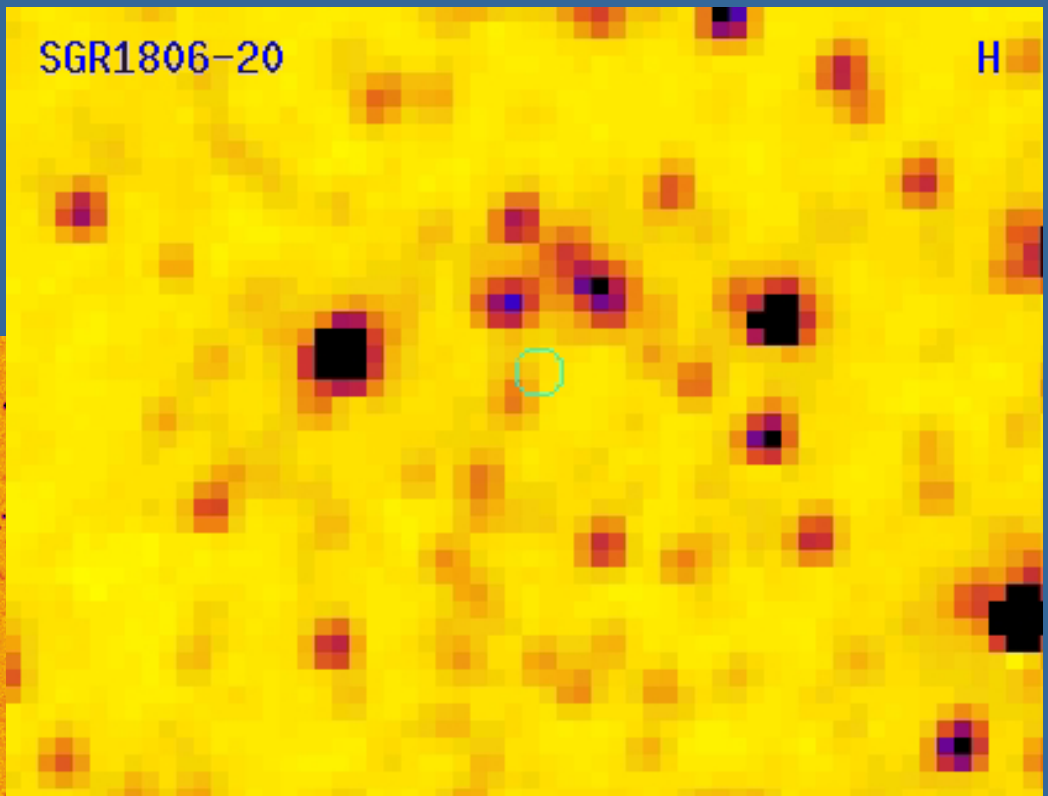


**The bright status discovered
by comparison with the
2mass catalogue**

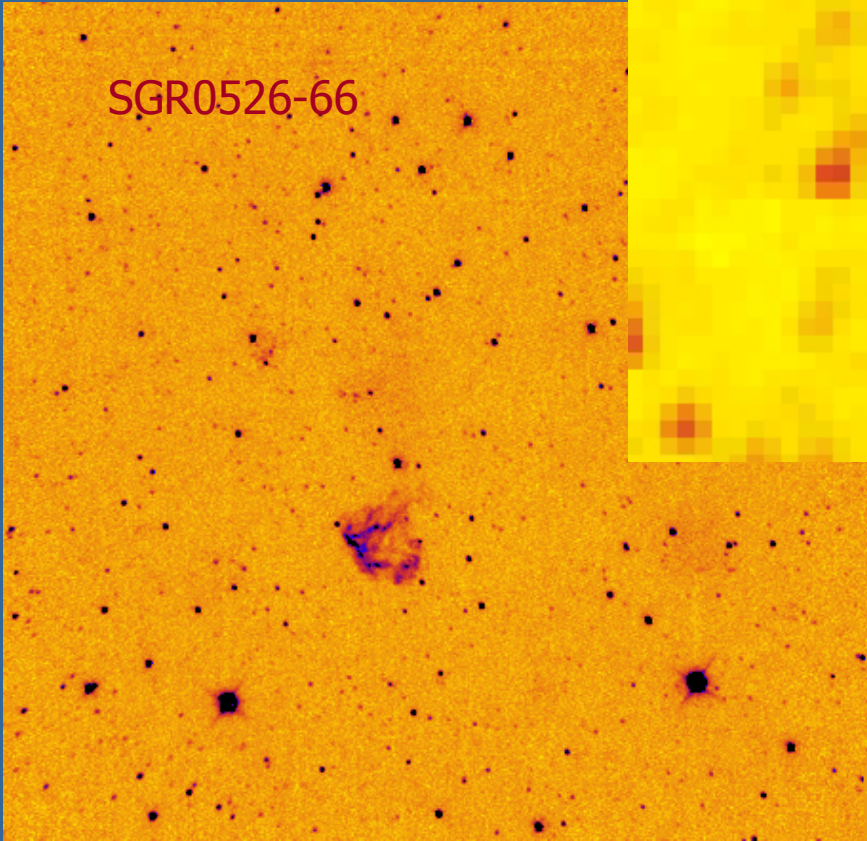
Some SGRs...

SGR1806-20

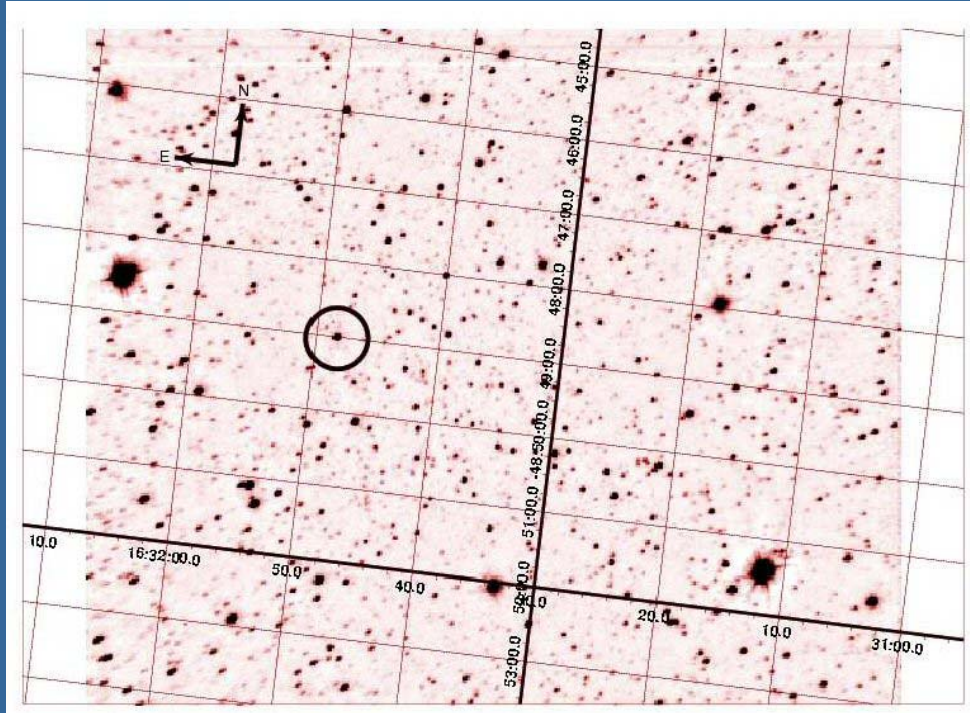
H



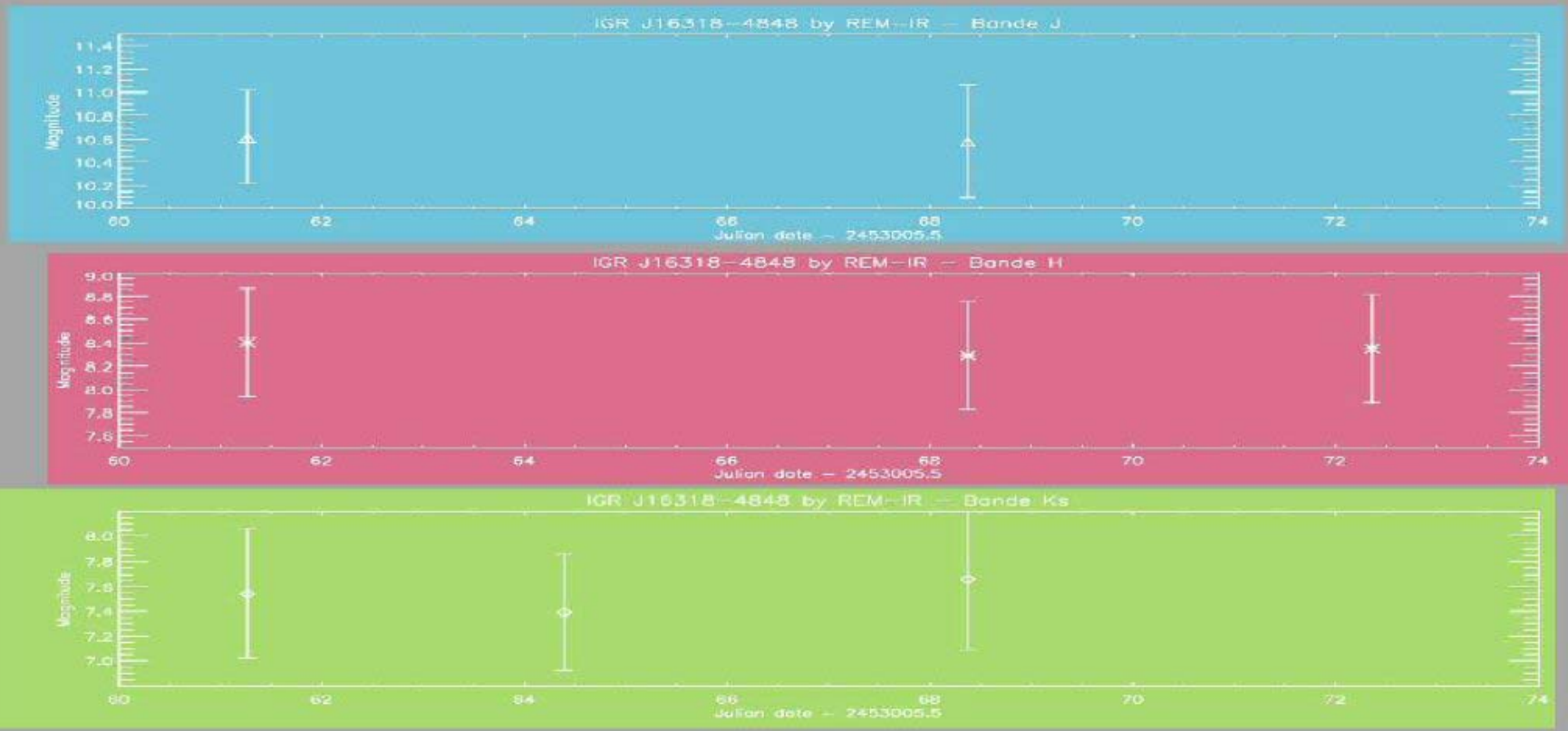
SGR0526-66



HMXB IGR16318-4848 High Mass X-Ray Binary.

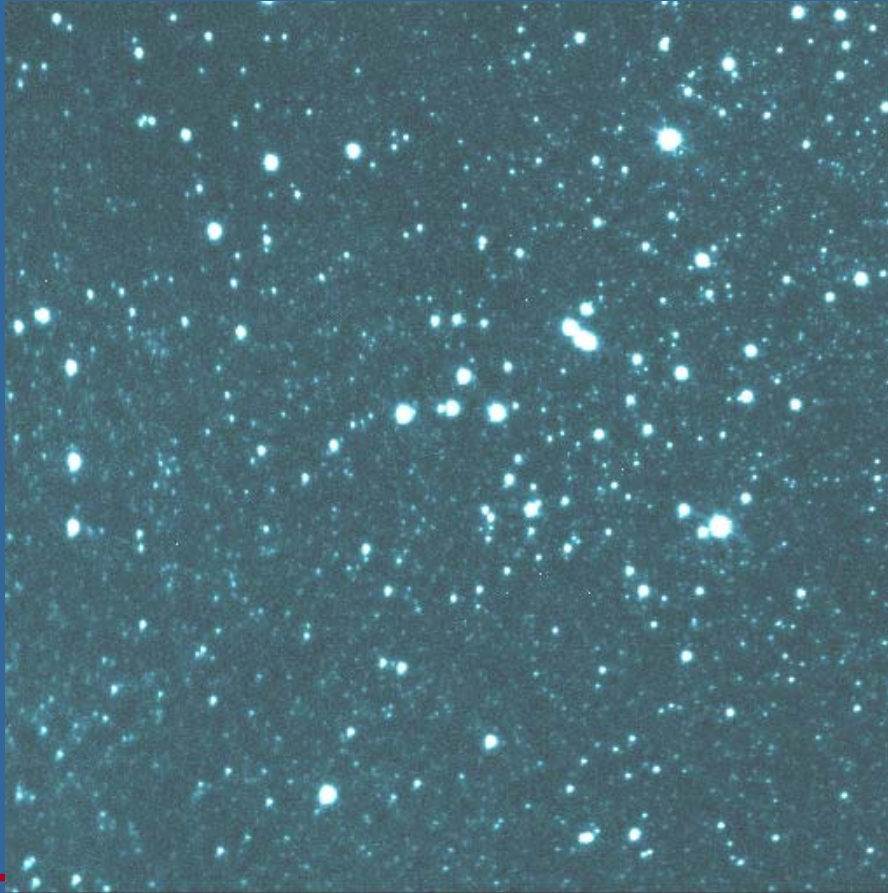


**The first gamma source discovered by the INTEGRAL
IBIS/ISGRI imager on 2003, January 29**



Looking for variability of the source to check the nature of the collapsed object

ROSS imaging of Open Clusters



Trumpler 26:

8 nights

ESO524-01:

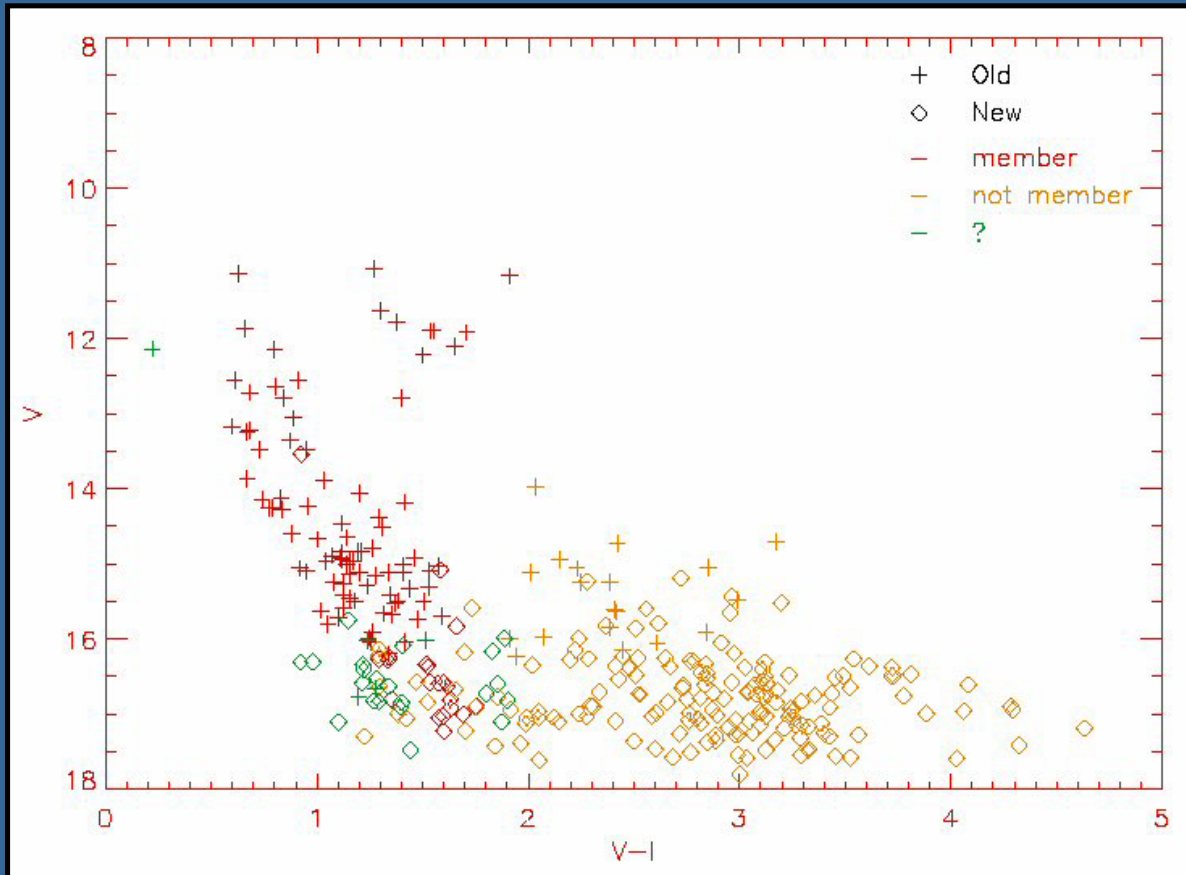
6 nights

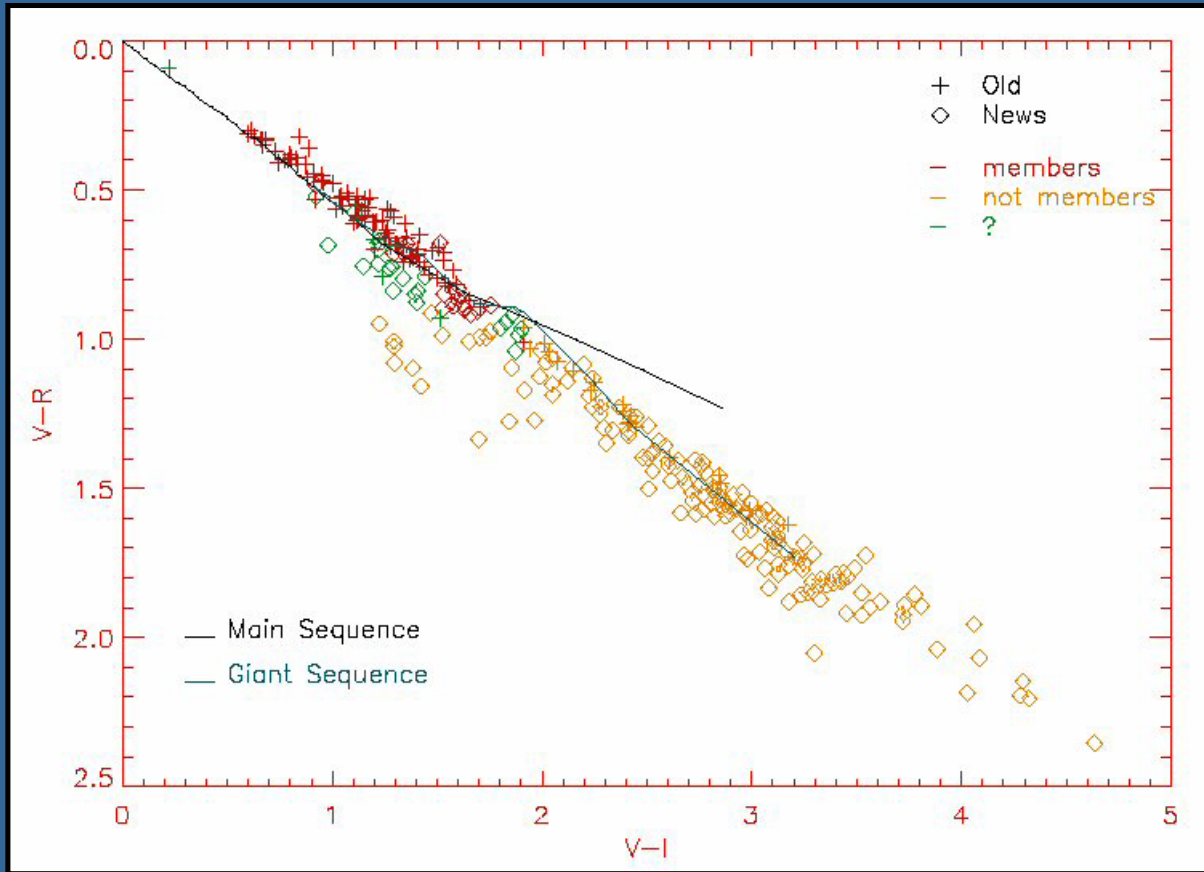
Collinder 347:

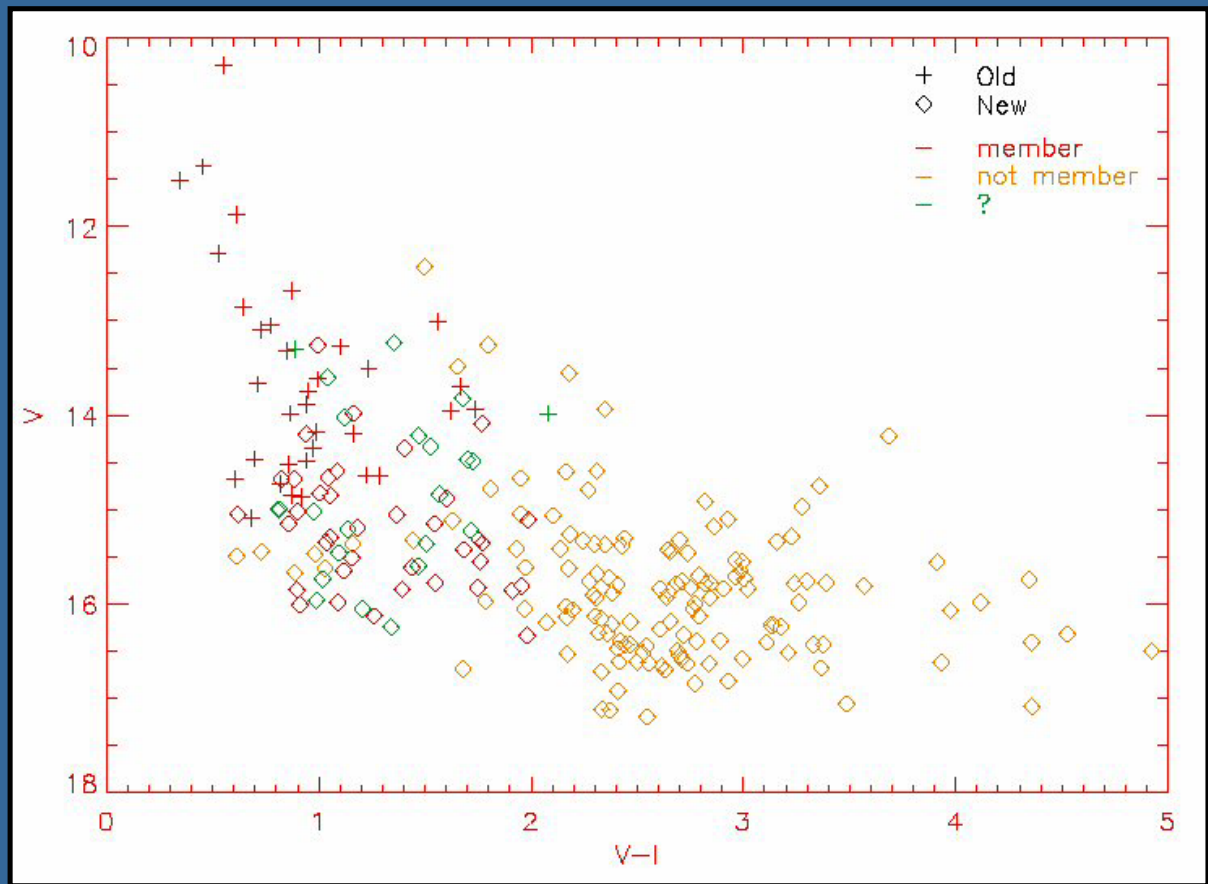
6 nights

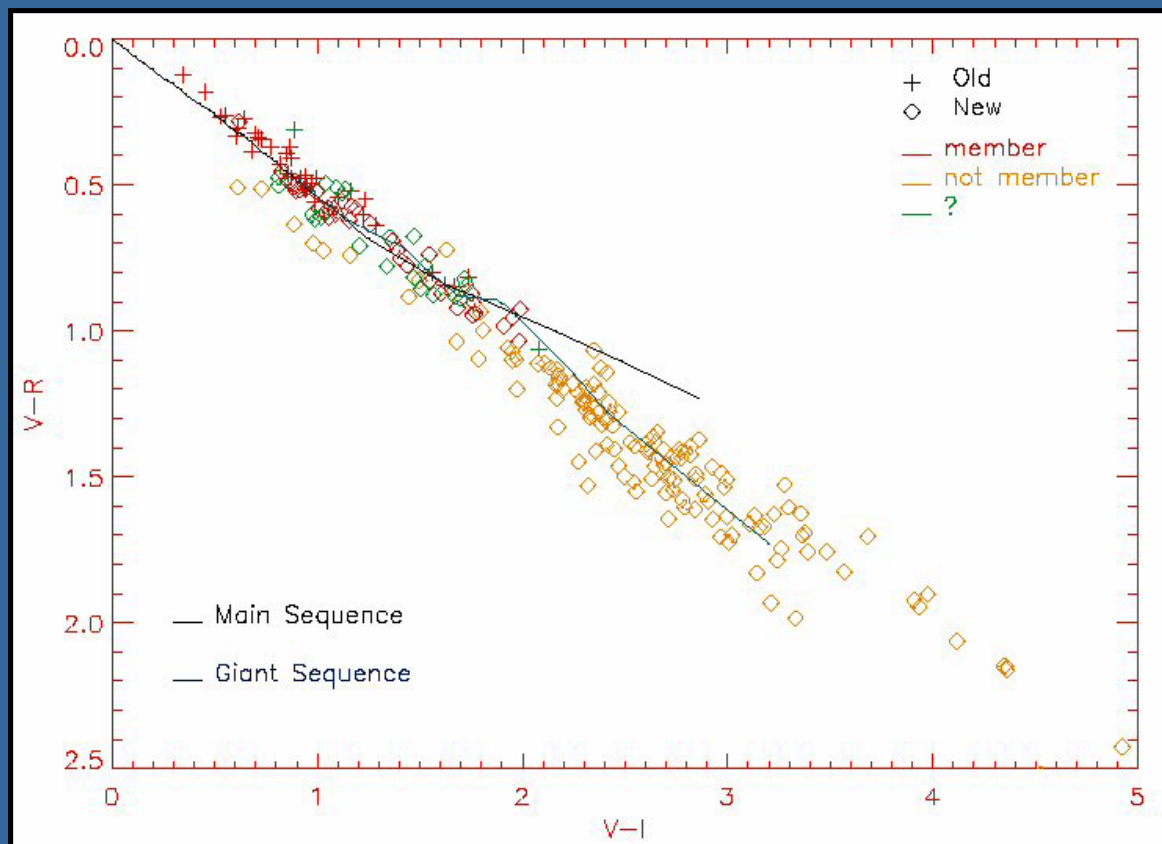
Trumpler 31:

6 nights

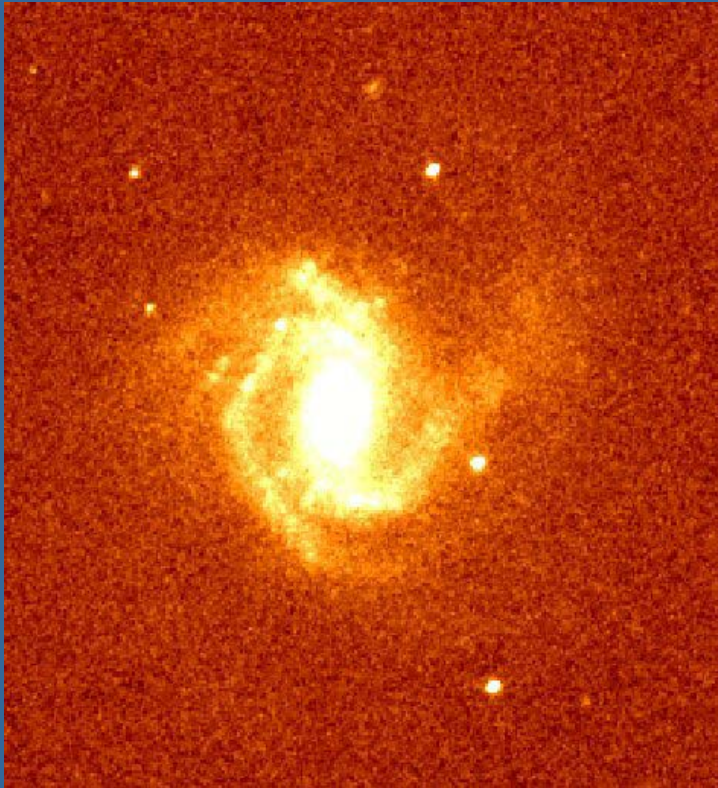




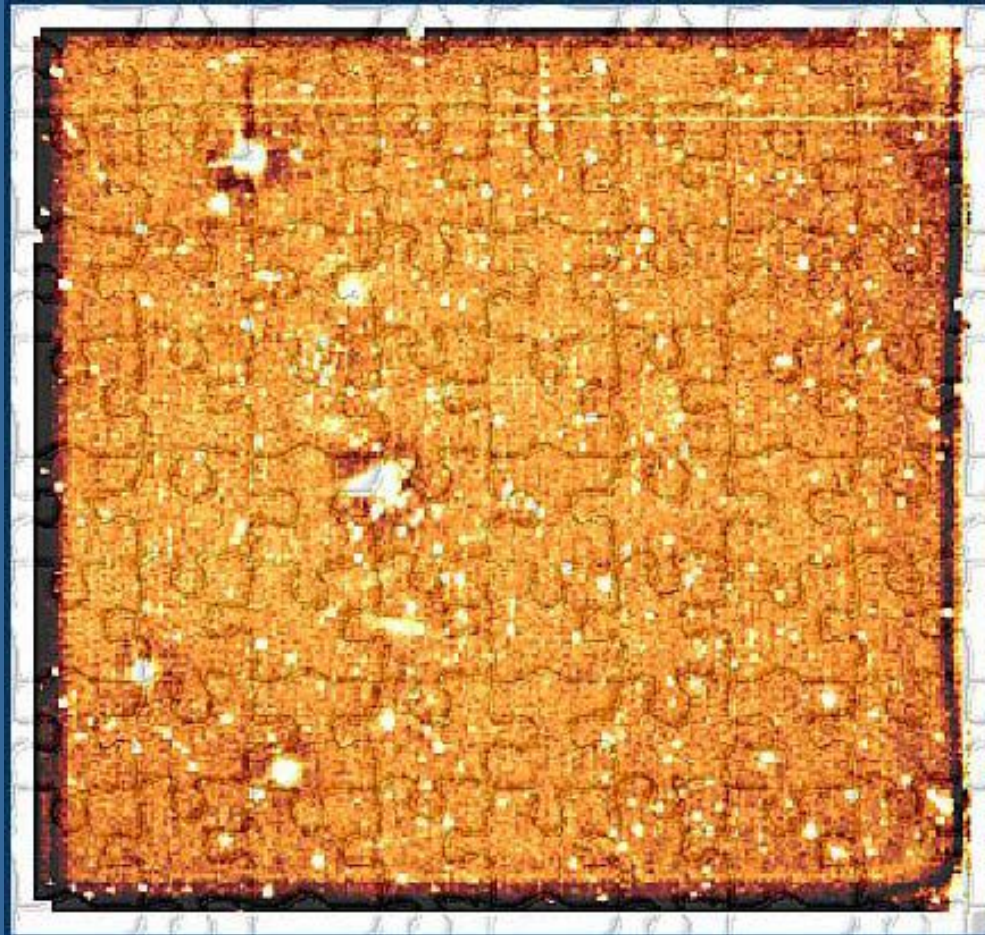




VCC Galaxies

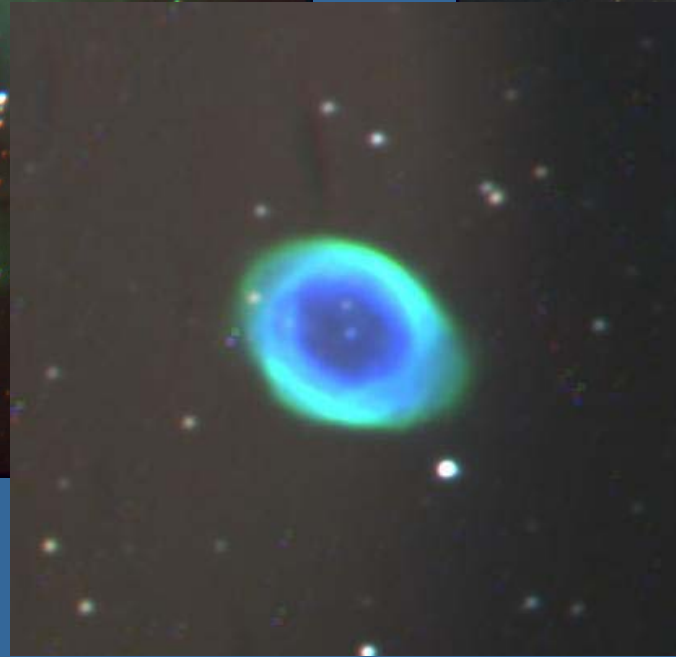
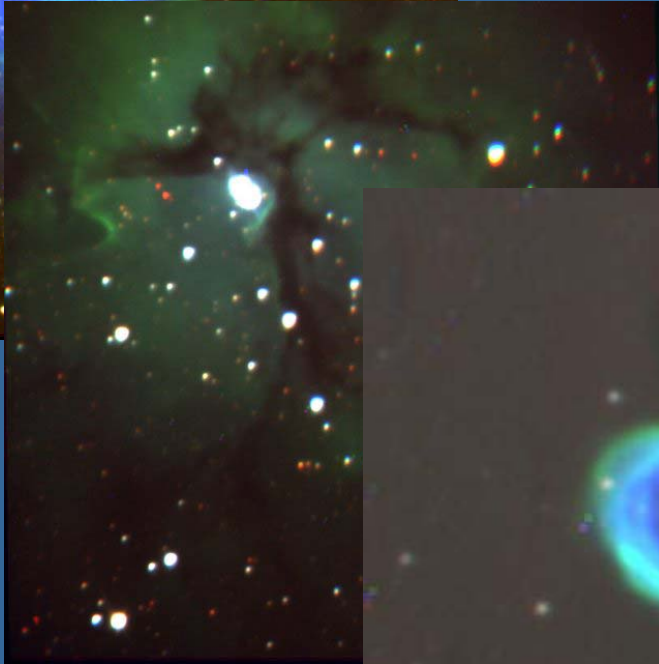
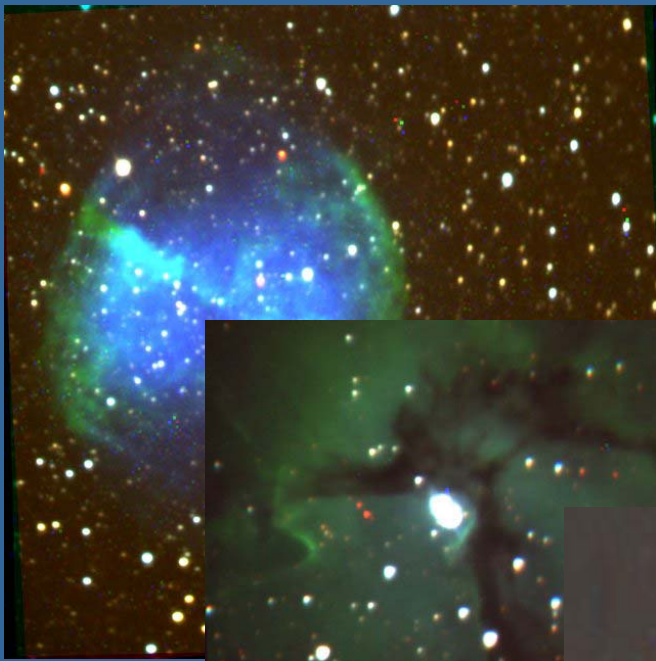


Extended object surface NIR photometry.



IRS 17
Mosaicing H₂
images of Molecular
Clouds

REM Pictures Gallery ...



REM will stop operation at the end of 2006

For reasons related to INAF (€€€€€)

For reasons related to ESO (1a Silla “closes”)

- **Overwhelmingly outstanding science results**
- **Continuation of operation of Swift**
- **AGILE at full pace**
- **Etc.**

..... “could” prolong REM life

We are interested in enhancing REM operativity



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