Multi-frequency Observations
Using REM at la Silla

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On behalf of the REM/ROSS team
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

- 10x10 am2 Fos FF

- 1.2 as pixel scale (diff.limited)
- 0.9–2.3 microns (Z', J, H, K)

- 512x512 HgCdTe chip @77 Kelvin

- Wobbling plate for dithering
... 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
... and a Visible Imaging-Spectrograph

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

Deviated
Nominal
Nôtre Dome de la Silla
Nôtre Dome de la Silla
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
- 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-\(\alpha\) if the GRB is high-z.

- IF Ly-\(\alpha\), we get \(\alpha,\delta\) 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
ROSS/photom:

<table>
<thead>
<tr>
<th>Band</th>
<th>lim mag(3σ)</th>
<th>lim mag(5σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>16.5</td>
<td></td>
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ROSS/Amici:

\[ V = 14 \text{ 5σ 1 sec exposure} \]

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

Limits:

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<tbody>
<tr>
<td>J</td>
<td>15.5</td>
<td>15.0</td>
</tr>
<tr>
<td>H</td>
<td>15.4</td>
<td>14.9</td>
</tr>
<tr>
<td>Ks</td>
<td>14.1</td>
<td>13.5</td>
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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
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.
New GRB?

- Yes:
  - Evaluate the best secondary target to point

- No:
  - Visible?
    - Yes:
      - Organize and perform observations
    - No:
      - Compute visibility data

- Put GRB in target list. To be observed when (and if) possible
AGILE AGILE Workshop, February 3, 2005

**PREPROCESS:**
- Sky and Bias Subtraction
- Flat fielding and dithering reconstruction
  - 5 images processed in 3.7 s

**Quick-look Scientific pipeline**
- Transient detection (SEXtractor) [0.2 s]
- Coordinates determination [2 s]
- Photometry (Z’JHK) (any object in the frame above a S/N threshold) [6 s]

**REMOS:**
- Target acquisition
- Start observation
  - 5-10 s up.tr.rec.

One Cleaned Image every 7.5 s

One Raw Image every 1.5 s

**REMOS:**
- Target acquisition
- Start observation
  - 5-10 s up.tr.rec.

**DECISION routine**
- Coordinates
- Redshift

**Web**
- >15 s

** UVOT **
- ROSS
- Tarot-S

**VLT**

**RRM**

**GRB coord.**
Put GRB in target list. To be observed when (and if) possible

Visible?

no

yes

New GRB?

no

yes

Evaluate the best secondary target to point

Organize and perform observations

Compute visibility data
**GX339-4**: a BH candidate

The bright status discovered by comparison with the 2mass catalogue
Some SGRs...

SGR0526-66

SGR1806-20
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 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