

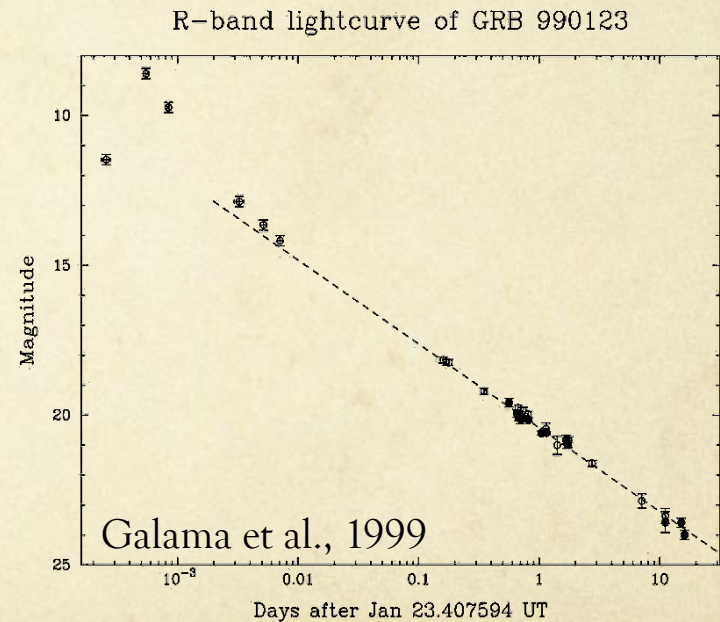


SkyMapper ToO Programs

Fang Yuan
ANU

Rapid response ToO

- Third party observations requiring immediate action
- GRB (Fermi GBM)
 - steep power-law decay in optical
 - few degree location error
- GW candidate (LIGO/VIRGO)
- Fast Radio Burst



GRB with SkyMapper

- Why GRB?
 - Massive star evolution, SN connection
 - Probe high z universe, star formation, ionization history
 - Short hard GRB, compact binary, GW emitter?
- Why Fermi (GBM) GRBs?
 - All-sky (10 keV - 40 MeV), 1 trigger / 1-2 days
 - Potential Fermi LAT (0.3 - 300 GeV) detection
 - Large error box, few to few hundred square degree

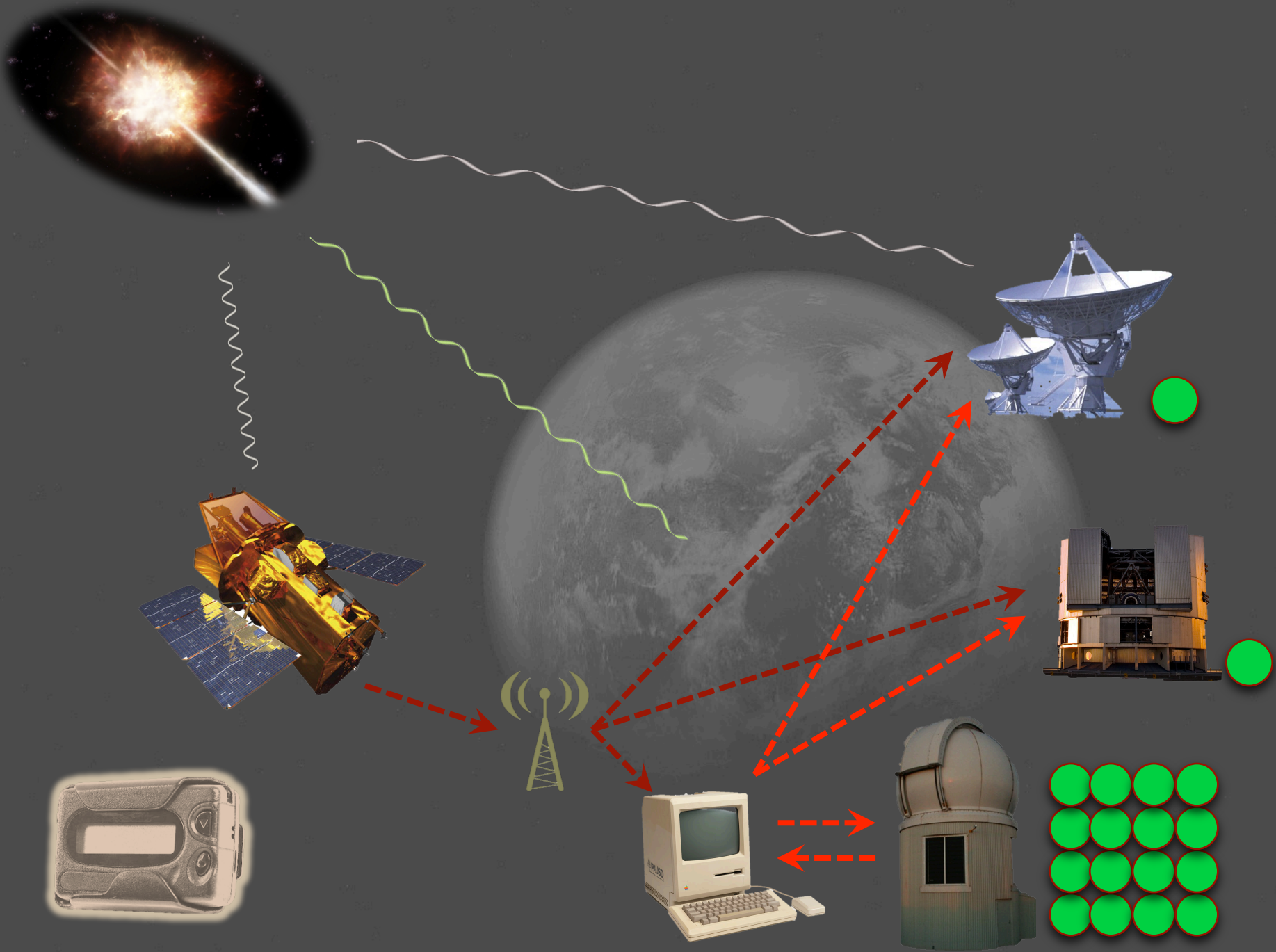


Image Credit: ESO/A. Roquette / NASA / Iztok Boncina/ESO / NRAO/AUI



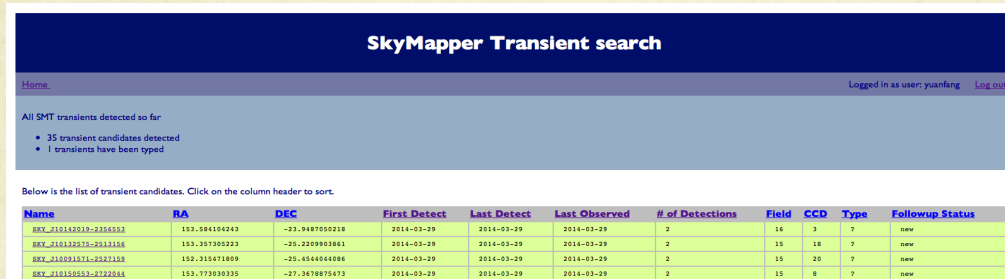
Override Observation

- Requires
 - Program ID
 - URL to be monitored by SM scheduler (every minute)
 - E.g. <http://www.mso.anu.edu.au/~yuanfang/GRB/fermiform/skymap.trigger>
 - Include: ra, dec, filter, 0, exptime, sequence, progID

```
09:44:41,-31:01:16,r,0,60,3844,20  
09:44:41,-28:38:01,r,0,60,3845,20  
09:44:41,-26:14:46,r,0,60,3846,20  
09:44:41,-23:51:31,r,0,60,3847,20  
09:54:14,-31:01:16,r,0,60,3848,20  
09:54:14,-28:38:01,r,0,60,3849,20  
...
```

Data Reduction

- Transient detection
 - Image subtraction (multiple epochs/color needed)
 - Modified version of SN search pipeline
 - Django development server



The screenshot shows the 'SkyMapper Transient search' interface. At the top, it says 'SkyMapper Transient search'. Below that, there's a navigation bar with 'Home' and 'Logged in as user: yuanfang Log out'. The main content area shows 'All SMT transients detected so far' with a list of 35 candidates, 1 of which has been typed. Below this, a note says 'Below is the list of transient candidates. Click on the column header to sort.' The table below has columns: Name, RA, DEC, First Detect, Last Detect, Last Observed, # of Detections, Field, CCD, Type, and Followup Status. The table contains 5 rows of data.

Name	RA	DEC	First Detect	Last Detect	Last Observed	# of Detections	Field	CCD	Type	Followup Status
SMY_210142019-2316593	153.684104243	-23.9487050210	2014-03-29	2014-03-29	2014-03-29	2	16	3	7	new
SMY_210142019-2513186	153.357305223	-25.2209903861	2014-03-29	2014-03-29	2014-03-29	2	15	18	7	new
SMY_210091871-2527188	152.315471809	-25.4544044086	2014-03-29	2014-03-29	2014-03-29	2	15	20	7	new
SMY_21010553-2722684	153.773030335	-27.3678875473	2014-03-29	2014-03-29	2014-03-29	2	15	8	7	new

- To be implemented
 - Non-detection -> limits
 - Detection -> confidence

SkyMapper ToO

- Responded to 5 Fermi GRBs since late 2013
 - no counterpart detected, yet
- Infrastructure ready
 - Override capability
 - Image subtraction pipeline
- Can be improved
 - Reliability against software failure
 - Automation
 - Learn from experience of transient surveys