

Swift New Opportunities

Nov 18, 2004



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NASA/GSFC

November 18, 2009

Nov 20, 2004



Swift - The Incredible Automaton

All metrics show increasing science usage & impact.

- **GRBs**

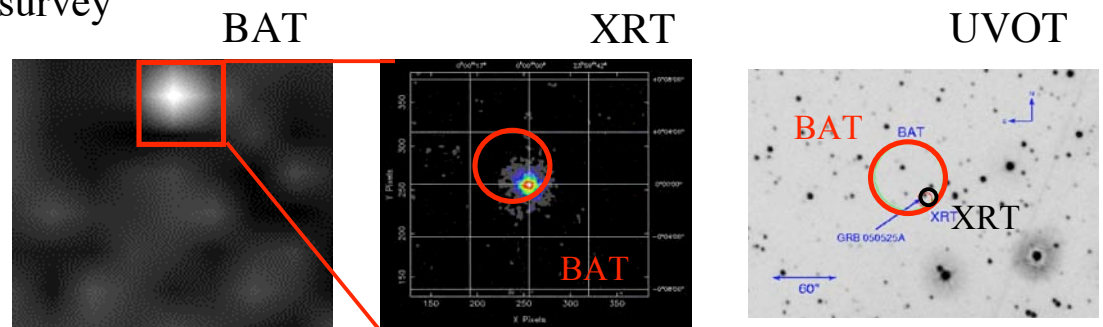
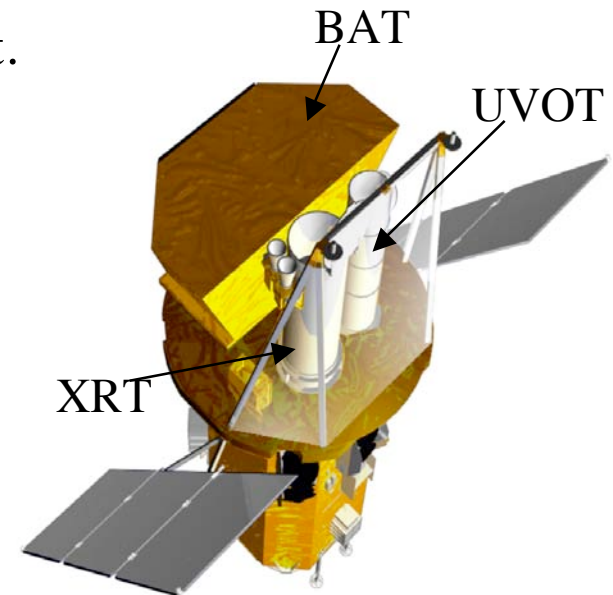
- >400 GRBs with arcsec positions
- >150 GRBs with redshifts (80% of world total)
- 93% of world X-ray afterglows
- >40 short GRBs with arcsec positions
- 6 GRBs with $z > 5$
- Nearby long GRBs with and without SNe

- **Non-GRBs**

- >500 TOOs per year
- Multiwavelength observations of comets, stellar flares, CVs/novae, SNe, AGN,
- >100 SN lightcurves in UV, 13 detections in X-rays
- Most sensitive hard X-ray all sky survey

- **Other**

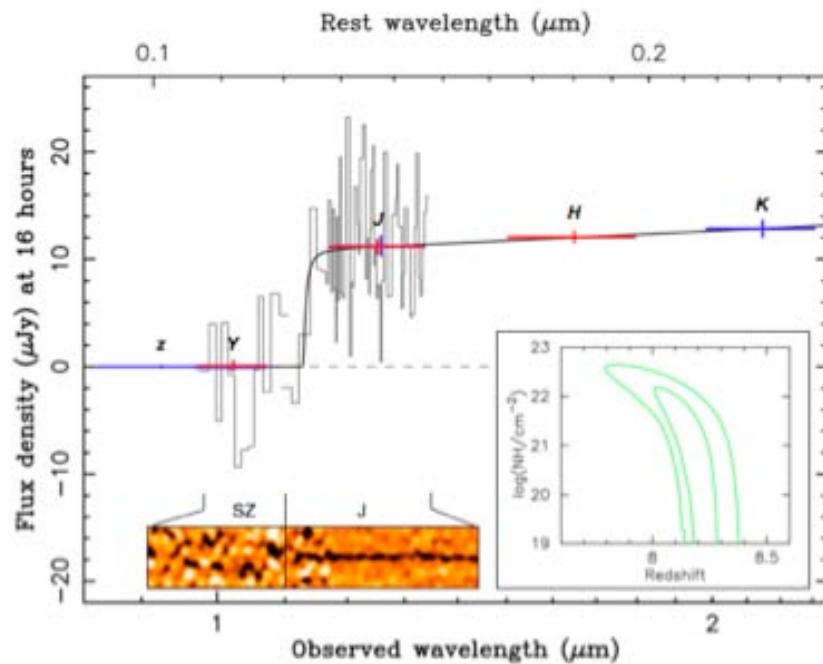
- GI program highly oversubscribed
- Paper citation rate among highest in astronomy



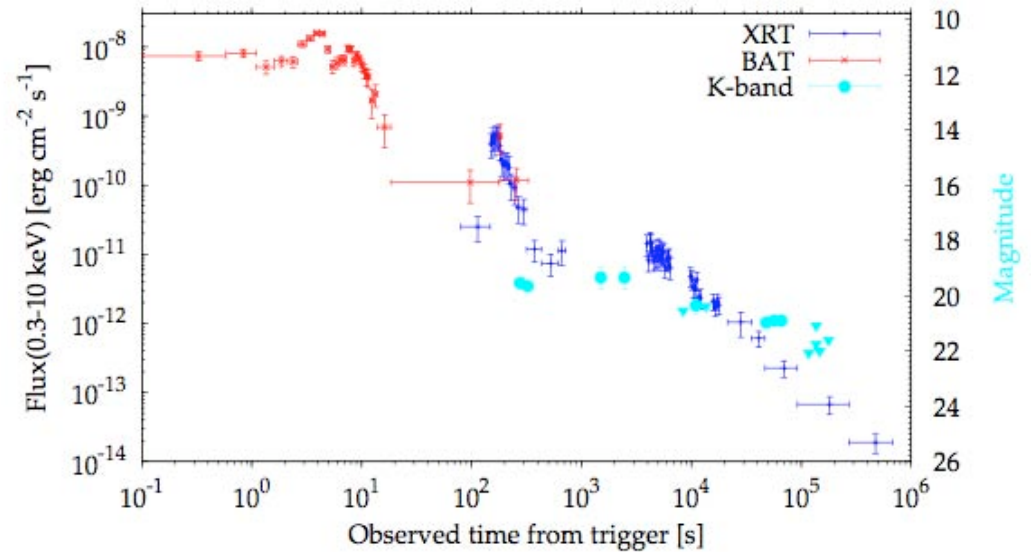
Blast from the past!

GRB 090423

$$z = 8.2$$



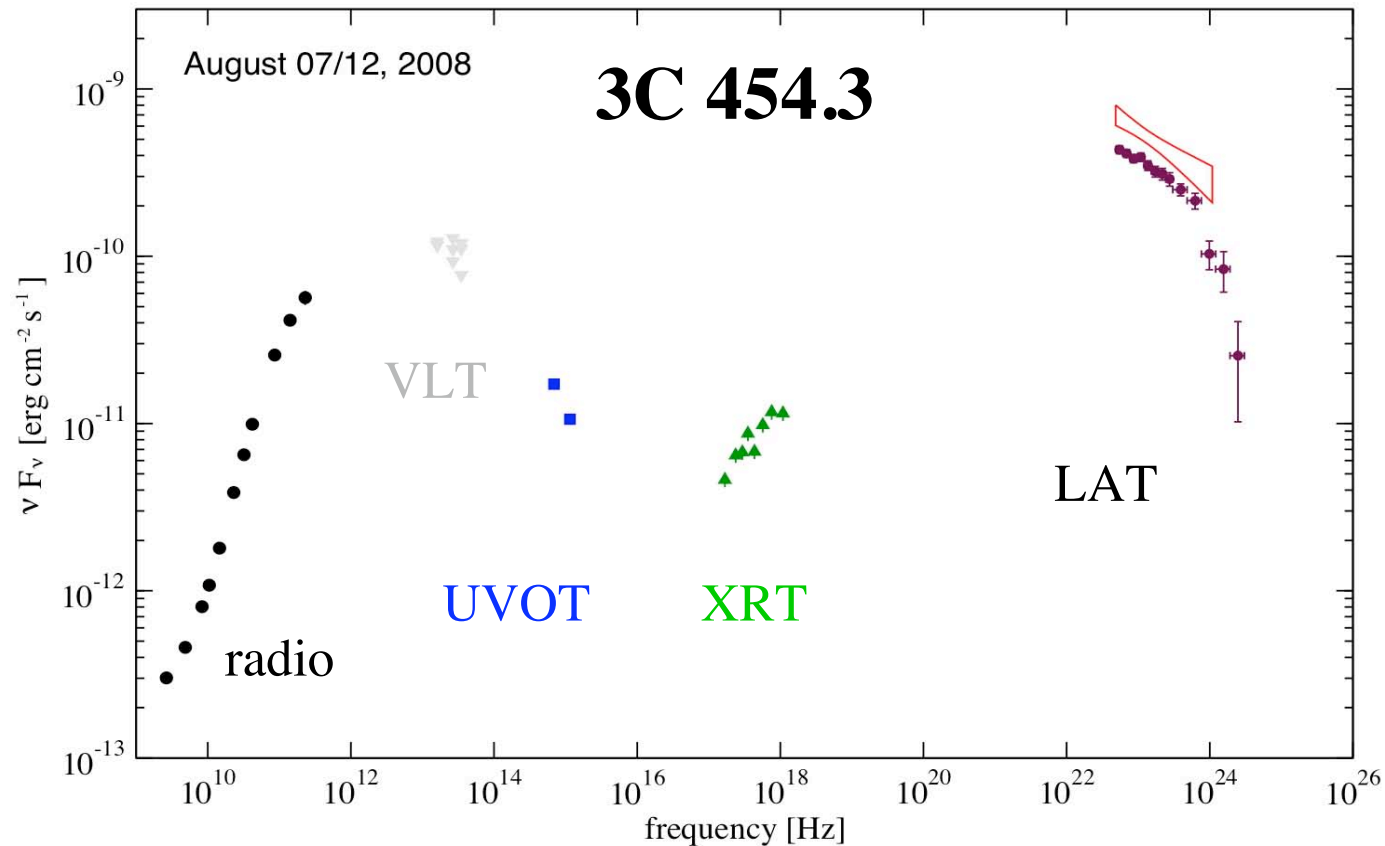
Tanvir et al. 2009



Salvaterra et al. 2009

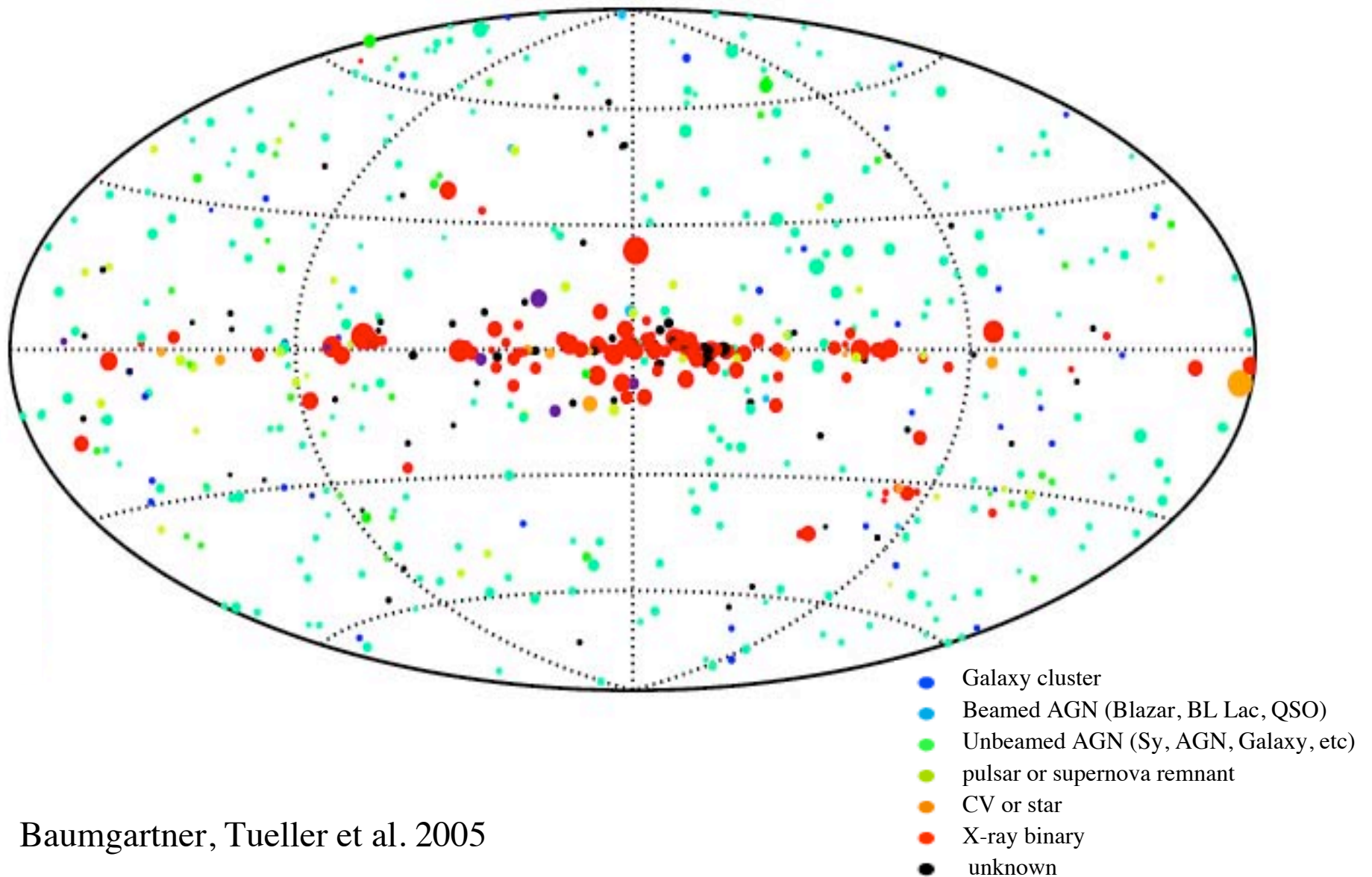
$t_0 + 17.5$ hours

LAT - *Swift* Observations of Blazars



Also, *Swift* follow-up observation
of all *Fermi* / LAT GRBs

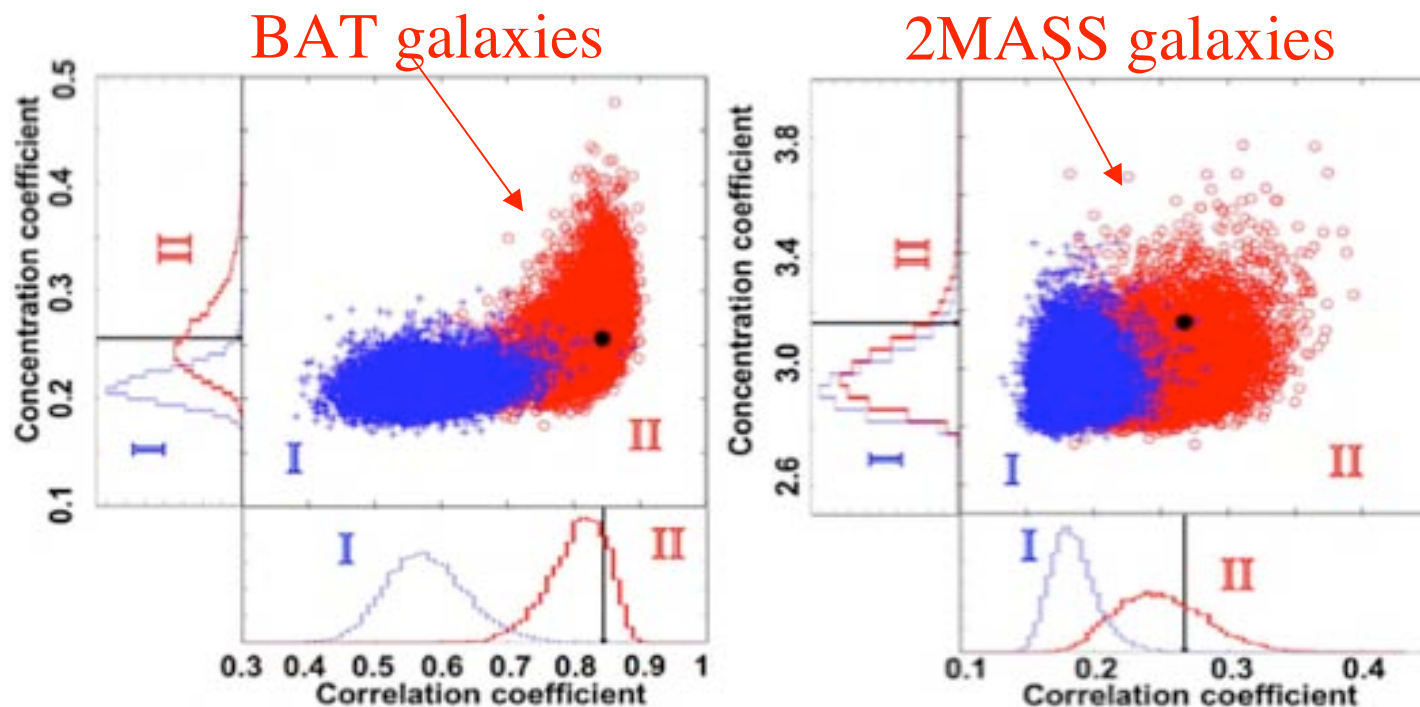
BAT Hard X-ray Survey



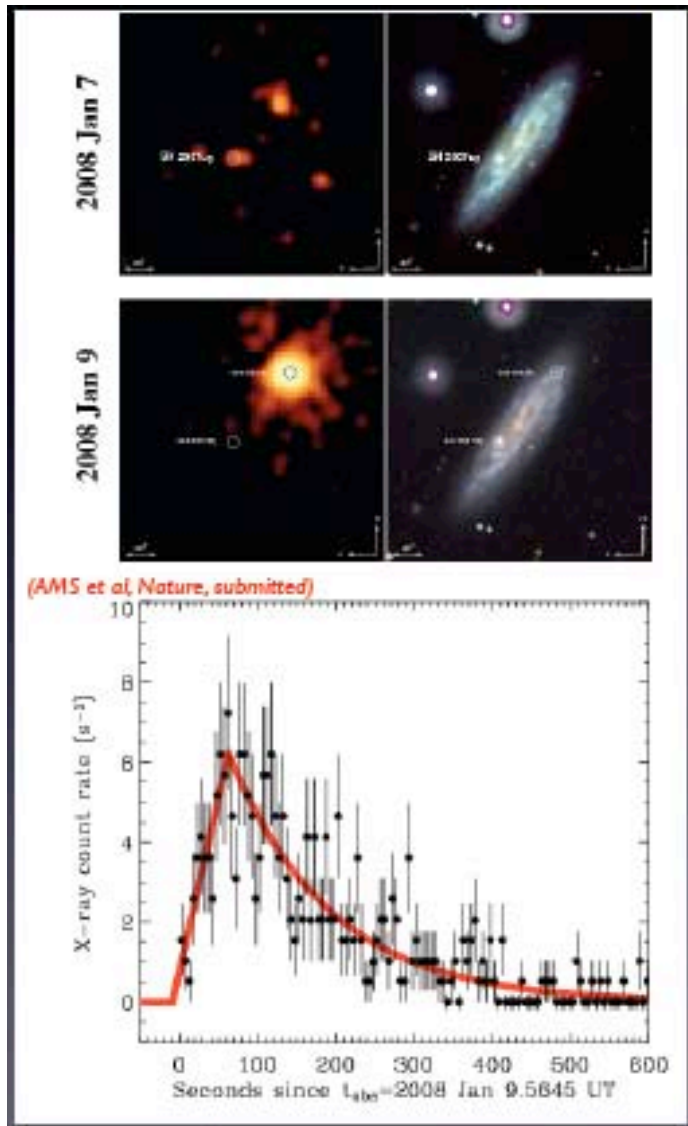
Baumgartner, Tueller et al. 2005

Auger UHE Cosmic Rays

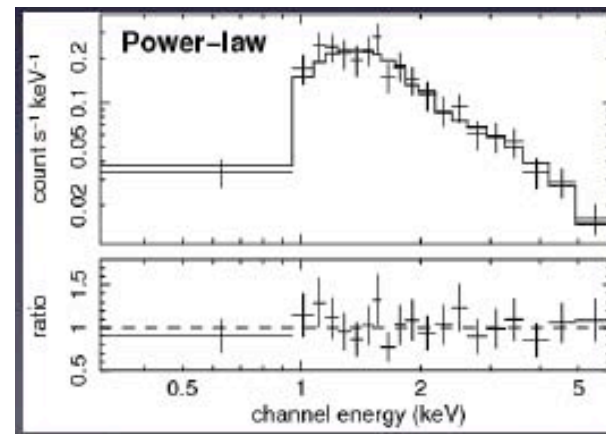
Correlations of arrival directions of $>6 \times 10^{19}$ eV *Auger* cosmic rays .
BAT catalog gives highest correlation



SN 2008D X-ray Outburst

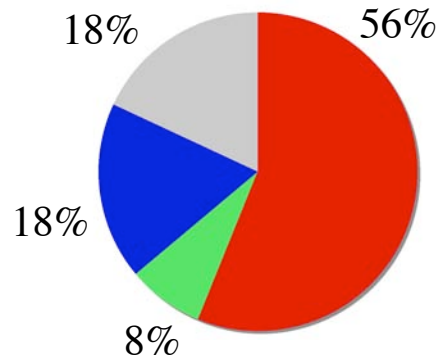


- *Swift* XRT monitoring of NGC 2770 (27 Mpc) revealed X-ray outburst from SN 2008D
- No BAT detection (i.e., not a GRB)
- SN Ib/c
- Shock breakout. May occur for all SN

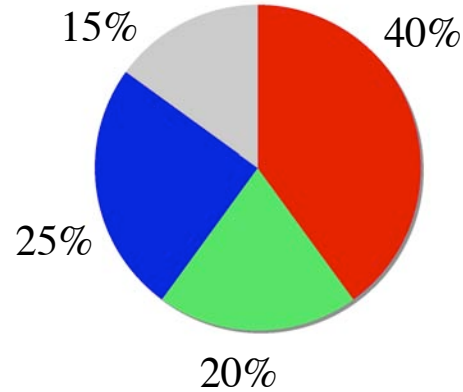


Evolving Observing Time

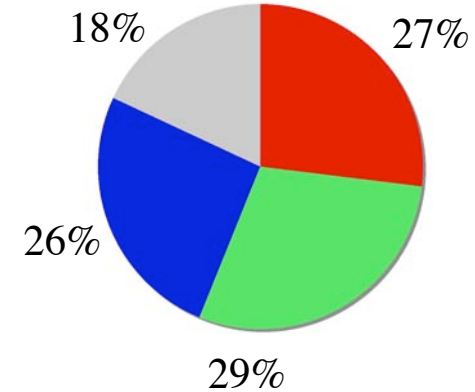
SR 2006



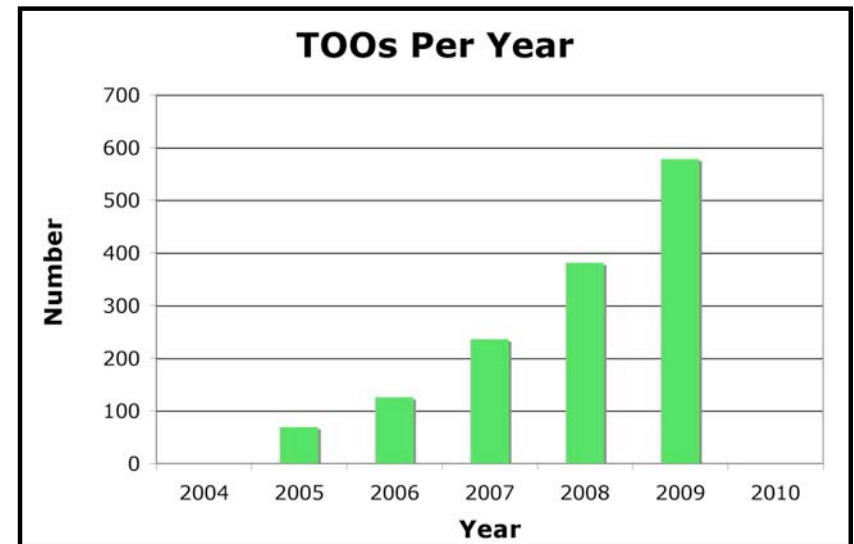
SR 2008



SR 2010



- GRBs
- TOOs
- Fill-ins
- SAA & Calibration

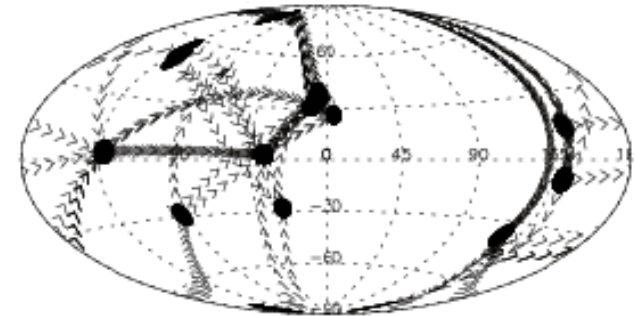


New Opportunities

Operations:

- BAT slew survey (BATSS)
(Grindlay, Copete, Barthelmy)
- Flexible BAT triggering
 - * Special triggering for bursters and superbursters
(in't Zand, Strohmayer, Markwardt)
 - * Autonomous slewing to non-GRB transients
 - * Galaxy positions in BAT trigger and/or ground catalog
(Berger, Barthelmy, Palmer)
- Automated / rapid tiling observations for large error boxes (Burrows, Palmer)
- Pre-approved rapid TOOs for LIGO and ICECUBE triggers (Gehrels)
- MOC automation to allow more flexible scheduling, more TOOs, more monitoring, (Nousek, Burrows)
- Pointing bias to increase overlap of BAT and LAT fields of view

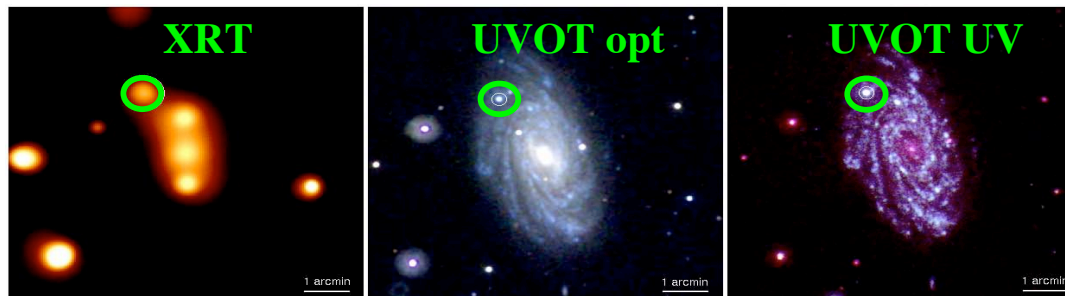
BATSS Slew Paths



New Opportunities

Key Projects:

- AGN observations of large samples
(Giommi, Kadler, Falcone, Romani, Brandt)
- Galaxy imaging surveys and mosaics (Immler)
- UV / optical and X-ray deep fields (Gronwall, Giommi)
- Sensitive X-ray observations of ROSAT catalog sources (Fox et al.)
- CV & novae fast-response & monitoring (Osborne, Bode, Schwarz, Starrfield)
- SN monitoring & rapid response (Soderberg, Roming, Brown, Milne)



New Opportunities

Coordination with Other Observatories:

- *Fermi* / LAT and TeV: GRBs, blazars, unidentified sources
(25% of Swift TOOs)
- MAXI rapid follow-up of transients and coordinated surveys
(HEAD special session)
- *Chandra* late-time GRB light curves
- HST short GRB hosts and deep imaging of high-z fields
- GBM / Suzaku / Konus joint GRB spectral studies
- Palomar Transient Factory optical transient follow-up
- LIGO search for EM signals from gravitational wave triggers
- ICECUBE / ANTARES search for EM signals from neutrino triggers
- *Auger* / BAT correlation studies of ultra-high energy cosmic rays
- LOFAR radio transient follow-up



High Resolution UV Image M31



Immler et al.