

The Newly Roboticized Palomar 60-inch Telescope

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The Facility





The P60 Facility

- 60-inch (1.8-m) telescope
- Originally conceived as a “feeder telescope” for P200
- Photometric calibrations for DPOSS
- CCD imaging (13') & IR imaging (2.6')
- Echelle spectroscopy ($R = 19,000$)

Undersubscribed following the end of DPOSS calibrations (Fall 2002).

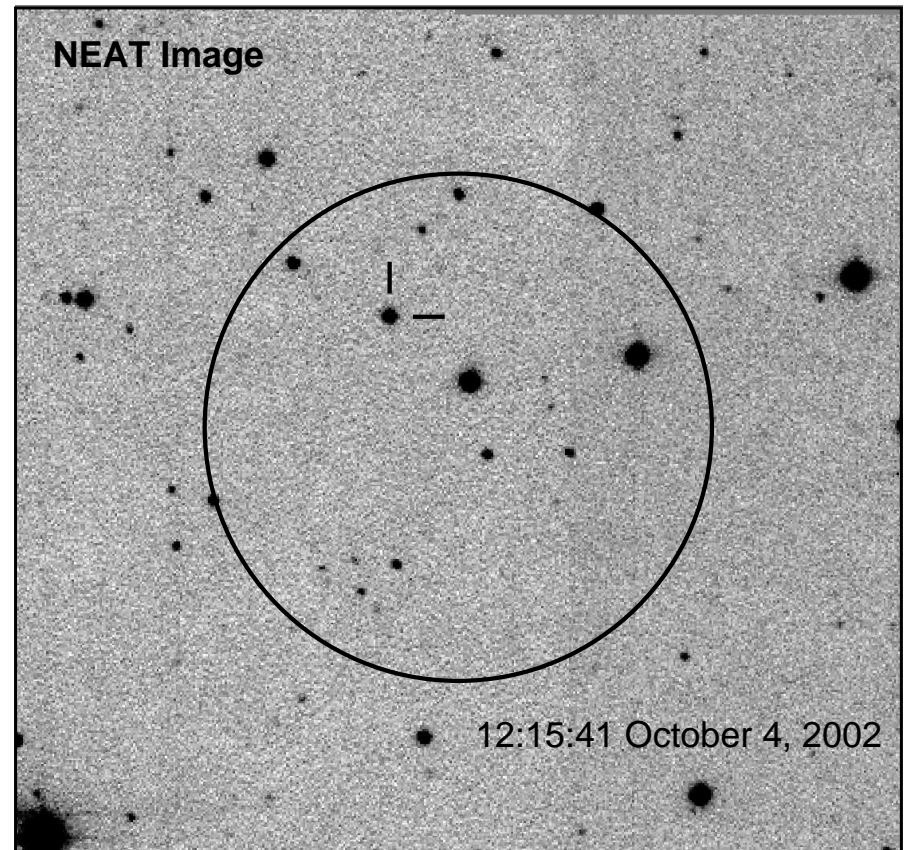


The Opportunity

GRB 021004

The second early-time afterglow after GRB 990123:

- 30' prompt alert from HETE
- Discovery from Palomar with P48+NEAT
- First images at t+9 min
- Discovery report at t+3 hours
- Earlier observations from RIKEN

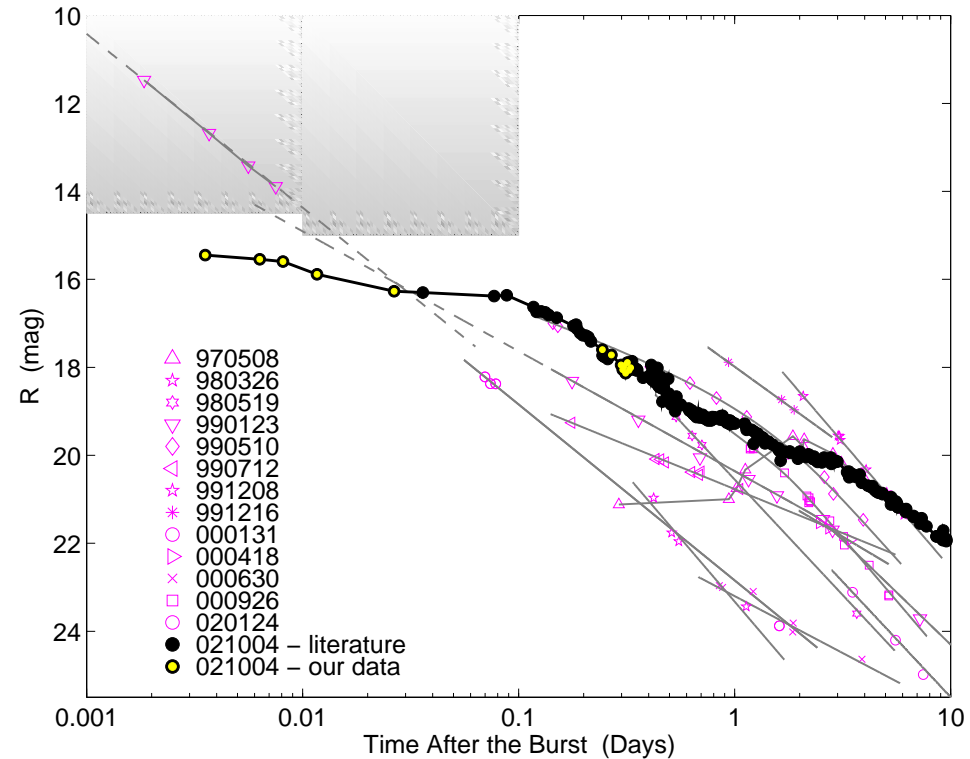


GRB 021004

Findings:

- Very slow early-time decay
- $f \propto t^{-0.4}$ for $t < 3$ hours
- Non-adiabatic evolution of the reverse shock
- Either a “Patchy jet”
- Or energy input to the shock regions

In the latter case, the implied energies are several times that corresponding to the GRB itself.

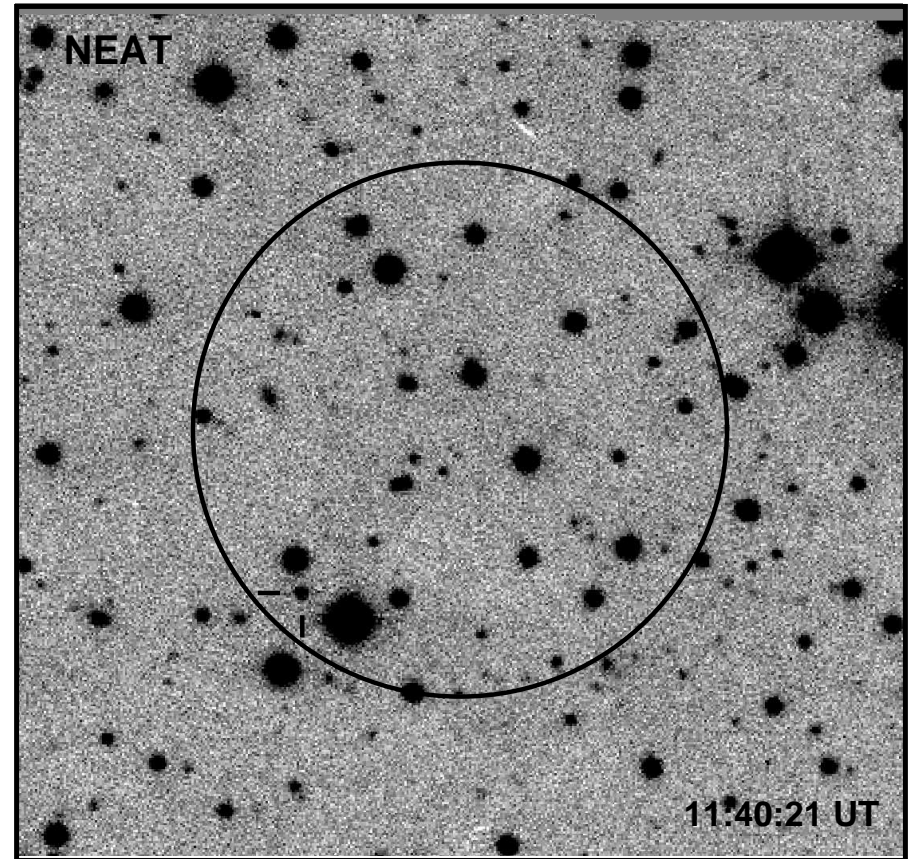


GRB 021004 lightcurve compared to other GRBs

Fox et al. 2003, Nature, 422, 284

GRB 021211

- Prompt *HETE-2* alert with a 30' radius
- First observation at $t + 20$ min
- Discovery GCN at $t < 1$ hour
- Earlier observations: RAPTOR, KAIT, Super-LOTIS

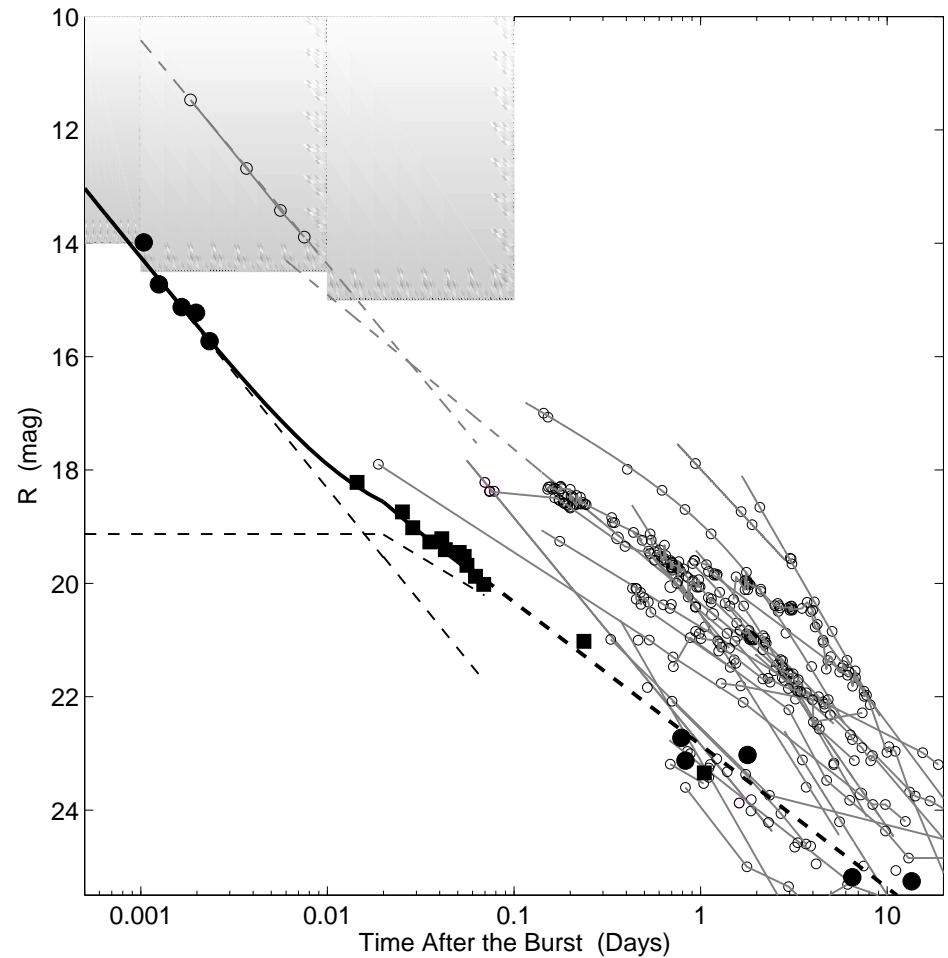


Fox et al. 2003, ApJ, 586, L5

GRB 021211

Findings:

- A faint/fast-fading afterglow
- Some “dark” GRBs are probably just faint
- Near-IR observations show that this is not extinction

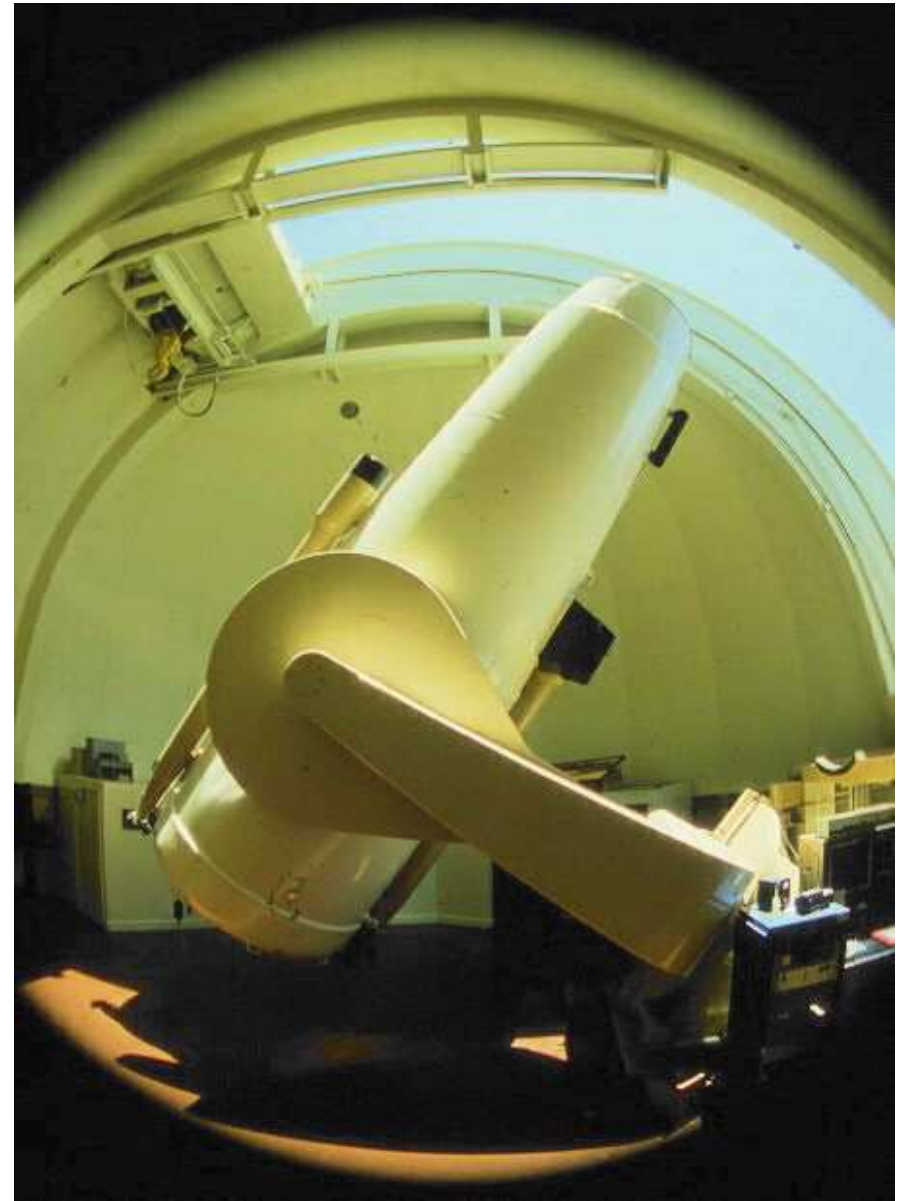


GRB 021211 lightcurve, and other GRBs

Fox et al. 2003, ApJ, 586, L5

P48 + NEAT

- Robotic P48+NEAT
- Three $1.1^\circ \times 1.1^\circ$ fields of view
- Used by Steve Pravdo and the NEAT team to hunt Near-Earth Asteroids
- Superseded by current QUEST camera

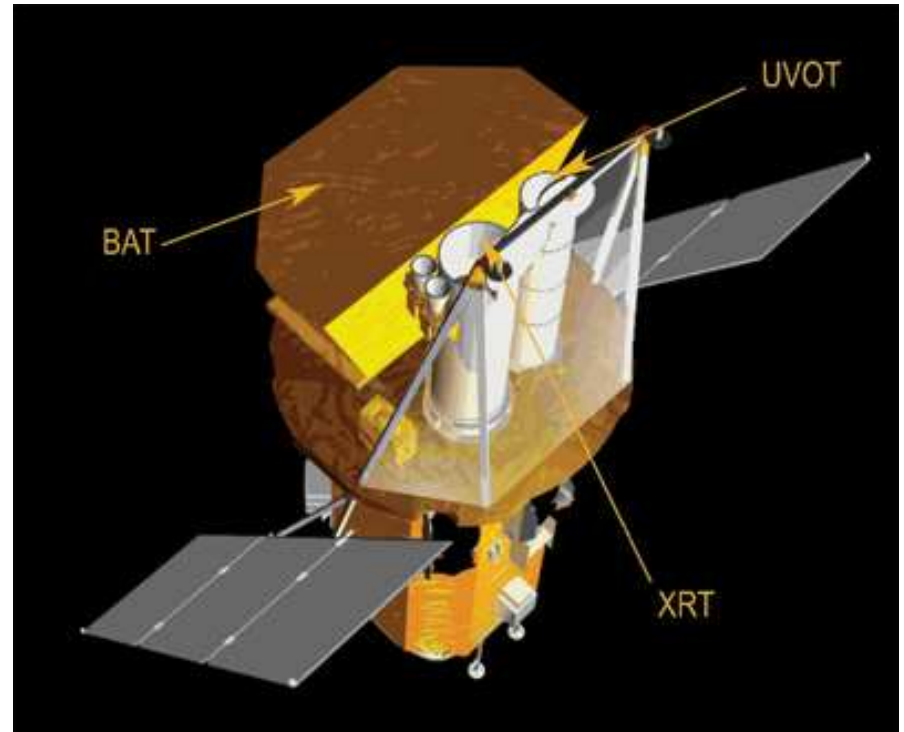


Palomar 48-inch Oschin Telescope

The *Swift* Mission

NASA's *Swift* mission will be devoted to the detection, localization, and observation of gamma-ray bursts and their afterglows.

- Wide-field BAT (1.5 sr) localizes to 2'
- Focusing instruments in the X-ray and UV/Optical
- Alerts disseminated in real-time
- Dedicated satellite follow-up for days to weeks
- Launch date: December 2004



Swift

The Retrofit

P60 Automation

Done:

- TCS systems and dome automated by Palomar (John Henning, lead)
- Runs without guiding
- Digital weather station
- Temperature sensors
- Manual operations: Telescope cover; liquid nitrogen
- Human safety override: P200 operator



P60 Automation

To Do:

- New CCD and controller (soon!)
- Improved safety systems
- Cloud sensor?

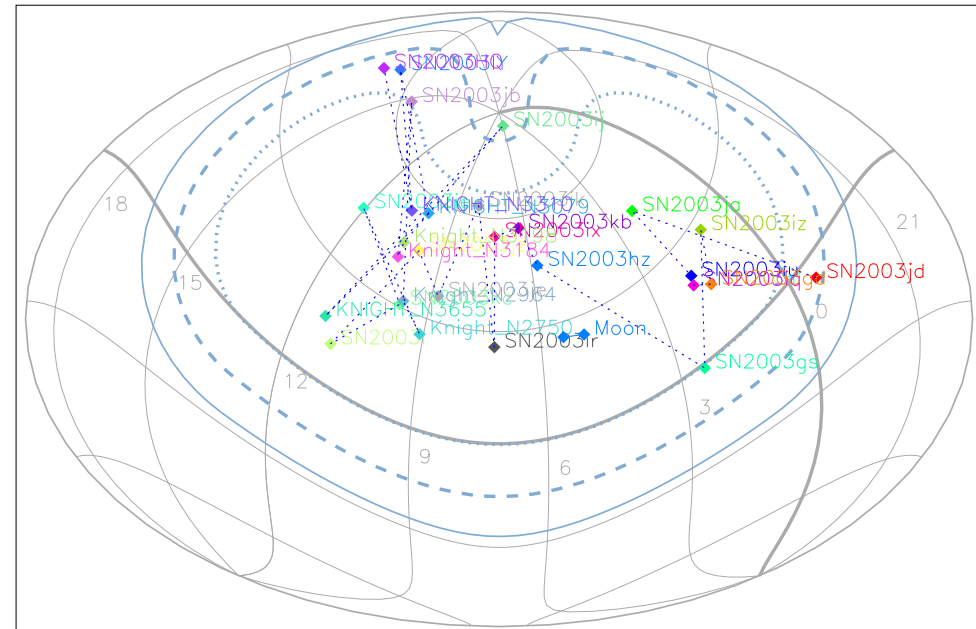


P60 Automation

Done:

- Observatory control system, observation scheduler and data pipeline (Caltech)
- GRB rapid response
- Web-accessible data archive through IPAC (10% time)

Palomar – Sun 4 Jan 2004

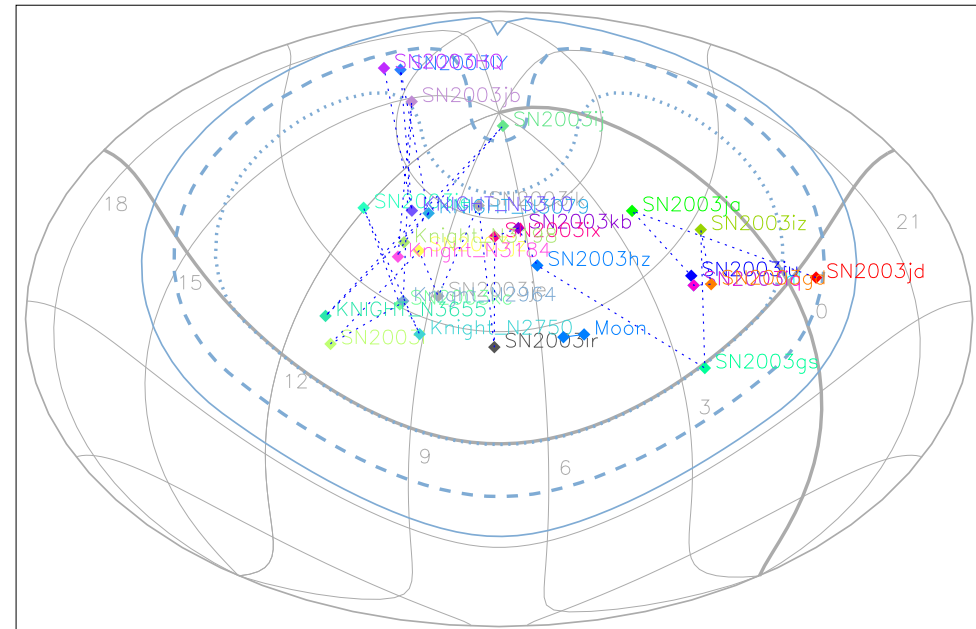


P60 Automation

To Do:

- Complete local observations and targets database
- Web-based reports
- Web-based updates
- Real-time GRB analyses
- Better scheduling
- Better data processing and feedback

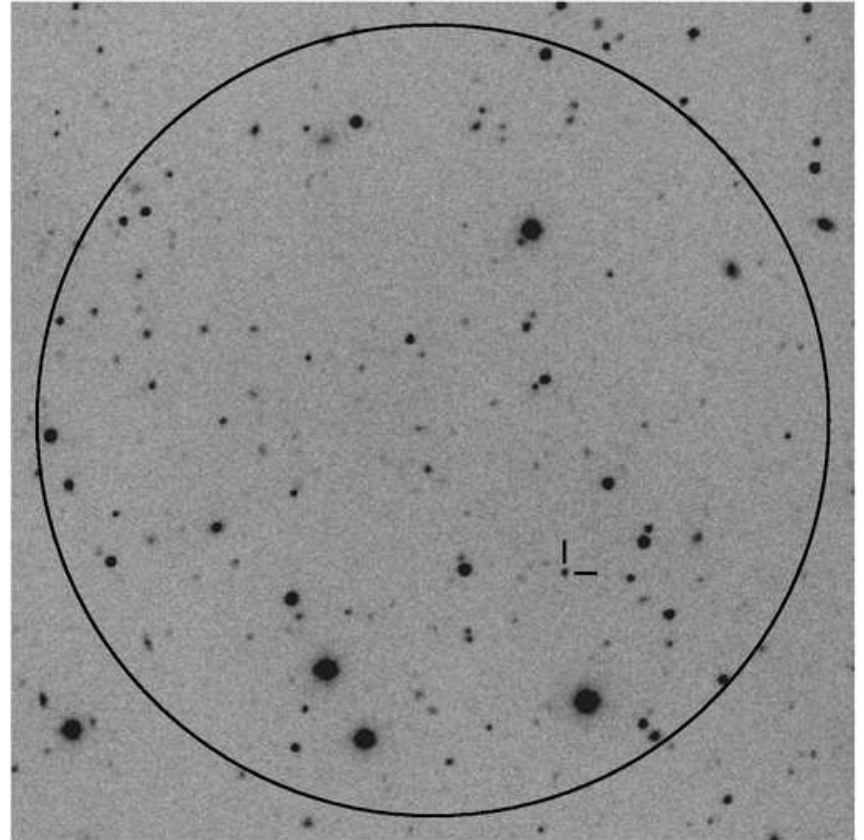
Palomar – Sun 4 Jan 2004



Discovery with P60

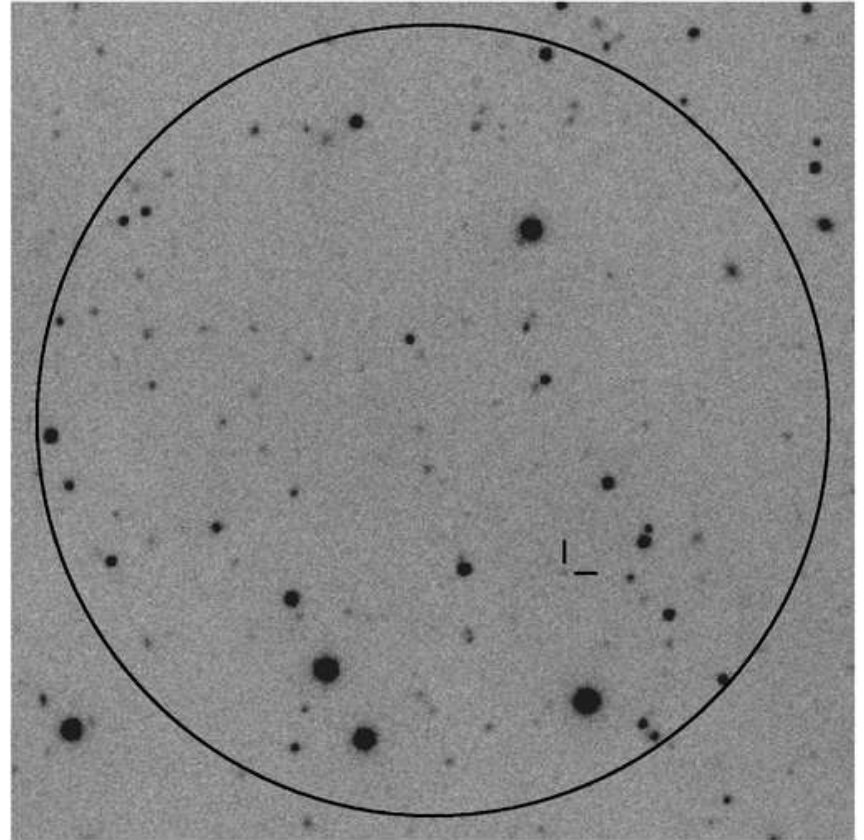
XRF 030723

- 30' prompt alert from HETE, refined to 2' after dawn at Palomar
- P60 observing in semi-automated mode the next night
- Our first observation at $t + 1.1$ days
- Comparison with $t + 2.1$ day image reveals afterglow (also seen in contemporaneous P200+WIRC imaging)
- Earlier observations: ROTSE-III, WISE



XRF 030723

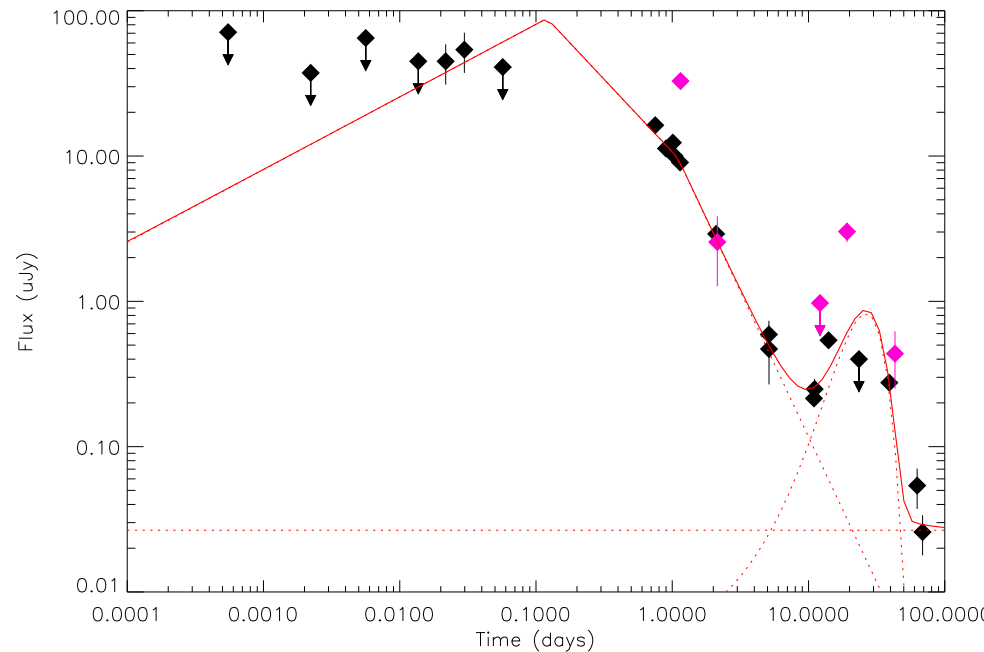
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XRF 030723

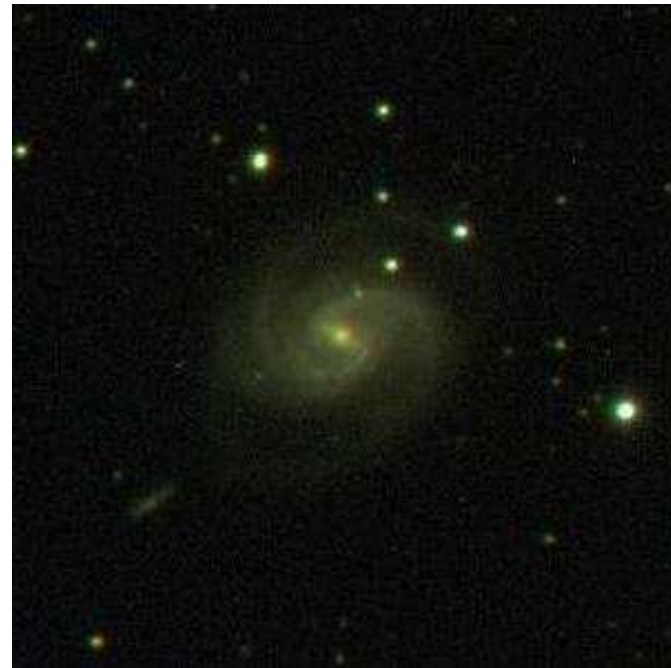
Findings:

- Peak flux of the afterglow is late (0.1 d) & faint (0.1 mJy)
- Probably implies low-density surroundings
- Consistent with lack of features in VLT spectrum
- Curious “bump” at $t + 20$ days: Seen in R , K_s , X-ray (?)



Supernovae

- Substantial time until the *Swift* launch in Dec 2004
- Currently monitoring approx. 30 supernovae per night (more with the new CCD)
- $R \approx 20$ in one minute
- Chief interests: Core-collapse events and the connection to GRBs
- Possible direction: Monitoring of late-type galaxies for Ibc events



SN2003ja

Summary

- The P60 has been roboticized and runs routinely in a fully automated mode
- All data are archived permanently at IPAC
- Its first discovery was the afterglow of XRF 030723
- It is currently waiting for further GRB alerts
- While waiting, it makes 4-band observations of 30 SNe per night
- Further contributions to supernova studies seem likely...



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