

The Lick Observatory Supernova Search (LOSS) with the Katzman Automatic Imaging Telescope (KAIT)

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A crew of undergraduates

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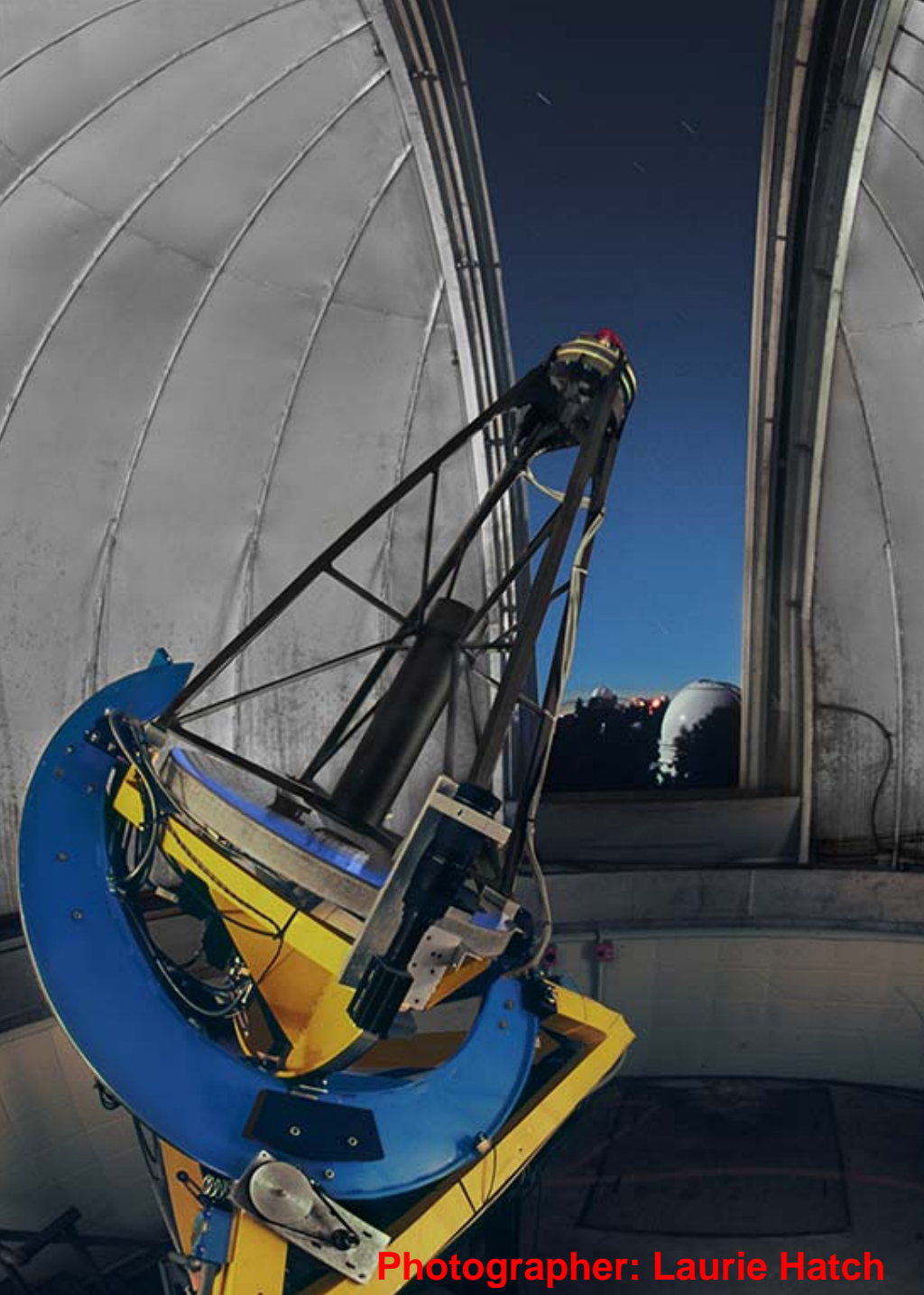
KAIT

Lick Observatory



Scientific motivations of LOSS

- Monitor a well-defined galaxy sample
- Find lots of young SNe (**search engine**)
- Photometric followups (**database**)
- Detailed log files (**SN rate, statistics**)
- GRB followup



KAIT

30 inch (0.76 m) mirror

Funded by NSF, the TABASGO foundation, the Sylvia & Jim Katzman Foundation, AutoScope Corp., Sun Microsystems, Hewlett-Packard Co., the University of California (Berkeley and Santa Cruz), and NASA.

Lick Observatory,
Mt. Hamilton (4200')
near San Jose, CA

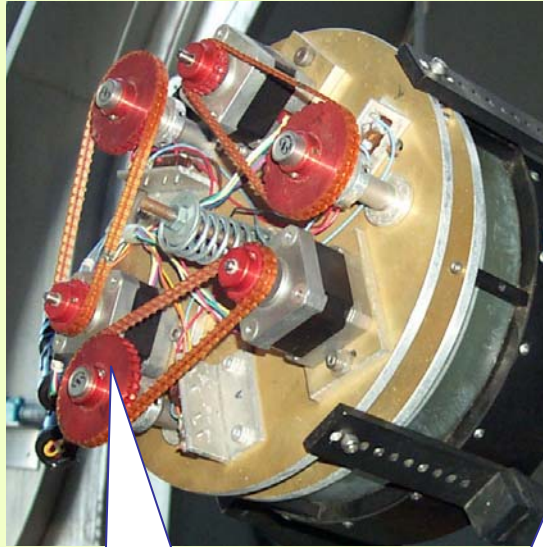
Photographer: Laurie Hatch

KAIT Hardware

Telescope



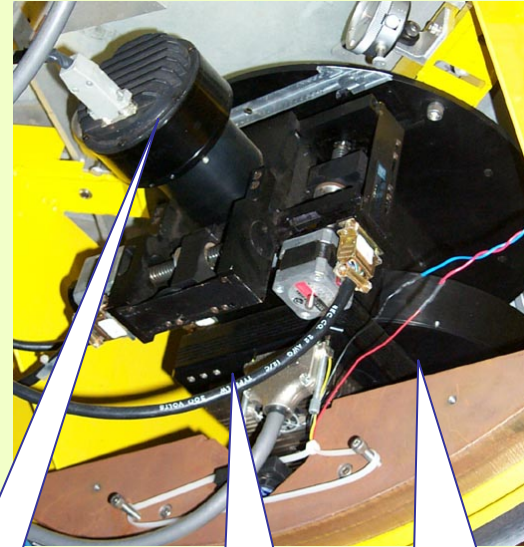
Secondary



Step motors

Guider

Cameras



Apogee

filterwheel

Weatherstation



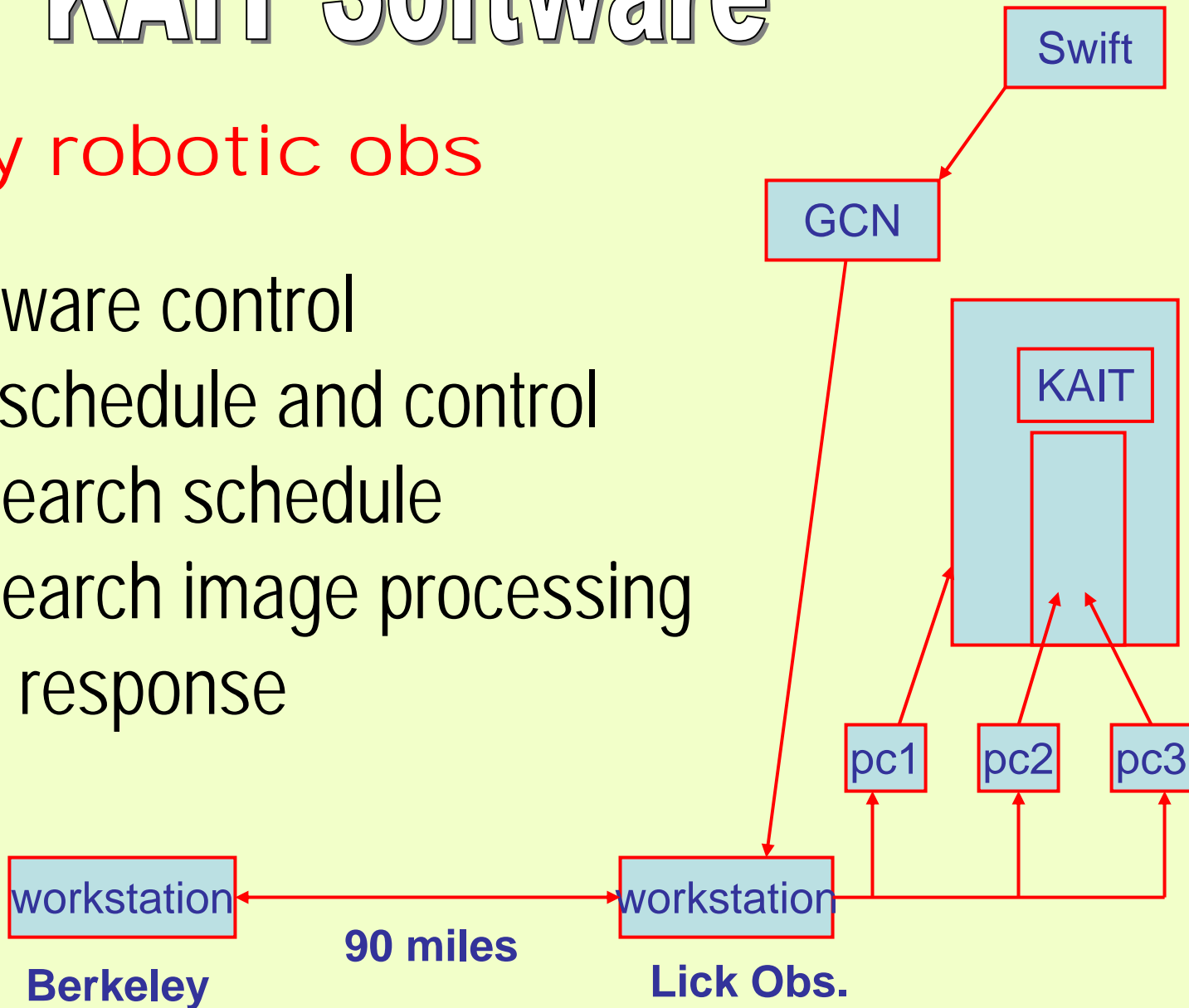
- 30 inch R-C telescope, f/8.2
- Laser optical encoders
- Compact and light-weight
- Precise secondary maneuver
- 20 slot filter wheel

- Apogee AP7 camera, 6.7' FOV, 0.8"/pix
- Off-axis guiding
- Automatic weatherstation

KAIT Software

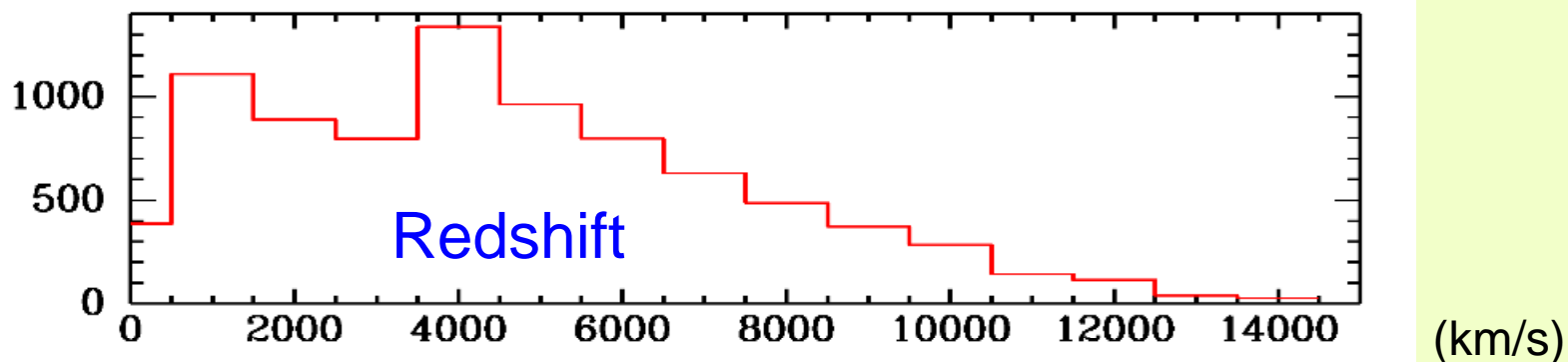
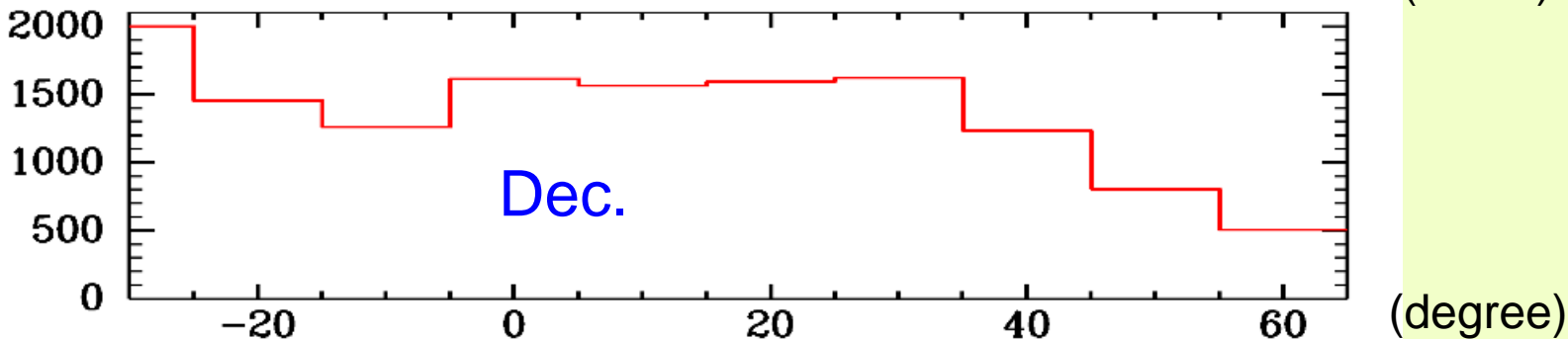
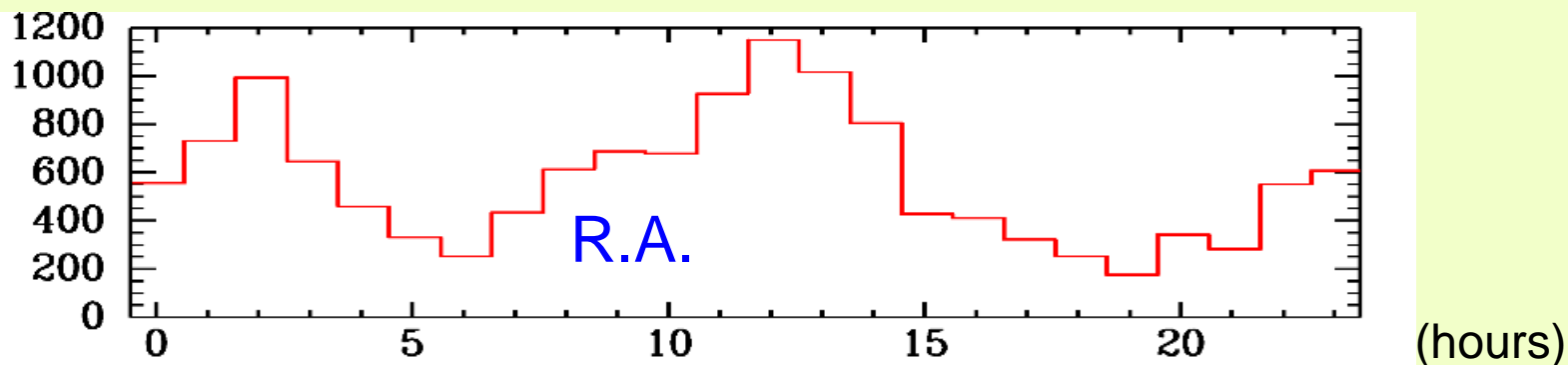
Fully robotic obs

- Hardware control
- Obs schedule and control
- SN search schedule
- SN search image processing
- GRB response

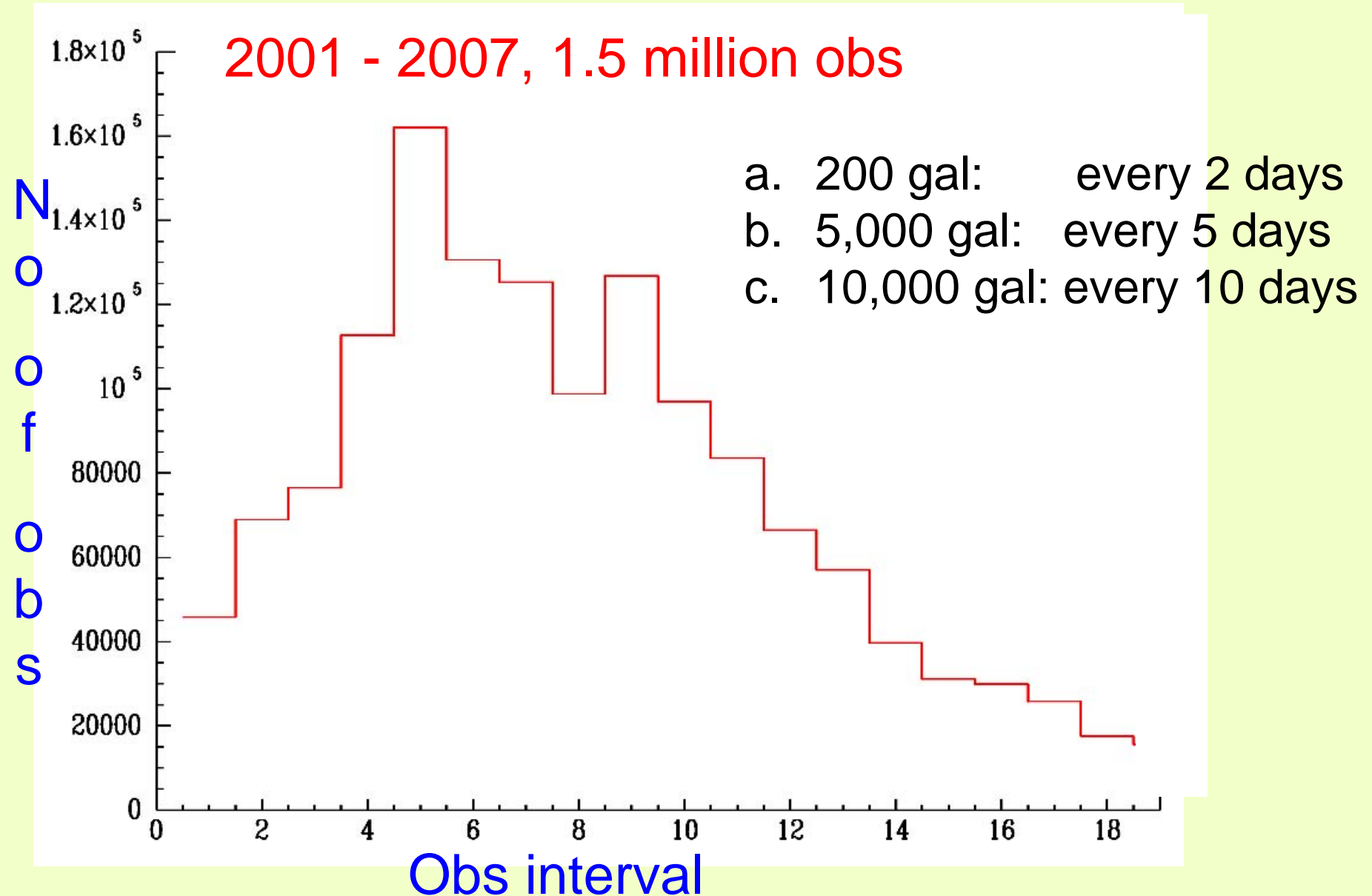


LOSS sample galaxies

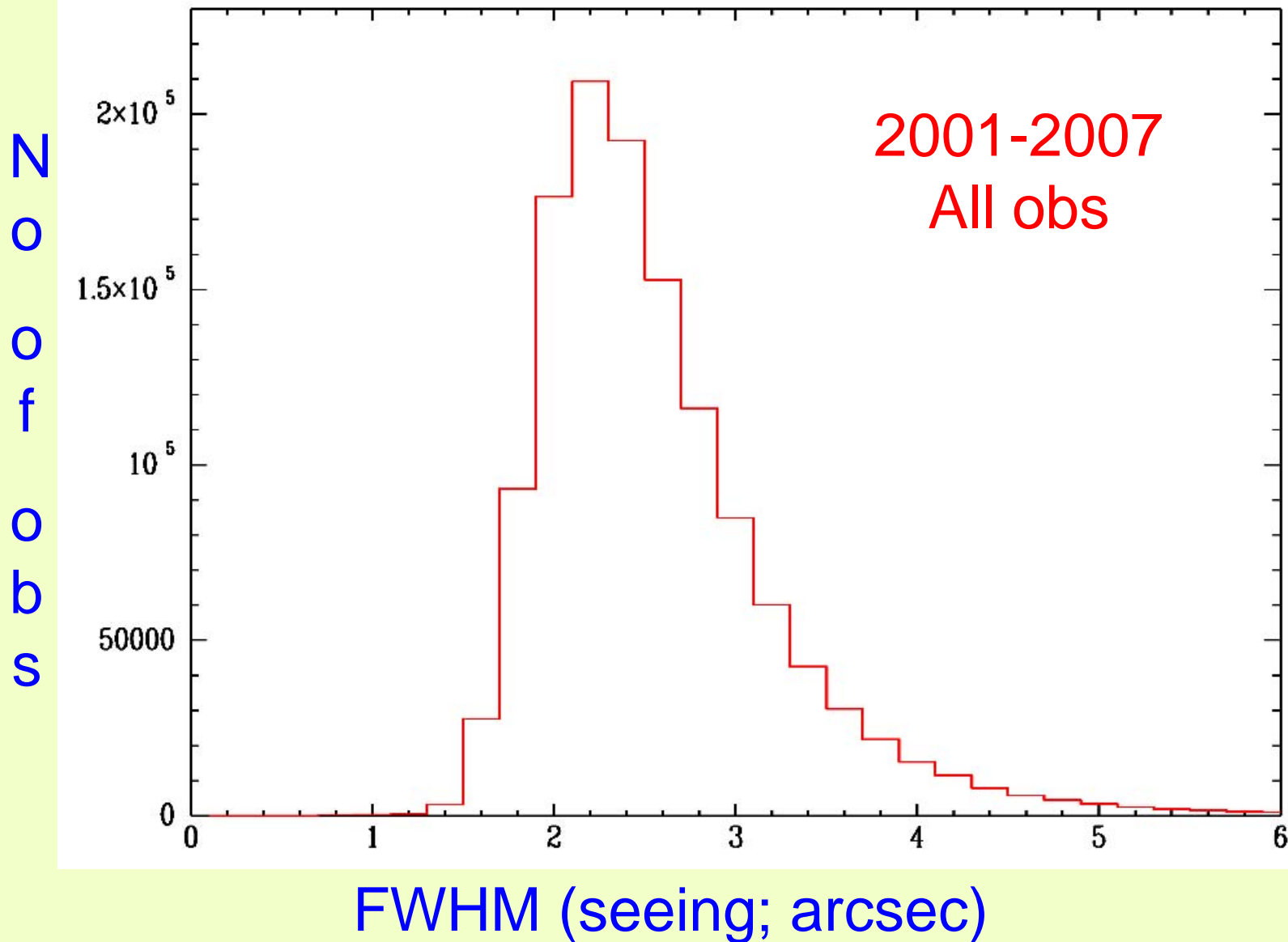
- Selected from RC3, UGC, ESO-Uppsala
- Limits on DEC, redshift
- Limits on brightness, diameter of the galaxies
- 14,000 fields, ~20,000 galaxies



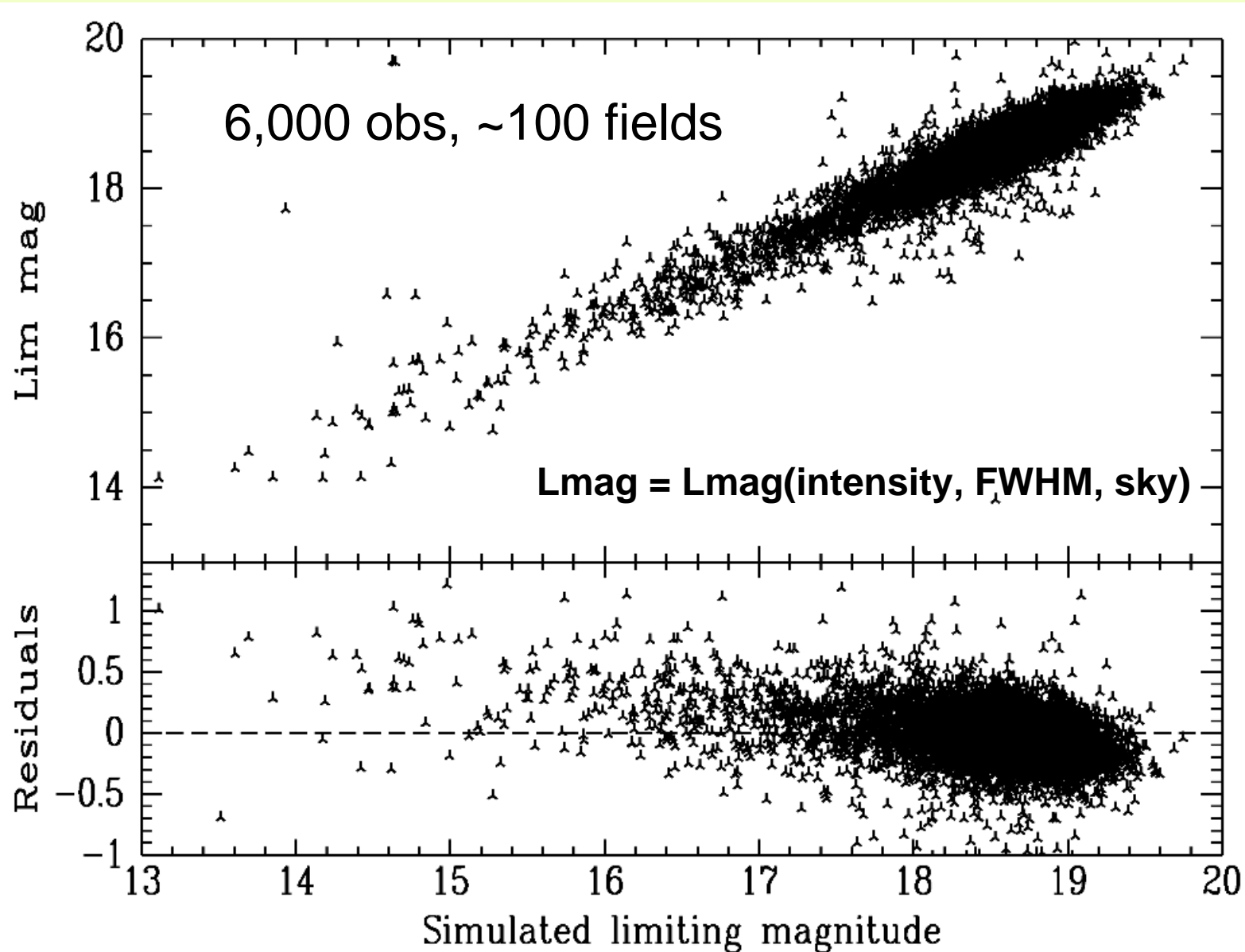
LOSS Cadence: 2-12 days



LOSS seeing: 2-3''



LOSS: typical depth (17.5-19.5 mag)



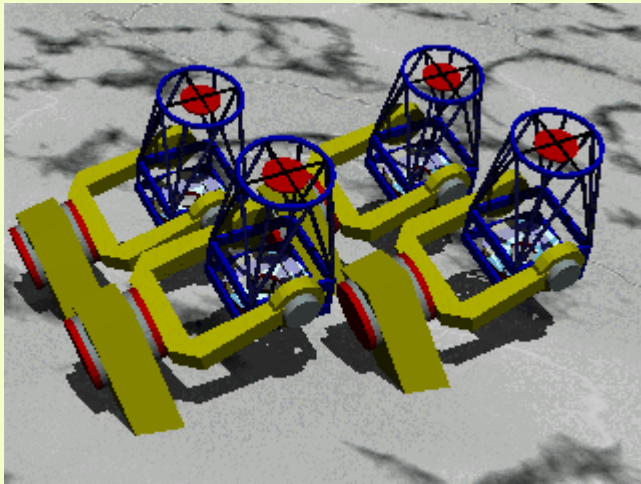
LOSS duration/The future of LOSS/KAIT

1. A Southern KAIT (or XXXT)

- All-sky coverage
- weather redundancy
- improved data quality

2. Challenges ahead

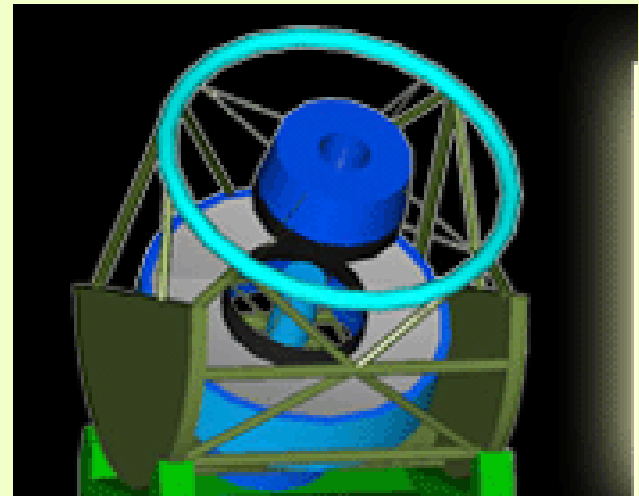
PAN-STARRS



$4 \times 1.8\text{m} \times 3^\circ$ FOV

Entire sky/7 days to 24th mag

LSST



$8.4\text{m} \times 3^\circ$ FOV

Entire sky /4 days to 24th mag

LOSS results: SN discoveries

- **1997: 1 (SN 1997bs)**
- **1998: 20 (world record)**
- **1999: 40 (world record)**
- **2000: 38 (including SN 2000A)**
- **2001: 68 (world record; SN 2001A)**
- **2002: 82 (world record)**
- **2003: 95 (world record)**
- **2004: 83 2005: 82 2006: 84**

<http://astron.berkeley.edu/~bait/kait.html>

Bottom line: KAIT discovered nearly 50% of all SNe brighter than mag 19 in the past 6-7 years.

LOSS results: followup efforts

- Prompt alerts to 80 astronomers/SN observers
- Carnegie Supernova Program (CSP)
- Caltech Core-Collapse Program (CCCP)
- Follow up with our own telescope network



KAIT



Lick 1-m



Lick 3-m



Keck I/II 10-m

10-20% of time

2-3 nights/mon

2 nights/mon

Occasional

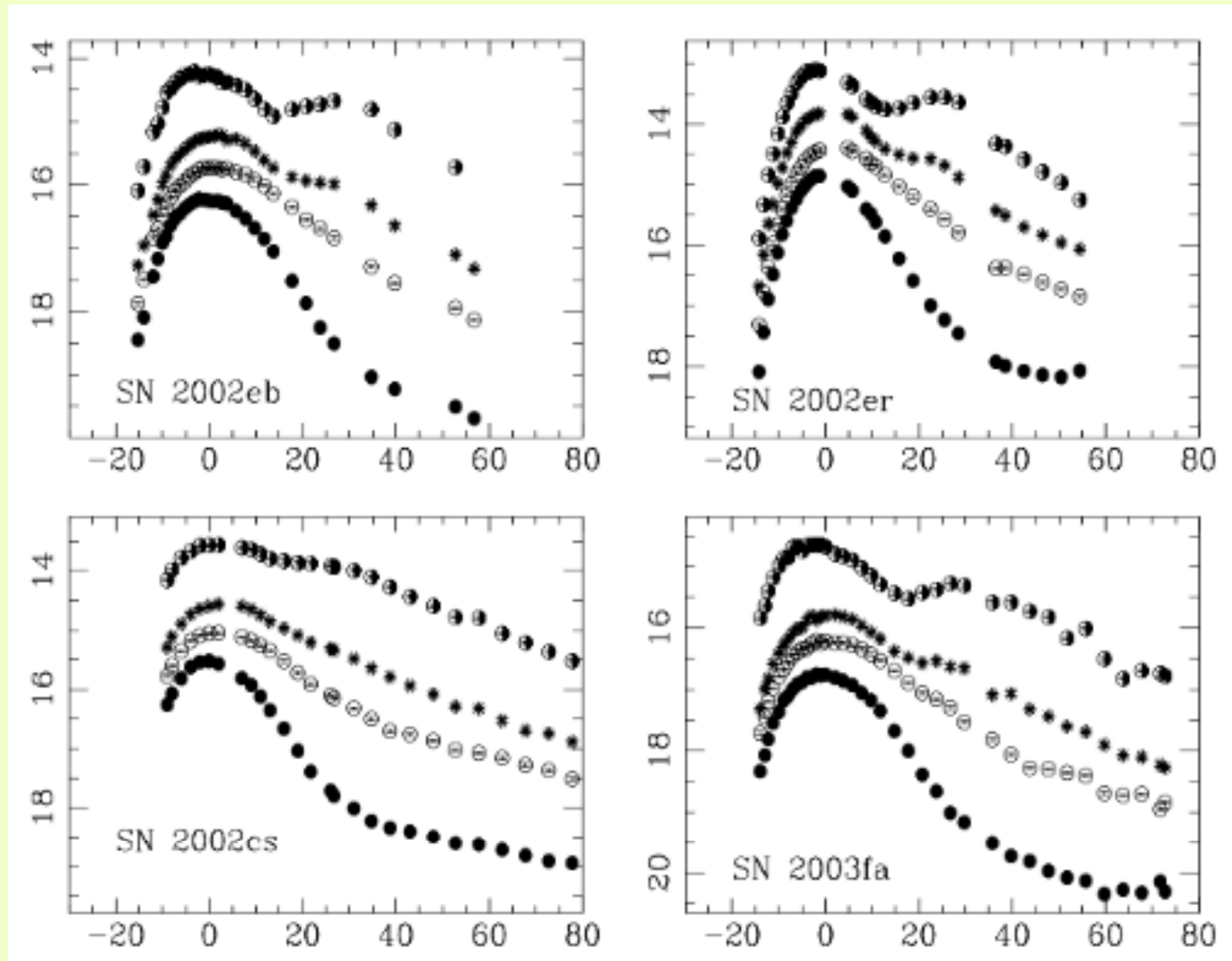
**Photometry
calibration**

**Calibration
photometry**

spectroscopy

spectroscopy

Sample Light curves of SNe Ia



- filtered (BVRI) photometry of 200 SNe
- Unfiltered photometry of 900 SNe

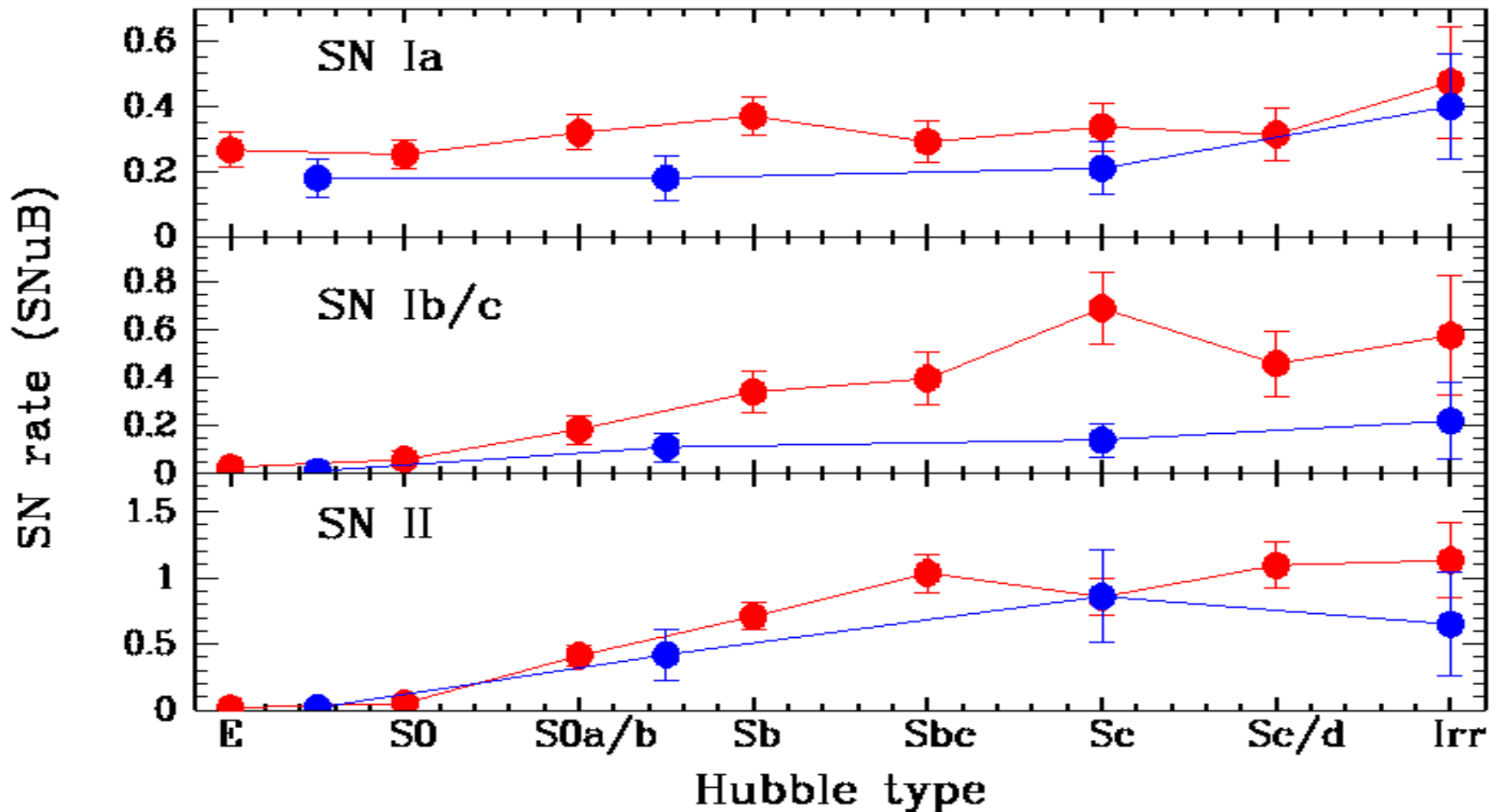
LOSS results: Nearby Supernova rate

Van den Bergh et al 2001, 2003, 2005; Leaman et al 2007 in prep

LOSS sample: 566 SNe in 13,000 galaxies

Previous best: 137 SNe in 4,000 galaxies

From 5 combined (plates and by eye) searches Cappellaro et al. 1999



On-going/planned projects:

- Photometry pipeline/data release
- Impact on Cosmology (low-z SN Ia sample)
- Hubble constant/Hubble bubble
- Distance fitters/extinction laws
- Local peculiar flow
- Low-z SN Ia sample (properties/statistics)
- Low-z SNe II (photometry/spectroscopy)
- Low-z SNe Ib/c
- Low-z SNe IIn, II-L, II-P
- Radial/spatial distribution of SNe
- Many Individual interesting objects
- SN rates/statistics
- SN luminosity function