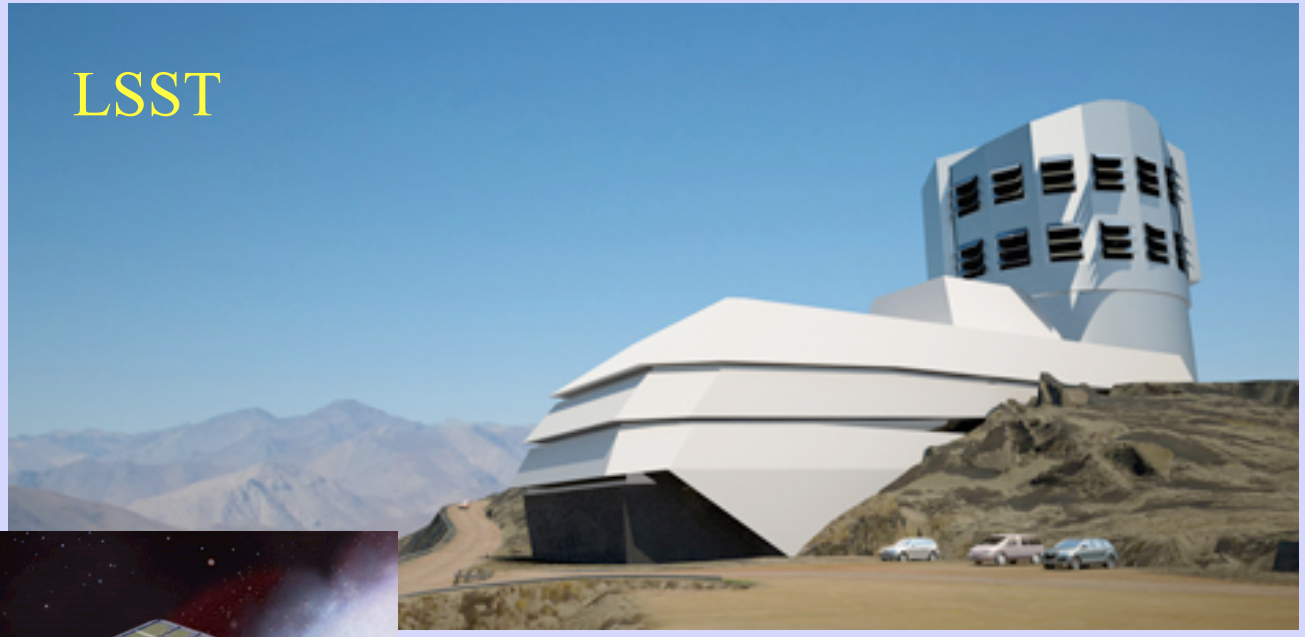
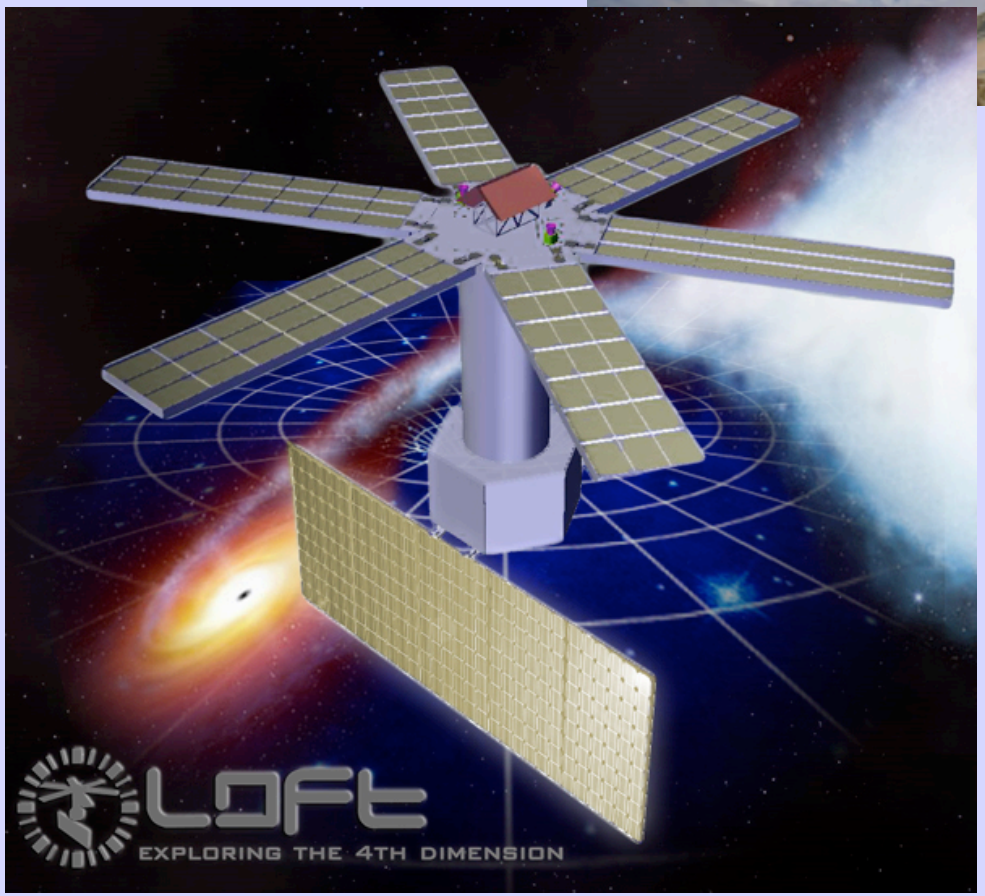
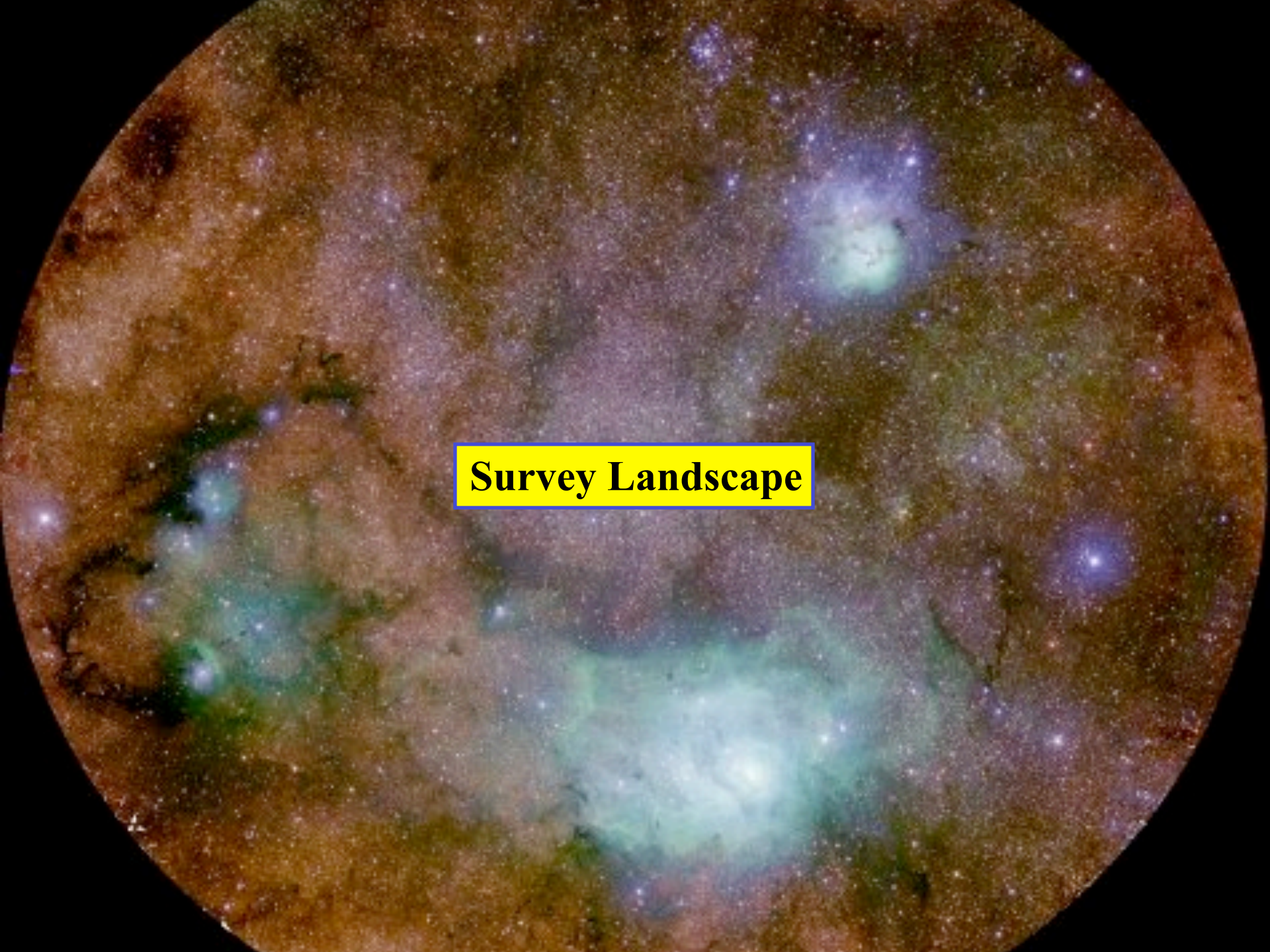
Wide Field Optical Surveys and LOFT





June 2013
Andy Lawrence
LOFT UK Science Meeting
RAS Burlington House

- Survey landscape
- LSST
- LSST and LOFT


Survey Landscape

Static atlases now and next

- Optical : SDSS+VST+DES ==> LSST, Euclid
- Infrared : UKIDSS+VISTA ==> Euclid
- Spectra : SDSS+2DF+6dF ==> WEAVE, BigBOSS

Are these good enough for all plausible WFM transients?

Future emphasis on the South

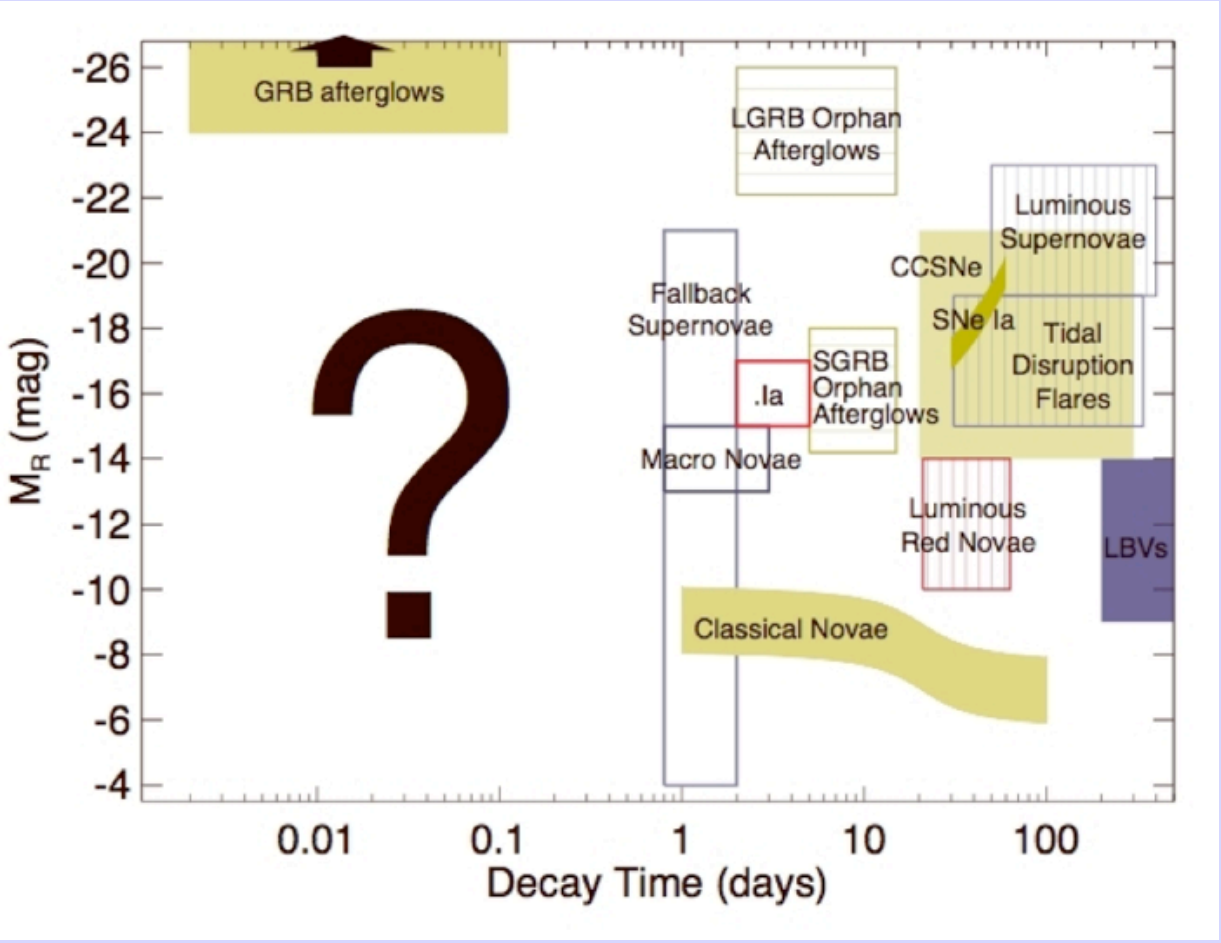
Possible large area MOS surveys

North :	WEAVE	WHT	1000 fibres	3sq.deg
	LAMOST	LAMOST	4000 fibres	19 sq.deg
South :	BigBOSS	Mayall	5000 fibres	7 sq.deg.
	4MOST	VISTA/NTT	3000 fibres	5 sq.deg
	HERMES	AAT	400 fibres	3 sq.deg.

All in uncertain state of funding and operational plan
e.g. 4MOST in competition with MOONS
for VLT 500 fibres 0.8-2um 500 sq.arcmin

Dynamic surveys now and next

- Past OGLE, MACHO, QUEST
- Present WASP, CRTS, PTF, PanSTARRS-1
- Future PS2, PS4, LSST



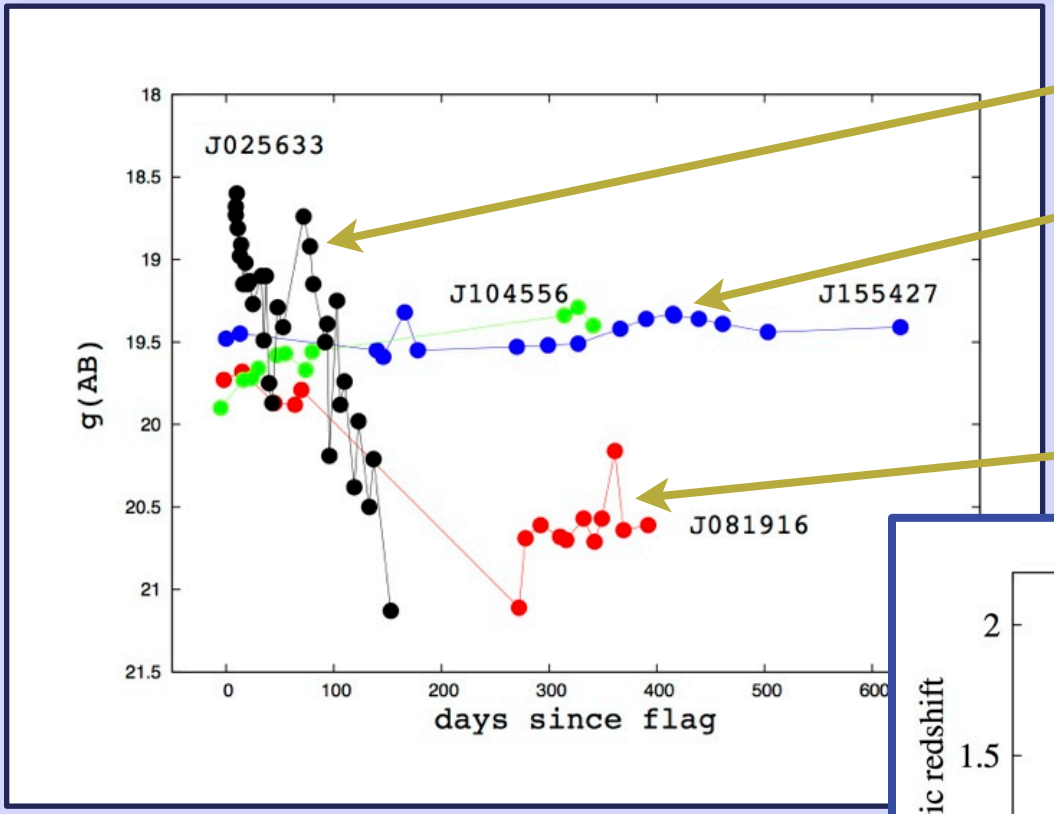
Object parameter space

	PTF	LSST
Luminous red novae	4/yr	1700/yr
Macronovae	2/yr	600/yr
SN1a	700/yr	200,000/yr
SNII	300/yr	100,00/yr

From LSST Science Book

Still some surprises?

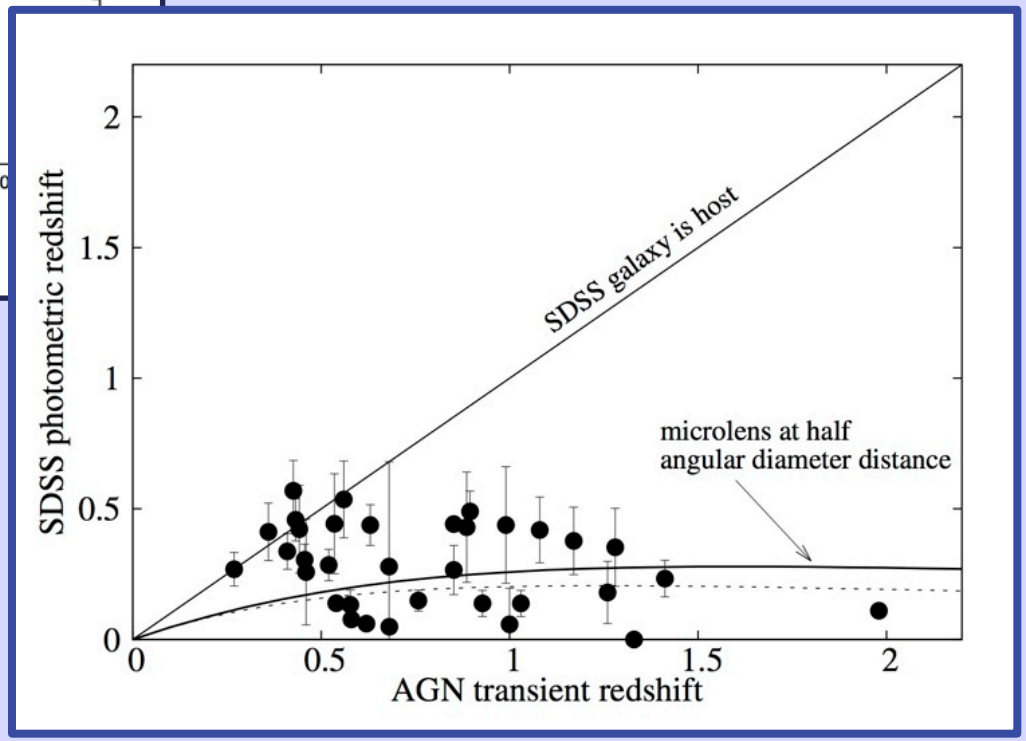
PS1+LT
Lawrence et al in prep



probable blazar

New class of slow blue transient : amplitude x 10-30

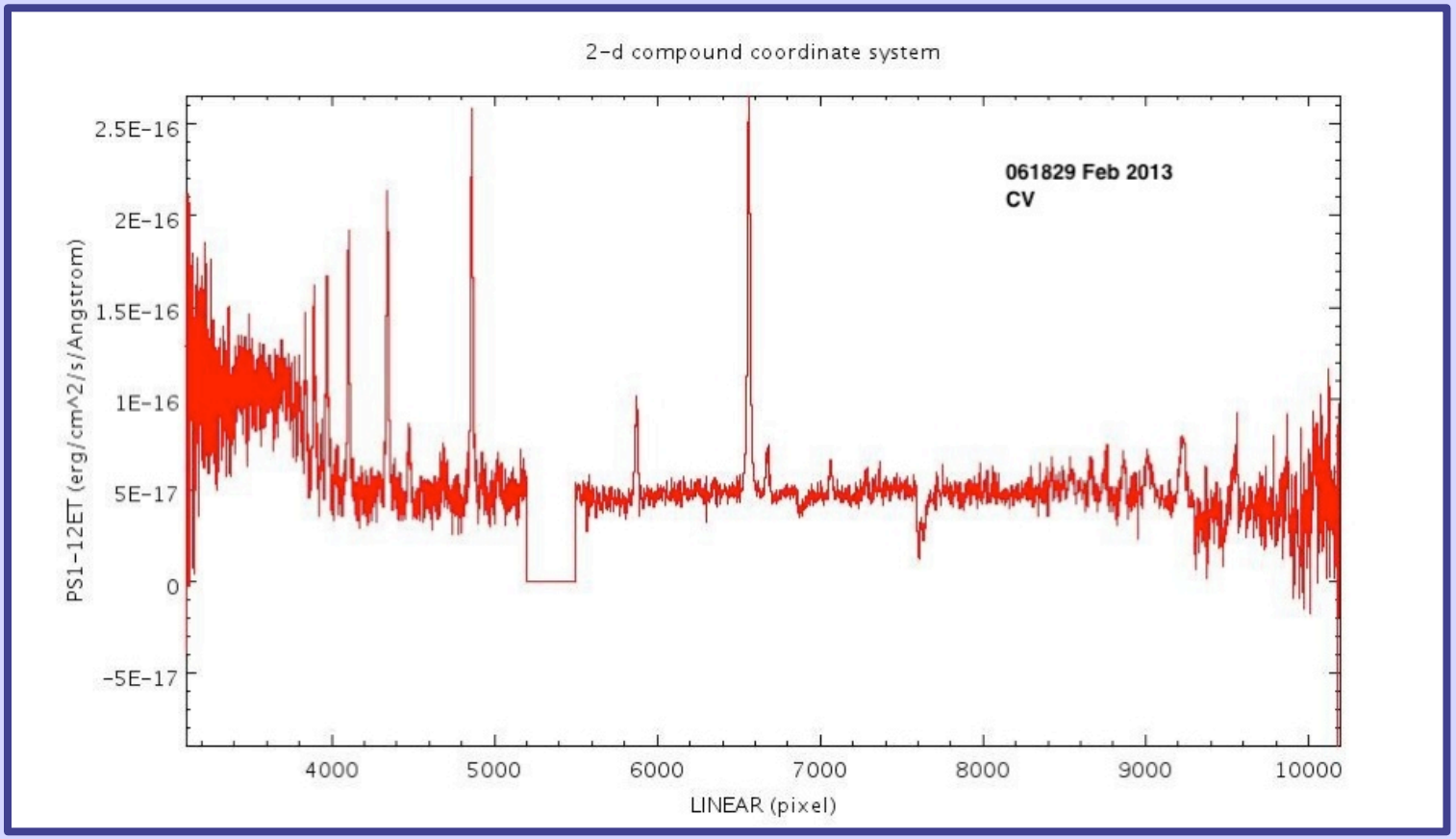
Nuclear Supernova



Transients are quasars at z~1
Existing galaxies photo-z ~0.3

probably rare extreme *microlensing events*

Unused transients



SDSS g=22

PS1 g=17

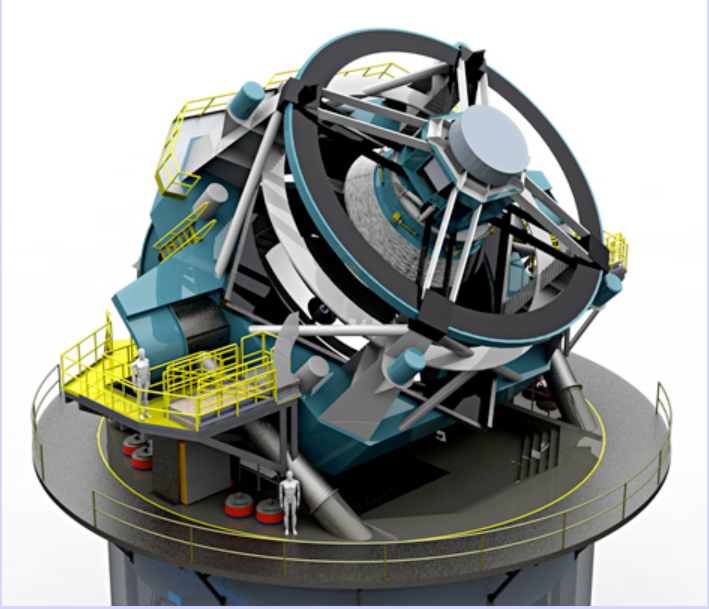
If its not a SN or an AGN, we ignore it !!

... data will be public next year...


LSST

LSST basics

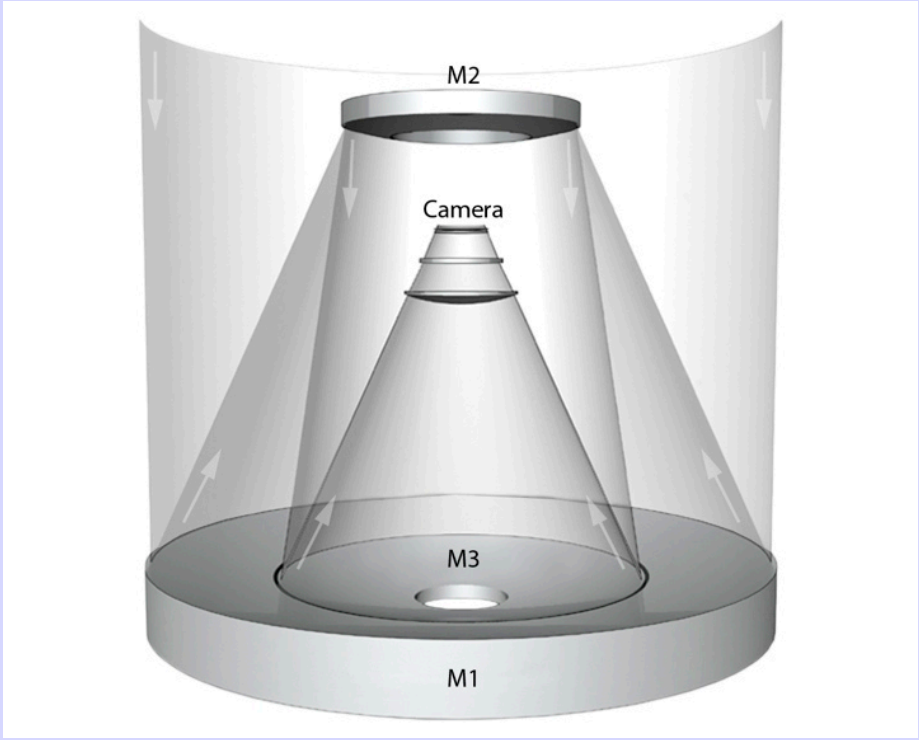
- US project
- D=8.4m / 6.5m effective
- FOV = 10 sq.deg.
- u g r i z y
- Cerro Pachon
- Ten year programme
- Capital cost $665M
- Operations $37M/yr



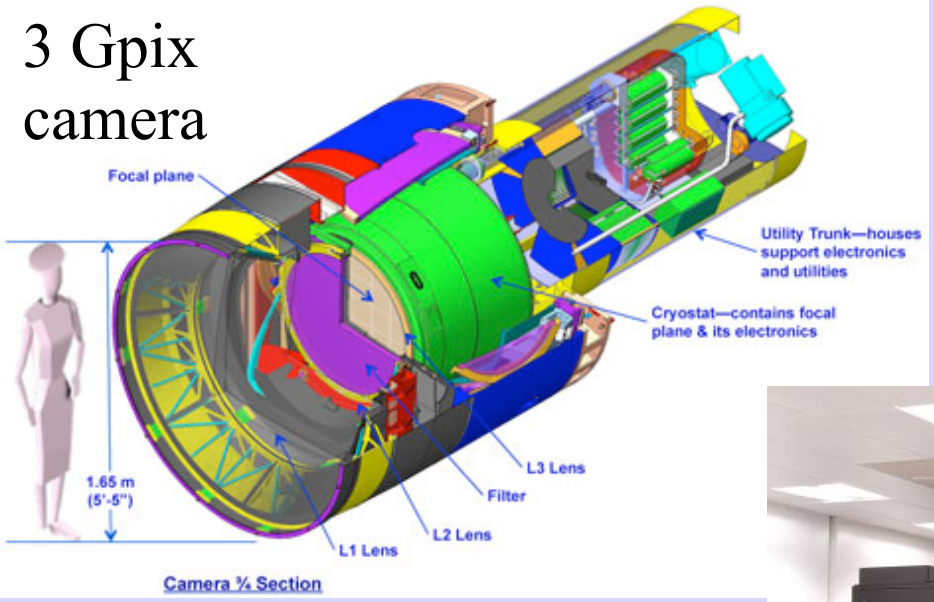
a movie of the sky with an 8m-class telescope

key features

3-mirror design for wide field



3 Gpix camera



serious approach to data processing and user tools

large mirror + large detector means large grasp

Science impact

- 10^{10} stars, 10^{10} galaxies
- Photo zs for 3×10^9 galaxies
- 250,000 SNe/yr
- Orbits for 10^5 NEOs and 10^5 Trojans
- Gaia-quality PMs – 4 mags deeper
- Light curves for 2×10^6 low-z quasars
- 1000 quasars with $6.5 < z < 7.5$
- …etc etc etc…
- plus The Transient Unknown

survey plan

Deep-Wide Survey : 18,000 sq. deg
pair of 15 sec exposures
repeat within hour
repeat within a few days
825 visits over ten years

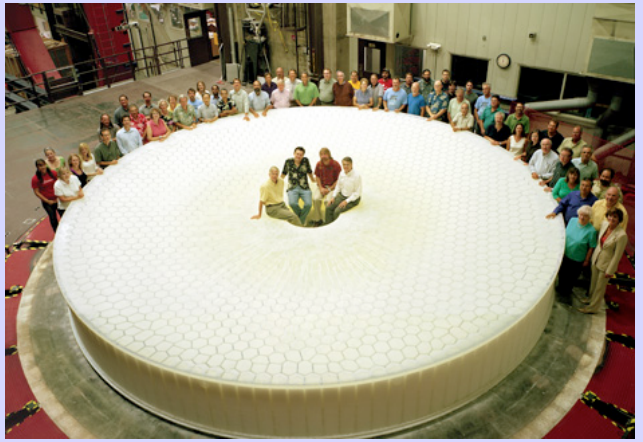
g=24 night
g=27.5 final

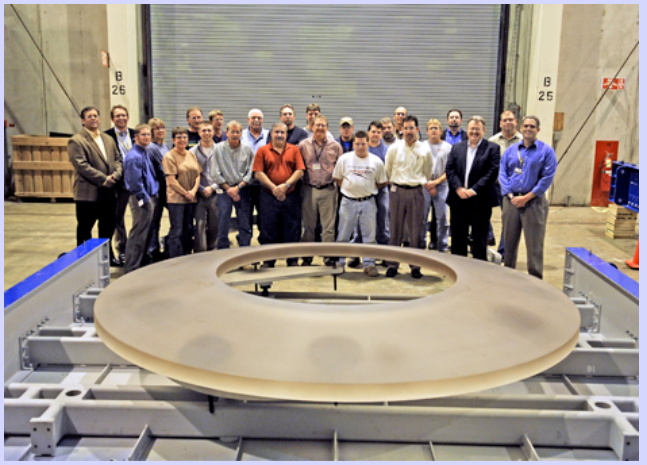
a million alerts/night
released within 60sec

Special regions + deep drilling fields
10% of time

status

M1/M3 and M2 cast
Camera construction started
Site partly levelled





Capital budget in 2013 NSF request
2014-19 construction
2020-21 commissioning
2022-32 operations

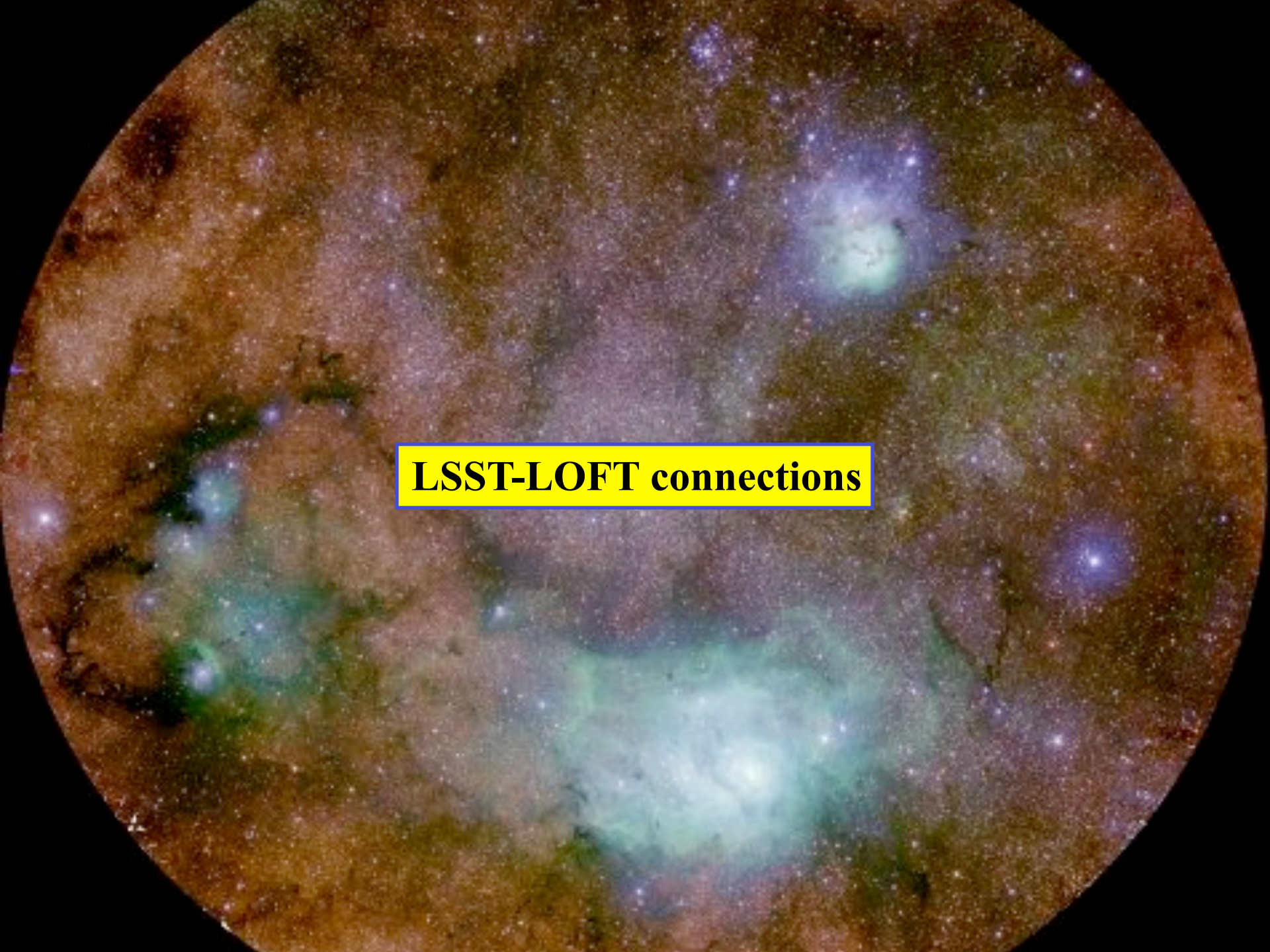
Instructed to find 30% of ops costs from partners

data policy

All data open to all US and Chile scientists
Alerts immediately worldwide public
- but not light curves!
Likely 2 year proprietary period

Access for others by named PI
at contributing Affiliate Institution
Cost $20K/yr/PI

16 UK Universities / 71 PIs expressed interest
Bid submitted to STFC prog.review
Well received but times are hard....


LSST-LOFT connections

What LSST does for LOFT

For half the sky :

- optical ID for all WFM transients
- light curves for all WFM transients days-years
- contemporaneous mags for all LAD-observed targets
- trigger LAD observations of brightest LSST transients

Always LOFT-limited

needs topic by topic science case study
- novae : prob yes
- AGN flares : prob no
- SNe : prob no
- GRBs : ??

What LSST does not do for LOFT

- high time resolution coverage
- precise simultaneous coverage
- UV and IR coverage
- spectra

What LOFT does for LSST

unlock the nature of the brightest LSST transients
possibly follow up rare events with risetime=hours

LOFT-LSST options

(1) Wait for proprietary period expiry. Analyse light curves post facto

(2) Individual LOFT scientists arrange their own access through Affiliate Institutions

(3) LOFT-LSST MOA?

FIN