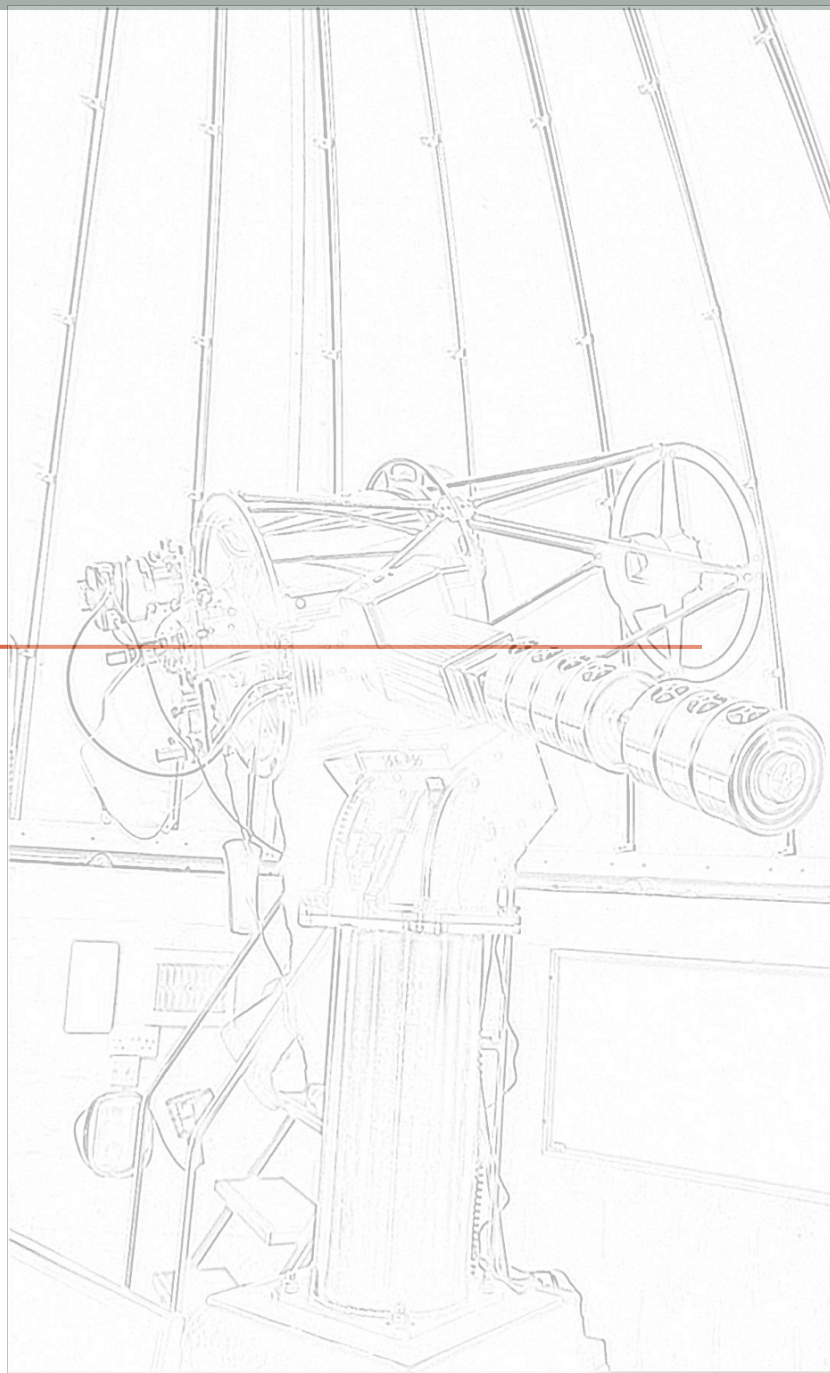
OBSERVING TRANSIENTS WITH THE UoL OBSERVATORY

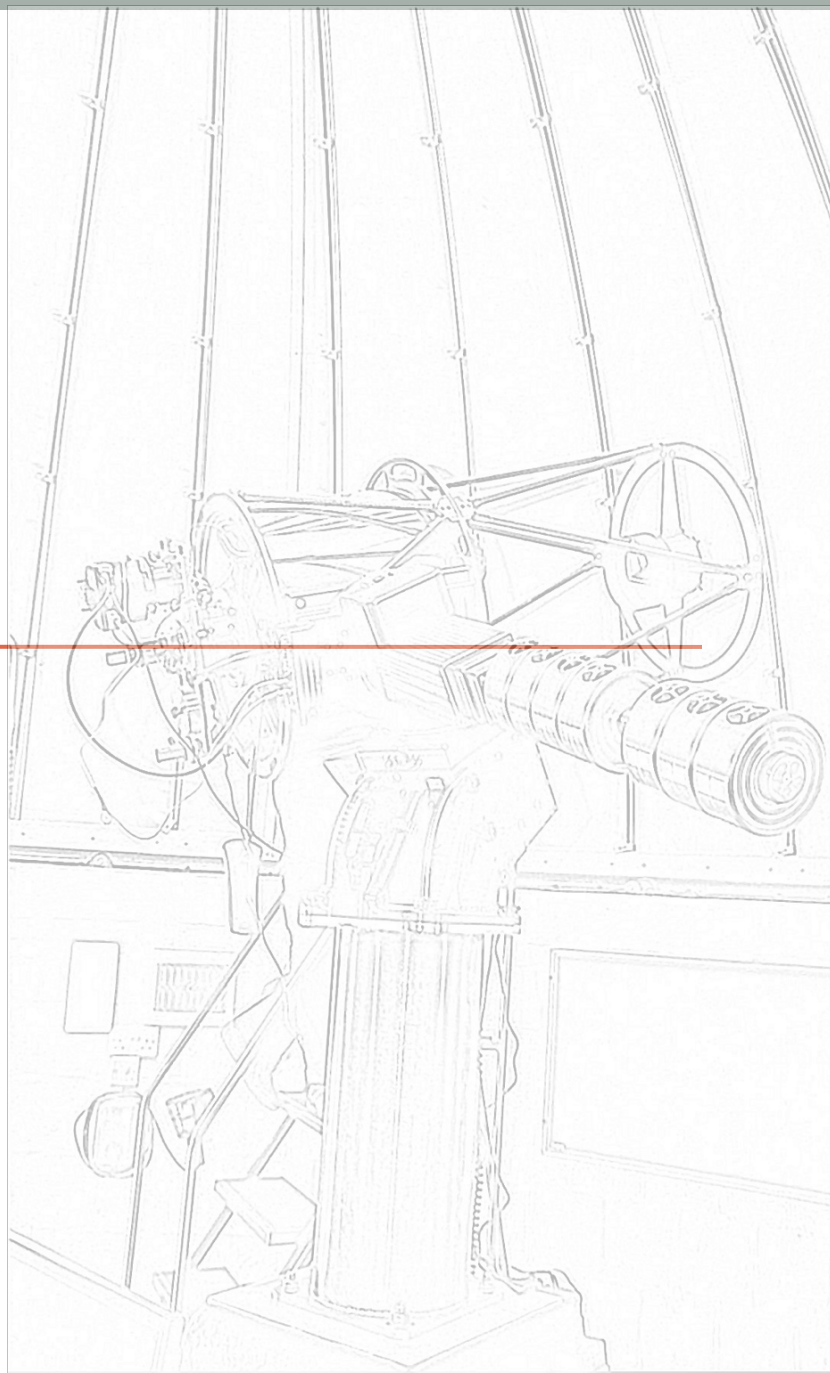
Klaas Wiersema

UNIVERSITY OF LEICESTER



OBSERVING TRANSIENTS WITH A TYPICAL UNIVERSITY TEACHING OBSERVATORY

Klaas Wiersema



UNIVERSITY OF LEICESTER

Background

This is a *teaching* observatory of the University of Leicester, used *by*

- (Under-)grad astronomy/physics students (we have ~110 1st year students)
- AstroSoc (astronomy and rocketry student society)
- Guests (e.g. scouts, spaceschool, open nights, Stargazing Live etc)
- Staff

and it is used *for*

- undergrad student research projects
- (STEM) outreach
- Fun!
- And a bit of science!

This is a teaching observatory very similar to many!

Picture: A. Dance

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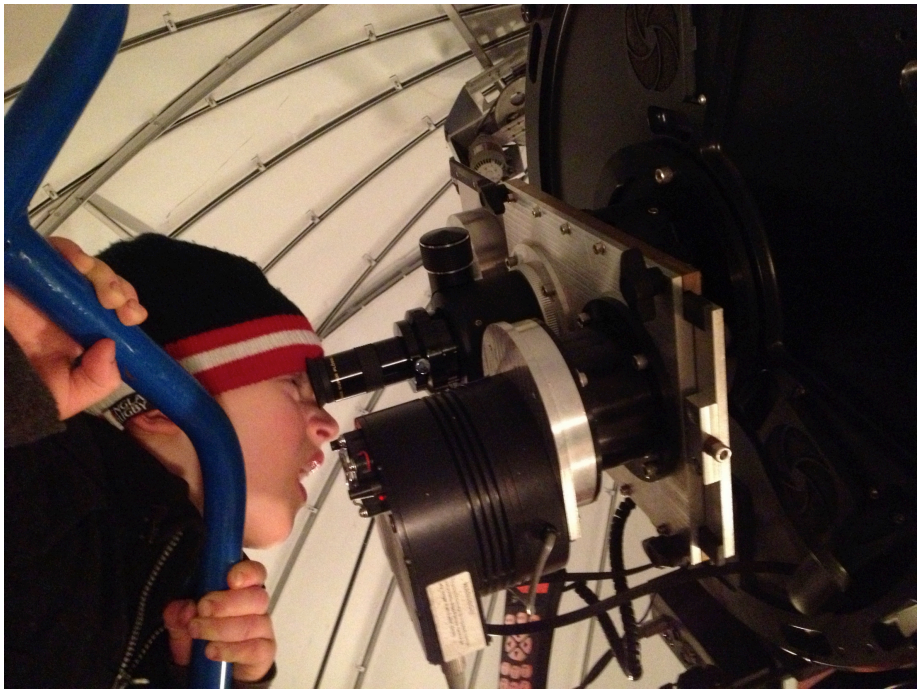
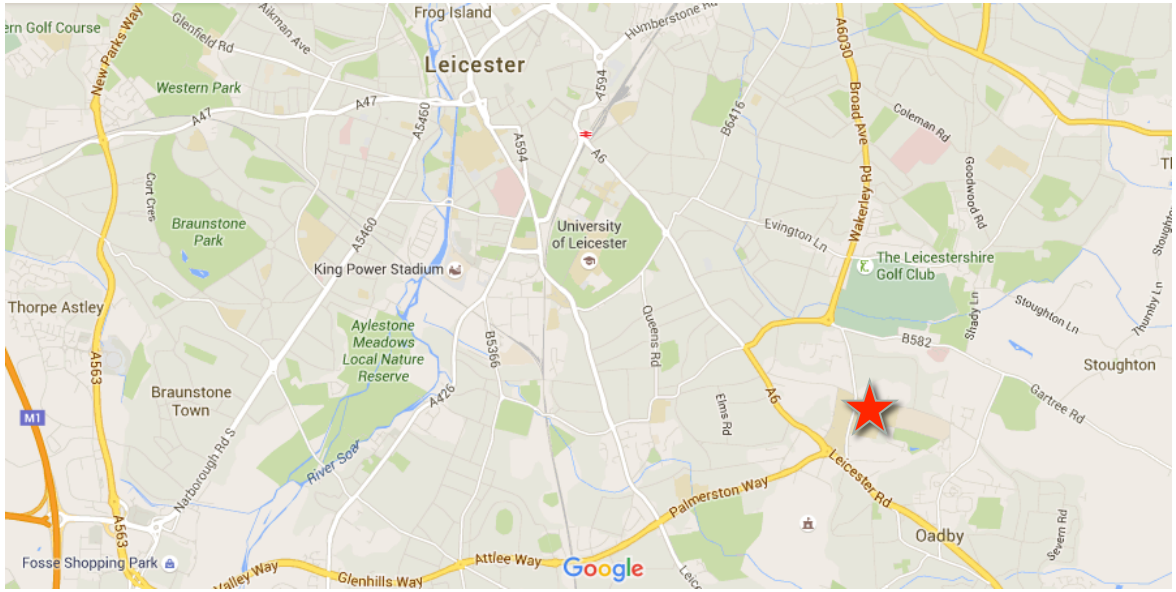


This is a teaching observatory very similar to many!

Background

Location: 1.07365 W, 52.61147 N, 112 m

In *Oadby*, a village attached to Leicester (UK), 2.5 miles from Uni, in between student housing. Good location for hands-on teaching and outreach (safe/easy access at all times).



Teaching observatory needs: to be robust to unsupervised handling by students; flexible; easy+safe+frequent access for students and public (i.e. not middle of nowhere); easy to use soft/hard ware; hands-on.

Student projects: science driven (e.g. transients, exoplanets, etc), technique driven (e.g. crowded field photometry techniques) or facility/method driven (e.g. VO data archive, CCD quality control, etc)

Background

Requirements for a teaching observatory and those for a research observatory aren't often the same. Requires compromises, particularly when on a small (~1k£/year) budget.

Research/science impact: sky brightness, seeing, availability, software and hardware choices (e.g. automation).

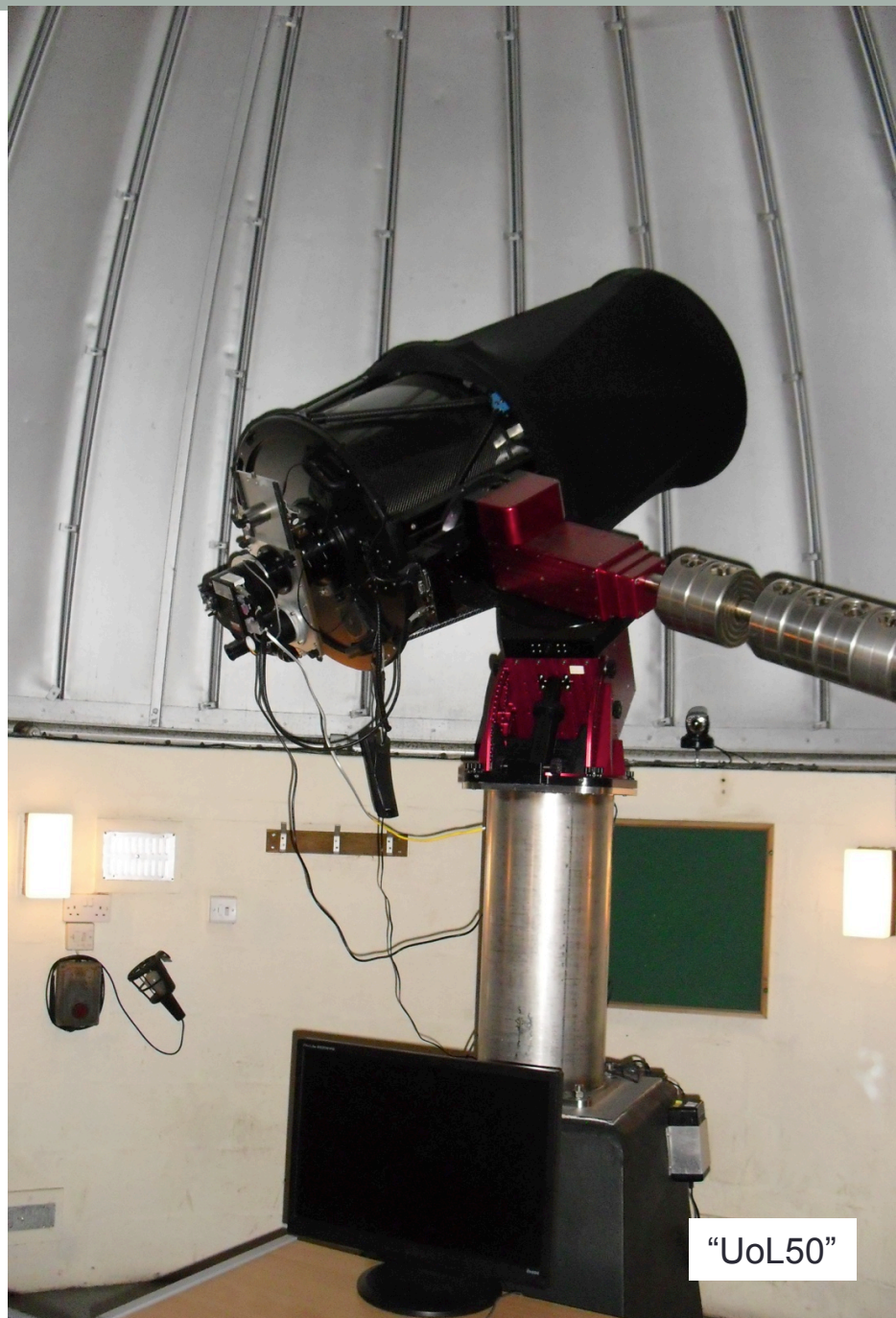
Photo: C. Mountford

Hardware

- Modernised observatory opened in ‘09 by Jeff Hoffman
- 20 inch Planewave CDK (corrected Dall-Kirkham), f/6.8. Funded through piCETL.
- Paramount ME
- SBIG ST2000XME
- Eyepiece / Camera selection through slide mechanism
- “Manual” dome

FoV: 11.9’ x 8.9’; 0.44” per unbinned pixel, 1600x1200 pix
Filters: 5 mounted in wheel, from U,B,V,R,I,Hα,C_2, grating

Engineering/maintenance: R. McErlean
Observatory director: A. Blain



Software

- Telescope/camera control: SkyX (easy to use for undergrads)
- Scheduling: custom software + iObserve (+ alert streams)
- Data reduction: Custom IRAF-based pipelines (*oadby* package) for file preparation (header editing, classification), processing, [spectral extraction and calibration], sorting files into archive format. At least once, the files are displayed for visual QC.
- Analysis: IRAF pipelines, SExtractor, Hotpants
- Some QC analysis (CCD parameters, ZPs, etc)

Fast response possibilities ("visitor" observing), can do some unusual observing modes on the fly (mosaicing, high time resolution through track rate hacks, etc), and adapt to conditions quickly – useful as they vary with viewing direction!
Not robotic - always a excellent observer present (me)…

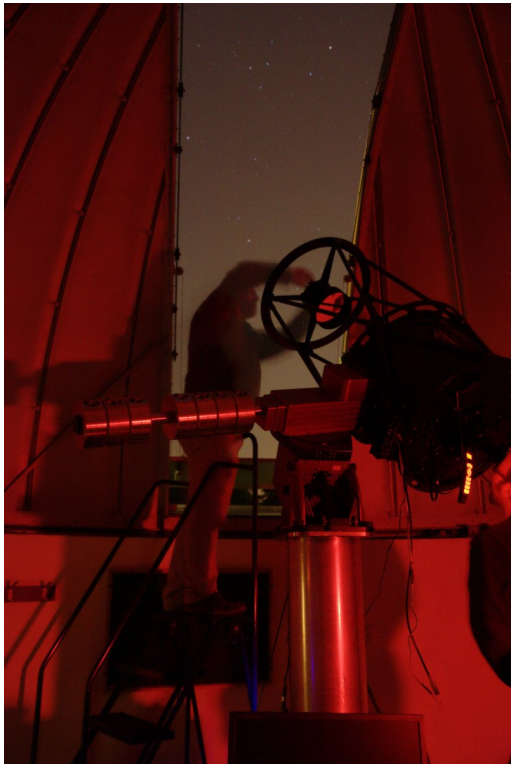


Photo: C. Mountford

Performance

Number of clear nights:

- ≥5hrs fully clear: ~18%
- ≥2hrs fully clear: ~30%
- ≥5hrs of <65% cloudcover: ~25%

Seeing:

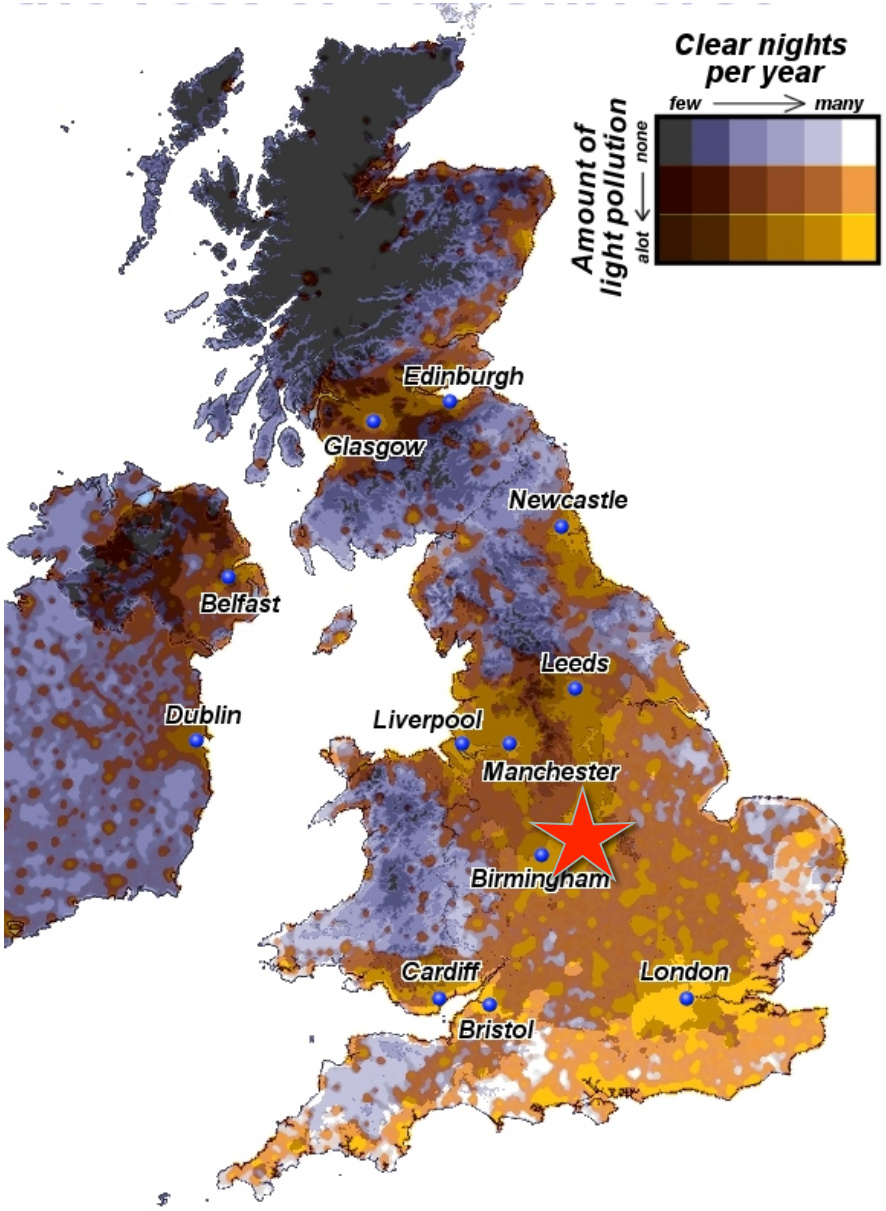
Poor (average 2.6”), related to view over city and sports center.
so usually use CCD with 2x2 binning.

Skybrightness: strongly dependent on viewing direction (~19m/arcsec^2)

Limiting magnitudes (5σ),:

- V~17.5 in 30s
- V~20 in 1800s

CCD is best in blue.



Performance

Number of clear nights:

- ≥5hrs fully clear: ~18%
- ≥2hrs fully clear: ~30%
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Seeing:
Poor, average 2.7'', related to
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so usually use CCD with 2x2 binning.

Skybrightness: strongly dependent on viewing direction (~19m/arcsec^2).

Limiting magnitudes (5σ),:

- V~17.5 in 30s
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CCD is best in blue.

Photo: D. Baskill

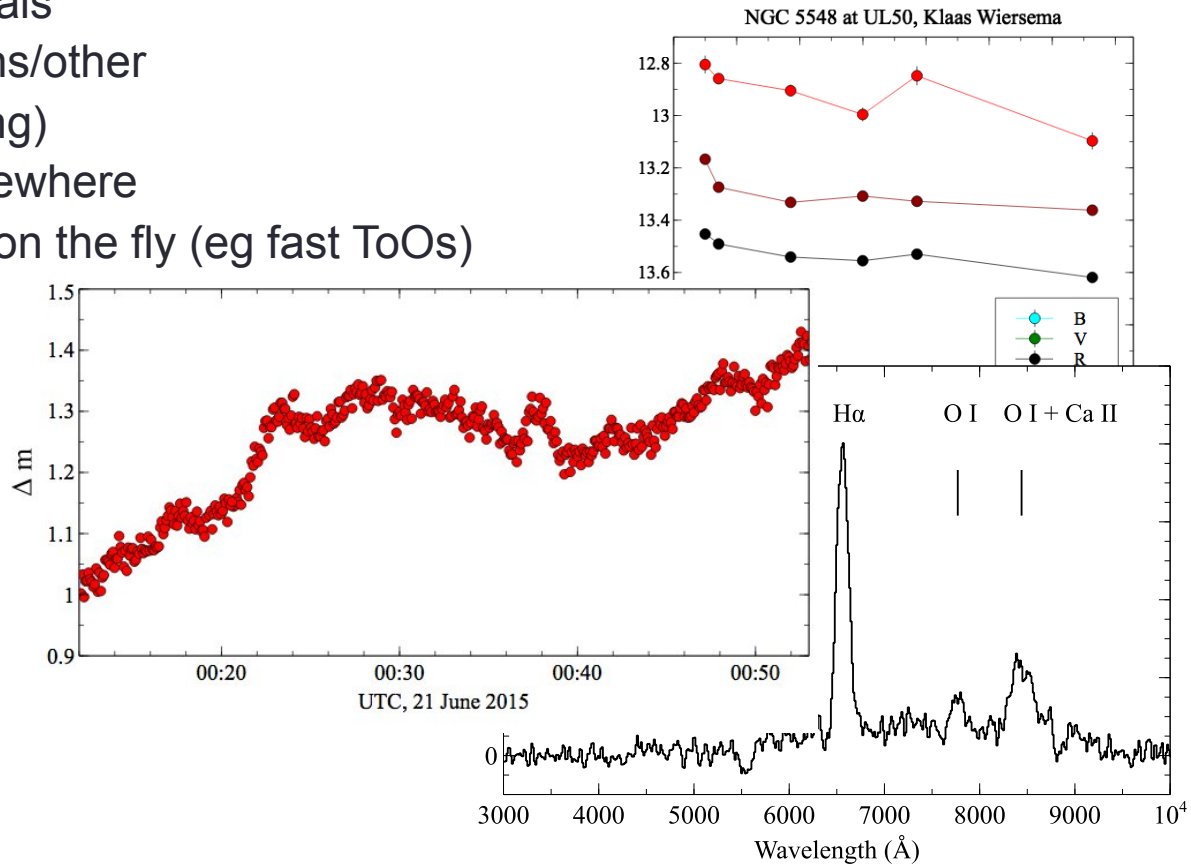
Best science targets for this setup

What we're quite good at:

- monitoring at irregular intervals
- SED-filling for space missions/other wavelengths (e.g. co-pointing)
- sources difficult to get to elsewhere
- sources requiring decisions on the fly (eg fast ToOs)
- Trying things out

Not good at

- fixed epochs
- specific cadences
- faint stuff
- high airmass

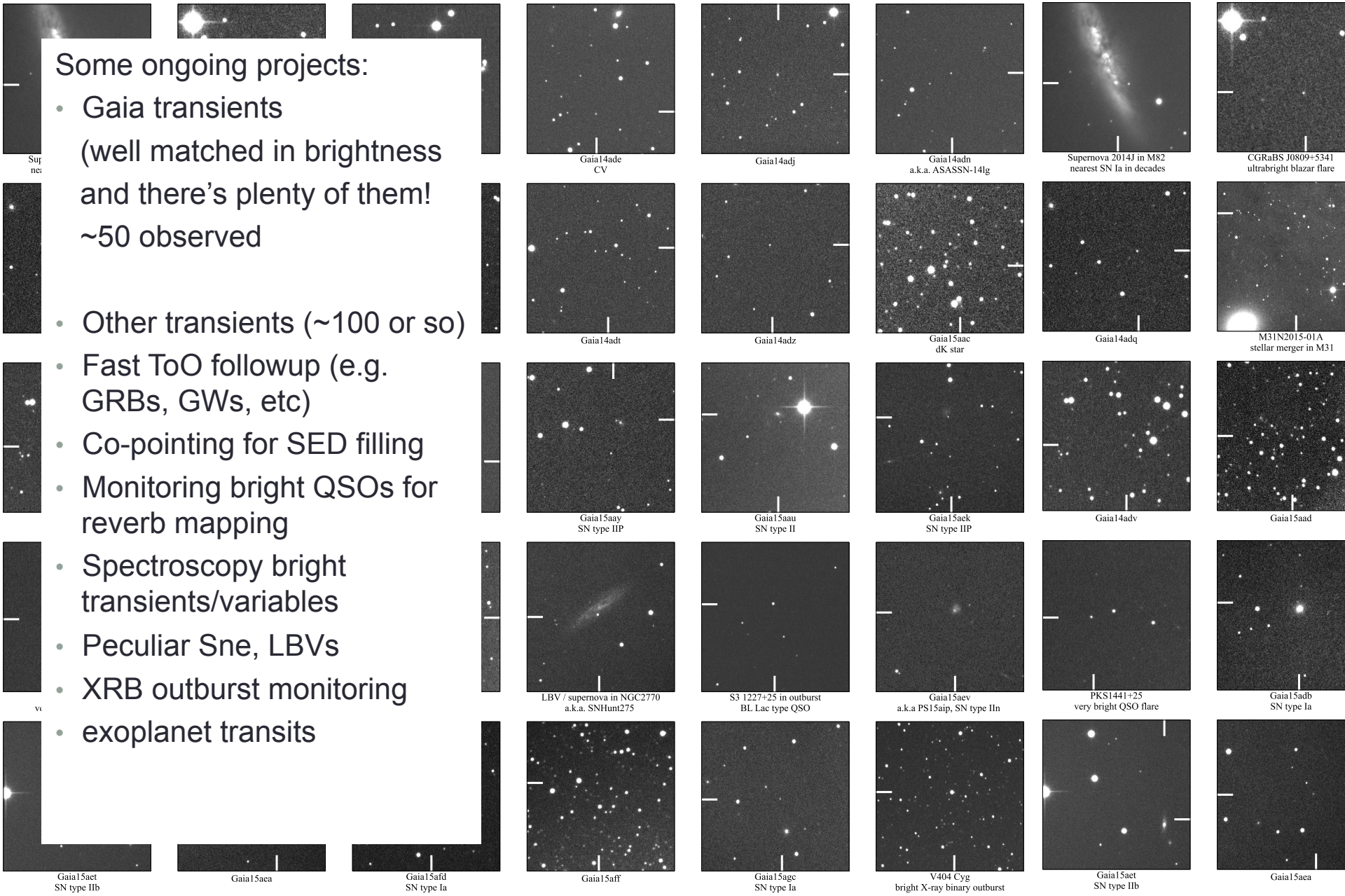


This kind of set-up, at this location, will not give transformative discovery data, but can provided real *added value* to other datasets/projects, for little effort and financial investment. Nice student project work/data! No hassle with proposals, time allocations. Contribute data to a handful of papers/year.

Best science targets for this setup

Some ongoing projects:

- Gaia transients
  (well matched in brightness and there's plenty of them!
  ~50 observed
- Other transients (~100 or so)
- Fast ToO followup (e.g. GRBs, GWs, etc)
- Co-pointing for SED filling
- Monitoring bright QSOs for reverb mapping
- Spectroscopy bright transients/variables
- Peculiar Sne, LBVs
- XRB outburst monitoring
- exoplanet transits



Future upgrades

If there's a windfall -

- Camera with bigger pixels (better matched to seeing) and larger size (FoV)
- *LE2Pol*
- Filterset
- dome automation
- upgrade telescope 2

And if we find the time (harder to find than funding..!)

- expand software suite
- train good students to get good science data

Would you like some data?

Field of Gaia15ael, observed 21/04/15 with Oadby, 30x30s in V, poor seeing. Statistical polarimetric errors assume N=4 waveplate angles, and $\sigma_P \sim 1/(\sqrt{(N/2)}*SNR(f_o+f_e)$, where $SNR(f_o+f_e)$ is the ord+exord beam SNR.