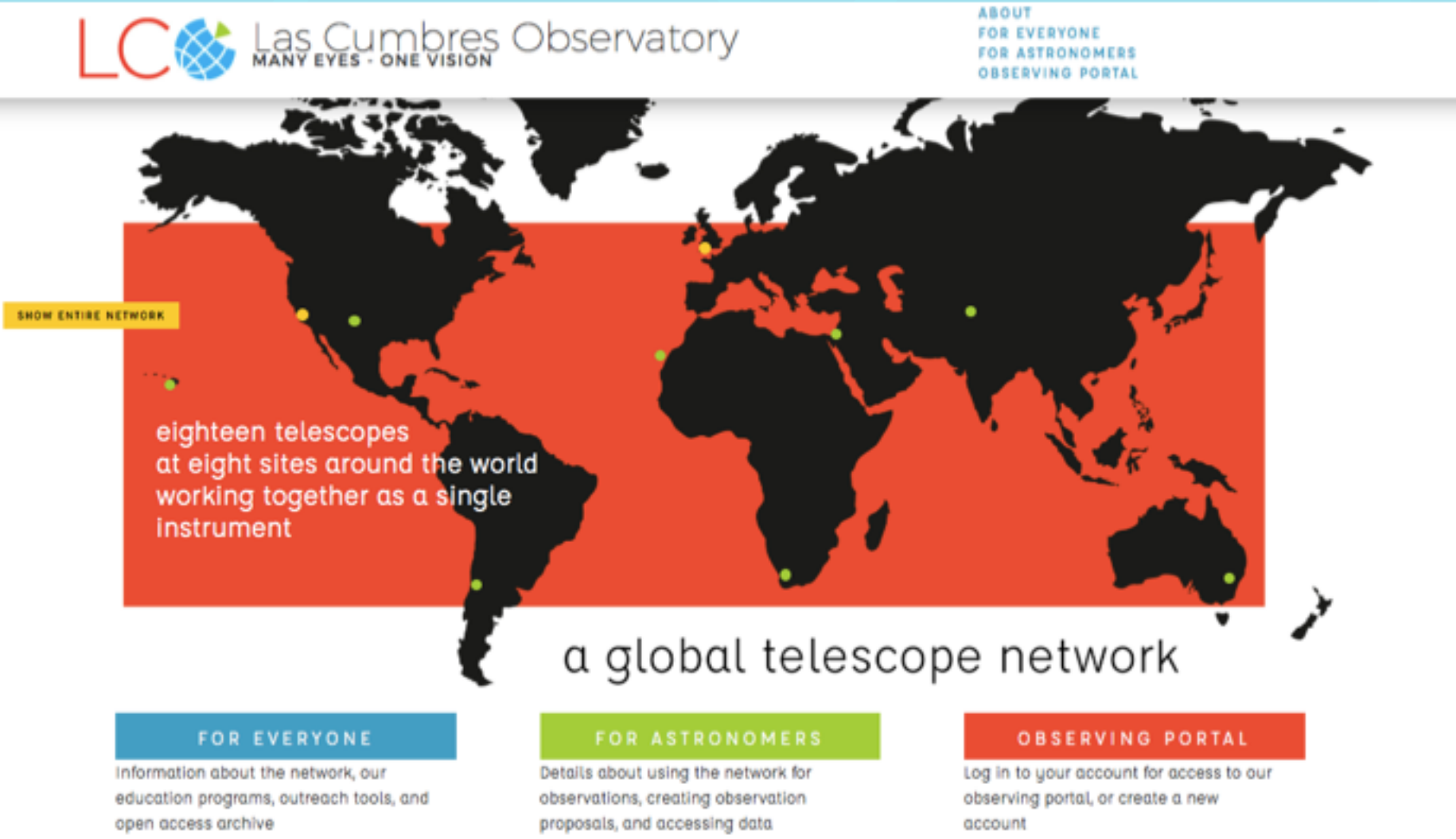


Las Cumbres Observatory in the Landscape of the 2020's

Todd Boroson, Observatory Director

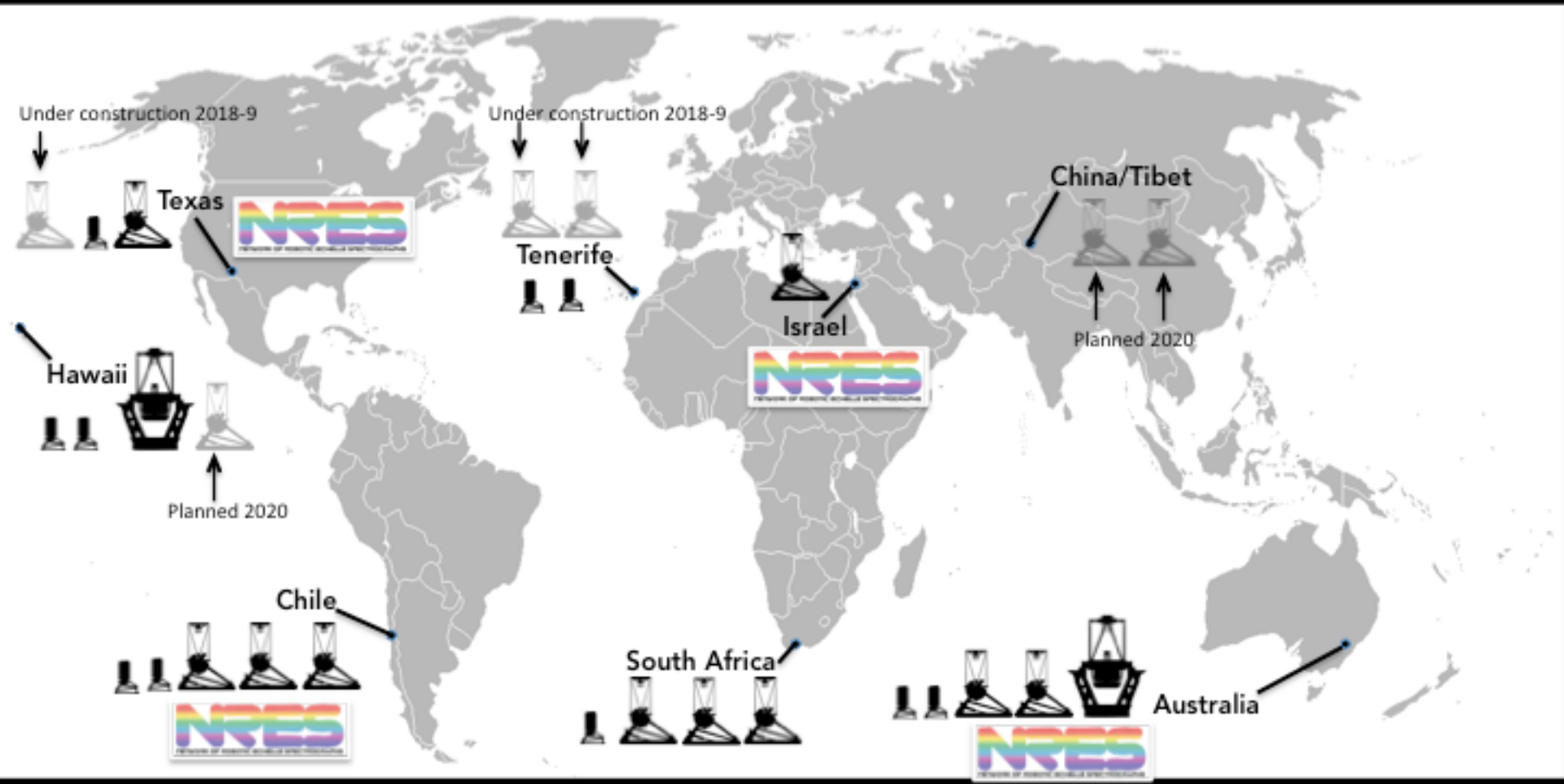
Why LCO?

- LSST follow-up is an important component of the Gemini strategic plan
- LCO has built and now operates a global network of optical telescopes for time domain follow-up
  - Target-of-opportunity ≠ interrupts
  - Dynamic scheduling
  - End-to-end automated data flow
  - Observatory API's
- NSF funded LCO's MSIP proposal with the intent of preparing community for LSST follow-up
- LCO is expanding this network in partnership with existing telescopes – perhaps including Gemini

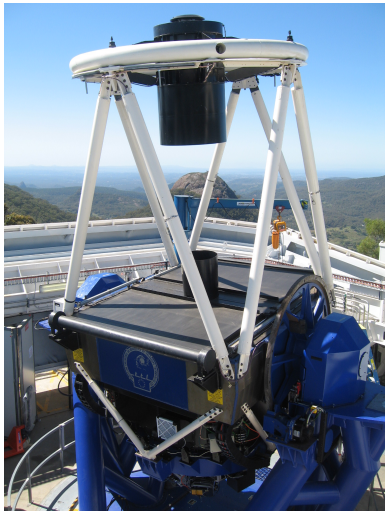
LCO

LCO Network


0.4m
1.0m
2.0m


Under construction 2018-9
Texas
Under construction 2018-9
Tenerife
China/Tibet
Planned 2020
Israel
Hawaii
Planned 2020
Chile
South Africa
Australia

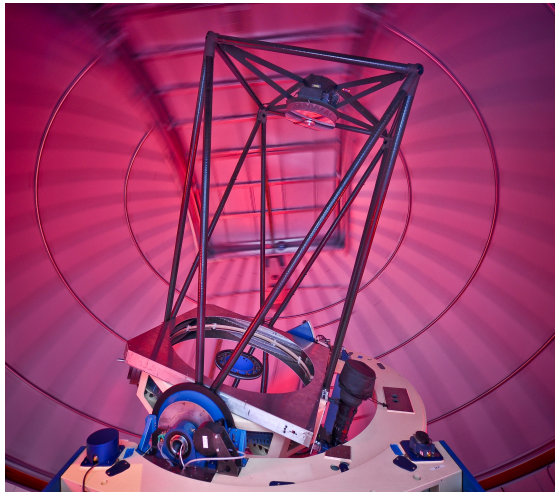
Our telescopes in the field



2-meter telescopes

1-meter telescopes

40-cm telescopes



How does it work?

- Allocation
- Submit a request for an observation
  - Single or cadence
  - Queue, Time-critical, or rapid-response
  - Tools for optimization
- Scheduler makes it happen
- Telescope operates robotically
  - Acquisition and guiding
- Calibrations done automatically
- Data returned to headquarters
- Pipeline processed and ingested into archive within 10 minutes of shutter close
- API's for request submission, request status, and retrieval of data
  - Automated management on user side (TOM toolkit)

Operating the entire global network

Observation windows

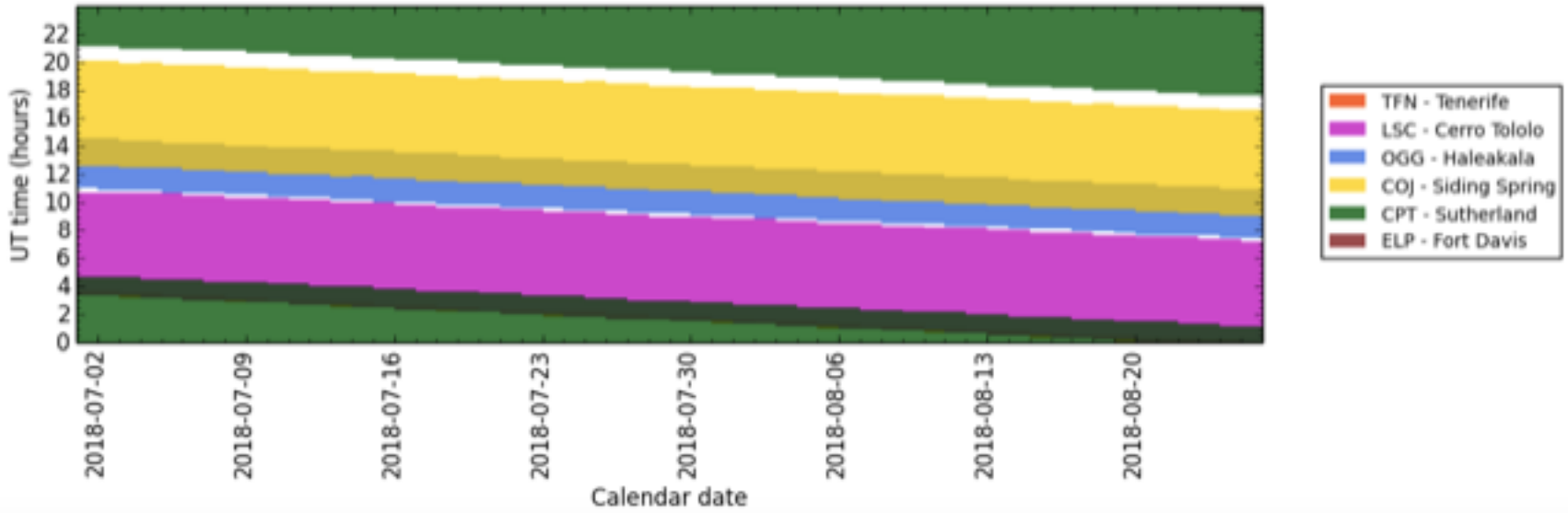
Target coordinates

RA and Dec may be entered as a float value (nn.nnn) or hours, minutes, seconds (hh:mm:ss.ss).

Right ascension 21:00:00 Declination -23:00:00 Maximum airmass 1.6

Seasonal visibility

Start date 2018-07-01 End date 2018-08-26 Show visibility

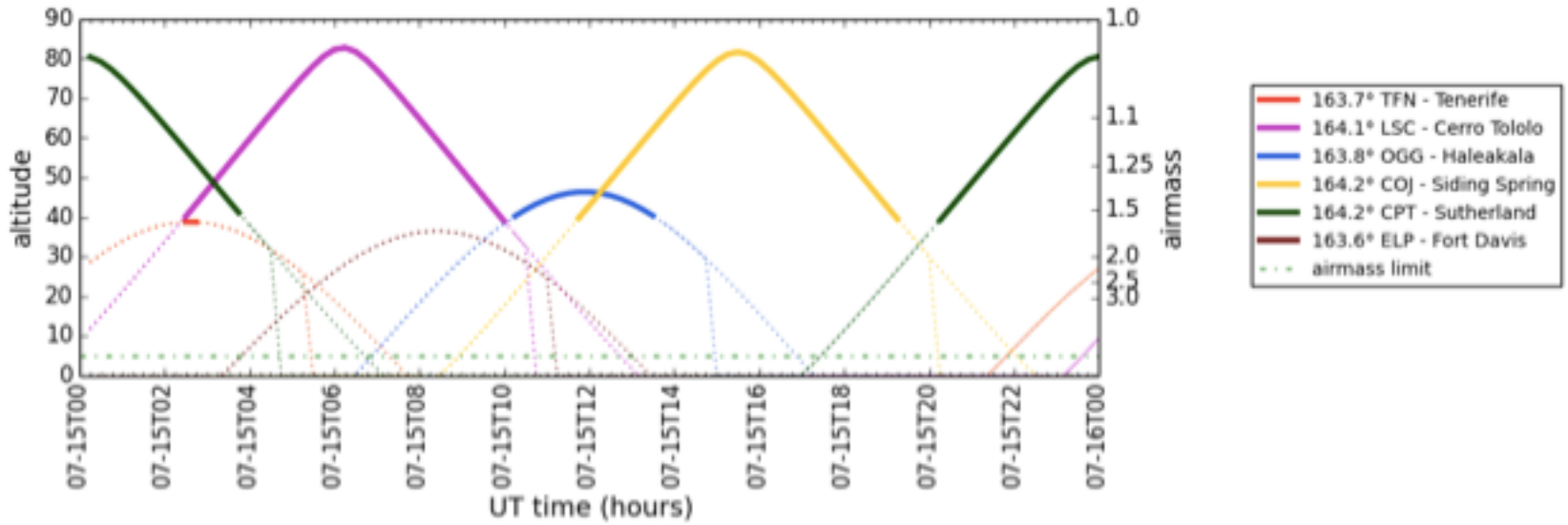


Observation windows

Daily visibility

Target date Default is today Show visibility

Solid lines represent the visibility window; dotted lines represent daytime or hour angle > 4.6. The angle in the legend is the average moon-target distance during the selected night.



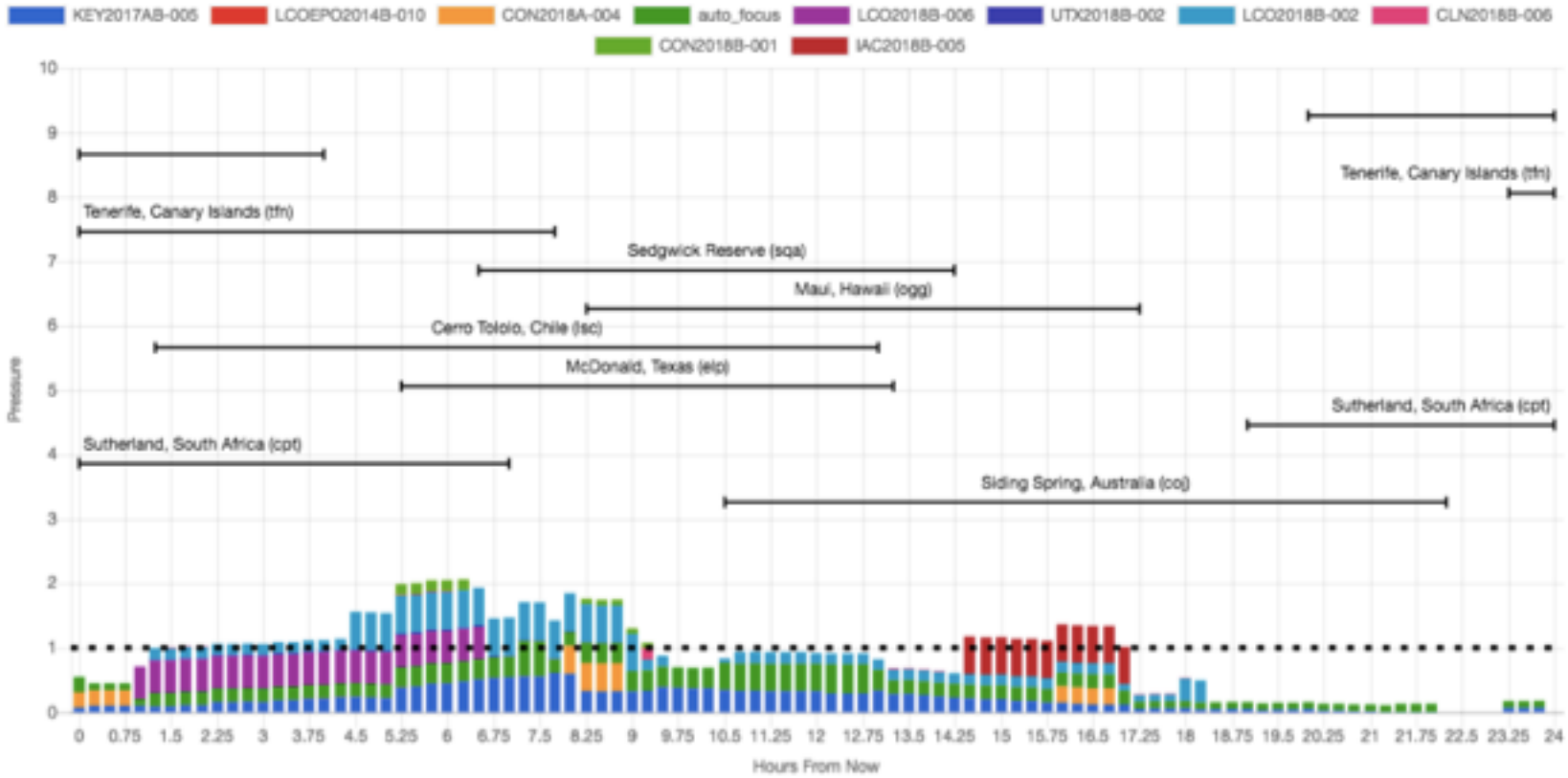
Network Pressure

Network Pressure

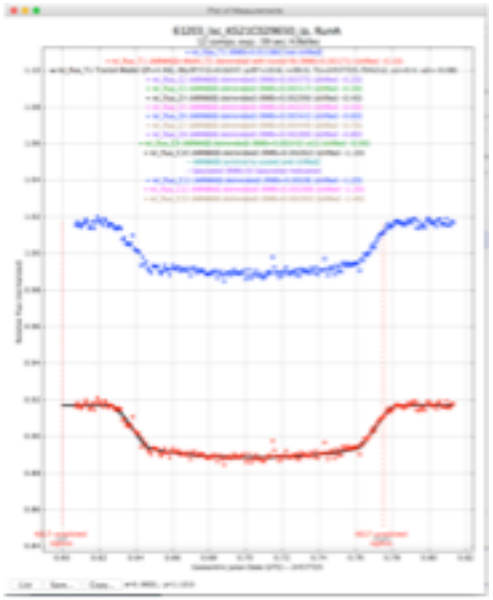
The pressure of a block is defined as its length divided by the total length of time during which it is visible. For each time bin, this value is further divided by the number of telescopes from which the block is visible during that time bin. An overall pressure of 1 (dashed line) means the network is perfectly subscribed on average (> 1 is over-subscription, < 1 is under-subscription).

This plot excludes moving targets.

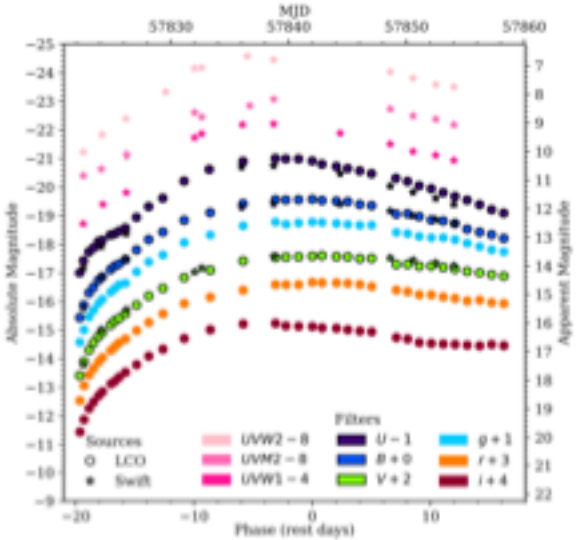
Instrument .4m SBIG **Site** All



Scientific Performance (imaging)



- Filters include Bessel-Johnson, Pan-STARRS, SDSS, Hα, Hβ
- 1-meter telescopes used to m=20 (imaging)
- 2-meter telescopes used to m=22 (imaging)
- For bright objects, achieve 2 mmag precision
- For faint objects, achieve photon-limited S/N



RESEARCH LETTER

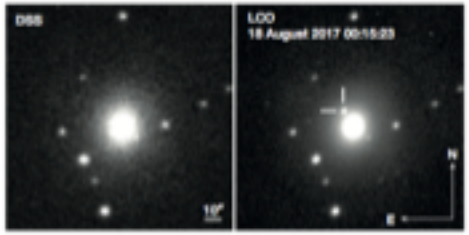
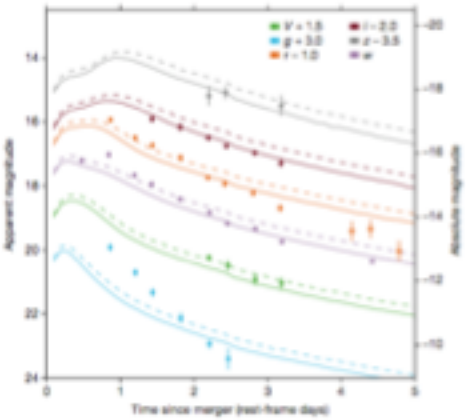


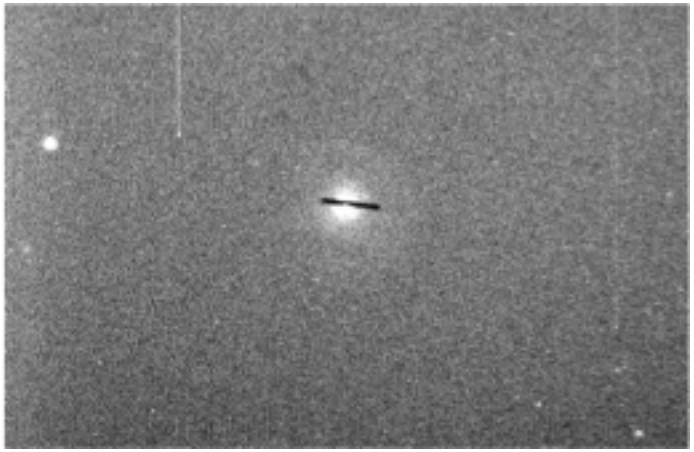
Figure 2 | LCO discovery image of the kilonova AT 2017gfo in the galaxy NGC 4993. The w-band LCO image (right), centred on NGC 4993, clearly shows a new source (marked with white ticks) compared to an archival image (left) taken on 9 April 1992 with the RG610 filter as part of the Anglo-Australian Observatory Second Epoch Survey (AAO-SES), retrieved via the Digitized Sky Survey (DSS).

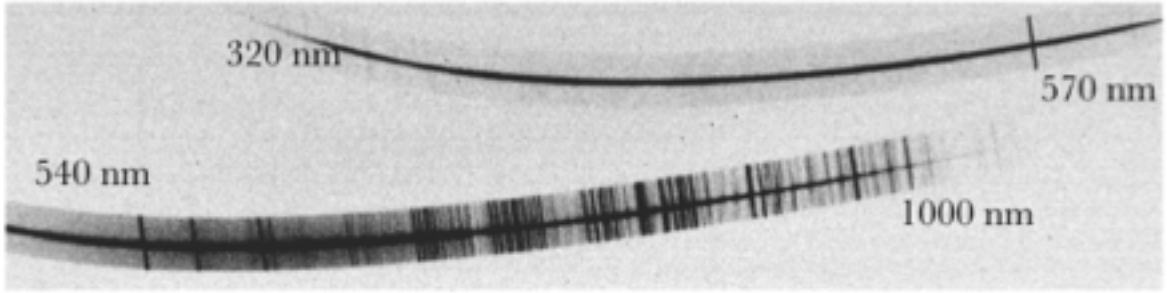
and location area included in the LIGO–Virgo three-dimensional localization[29] (see Methods)

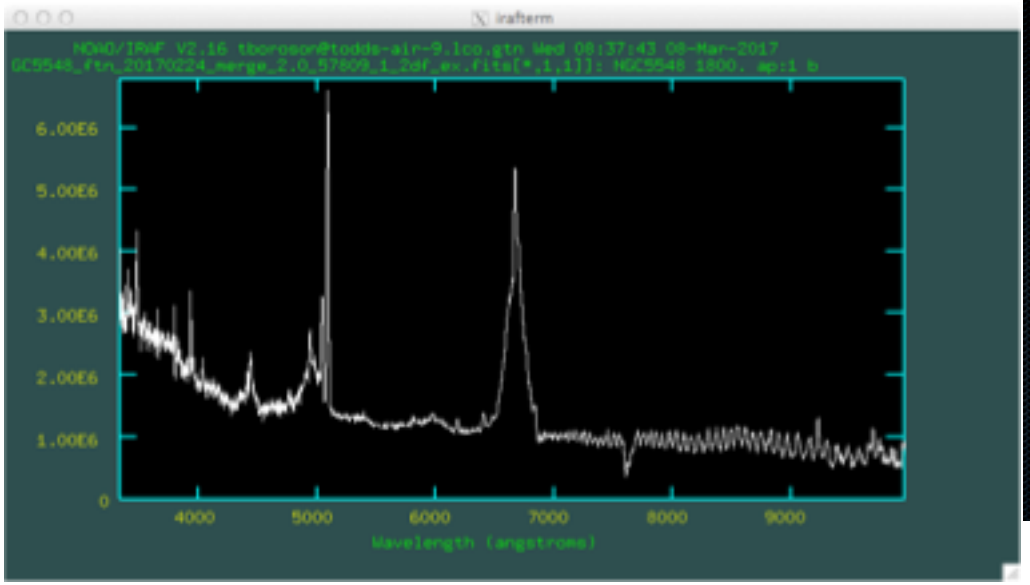


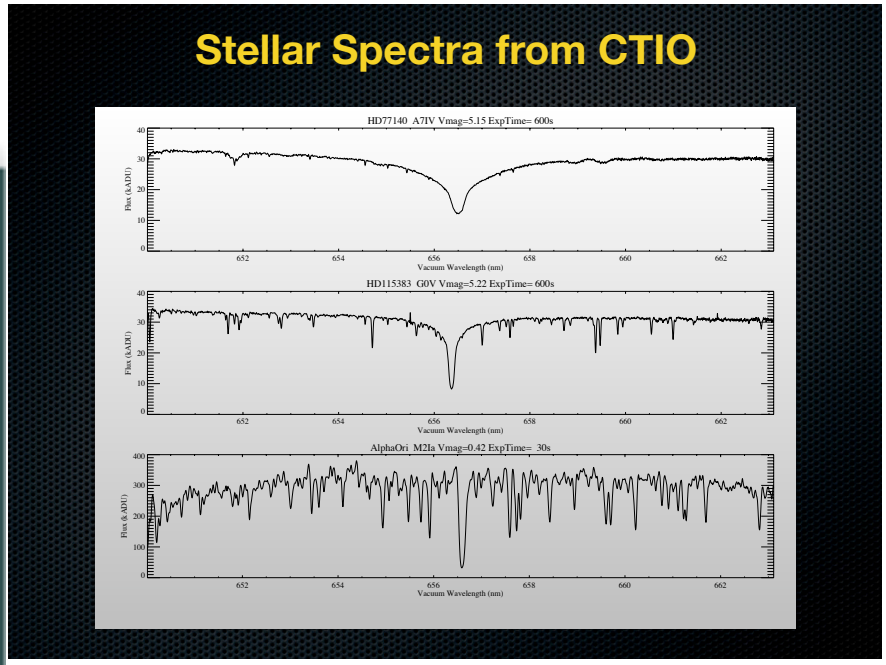
- Multiple longitudes allow more frequent – or even continuous – monitoring than a single site

Scientific performance (spectroscopy)









The future – LCO & Gemini?

- Complete northern ring
- Incorporate Wise 1m (NRES/100%) into network
- Begin to expand network in partnership with SOAR 4m (Goodman Spec/?%)
- Discussions with other observatories (Gemini, CFHT, SALT)
  - Degree of integration is still being discussed
- Development of software infrastructure (TOM toolkit)
- Lots of remaining questions
  - How will time allocation work?
  - What modes will be supported for dynamic scheduling?
  - How will time-domain and non-time-domain fit together?
  - Is there advantage to joint scheduling?
  - Can we automate the process end-to-end?

Las Cumbres **Observatory**

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