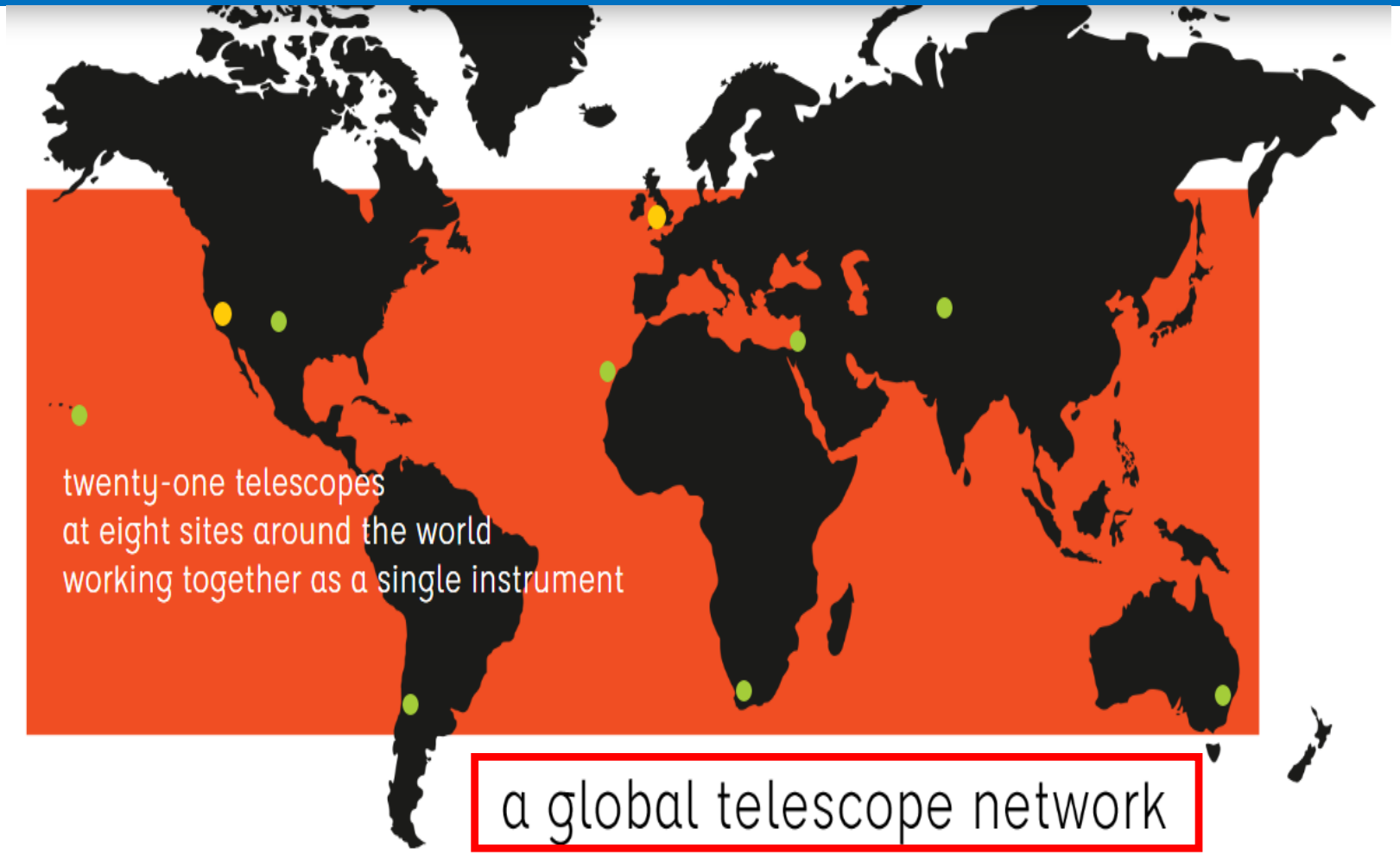
LCO:Las Cumbres Observatory



Weicheng Zang
Advisor: Xiaofeng Wang

Outline

1. Telescopes and sites of LCO

2. Power of LCO global network

3. Science and LCO Key projects

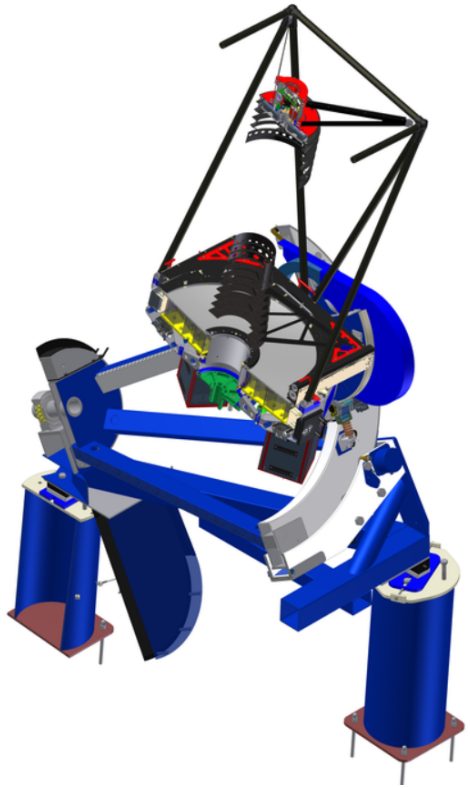
4. How to apply LCO time

Telescopes and sites

- twenty-two telescopes at eight (seven) sites around the world.

- 10 1-meter telescopes
- 2 2-meter telescopes
- 10 0.4-meter telescopes

1-meter telescope



Optical:

FOV: 26x26 arcmin

Pixel scale: 0.39 arcsec

CCD: 4Kx4K pixel

Cycle time (overhead+readout): 42s

Filter wheel options: 21s

Airmass: <3.8 (15degree horizon limit)

Precision: ~0.3% for V=11mag (single point)

Filter: Johnson/Cousins UBVRI

Sloan primed ugri

PanSTARRS z,y

1-meter telescope

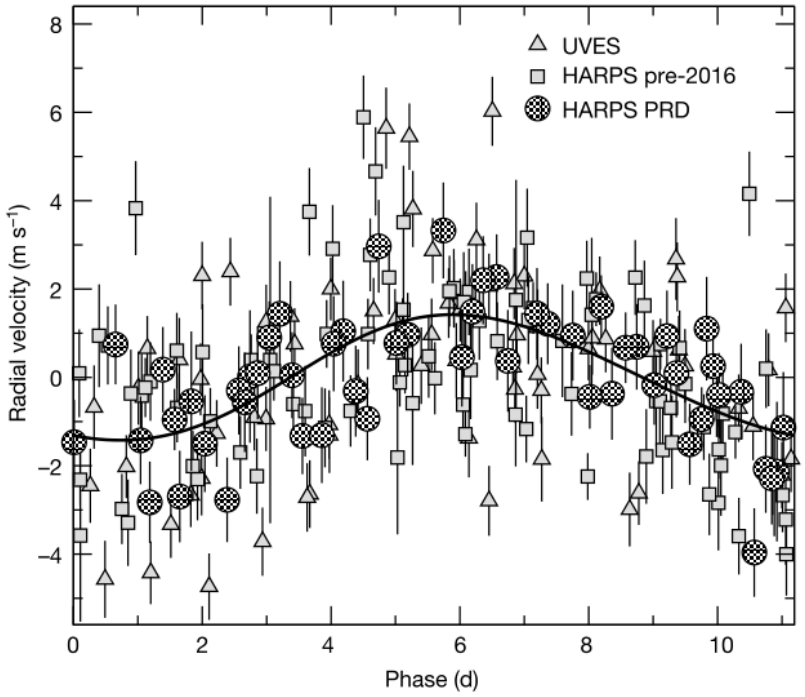
Robotic Echelle Spectrographs (NRES)

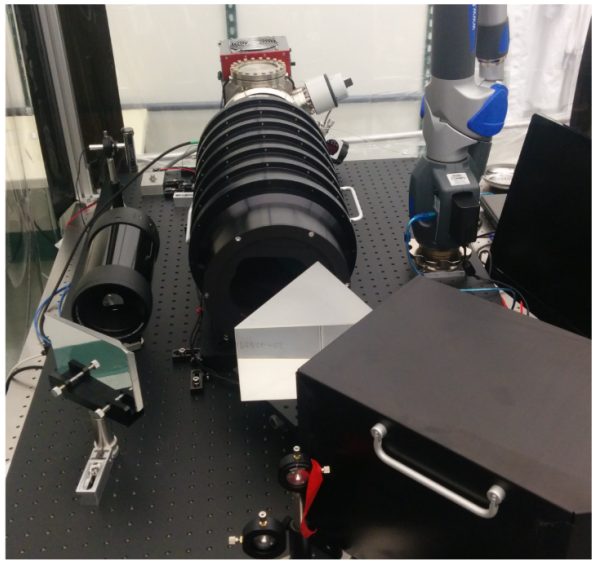
primary motivation: measure RV of planet system.

Number: six telescopes at different sites.

high-resolution: R~53,000

Precision: 3 m/s for V=12mag





0.4-meter telescope

Optical:

FOV: 29x29 arcmin

Pixel scale: 1.14 arcsec

CCD: 2Kx3K pixel

Cycle time (overhead+readout): 32s

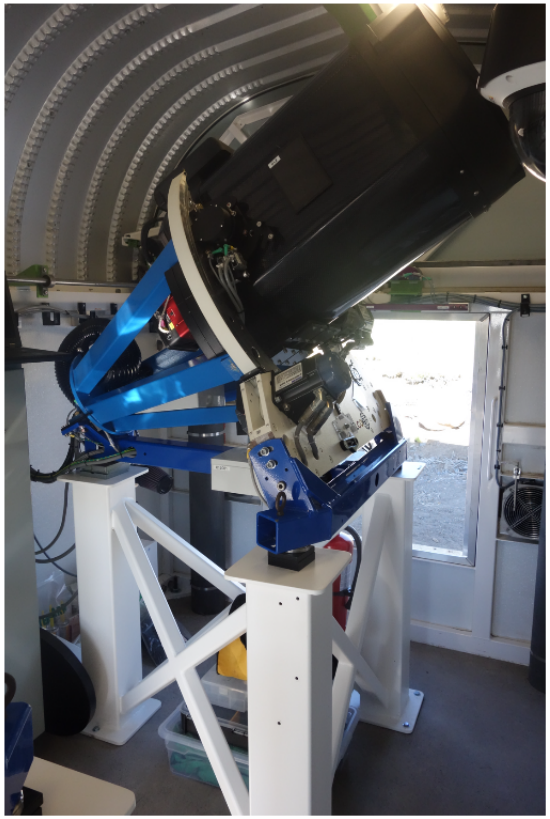
Filter wheel options: 9s

Filter: Johnson/Cousins BV

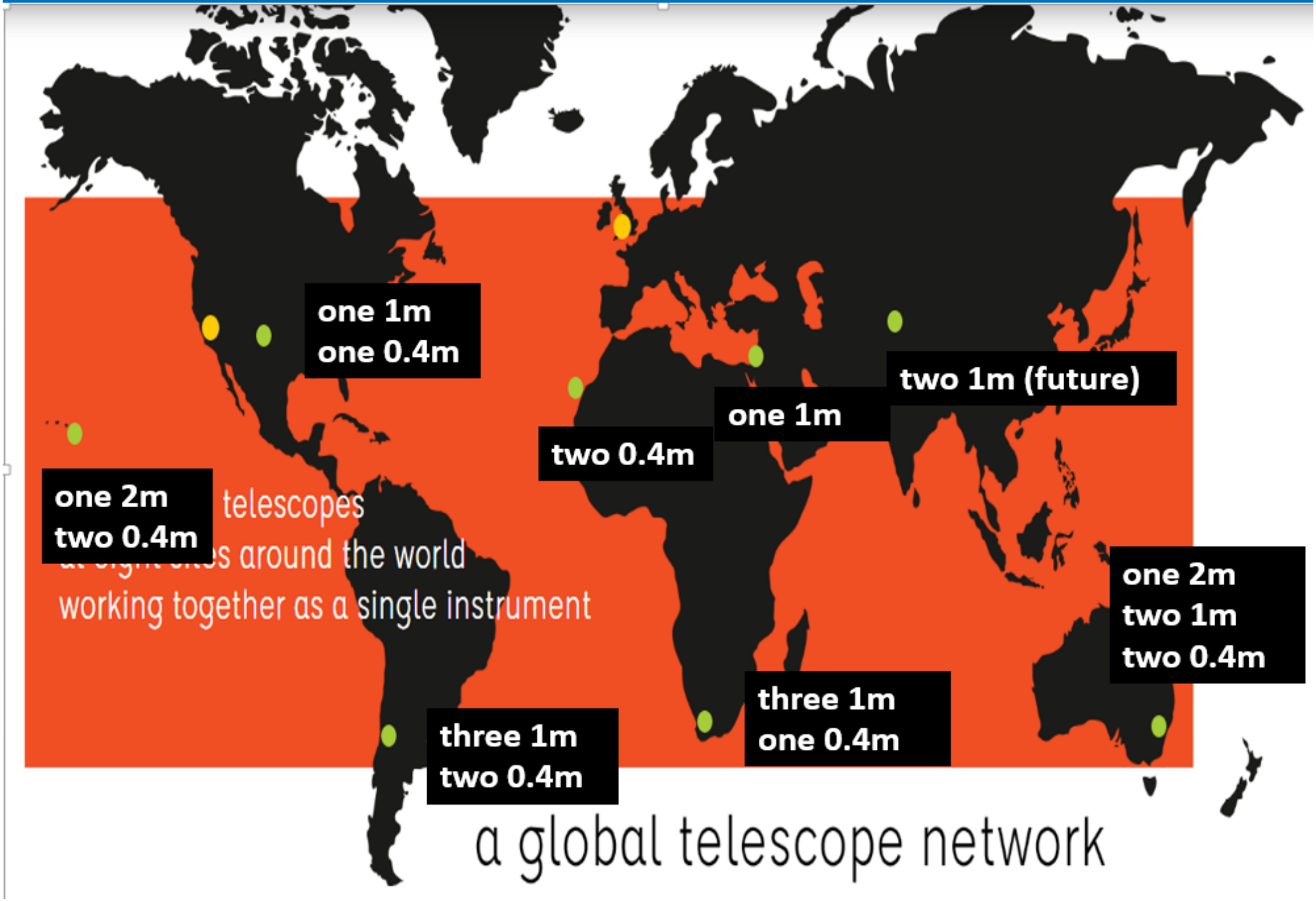
Sloan primed ugriz

PanSTARRS w

Purpose: science observations and education



Sites

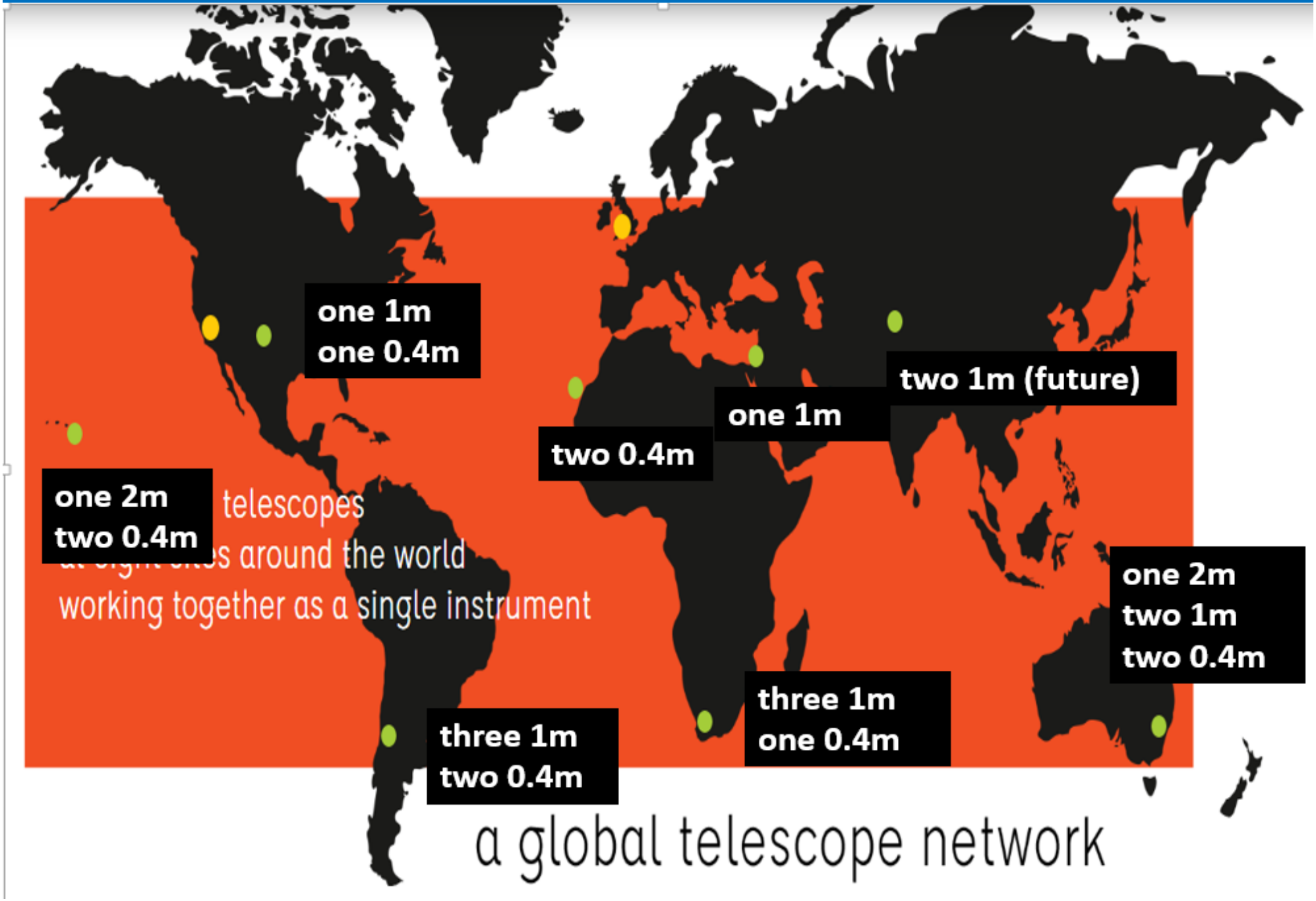

one 1m
one 0.4m
two 0.4m
one 1m
two 1m (future)
one 2m
two 0.4m
telescopes
s around the world
working together as a single instrument
three 1m
two 0.4m
three 1m
one 0.4m
one 2m
two 1m
two 0.4m
a global telescope network

Motivations

- **Theory appears to predict fewer free-floating planets than observations (Ma, Mao et al. 2016)**
- **needs to measure the population empirically (e.g. with K2C9)**
  - Applied for CFHT time for (Penny, Zhu, Fouque, Dong + SM)
- **Gradually building up the microlensing team**
  - Joined RoboNET through LCO
  - two 1m telescopes to be built in Tibet: $4m
  - Needs to build up observational and theoretical expertise

2019: ~2500 hours

Power of LCO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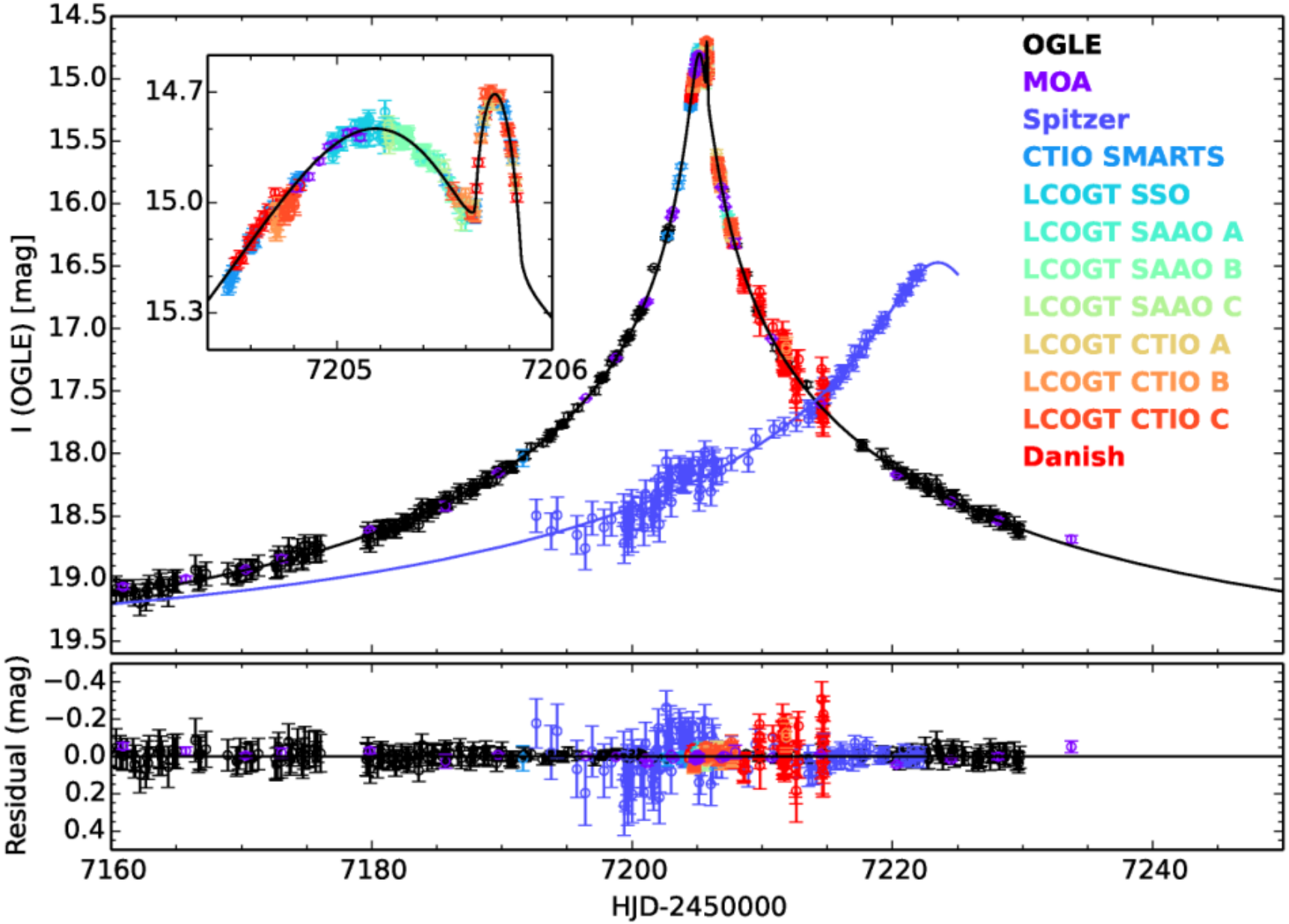
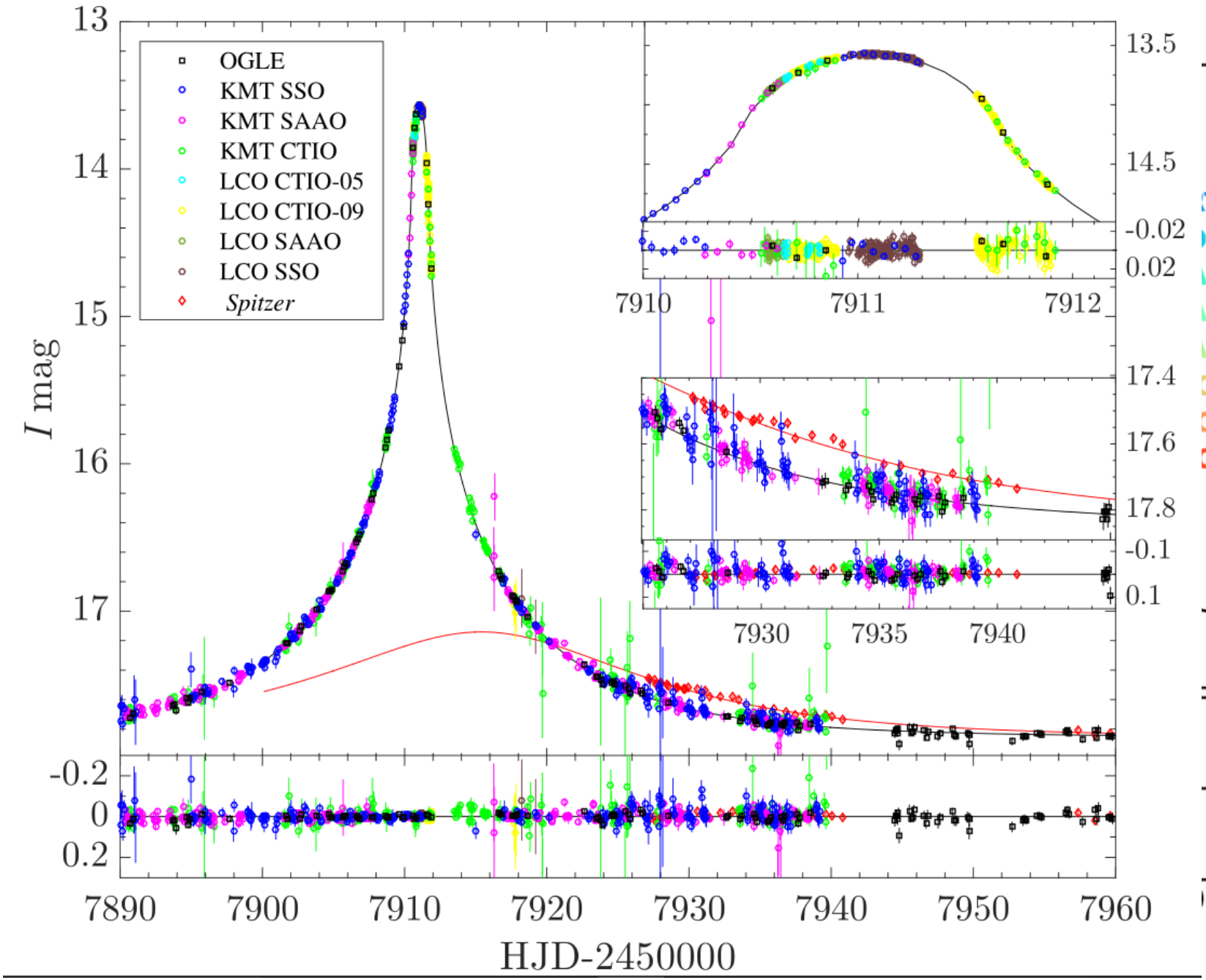
Global Network



Flexible (high) Cadence



Flexible exposure time

Observatory Tools

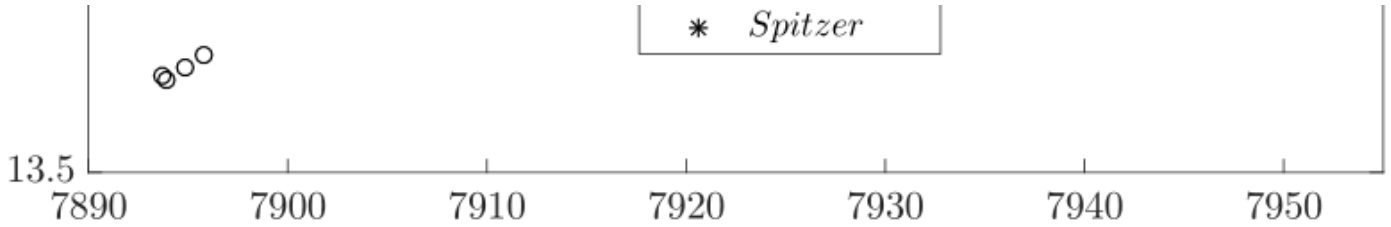
Saturated at I ~ 13mag

Exposure Time Calculator

We have provided a tool to help you decide what exposure time your target will need on our different classes of telescope and using different filter sets.

Target Visibility Calculator

When planning your observing request it is import to make sure your targets will be visible, from which sites and during which time periods. The Visibility Calculator will show you all of this.



Science of LCO

- The areas of astronomy most interesting to us are those which take full advantage of this sort of network.

- Targets which appear suddenly and without warning like supernovae and asteroids.

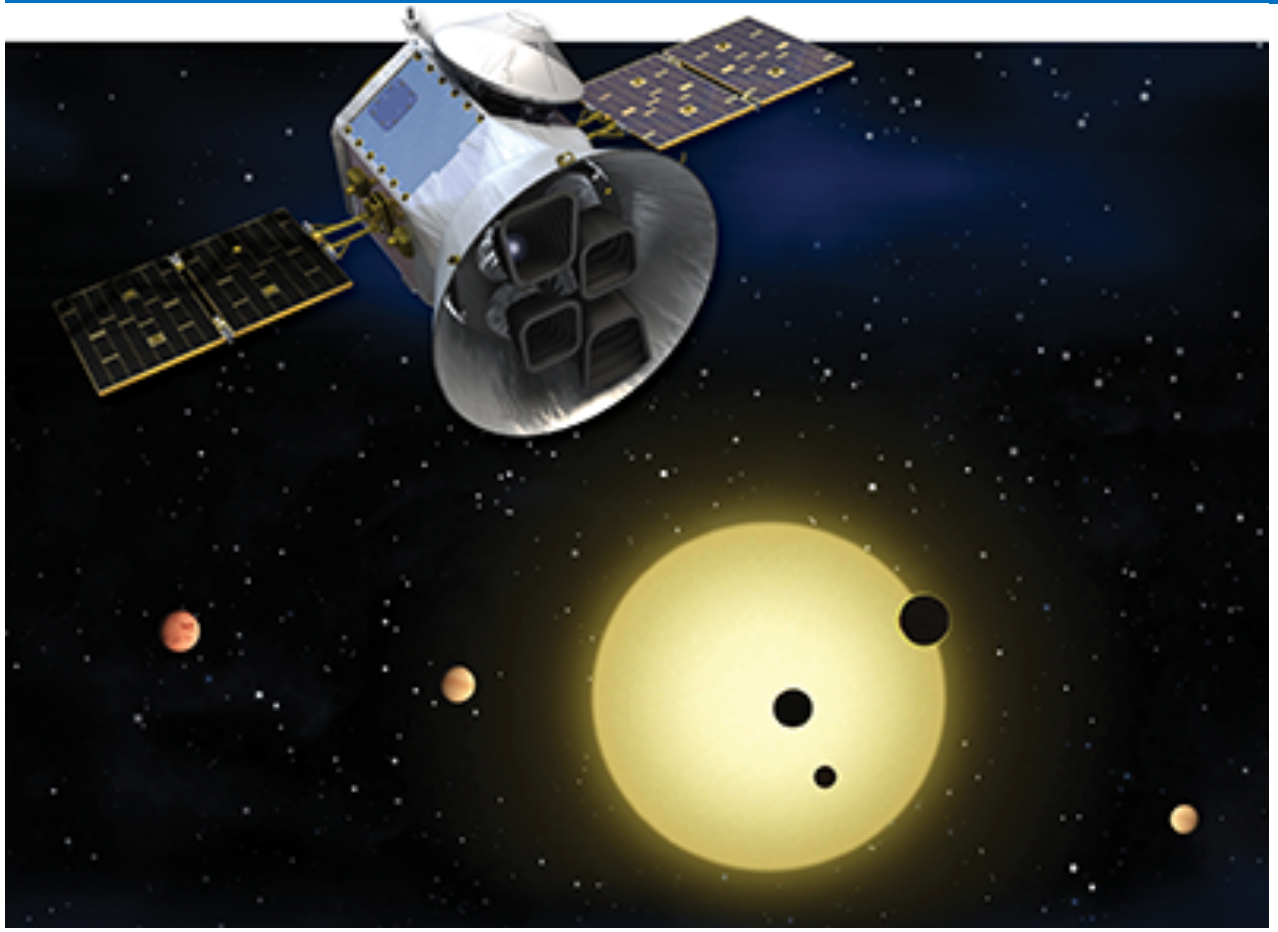
- Objects which need to be observed for long periods in darkness like exoplanets and binary star systems.

LCO Key Project

Science Collaboration Key Projects

PI name	PI Institution	Contributing Institutions	Title	Semesters	2018A hours				
					FLOYDS (2m)	Spectral (2m)	NRES (1m)	Sinistro (1m)	SBIG (0.4m)
Brown, T., Mazeh, T.	LCO, U. Tel Aviv	LCO, SUPA	Using NRES to Validate and Characterize Exoplanets Found by TESS and Other Surveys	2017AB-2020A			2150		
Horne, K.	St. Andrews U.	SUPA, LCO, ANU, SAAO	Echo Mapping of AGN Accretion Flows	2014A-2018A		140		975	
Howell, A.	LCO	LCO, NAOC, NOAO, ANU, TAU, UTexas	The Global Supernova Project	2017AB-2020A	274	250		1109	
Robertson, P.	Penn State Univ.	LCO	High-Cadence Monitoring of the Sun's Coolest Neighbors	2017AB-2020A				100	1400
Shporer, A.	Caltech	LCO, ANU, SUPA, SAAO, IAC, UTexas, UHawaii	Transiting Exoplanet Science with LCO - The Network Awakens	2017AB-2019A		65	301	300	339
Tsapras, Y.	U. Heidelberg	SUPA, LCO, NAOC	ROME/REA - A three-color window to planets beyond the snow-line	2017AB-2020A				740	

TESS: Transit Exoplanet Survey Satellite



- TESS was launched yesterday
- Will discover more than 5000 nearby exoplanets

- Two problems:
- 1. Pixel Scale of TESS is 0.7 arcmin/pixel. Highly blended
- 2. Measure the Radius of the components, not the mass

LCO-TESS Key Project

Key Project 1: Transiting Exoplanet Science with LCO - The Network Awakens

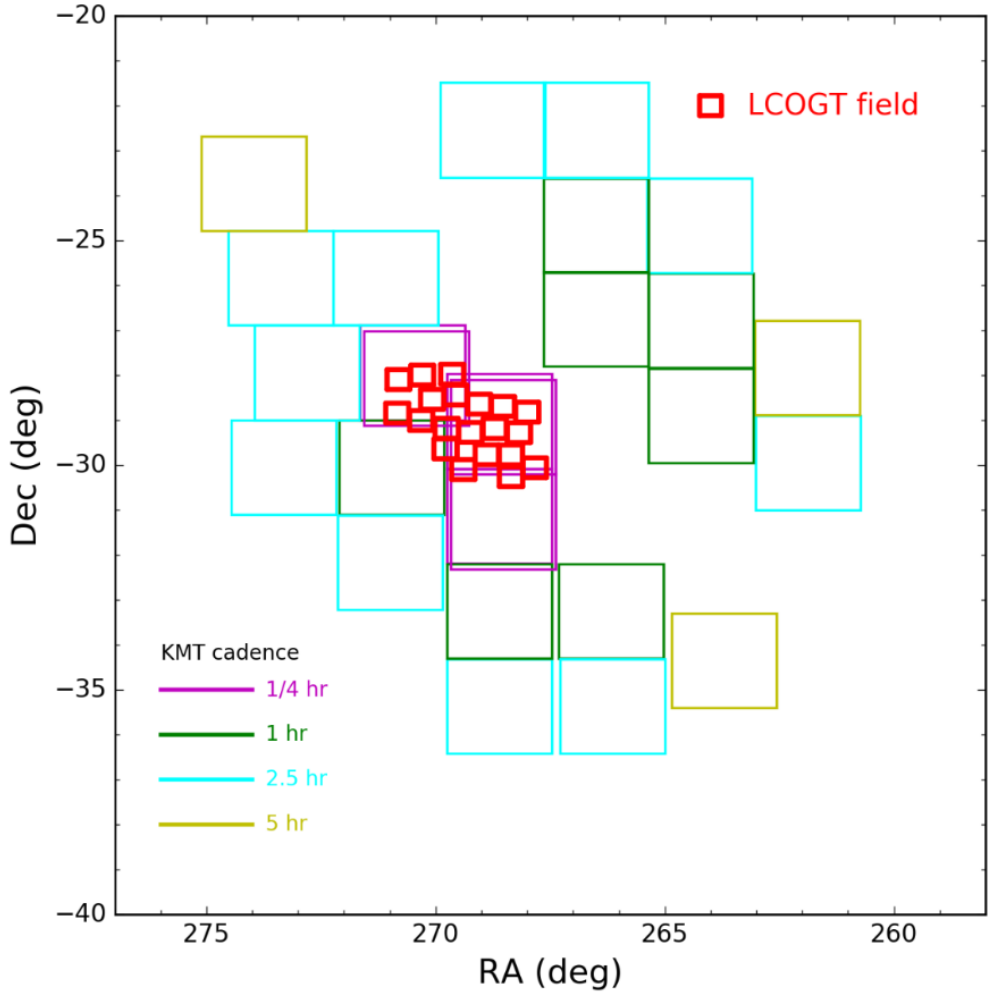
Find the host star of the planet system.

Key Project 2: Using NRES to Validate and Characterize Exoplanets Found by TESS

Measure Radius Velocity of Host star, in order to answer

1. The exoplanet mass/period distribution.
2. The inclination

LCO Microlensing Key Project



- **FOV of LCO: 26x26 arcmin**
- **FOV of KMTNet: 2x2 degree**
- **ROME: 3 exposures per 8hrs**
- **REA: < 30min cadence**

- **LCO Network is suitable for Follow up, but not for wide-field survey!**

How to apply LCO time

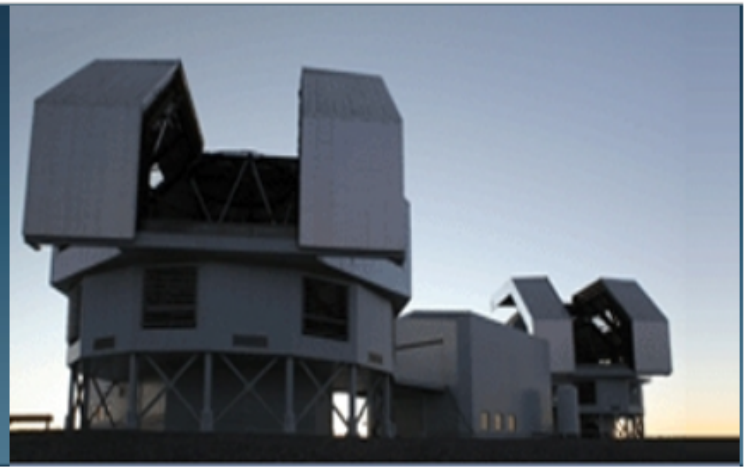
Telescope Access Program

Home | Facilities | Observing | Data & Tools | Future Instrumentation | Events | Announcements | About

The Telescope Access Program

The Telescope Access Program (TAP) gives all China-based astronomers access to internationally competitive medium- and large-aperture optical-infrared telescope facilities.

>>More about TAP



Quick Links

- Available Instrumentation
- Proposal Information
- TAP policies
- **Approved Programs**
- **TAP++ Key Projects**
- **2018B Call for Proposals**
- Contact TAP
- 3rd TAP Workshop

- **Each semester China has 200 hours 1-m network**
- **2017B: 3 proposals; 2018A: 4 proposals**

Trade among aperture sizes

- Todd's official rate: 4 (0.4m) = 2 (1m) = 1 (2m).

- Shude's rate: 1 (1m) = 6.25 (0.4m) by aperture size

- Todd's personal rate: The 0.4m's are usually undersubscribed, so, while I give the official rate above, let me know if you need more than that.

- Spitzer Microlensing project:

2017: 200 hours 1-m

2018: 120hr (0.4m) from China
100hr (0.4m) from IPAC
90hr (1m) from Wise.

Purchase network observing time

- 1-meter: 3000 hours
- 2-meter: 400 hours
- 0.4-meter: **enough**

- $350/hr + $3,000 (admin fee) for 20-99 hours per year (adr advance)
- $300/hr for 100-499 hours per year (admin fee waived)
- $250/hr for 500 or more hours per year (admin fee waived)

Summary

- LCO is a Global Telescope Network and can conduct 24-hours observations.

- LCO Global Network has flexible cadence and exposure time.

- 1-meter telescope is the main scientific telescopes of LCO and has two mode: Optical and NRES.