Palomar Observatory

HPWREN Networking for Cutting Edge Astronomy

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(with contributions from Christoph Baranec, Mansi Kasliwal, and Jennifer Milburn)

Palomar Observatory

- Constructed in 1948
- Run by the California Institute of Technology; ~25 employees on-site in the mountains north of San Diego
- Cornerstone 200-inch Hale Telescope; still among the largest in the world
- Smaller telescopes including 48-inch Schmidt, and 60-inch roboticized

Astronomy in the 21st Century

- Increasingly data-driven: new projects and instruments talk in terms of petabytes(!) of data over their lifetimes
- Instrument capabilities and detector sizes increasing just like IT resources: not only your personal digital camera has 10^7 pixels!
- Growing field: time-domain astronomy – analyze temporal variations in astronomical sources; implies monitoring large portions of the sky at frequent intervals
- New technologies also invigorating the 60-year-old observatory: Adaptive Optics (AO), remote operations

Palomar Transient Factory

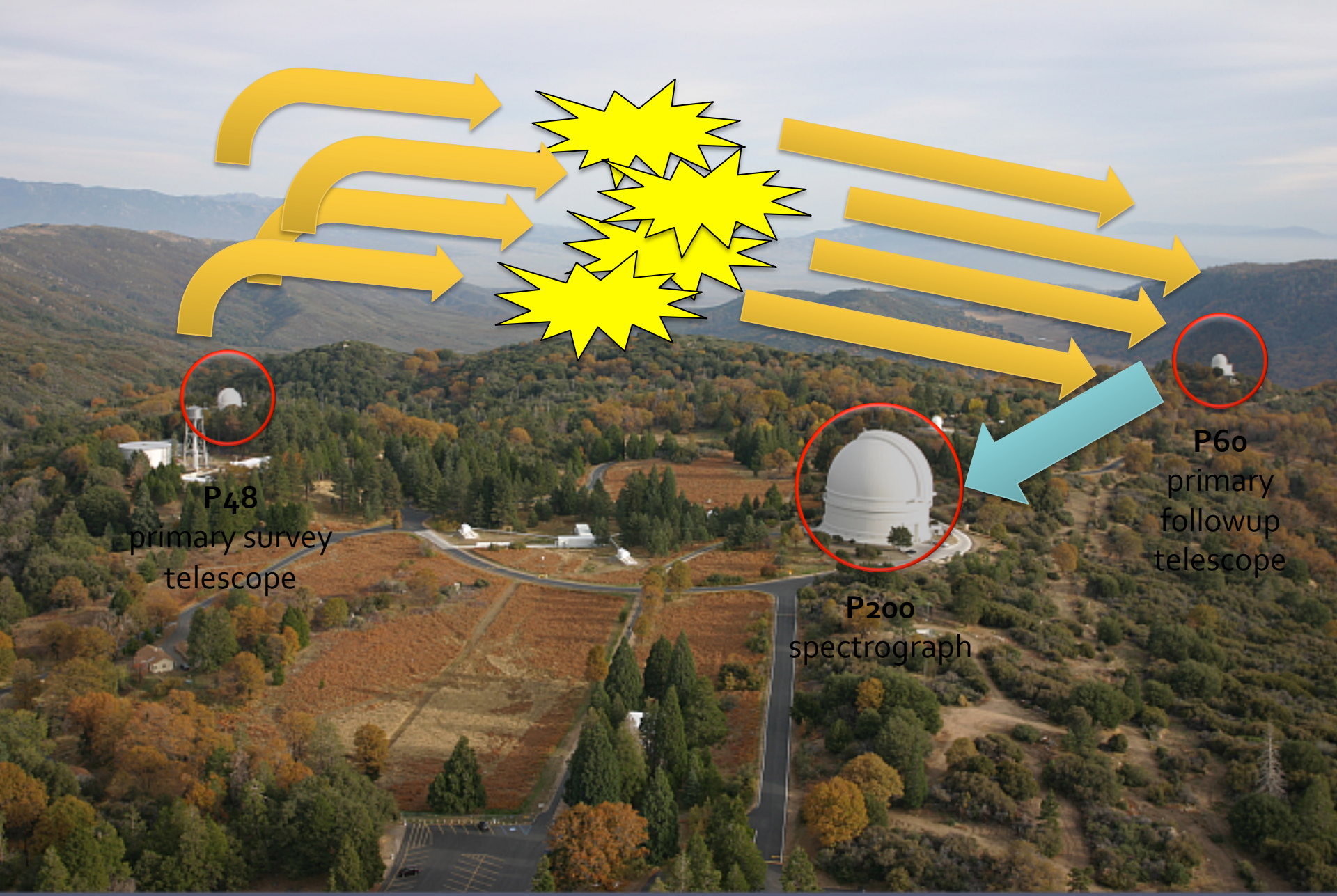
A wide-angle, high cadence survey dedicated to systematically chart the transient sky.

Palomar 48-inch

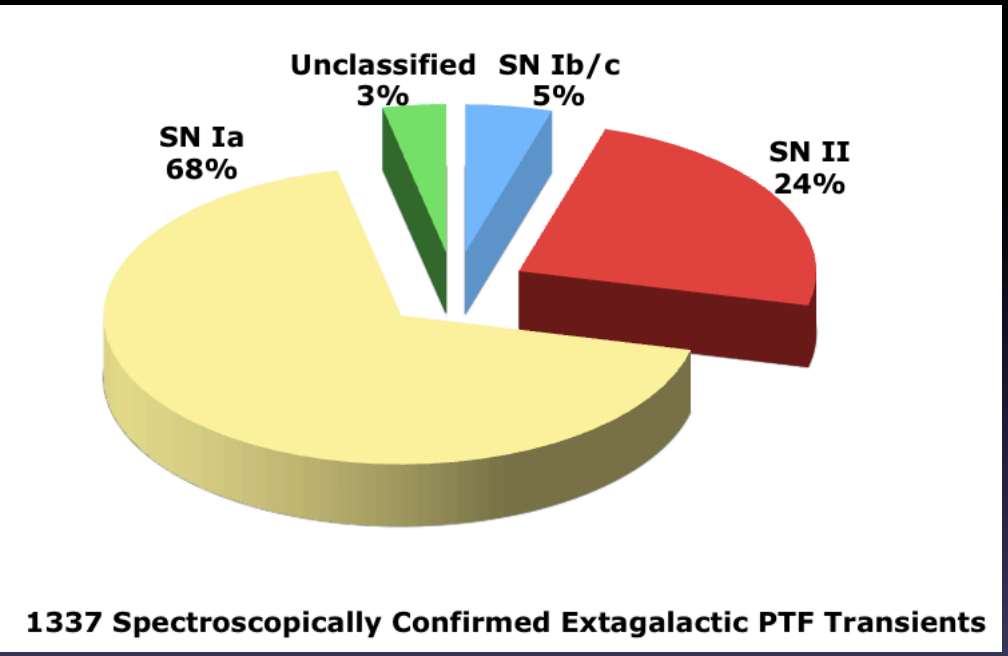
Palomar 60-inch

Discovery Machine + Classification Engine


P48
primary survey
telescope
P60
primary
followup
telescope

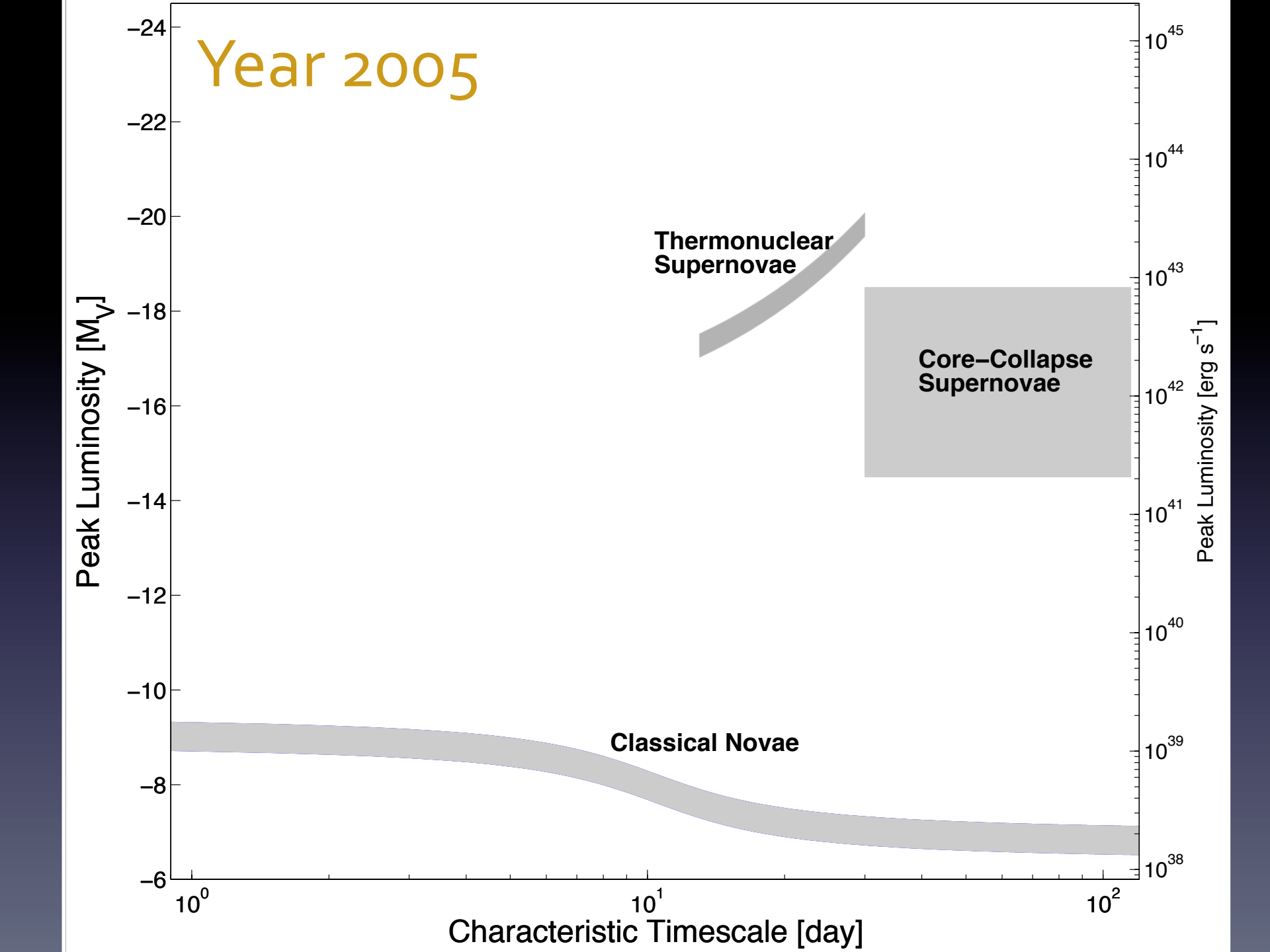

P48
primary survey
telescope
P200
spectrograph
P60
primary
followup
telescope

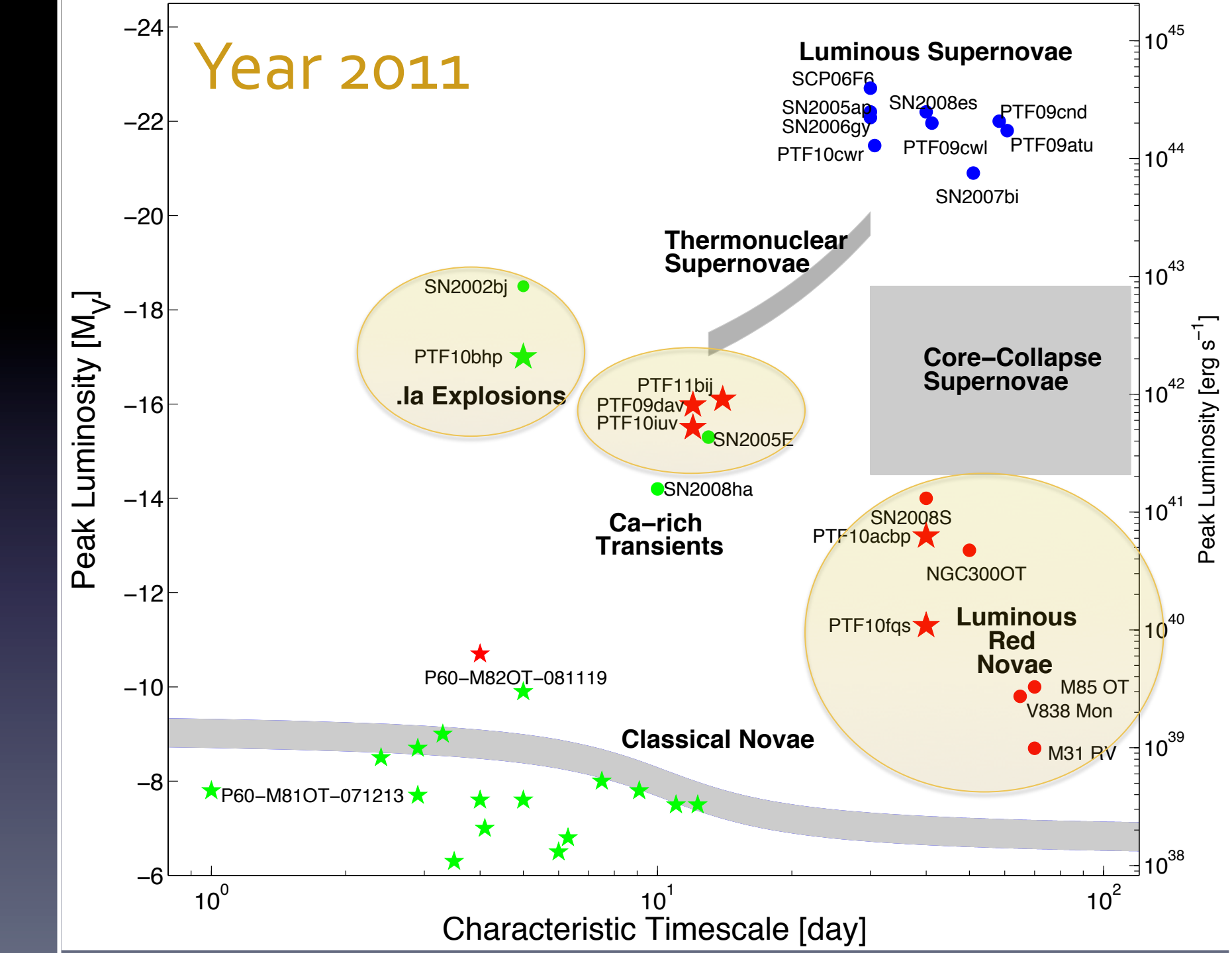
The PTF Scorecard



5. PTF 10bzf (SN 2010ah): a broad-line Ic supernova discovered by the Palomar Transient Factory (ApJ)
6. Real-Time Detection and Rapid Multiwavelength Follow-up Observations of a Highly Subluminous Type II-P Supernova from the Palomar Transient Factory Survey (ApJL)
7. The Extreme Hosts of Extreme Supernovae (ApJ)
8. Evidence for an FU Orionis Outburst from a Classical T Tauri Star (ApJ)
9. PTF10nvg: An Outbursting Class I Protostar in the Pelican/North American Nebula (AJ)
10. Hubble Space Telescope Studies of Nearby Type Ia Supernovae: The Mean Maximum Light Ultraviolet Spectrum and its Dispersions (ApJ)
11. Galaxy Zoo Supernovae (MNRAS)
12. Rapidly Decaying Supernova 2010X: A Candidate ".Ia" Explosion (ApJL)
13. Supernova PTF 09uj: A Possible Shock Breakout from a Dense Circumstellar Wind (ApJ)
14. The Palomar Transient Factory Survey Camera: 1st Year Performance and Results (SPIE)
15. PTF10fqs: A Luminous Red Nova in the Spiral Galaxy Messier 99 (ApJ)
16. Core-Collapse Supernovae from the Palomar Transient Factory: Indications for a Different Population in Dwarf Galaxies (ApJ)
17. Mysterious transients unmasked as the bright blue death throes of massive stars (Nature)
18. The Palomar Transient Factory: System Overview, Performance and First Results (PASP)
19. Exploring the Optical Transient Sky with the Palomar Transient Factory (PASP)
20. The 12Kx8K CCD mosaic camera for the Palomar Transient Factory (SPIE)

(AND 14 more……)


Year 2005
Thermonuclear Supernovae
Core–Collapse Supernovae
Classical Novae
Peak Luminosity [M_V]
Peak Luminosity [erg s^{-1}]
Characteristic Timescale [day]
−24
−22
−20
−18
−16
−14
−12
−10
−8
−6
10^{45}
10^{44}
10^{43}
10^{42}
10^{41}
10^{40}
10^{39}
10^{38}
10^{0}
10^{1}
10^{2}



Kasliwal 2011 (PhDT)

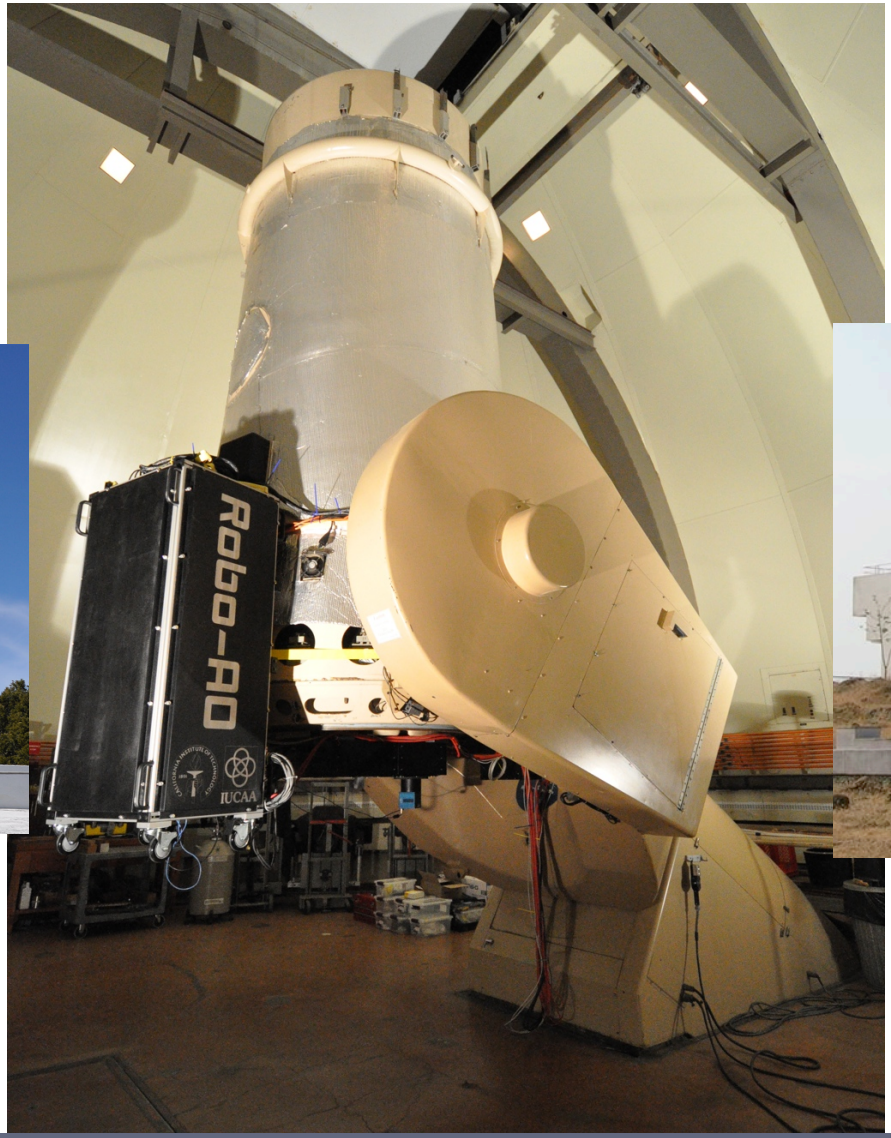
Robo-AO:
First Light and Operations

Christoph Baranec (PI)

on behalf of the Robo-AO collaboration partners at
the Inter-University Centre for Astronomy and Astrophysics and the California Institute of Technology

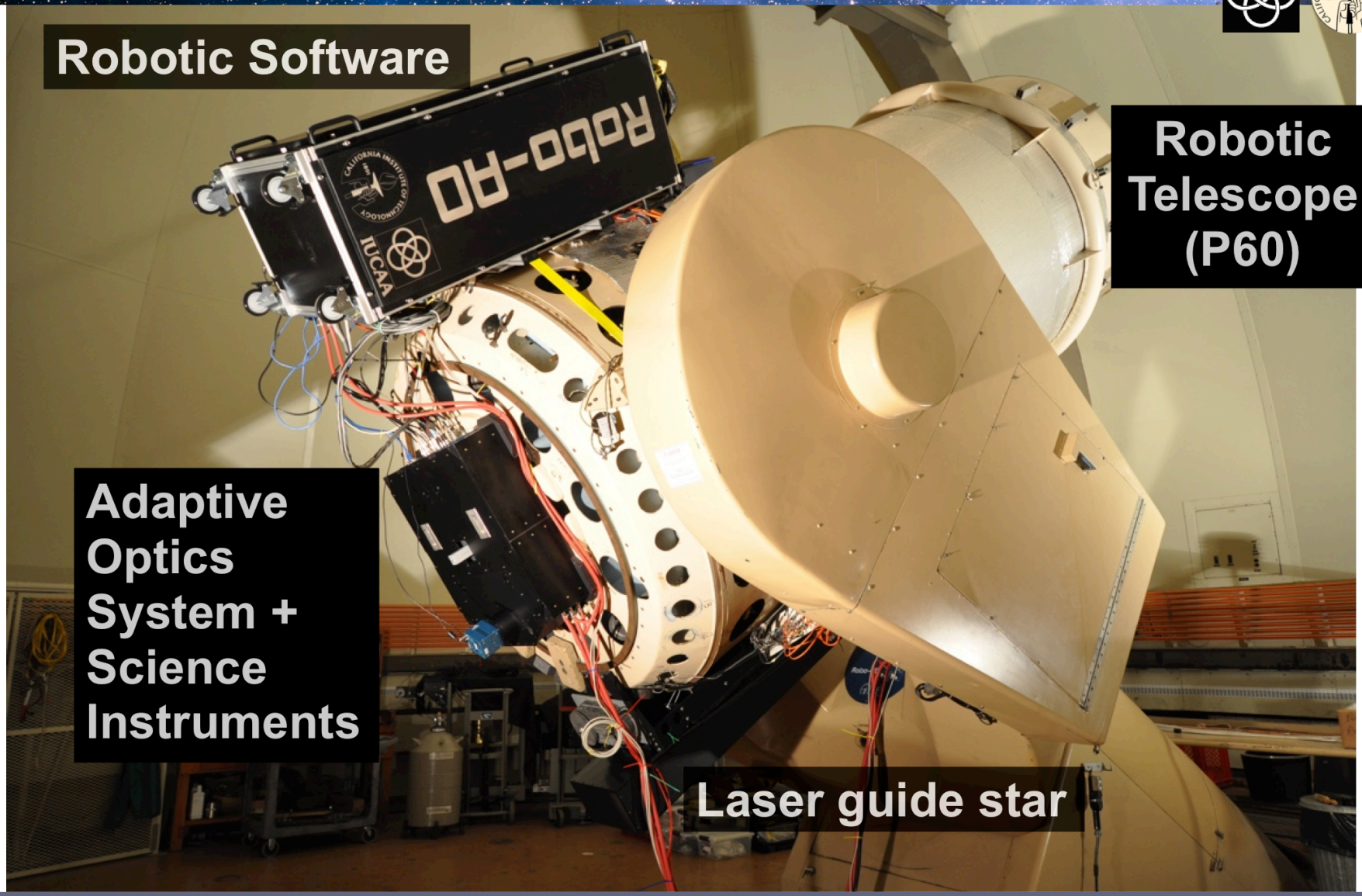
Robo-AO

Caltech's 1.5 m P60 telescope at Palomar Observatory

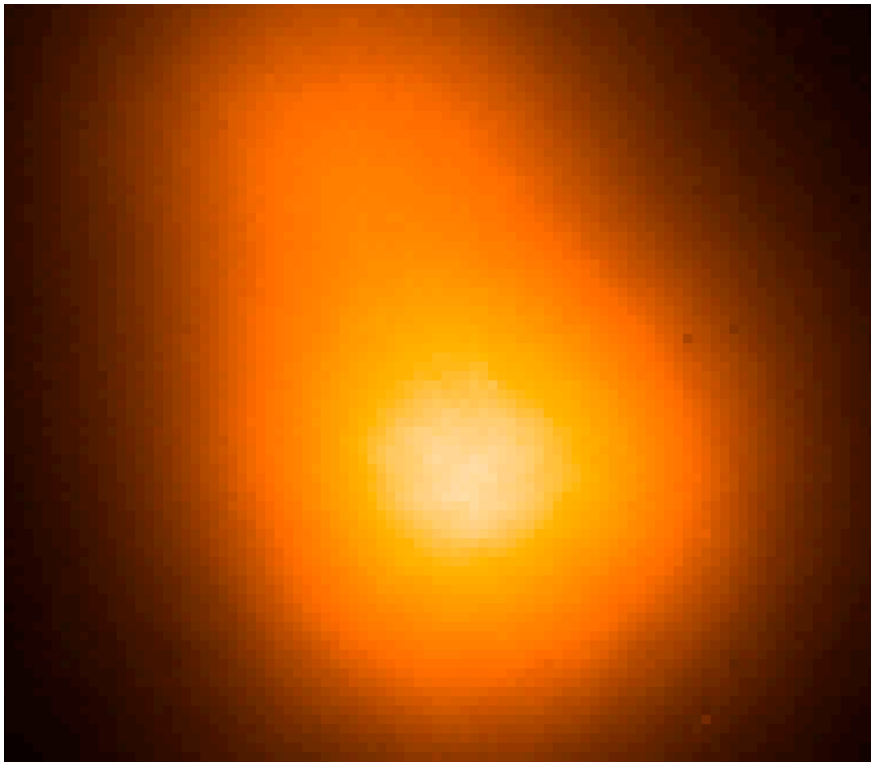


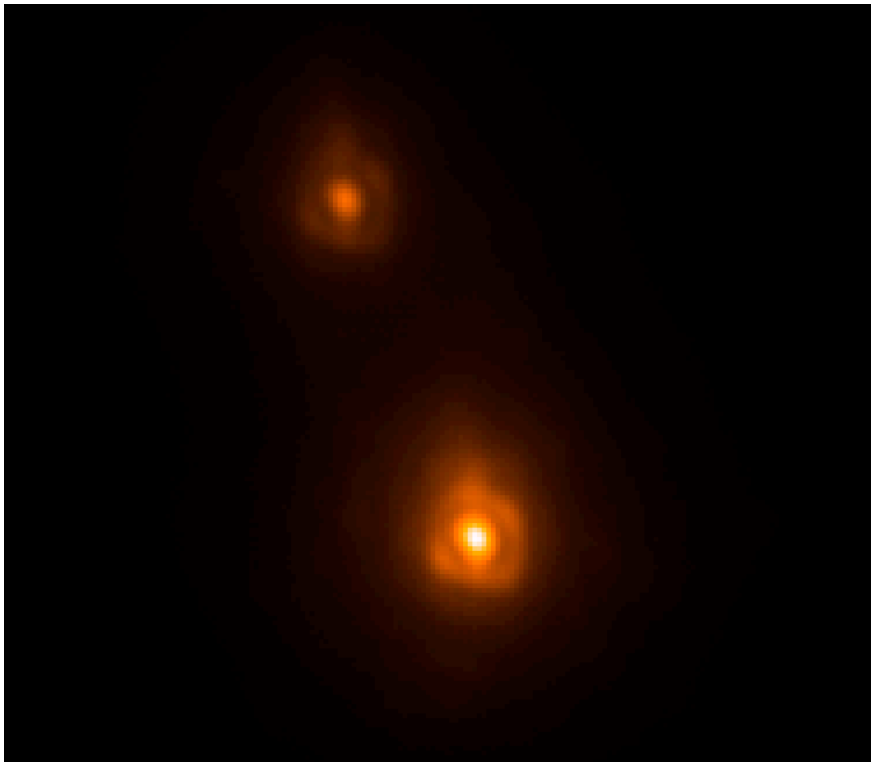
IUCAA's 2 m telescope at Girawali Observatory

Robo-AO on the P60



Kruger 60 A/B (z’)





1.86” separation, factor of 10 in peak intensity

Corrected: Strehl ~20%, 178±14 nm RMS error, FWHM = 0.13”

Palomar Remote Operations

- Many astronomical observatories enabling remote observing by astronomers who are not physically present at the observatory (e.g., Keck, Gemini)
- Telescopes typically in very remote locations (e.g., Hawaii, Chilean mountains) -> saves travel costs and enables observations by those who cannot travel
- Also enables larger and more widely dispersed groups of astronomers to collaborate, including more student involvement
- Palomar approach uses VNC sessions to provide remote astronomers access to the instrument controls, from a pair of Remote Observing Facility (ROF) rooms on the Caltech campus
- Requires minimal bandwidth, but high reliability

IT Operations at Palomar

- IT efforts at Palomar Observatory are now being directed by the on-campus team who manages IT for the Caltech Astronomy Department
- Major efforts currently underway:
  - Replacement of wired network with modern Cisco-based routers and switches
  - Installation of firewall for increased security
  - Inventory management of IT hardware and software
  - Development of upgrade and maintenance procedures which will balance the need for security and reliability with the frequent requirement of long-term stability of observing hardware and software
- Future efforts:
  - Replacement of wireless LAN with modern enterprise-grade WAP
  - Evaluation and improvement of wireless WAN used to connect remote locations on the Observatory grounds and specific fire stations
  - Development of procedures and training to integrate everyday IT maintenance into the mountain staff's responsibilities