Nine Years of Remote Observing, Close Cooperation and Shared Efforts

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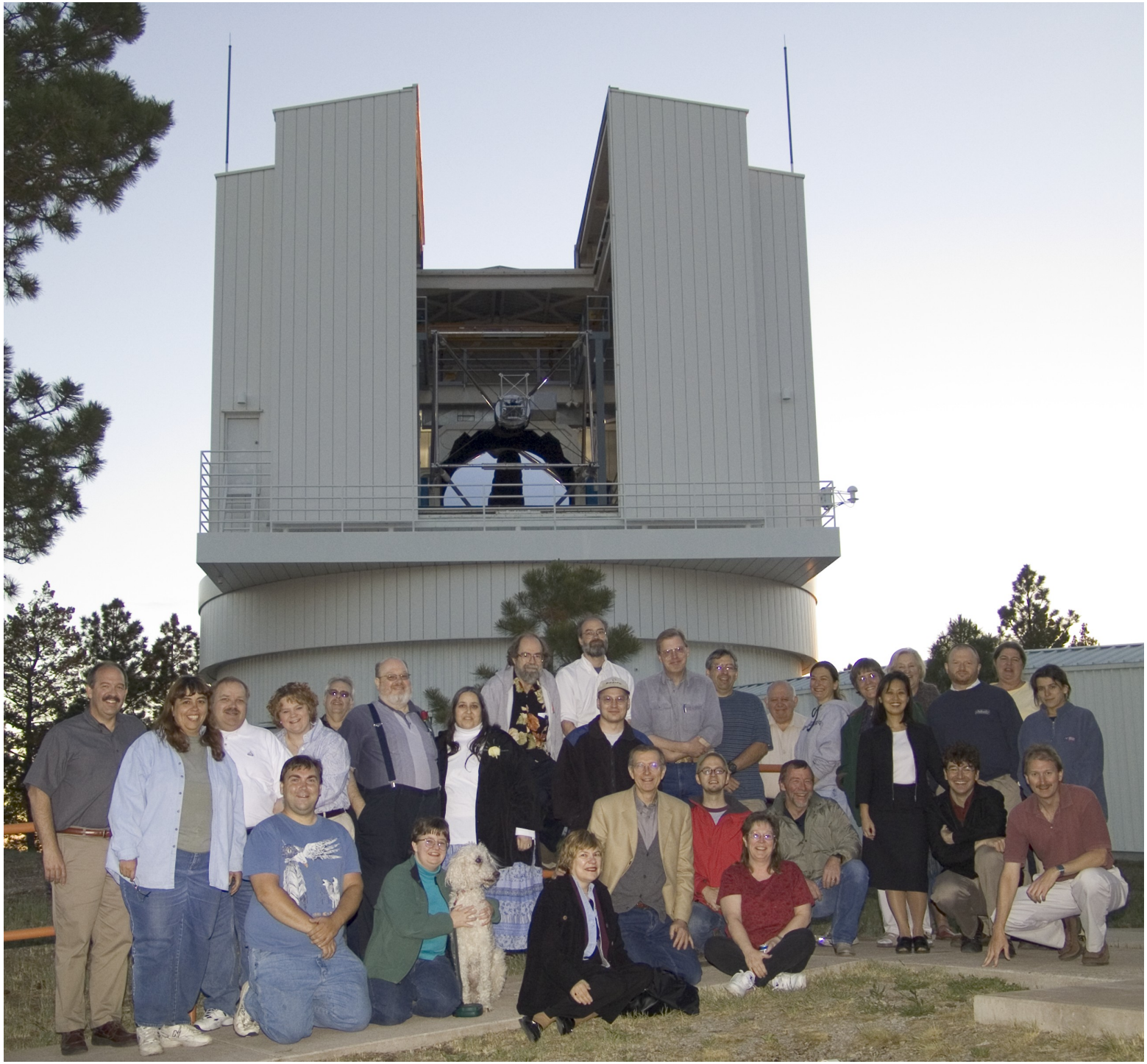
Apache Point Observatory, Sunspot, NM – May 13, 2014



Vision, reality

Remote hands-on internet operation: works great

Fast-change multi-instrument capability: manual at first; heading toward multi-port fast change capability

Excellent pointing and tracking: 1 arcsec goal; can usually point to within ~few arcsec

Excellent delivered image quality: 0.5 arcsec goal; often sub-arcsecond, but still feel we could improve about .3 arcsec

Full suite of science instruments: Got them, upgraded them, have plans and paths to replace aging instruments

Ten years of improvements, e.g.,

- **1994-96**: adaptive optics tests, added offset guider, calibration lamps, laser guide star tests, replaced enclosure wheels
- **1997-98**: commissioned SPIcam, new M1 support servo, 2ndary bracing and stiffening, DIS slit viewer, commissioned Echelle, thermal management program, automated cal lamps
- **1999-2000**: New 2ndary mirror, rotation and tilt of tertiary, telescope monitoring telemetry system, S-H optics tester and collimation procedures, new gratings for DIS, 100-baseT LAN
- **2001-04**: aluminum flooring, DIS upgrades, new remote observing software, stray-light baffles completed, NIC-FPS delivered
- **Future**: fast guiding, more instrument rotators, mirror coating facility, new axis controllers, auto-focus, 2ndary/tertiary supports & actuators

Demons

Including: Local and upper atmosphere turbulence, light pollution, moon, lightning, condensing humidity, clouds, rain, snow, dust & pollen, wind, low temperatures, daytime UV, altitude, smoke & fire, heat around telescope optics paths, power outages, phone outages, internet outages, airplanes and contrails, remoteness of location, meteors and cosmic rays, and Miller moths ….

Visiting Instruments

- 10-micron array - Dan Gazari
- 12-micron spectrograph - Don Jennings
- **Drift-scan Camera - Tim McKay, Jim Annis**
- **SPIcam - Chris Stubbs**
- **Goddard Fabrey-Perot imager - Bruce Woodgate**
- AOTF - John Hillman, Nancy Chanover
- **ChAOS, ChILE - Ed Kibblewhite**
- InSB IR Camera - Bruce Woodgate
- LLNL FTS - Chris Stubbs
- **Amber Camera - Dick Newton**
- InSB IR Camera - Sean Casey
- **APOLLO Lunar Ranging- Chris Stubbs**
- CorMASS - Mike Skrutskie, John Wilson

Some ten-year statistics

- Telescope has seen ~20,000 hours on the sky
- More than 300 astronomers “trained” to observe remotely
- Remote observing outnumbers on-site observing 3:1
- 776 postings to apo35general mailer
- 13 “visiting” instruments
- 38,000 gallons of LN2 consumed
- 24 on-site staff, currently 14

Apache Point Observatory

21 November 2000

3.5-m Telescope Annual Report

Overview

- 3.5-m telescope near baseline specification for imaging performance;
- Telescope, instruments, and software operationally robust, down-time negligible;
- Focussing on enhancements, efficiency, new/upgraded instrumentation;
- Instituted SDSS "synergy" opportunities;
- Having continuing "challenges" in staff hiring and retention;
- Repairs to primary mirror deferred, no immediate concerns;
- Made substantial progress on Capital Improvement Fund (CIF) projects;
- Remote observing mode still effective and preferred (~3 to 1), supporting more than 160 certified remote users—see appendices;
- Concerns about scientific productivity; and
- Budget request for 2001 similar to 2000 budget with minor adjustments and request of additional half-time Observing Specialist.

CIF Plans for 2001 and beyond

'Newer'	'Better'	'Safer & Reliable'
Fast guider-2001	**Baffles, calibration-2001**	M1 support-done
New top end-2001	**(New top end-2001)**	**(New top end-2001)**
DIS UV response-TBD	**DIS detectors-2001**	**Limits & interlocks-2001**
	DIS slitviewer-done	Telescope telemetry-2001
	Software rewrite-2001	
New Instruments:	Image quality	**New axis controllers**-2001
- **IR imager-2001**	- M1 AO-done	Aluminization chamber-TBD
- IR spectrograph-TBD	- closed loop focus-TBD	
- narrow-band imager-FP	- **thermal**-ongoing	
Instrument port-2001	- DIMM-ongoing	
	Echelle upgrades-TBD	
	APO/NMSU network-TBD	
	general network-TBD	
	guiders and **rotators**-2001	
	operations efficiency campaign-2001	

20/20 Hindsight Observations

- During the period 1996-2004, the APO 3.5-meter and its instruments were being commissioned, repaired, upgraded and operated simultaneously and successfully!
- This remarkable juggling act was accomplished with an inadequate director and without adequate financial or human resources.
- This near miracle was accomplished via the talents & extreme dedication of the on-site staff and a few heavily involved individuals at the ARC member institutions. *THANK YOU!*