LBT OBSERVATORY NEWSLETTER

November 2026 Issue 2026.2

From the Director

Joe Shields

Gaia DR4 Follow-up. Many discoveries from the LBTO result from follow-up studies leveraging information from other observing facilities, and the Gaia Data Release 4 (DR4), scheduled for December 2, 2026, will be a rich source of candidate targets for which brief LBT observations will produce exciting findings. To maximize the science return from this distinctive opportunity, LBTO will be reserving the majority of Directors Discretionary Time (DDT) in the 2027A semester for Gaia follow-up studies.

To request DDT for Gaia follow-up, observers should submit proposals using the DDT form available on the LBTO website. Requests should indicate specific targets selected from DR4, following its availability to the public. Full consideration will be given to proposals submitted by January 15, 2027. Scientists from institutions currently accessing the telescope through LBT Membership or other agreements will be given priority.

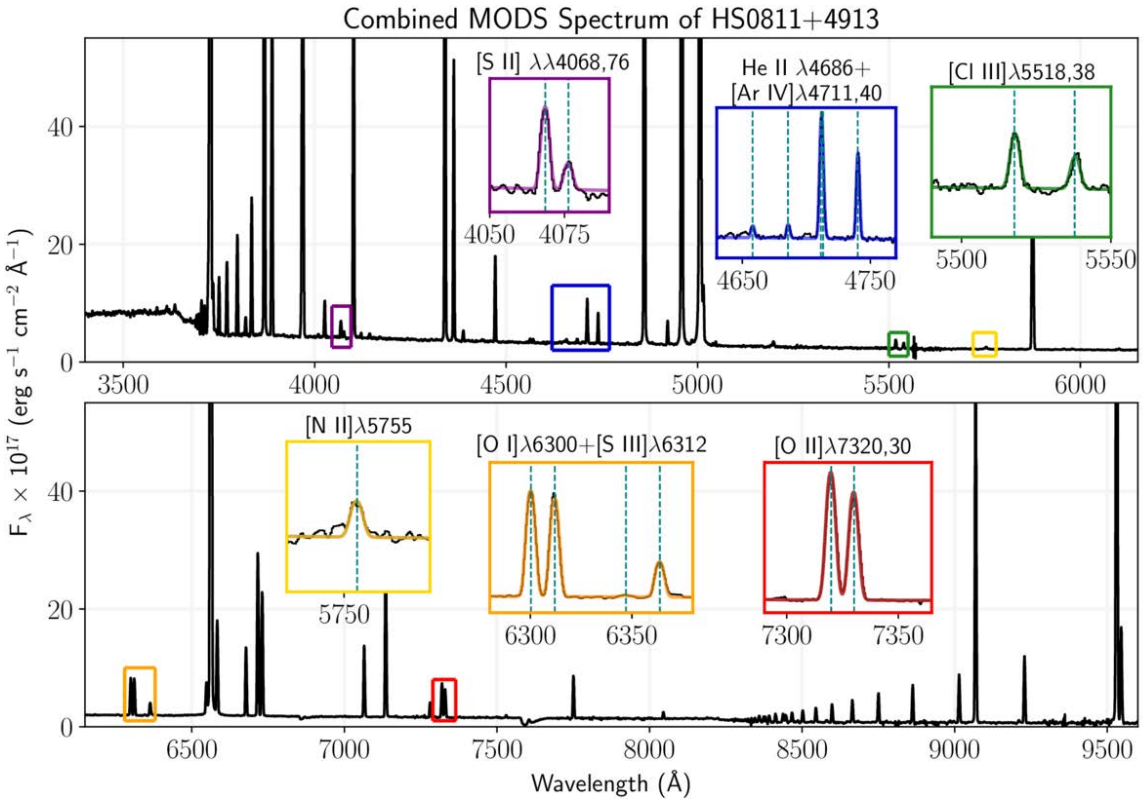
LBT 2027 Science Conference. LBTO will be sponsoring a conference to be held in Tucson on October 20-22, 2027, with a focus of *Brave New Worlds: Science Opportunities with New Instrumentation at the Large Binocular Telescope*. A first announcement will be forthcoming shortly and details will be posted on the conference website https://www.lbto.org/BNW27 as they become available.

LBTO Science Highlights

The Large Binocular Telescope Primordial Helium (LBT Y_P) Project

The concordance between predictions and measurements of the elemental abundances established in the early universe is one of the pillars of Big Bang cosmology. A recent series of papers by Skillman, Pogge et al. based on LBT observations has resulted in a new precision measurement of the primordial helium abundance and test of the Big Bang Nucleosynthesis (BBN) paradigm, with important consequences also for particle physics.

The study used MODS spectra of a sample of 62 low-metallicity ($\lesssim$20% solar O/H) HII regions in nearby galaxies, with most sources also observed with LUCI to measure the near-infrared helium 1.083μm emission line. The data allow determination of nebular abundances in environments with minimal nucleosynthetic processing through stars, such that the helium abundance reflects the primordial value to within measurement uncertainties. Forbidden lines in the spectra were used to measure electron density and temperature to minimize uncertainties in the estimated helium and hydrogen emissivities underlying the abundance determination from the measured line fluxes. The high signal-to-noise-ratio data and careful attention to systematic errors enabled a factor of 3 reduction in the abundance uncertainty relative to previous work, resulting in a precision of ±0.5%.



Example MODS spectrum showing emission line features used in the analysis for the LBT Y_P project (Rogers et al. 2026).

The resulting value, expressed as primordial helium mass fraction $Y_P = 0.2458 \pm 0.0013$, is consistent with the BBN prediction of 0.2467 ± 0.0002. The Y_P value combined with measurements of the deuterium abundance and cosmic microwave background specifies in turn the number of light neutrino species in the BBN epoch, with a measured result of 2.925 ± 0.082, consistent with the Standard Model prediction of 3. Like the new Y_P value, the neutrino result embodies a significant improvement in measurement uncertainty, which is important in excluding some theoretical scenarios outside of the Standard Model proposed to explain other experimental results.

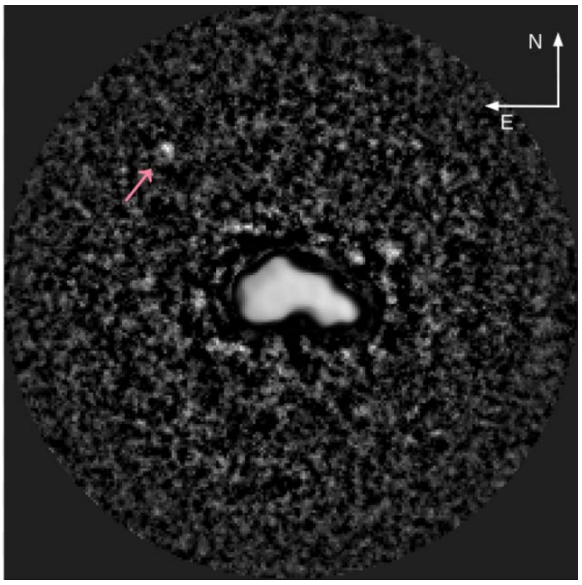


An Asteroid with Trilobate Structure

The morphology of asteroids carries important information about their formation, evolution, and structural properties. Given their small size, however, detailed information on asteroid morphology can be challenging to obtain.

A recent study by Minker et al. used SHARK-VIS imaging to gain important new information on the morphology of main belt asteroid (44) Nysa. This object is one of the largest E-type asteroids, characterized by high albedo and composition understood to have a high proportion of silicates relative to iron. Previous observations of this source using stellar occultation, radar, and the Hubble Space Telescope suggested a complex morphology but were not definitive. In the new study, Nysa, with a diameter of ~75 km, was observed at optical wavelengths while at

a distance of 1.14 a.u. The analysis was supported by images acquired with VLT/SPHERE/ZIMPOL and independent light curve measurements from smaller telescopes.



Composite R-band image of Nysa (center) with residuals after blind deconvolution, revealing a complex morphology as well as the presence of a satellite indicated by the red arrow. The SHARK images have a resolution of 20 milliarcsec. The satellite is separated from Nysa's center by ~215 milliarcsec in the image.

Observations covering the asteroid's rotation period of 6.4 hrs enabled recovery of information on the full three-dimensional structure of the source, and also led to the discovery of an orbiting satellite ~1 km in size.

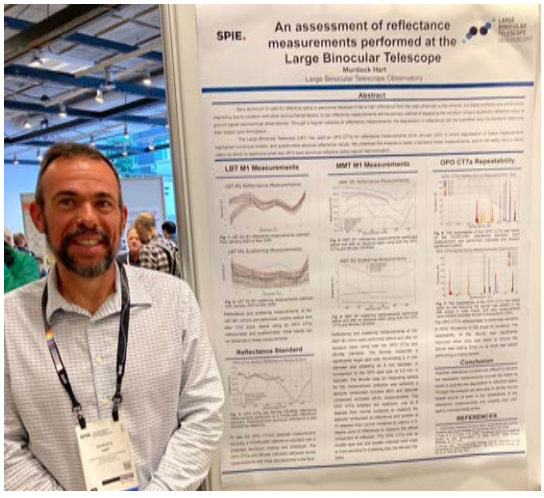
The resulting images reveal an unusual morphology with multiple distinct features, apparently organized into three components. The system may be a unified but very irregular single object, or a contact trinary of independent parts. If the former, the system has likely been shaped by collisions but characterized by significant internal strength enabling it to remain intact but battered. Analysis of the satellite dynamics will provide a density constraint for the primary, and models are expected to clarify the stability for a multicomponent scenario.

LBT at SPIE

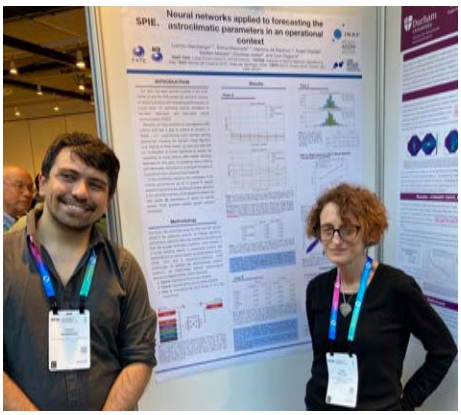
The LBT community was well represented at the SPIE Astronomical Telescopes + Instrumentation conference held in Copenhagen, Denmark, in July. A total of 32 talks and posters related to the Observatory were presented by personnel from LBTO Members and staff. Photos of some of the presenters follow.



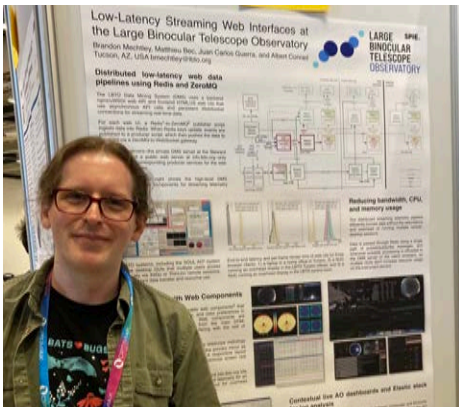
Jonathan Crass (OSU) presenting his talk on "iLocater at the LBT."



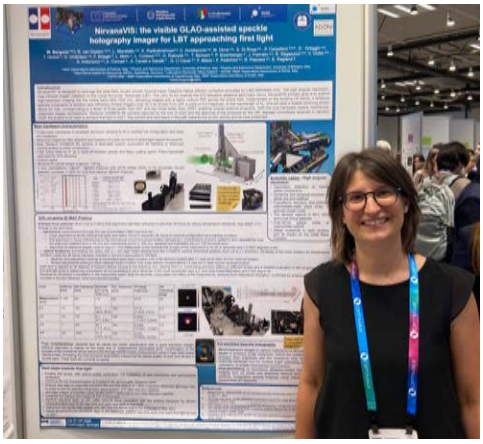
Murdock Hart (LBTO) with his poster, "An assessment of reflectance measurements performed at the Large Binocular Telescope."



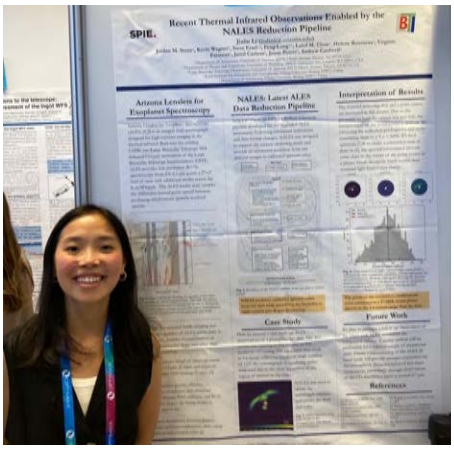
Carmilo Weinberger and Elena Masciadri from INAF-Arcetri with their poster, "Neural networks applied to forecasting the astroclimatic and meteorological parameters in an operational context."



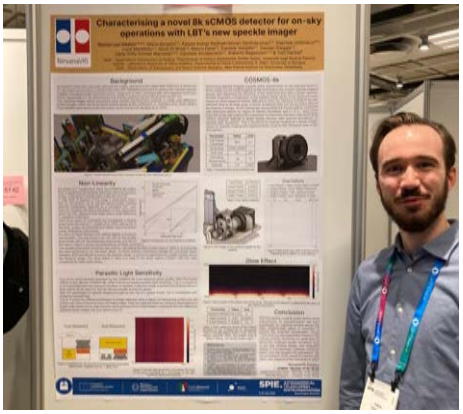
Brandon Mechtley (LBTO) with his poster, "Low-latency streaming web interfaces at the Large Binocular Telescope Observatory."



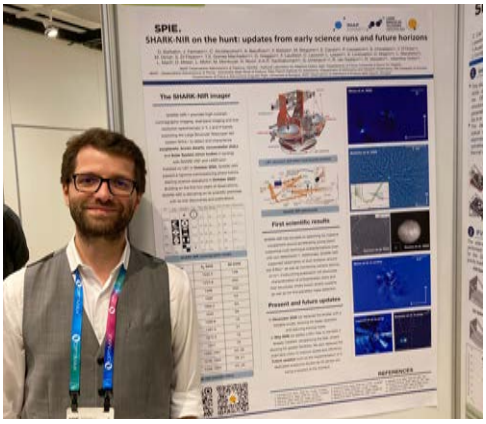
Maria Bergomi (INAF-Padua) with her poster, "NirvanaVIS: the visible GLAO-assisted speckle holography imager for LBT approaching first light."



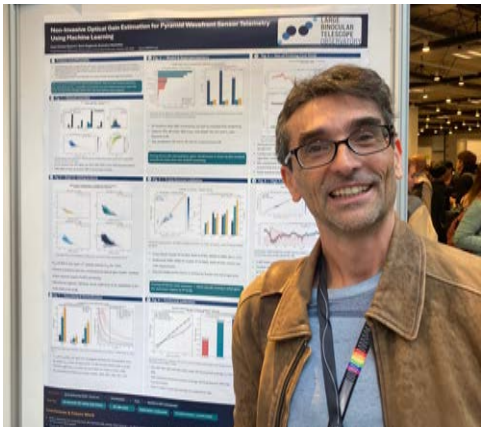
Jialin Li (U. Arizona) with her poster, "Recent Thermal Infrared Observations Enabled by the NALES Reduction Pipeline."



Remon van Gaalen (INAF-Padua) with his poster, "Characterizing a novel 8k sCMOS detector for on-sky operations with LBT's new speckle imager."



Domenico Barbato (INAF-Padua) with his poster, "SHARK-NIR on the hunt: updates from early science runs and future horizons."



Juan Carlos Guerra (LBTO) with his poster, "Non-invasive optical gain estimation in pyramid wavefront sensors from telemetry using machine learning."

Summer Shutdown Updates

The hardware for the LBT primary mirror recoating system has been undergoing a major renovation, with the result that no recoating was conducted during the 2025 or 2026 Summer Shutdowns (SSDs). The system update is expected to be completed early next year and available for use during the 2027 SSD.



LBT staff Dan Rapoza, Chris Love, and Mason Mulholland working on the M1 aluminization system.

In lieu of recoating during the 2026 SSD, the LBT staff did a major revisit of procedures for washing the primary mirrors, with new protocols tested on both M1s. Changes included use of new backpack sprayers and airwands, and use of deionized water instead of distilled water.



Washing of the SX M1 in progress during the 2026 SSD.

The new procedure was easier to execute and the results also appear favorable. Measured SX M1 reflectivity and scattering values for pre- and post-aqueous cleaning show that, at blue wavelengths, reflectivity increased by ~5%, and scattering was reduced by ~6%. Measurements for DX M1 show that reflectivity increased by as much as 10% at the far blue end while scattering was reduced by ~3-4%. Equipment acquired to generate deionized water will remain available for use in future washes.



The SX primary mirror before and after washing. Photo credit: J. Hinz.

The tertiary mirrors were also washed using similar procedures, unlike in previous years when the M3s had been recoated or cleaned with First Contact solution. The washing of the M3s was straightforward, requiring only 30-40 minutes per side. The SX M3 seemed to benefit the most from the wash, though both mirrors showed significant improvement in reflectivity and scattering values.

Queue Observing Status
Joannah Hinz

LBTO has made changes to the scheduling of allocated time for the 2026B semester. Blocks identified as QUEUE now include Arizona, MPIA, and AIP allocations, as well as six nights of engineering time and six nights of Director's Discretionary Time (DDT). Previously, engineering and DDT nights were labeled "ECD" (with C leftover from past commissioning nights) and were scheduled as single nights throughout the semester.

Additionally the SHARK-NIR instrument team, through INAF, requested that six of their GTO nights be included in QUEUE blocks. The LBTI team also requested to be part of the QUEUE blocks, likely beginning in November 2026 once work on the NIC is completed.

The motivation for these changes comes from several factors: increased opportunities to respond to DDT and time-sensitive requests, more flexibility to accommodate engineering and software upgrades, better observing support for institutions purchasing small amounts of telescope time, and anticipated improvement in completion rates for programs requiring excellent seeing and weather conditions.

Scheduling of QUEUE time in future semesters will continue in response to requests from the LBT user community.

iLocater Update

Following installation of the iLocater extreme precision radial velocity spectrograph at the LBT in June, commissioning of the instrument is ongoing during the 2026B semester. Observations of the Sun are now being obtained with iLocater using a solar monitor on the LBT balcony. Work is nearing completion on controls for the HVAC system to optimize temperature stability in the iLocater chamber on level 3L.



Dan Rapoza at work on the HVAC Programmable Logic Controller for iLocater. Photo credit: J. Riedl.

The Laser Frequency Comb (LFC) acquired to enable precision wavelength calibration for iLocater was also intended for use with PEPSI. In August Frank Diones and Ilya Ilyin from the Leibniz Institute for Astrophysics Potsdam completed modifications to one of the PEPSI calibration units allowing selection of the LFC as an input source. Following software updates and testing, the LFC is expected to be available for routine use as a calibration source for PEPSI.

LBT Archive
Al Conrad

Work is progressing to make data from PI instruments – in addition to Facility Instruments – available in the LBT Archive. In particular, efforts are underway to provide access to data from the second-generation PI

instruments SHARK-NIR, SHARK-VIS, and iLocater. At the current time, all SHARK-NIR data are available in the Archive and SHARK-VIS data are partially available, with more coming soon. Planning is underway to incorporate iLocater data in the Archive beginning in early 2027.

Adaptive Optics Update
Sam Ragland

Work is progressing on the Adaptive Secondary Mirror (ASM) formerly at Magellan Observatory and now undergoing renovation for use as a spare unit at LBTO.

The Magellan ASM reference body – modified in collaboration with the U. Arizona Wyant College of Optical Sciences last year – was recoated at A.D.S. International Srl, while outer actuators were co-fabricated by A.D.S. International and Microgate Srl to accommodate the LBT optical beam size.



The Magellan ASM following reintegration activity at the University of Arizona Optical Sciences lab.

Additionally, custom brass inserts for the reworked reference body were designed and manufactured by Microgate. Reintegration of the refurbished unit into the system, including replacement of the glycol hoses, is nearly complete thanks to joint efforts with Optical Sciences, A.D.S. International, and Microgate.



TS4 following recoating at Sunnyside, with Optical Sciences staff member Dan Caywood.

In parallel efforts, thin shell TS4 was recoated in anticipation of its use in conjunction with the Magellan ASM unit. Recoating was completed in Tucson at the Steward Observatory Sunnyside facility through a collaboration with Steward Observatory, Optical Sciences, and A.D.S. International.

Remaining integration tasks for thin shell operation are scheduled for completion later this year, paving the way for full unit calibration, daytime performance validation, and on-sky verification in 2027.

Road Hazards at Mt Graham

Individuals traveling to Mt Graham are well aware that Swift Trail (AZ Highway 366) and the Mount Graham International Observatory access road require careful attention while driving, due to steep grades, sharp curves, rough road surfaces, and no guardrails. Risks associated with travel increase in the winter months due to inclement weather and resulting ice, snow, and fog. Drivers are reminded to reduce speed as appropriate for such conditions, observe winter vehicle and emergency gear requirements in effect November 15 – April 15, and also follow any guidance provided by Observatory staff regarding travel up and down the mountain.



Rocks on the Mt Graham road. Photo credit: J. Riedl

Precipitation and wind can also lead to other hazards on the roadway that merit careful attention. Rockfalls on the road increase following precipitation that produces local erosion and loosening of soil. Rain and wind also create the conditions that result in falling trees that can block the road.



Downed tree on Mt Graham. Photo credit: T. Castro

The potential for rocks and trees on the road underscores the importance of maintaining an appropriate speed allowing timely response to unexpected obstacles, particularly when coming around a curve or when visibility is reduced by fog or rain.

If you encounter rockfalls or trees on the road, please report this information to Mount Graham International Observatory (MGIO) via radio, or via phone to the MGIO duty contact number 928-965-3100. MGIO will deploy its personnel or work with other agencies to remove debris on the road as soon as possible.

Personnel Update: July – October 2026

Arrivals:

Desirae Mendez	Sr Admin Ops Coordinator
Denise Moynihan	Sr Fin/Admin Coordinator

Departures:

Guido Brusa	AO Engineer
Amor Felix	Sr Fin/Admin Coordinator
Douglas Miller	AO Scientist
Jacob Runyon	Health/Safety/Env Spec
Xianyu Zhang	AO Scientist