

# Press Release

3. Juli 2018

## Menlo Technology for Astronomy

*With the recent installation of the firm's Astrocomb for the European Southern Observatory's Very Large Telescope in Chile, physicists from Menlo Systems have made an important contribution to the future exploration of the Universe. Thanks to the AstroComb, starlight can now be analyzed with greater accuracy and precision than ever before.*

**It takes extraordinarily sensitive optical technologies to peer into the farthest depths of the Universe. Capturing and characterizing the light emitted by stars and galaxies in these remote regions requires virtuosos who can push their telescopes and detectors to the limit. Now, for the first time, the light impinging on the four main telescopes that make up the Very Large Telescope (VLT) run by the European Southern Observatory (ESO), has been successfully combined in a single spectrograph. The analysis of the starlight is improved by the AstroComb developed by Menlo Systems in Munich-Martinsried.**

On top of the Cerro Paranal in Chile, ESO engineers and astrophysicists have made a dream come true. They have succeeded in combining the light collected by each of the Observatory's four main telescopes from an object in the farther reaches of the Universe, and directing it into the newly developed ESPRESSO spectrograph for analysis. Feeding all the light into a single instrument gives astronomers access to information that was not previously available. In other words, they will now be able to peer even further into the workings of the Universe. In effect, the new-found ability to merge the light from all four of the VLT's 8.2-m mirrors into a single image makes the VLT into the largest optical telescope in the world, in terms of the area of its light-collecting surface.

Menlo Systems' contribution to this engineering feat is the AstroComb, an instrument which greatly enhances the precision with which light can be analyzed. The AstroComb is a frequency comb designed specifically for the use in astronomy. Together with Prof. John Hall, Prof. Theodor Hänsch, Director of the Max Planck Institute for Quantum Optics and the founder of

---

Menlo Systems, received the Nobel Prize for Physics in 2005 for the invention of the frequency comb.

As the name suggests, a frequency comb is a collection of tens of thousands of equidistantly spaced laser lines. Every one of these lines is made up of light of a known frequency, defined in respect to a basic frequency standard, such as an atomic clock or the GPS. As a result, frequency combs can be used to measure single frequencies with extremely high accuracy.

For the calibration of the new spectrograph at ESO, the frequency comb is generated and fed into the ESPRESSO instrument in parallel with the collected starlight. Both the starlight and the frequency comb are then separated into their spectral components by passage through a very large diffraction grating, and projected onto a CCD-based camera. This reveals the individual teeth of the comb, which can then be used like a ruler to assign precise frequencies to the absorption lines in the spectrum of the starlight.

Thanks to the AstroComb, engineered by Menlo Systems, physicists can now measure with unprecedented accuracy and precision, the spectra of the light that reaches the Earth from the farthest known objects in the Universe. Stellar spectra encode information about the chemical make-up of a single star or an entire galaxy, and their distance from us. In order to interpret them, astrophysicists must measure and analyze the frequencies of the features ("lines") they obtain as precisely as possible. The ability to compare the lines in the extraterrestrial radiation with those of the frequency comb now makes this task more informative.

Astrophysicists plan to use the ESPRESSO spectrograph to search for and characterize Earth-like exoplanets. With the AstroComb, they are now in a position to detect minimal shifts in the spectral lines of stars. Dynamic changes of this sort can disclose whether or not a given star actually hosts planets – and they can be used to determine the orbital periods of exoplanets, their distances from their parent star and their sizes. Astronomers will also use ESPRESSO to observe quasars. Quasars are the most luminous class of active galactic nuclei, and are powered by enormously massive black holes. In addition, researchers hope to investigate whether or not the constants of nature are in fact constant. All of these quests require observational techniques that combine great precision and sensitivity with extreme robustness to external perturbations. Menlo's AstroComb makes an essential contribution to the achievement of these goals.

The extension of ESO's observational capacities constitutes an important advance in high-resolution astronomical spectroscopy. "AstroCombs represent a new mode of wavelength analysis, which yields observational data of unprecedented accuracy and precision," says product manager Dr. Tilo Steinmetz. Menlo's Managing Director Dr. Michael Mei is proud of the firm's success in Chile. "We are very pleased to have contributed to sharpening our view of the Universe. I look forward to many new insights into the depths of the cosmos."

---

**Author: Thorsten Naeser**

**Contact**

**Menlo Systems GmbH**

Am Klopferspitz 19a  
82152 Martinsried  
Germany  
Phone: +49 89 189166 0  
Fax: +49 89 189166 111  
[sales@menlosystems.com](mailto:sales@menlosystems.com)  
[www.menlosystems.com](http://www.menlosystems.com)

**Menlo Systems, Inc.**

56 Sparta Avenue  
Newton, NJ 07860, USA  
Phone: +1 973 300 4490  
Fax: +1 973 300 3600  
[ussales@menlosystems.com](mailto:ussales@menlosystems.com)

**About Menlo Systems**

Precision in Photonics. Together we shape light.

Menlo Systems GmbH is a leading developer and global supplier of instrumentation for high-precision metrology. The company with headquarters in Martinsried near Munich is known for its Nobel Prize winning optical frequency comb technology. With subsidiaries in the US and China and a global distributor network, Menlo Systems is closely connected to its customers from science and industry. The main product lines are optical frequency combs, time and frequency distribution, terahertz systems, ultrafast and ultrastable lasers, and corresponding control electronics. Besides standard production, Menlo Systems develops and manufactures custom made solutions for laser-based precision measurements.

---

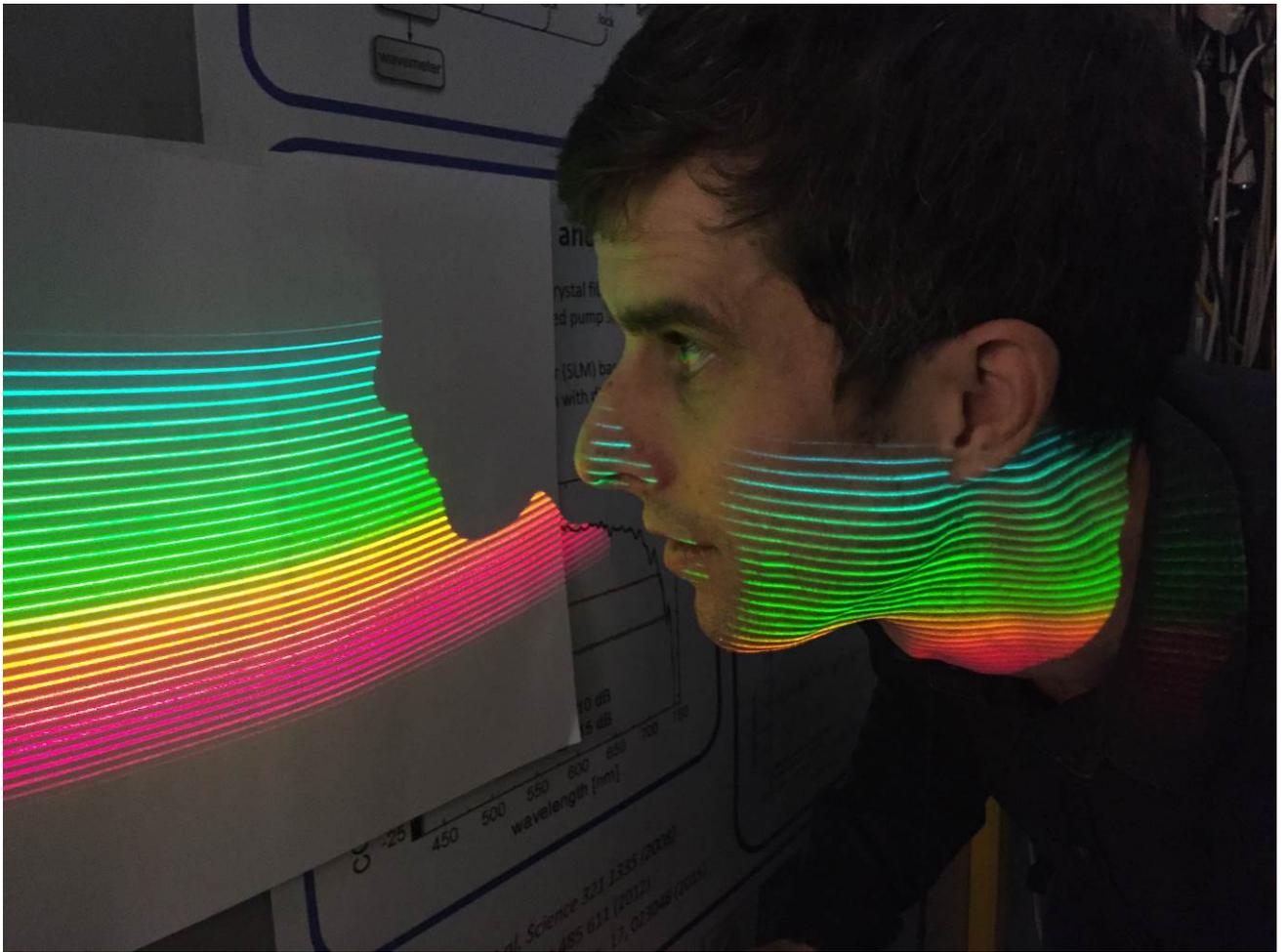
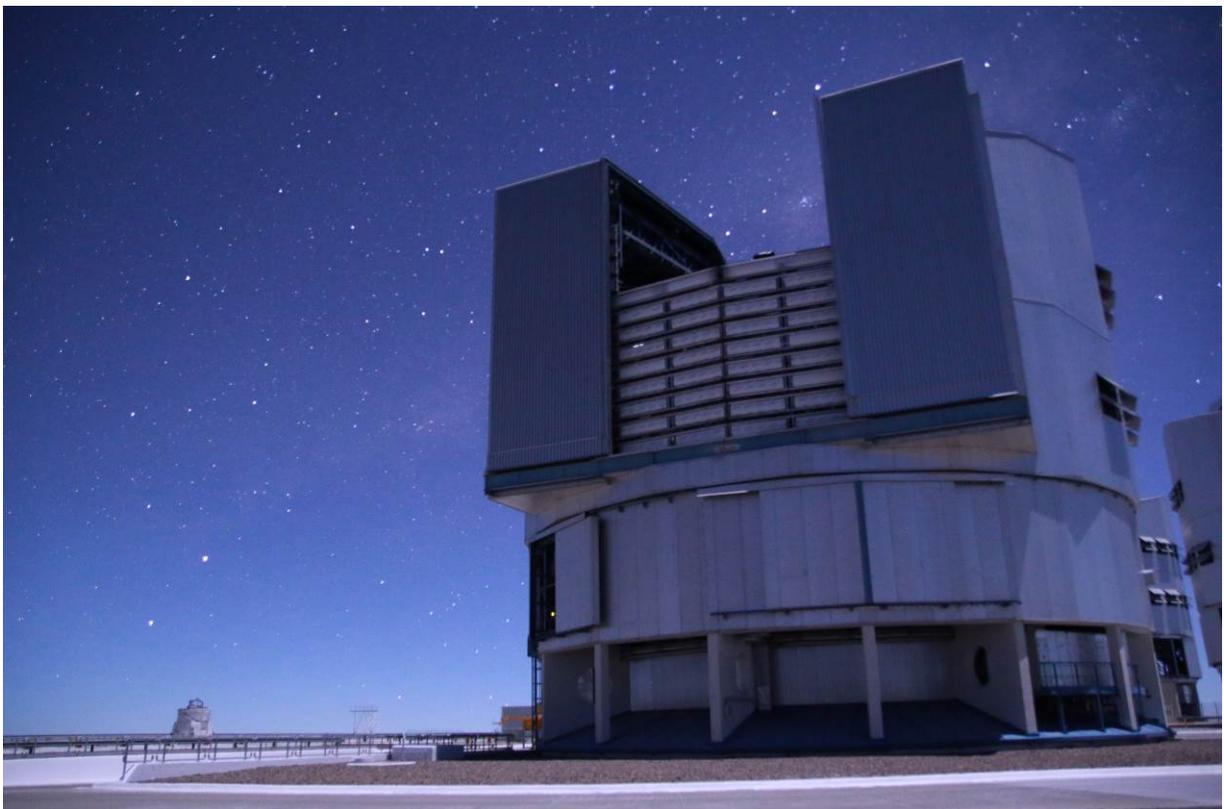
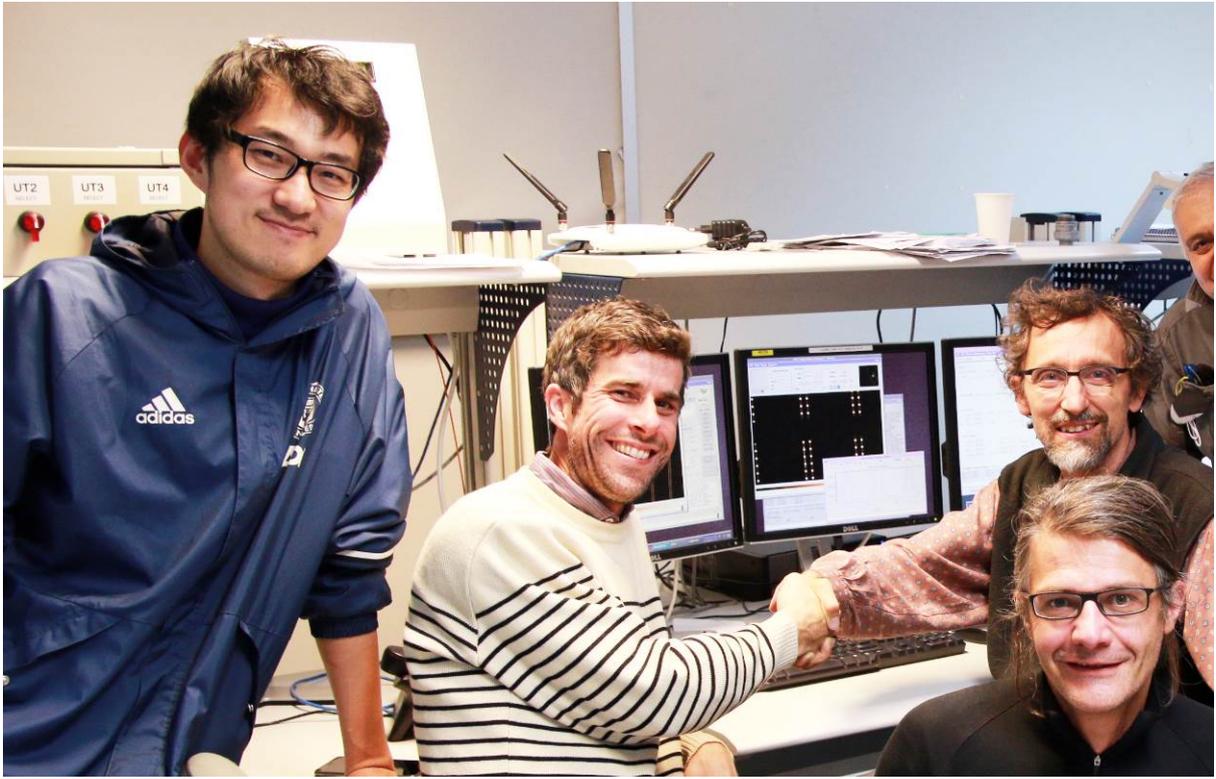


Figure 1: Dr. Tilo Steinmetz, Menlo's AstroComb product manager inspects the comb modes of the ESPRESSO-AstroComb that are projected onto a screen by means of an echelle spectrograph.



VLT's UT4 (unit telescope 4) during the ESPRESSO-AstroComb commissioning at Paranal.



Menlo's AstroComb team members together with ESO scientists are celebrating the 'first light' of the astrocomb on the ESPRESSO spectrograph.