Menlo Systems GmbH
Am Klopferspitz 19
D-82152 Martinsried / Munich

Dr. Ida Kozma
Marketing Manager

Phone +49 89 189166 0
Fax +49 89 189166 111
i.kozma@menlosystems.com
www.menlosystems.com

Press Release

September 4, 2008

Menlo Systems meets astrophysics:

"First light" for frequency combs to enable cosmic dynamics experiments

Menlo Systems is proud to announce its latest contribution to advancing frequency combs for the use in astrophysics. In a combined effort with Menlo Systems and two international teams of scientists – one at the Max Planck Institute of Quantum Optics (MPQ) together with the European Southern Observatory (ESO) and one at the Harvard-Smithsonian Center for Astrophysics together with the Massachusetts Institute of Technology (MIT) - a new technique was developed using laser frequency combs for improving the precision and stability of wavelength calibration of astrophysical spectrographs (1,2).

Astronomers use spectrographs to spread the light from celestial objects into its component colors in the same way as water droplets create a rainbow from sunlight. By analyzing the resulting spectrum they can measure the velocities of stars, galaxies and quasars, search for planets around other stars, or study the expansion of the Universe. For more information see e.g. http://www.mpq.mpg.de/~haensch/comb/Astrocomb/english.html. A spectrograph must be accurately calibrated so that the colors of light can be correctly measured, just like a precise ruler is needed to measure length accurately. In this case the laser frequency comb provides a ruler with an extremely accurate and fine grid, for measuring colors – or more accurately frequencies.

Such a ruler, a so called "astro-comb", uses a mode-locked femtosecond laser and a Fabry-Pérot filtering cavity (see Figure A). When linked to an atomic clock it provides a precise and stable wavelength standard against which light from a star can be measured. The first successful laboratory demonstration was conducted by the Havard group (1), by mode filtering using a Menlo Systems Octavius laser. The MPQ/ESO team has tested a prototype device at the VTT (Vacuum Tower Telescope) solar telescope in Tenerife, on 8 March 2008. Using a frequency comb generated by a FC1500 fiber-based optical frequency synthesizer from Menlo Systems, they measured the spectrum of the Sun in infrared light (see Figure B). These results of the first light for frequency combs on an astronomical telescope are published in this week's issue of Science (2). The technique promises to achieve an unprecedented accuracy and to make many observations that have previously been considered technically unachievable possible.

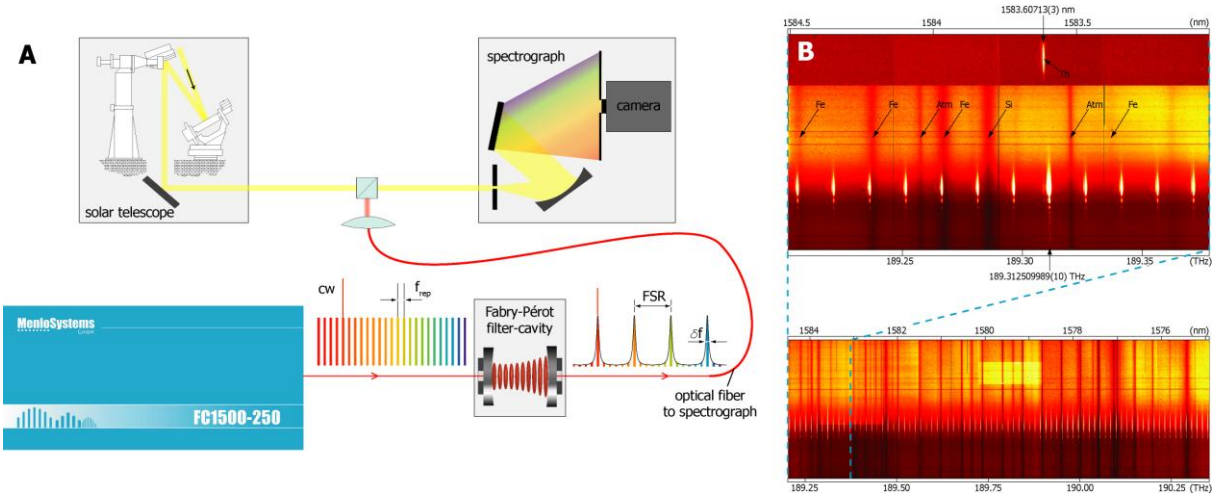

Figure: A) The top left shows a scheme of the solar telescope (VTT) on Tenerife which has been used for the work in (2). The light from the Sun is superimposed with the Menlo Systems FC1500 frequency comb by means of a beam splitter. Together they are fed to a spectrometer (upper right). Since the original mode separation of the frequency comb (250 MHz) are too close to be resolved by the spectrograph, it is first filtered using an external Fabry-Pérot filter cavity to 15 GHz. B) A section of the measured spectrum, magnified on top. The dark lines are caused by absorption of gaseous elements in the photosphere of the Sun and by absorption in Earth's atmosphere. The spectral lines of the frequency comb appear as bright streaks that are used as precise calibration lines for the entire solar spectrum.

1. C.-H. Li, A. J. Benedick, P. Fendel, A. G. Glenday, F. X. Kärtner, D. F. Phillips, D. Sasselov, A. Szentgyorgyi, R. L. Walsworth, *Nature* **452**, 610 (2008).
2. T. Steinmetz, T. Wilken, C. Araujo-Hauck, R. Holzwarth, T. W. Hänsch, L. Pasquini, A. Manescau, S. D'Odorico, M. T. Murphy, T. Kentischer, W. Schmidt, T. Udem, *Science* **321** (2008).

Author: Dr. Tilo Steinmetz, Menlo Systems GmbH