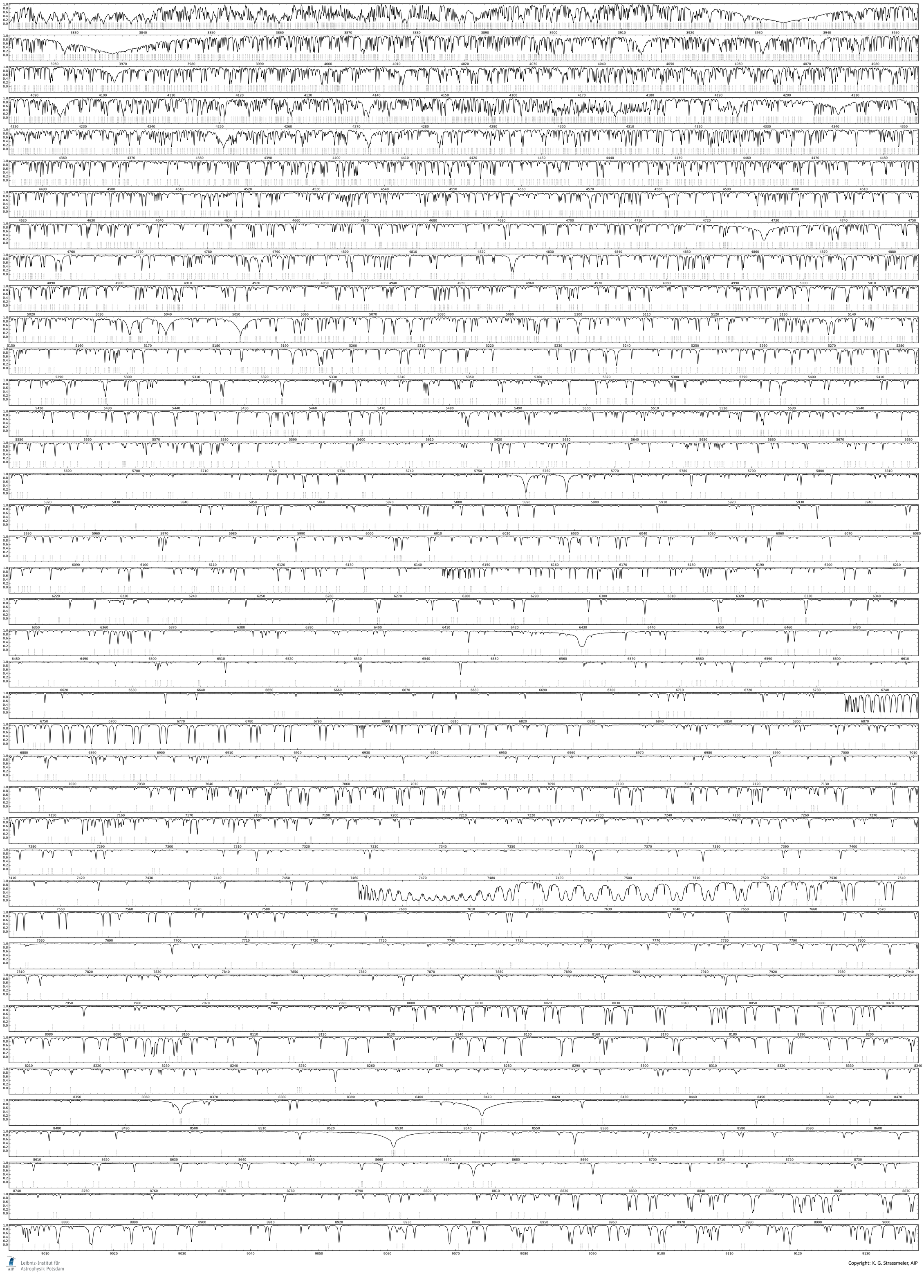
The fingerprint of a star: Sun

Back in 1859, Gustav Kirchhoff had identified the cause of the dark lines in the solar spectra seen by Joseph Fraunhofer and others. When certain chemicals were heated in the gas burner developed by Robert Bunsen, characteristic bright lines appeared in the spectrum. In some cases these were at exactly the same points in the spectrum as Fraunhofer's dark lines of the solar spectrum. The bright lines were light coming from the hot gas of the burner, whereas the dark lines in the solar spectrum are absorption of light in the cooler gas above the Sun's surface. Soon, Kirchhoff and Bunsen found that every chemical element produces a unique series of these dark absorption lines. This provides a sort of a "fingerprint" and allows the identification of particular chemical elements on the surface of a distant star but also the quantitative determination of their abundance. Today, we also use spectra to determine the global effective temperature and gravity, detect velocity fields, identify stellar winds, resolve and map starspots in analogy to Sunspots, or follow the time-dependent effects of non-radial pulsations or extra-solar planets. The poster shows the optical spectrum of the Sun obtained with the Potsdam Echelle Polarimetric and Spectroscopic Instrument (PEPSI) of the Large Binocular Telescope (LBT) recorded just like the Sun-as-a-star. It plots the normalized intensity as a function of wavelength in Angströms (1Å=0.1nm) from the top left corner to the bottom right corner. The spectrum is covered for wavelengths between 382nm (top left) and 914nm (bottom right) with an average spectral resolution of R=$\lambda/\Delta\lambda$=220,000 or approximately 1.4 km/s. Its average dispersion is 0.007 Å/pixel. A hundred individual exposures were average combined with individual exposure times between 1.5s for the reddest wavelengths and 15s for the bluest wavelengths. All data were obtained with the Solar-Disk-Integration (SDI) telescope on the LBT Observatory kitchen balcony on Nov. 17, 2016. A subset of spectral absorption lines is identified in the graphics and marked with dashes beneath the spectrum. The annotation indicates the chemical element (e.g., Fe for iron), the ionization state (I for a neutral line, II for an ionized line), and the wavelength in Angström. Note that the annotation text appears darker the stronger the line. The line identifications and the wavelengths were taken from the Vienna Atomic Line Database. The original spectrum has been published in Astronomy & Astrophysics (Strassmeier, K. G., Ilyin, I., & Steffen, M. 2017, A&A). For further details and for spectra of other stars see https://pepsi.aip.de/.



Leibniz-Institut für
Astrophysik Potsdam