

PEPSI deep-spectrum library

Gaia benchmark stars and other M-K standards

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We provide a homogeneous library of high-resolution, high-S/N spectra for 48 bright AFGKM stars, some of them approaching the quality of solar-flux spectra. Our sample includes the northern Gaia benchmark stars, some solar analogs, and some other bright Morgan-Keenan (M-K) spectral standards. Well-exposed deep spectra are created by average-combining individual exposures. Our data-reduction process relies on adaptive selection of parameters by using statistical inference and robust estimators (see poster by I. Ilyin). We employ spectrum synthesis techniques and statistics tools in order to characterize the spectra and give a first quick look at some of the science cases possible.

With an average spectral resolution of $R \approx 220,000$ (1.36 km s^{-1}), a continuous wavelength coverage from 383 nm to 912 nm, and S/N ratios between 100:1 for the faintest stars in the extreme blue and 6,000:1 for the brightest star in the red, these spectra are made public for further data mining and analysis. Preliminary results include new stellar parameters for 70 Vir and α Tau, the detection of the rare-earth element dysprosium and the heavy elements uranium, thorium and neodymium in several RGB stars, and the use of the $^{12}\text{C}/^{13}\text{C}$ isotope ratio. We also found Arcturus to exhibit tiny Ca II H&K and H α residual profile changes with respect to the KPNO-atlas spectrum taken in 1999.

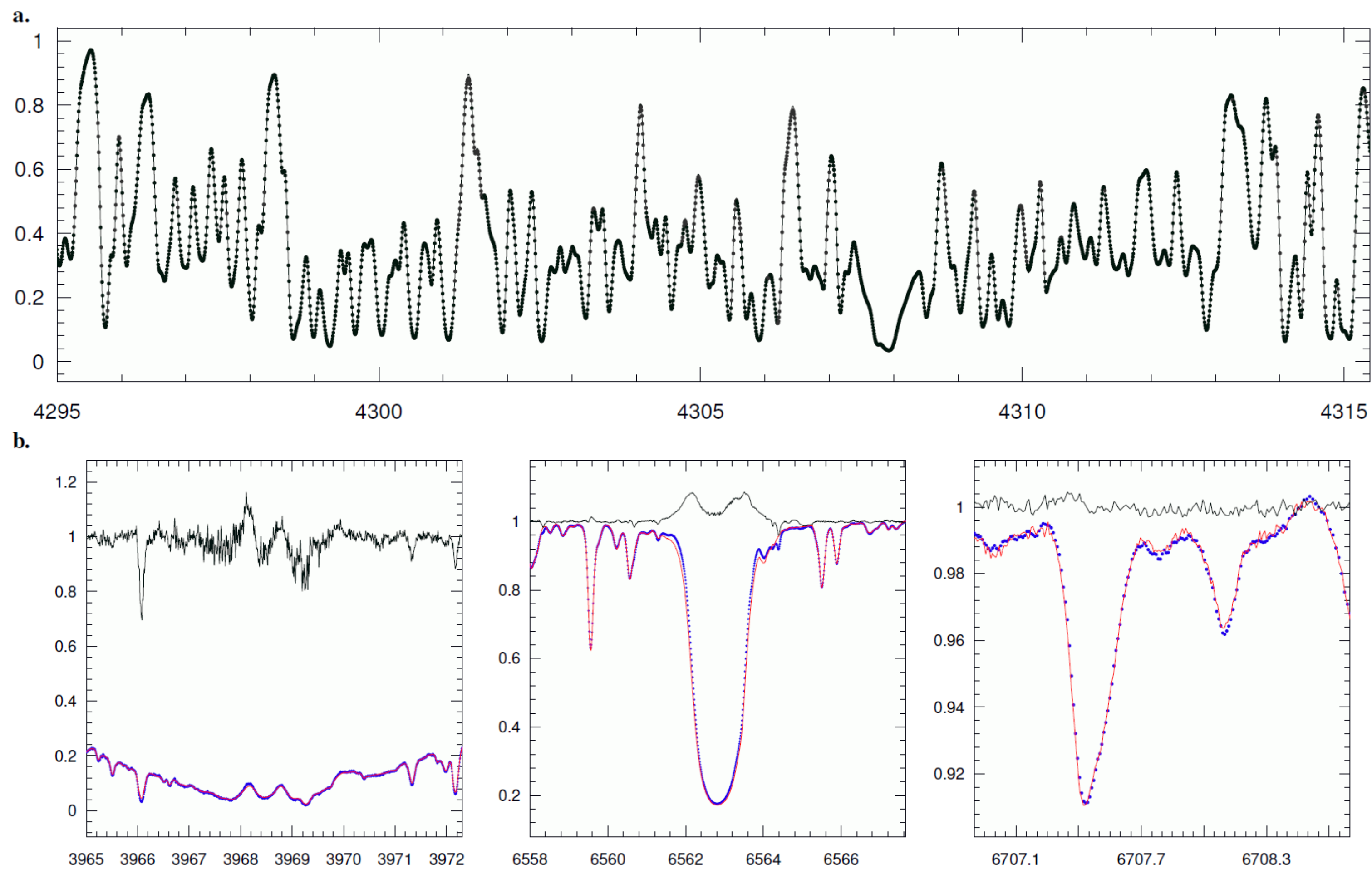


Fig. 4. A comparison of the deep PEPSI spectrum of Arcturus with the KPNO Arcturus atlas from Hinkle et al. (2000). *a.* Shown are the numerous CH lines centered around the Fe I/Ca I blend at 4308 Å that constitute the Fraunhofer G-band. The dots are the PEPSI spectrum and the line is the KPNO atlas. The match is nearly perfect. *b.* Three wavelength regions where chromospheric activity may be detected. Each panel shows the ratio spectrum PEPSI:KPNO (line around unity), the KPNO spectrum (line), and the PEPSI spectrum (dots). From left to right, the core of the Ca II H line, H α , and the Li I 6708-Å doublet.

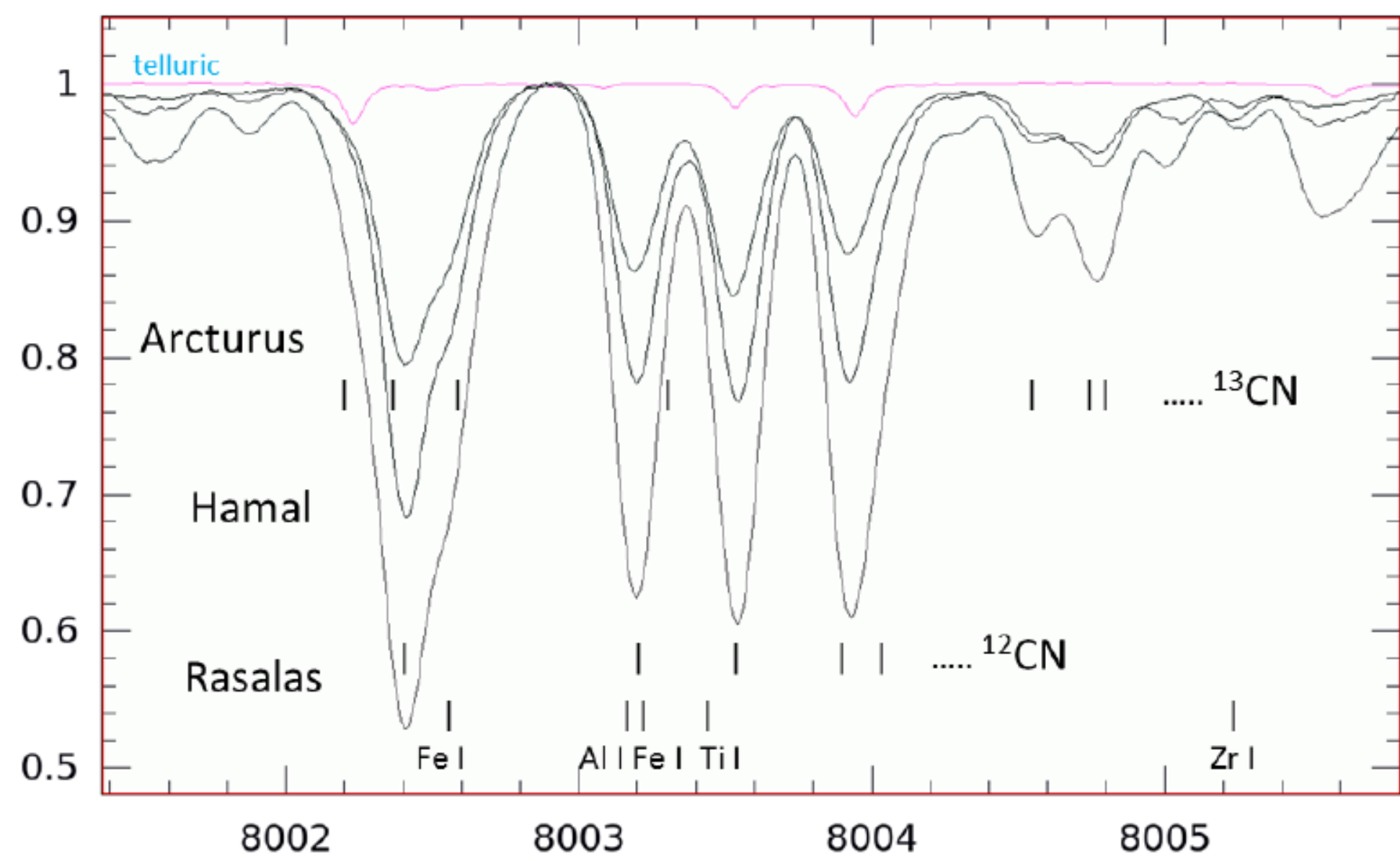


Fig. 6. A comparison of the 800-nm region of three RGB stars in this library; from top to bottom, Arcturus (α Boo, K1.5III), Hamal (α Ari, K1IIb), Rasalas (μ Leo, K2III). The region contains many ^{12}C and ^{13}C lines from which the $^{12}\text{C}/^{13}\text{C}$ ratio is derived. A telluric spectrum scaled to the Rasalas observation is shown on the top.

Star	M-K	Combined S/N ratio										N spectra																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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