FASMA:
a package for stellar parameters and chemical abundances

M. Tsantaki[1], D. Andreasen[2]
[1]Osservatorio Astrofisico di Arcetri – INAF, [2]Instituto de Astrofísica e Ciências do Espaço

Abstract

FASMA delivers the atmospheric stellar parameters:
effective temperature,
surface gravity,
metallicity,
microturbulence,
macroturbulence,
and rotational velocity
based on the spectral synthesis technique. The principle of the technique relies on the comparison of synthetic spectra with observations to yield the best-fit parameters under a $\chi 2$ minimization.
FASMA also delivers **chemical abundances of 13 elements (Li, Na, Mg, Al, Si, Ca, Sc, Ti, V, Cr, Mn, and Ni).**

The python code is wrapped around the spectral synthesis package: MOOG version 2019 (Sneden et al. 1973) in a **very user-friendly** way.

Methodology

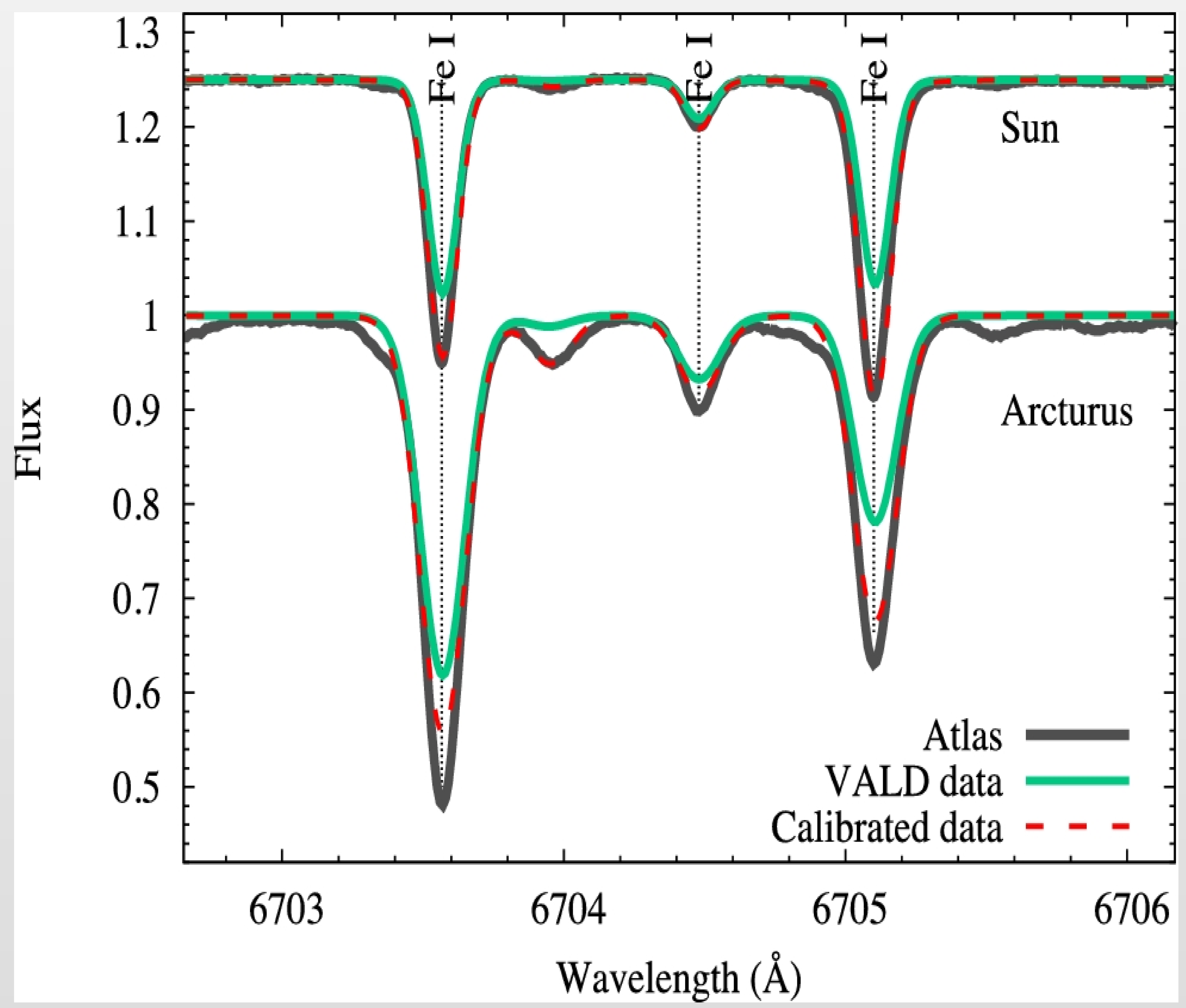
The synthetic spectra are created on-the-fly and are convolved with: 1) macroturbulence, 2) projected rotational velocity, 3) instrumental broadening to match the observations.

Models atmospheres: Kurucz **(**Kurucz 1993) & MARCS models (Gustafsson et al 2008).

Line lists: Tsantaki et al. (2018) for stellar parameters and Adibekyan et al. (2015) and Delgado Mena et al. (2015) for the chemical abundances.

Spectral manipulation: local normalization and filters for cosmic rays

The line list

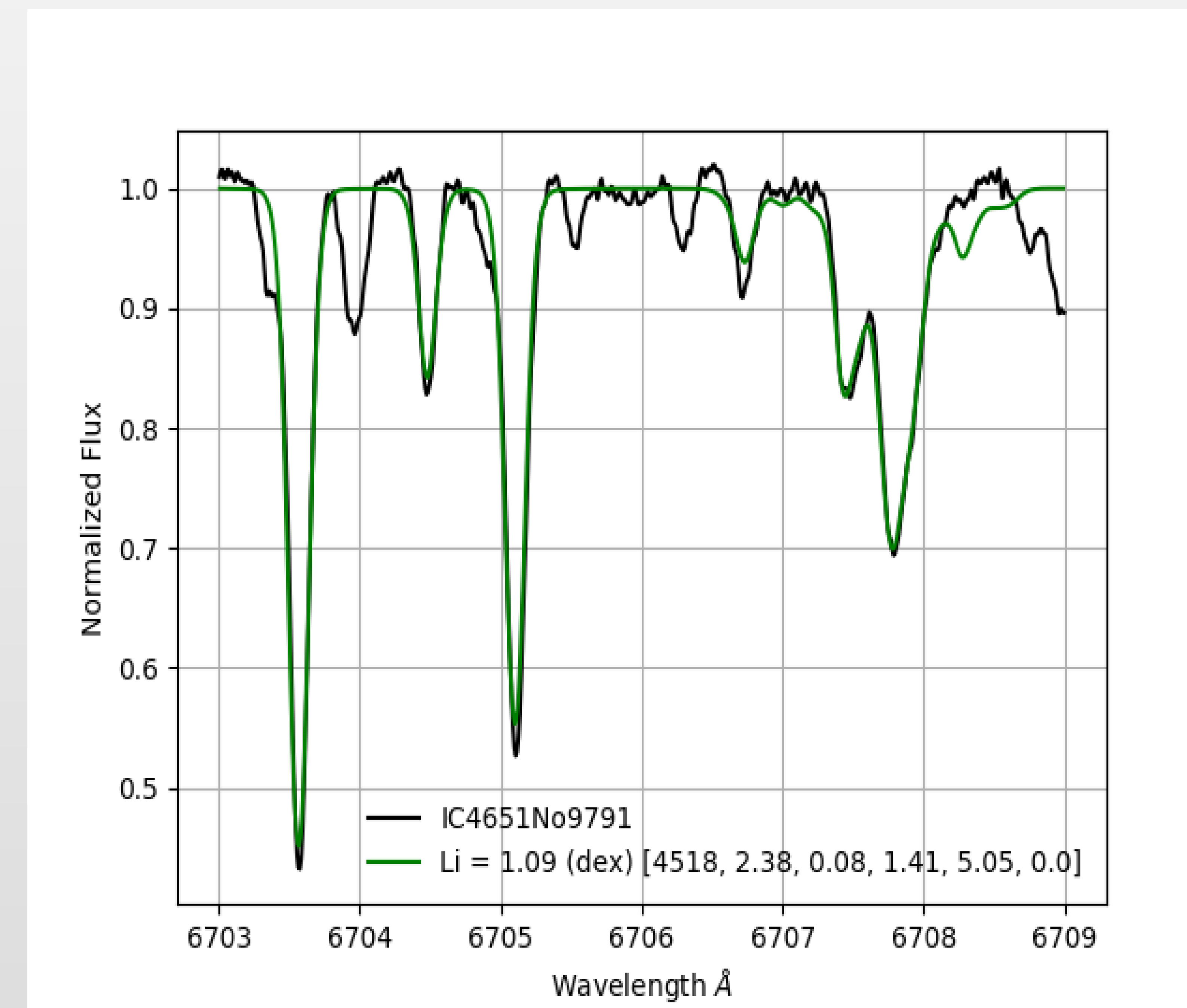


The atomic data of the line list is calibrated based on the Solar & Arcturus Atlases. Comparison of synthetic spectrum with VALD3 data (green line), synthetic spectrum after the calibration of the atomic data (red line) and the Atlases (black line) (see Tsantaki et al. 2018).

Resutls

FASMA has been used in the following works:
- characterization of planet hosts for the Ariel mission Brucalassi et al. 2021
- characterization of high and medium resolution samples Tsantaki et al. 2018
- derivation of Li abundances for giant stars in open clusters (Tsantaki et al. 2021 in prep.)

Li abundances



An example of the fit of the lithium line for a giant star from our recent work on Li abundances in open clusters. The synthetic fit is in green and the observations in black.

References

Code description: Tsantaki et al. 2020
https://github.com/MariaTsantaki/FASMA-synthesis
Science validation: Tsantaki et al. 2018

Acknowledgements

We knowledge the funding from MIUR Premiale 2016: MITIC