MEGASTAR: MEGARA-GTC Stellar Spectral Library

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- MEGARA is an optical integral field and multi-object fiber-based spectrograph for the GTC, commissioned at the telescope in 2017 and in operation as a common user instrument since 2018.

- MEGASTAR is an instrument-oriented empirical library from MEGARA HR star data, crucial for the correct interpretation of the stellar content in the observations. HR spectra have R ~ 20000 in the spectral intervals 6420 – 6790 Å (HR-R) and 8370 – 8885 Å (HR-I). The pilot project was presented in SEA-2018 based on commissioning observations. Since then, we have been awarded filler-type Open Time in 2018B, 2019A, 2019B and 2020A, observed and reduced more than 1000 spectra, created a database and published the first paper (García-Vargas et al. 2020).

- The advantage of using MEGARA IFU is to obtain a stellar library with homogeneous spectral resolution regardless seeing conditions or alignment errors between the target and the entrance focal plane (slit), which is a problem in other atlases, especially at such high spectral resolution.

- We are about to submit the second paper (Carrasco et al. 2020) with the results of the Release 1.0 of MEGARA-GTC spectral library, a set of 838 spectra from 414 stars obtained with the granted time in the first three semesters that become public to the community.

- We describe the project and, in particular, the imminent launch of the release 1.0 and the public database.
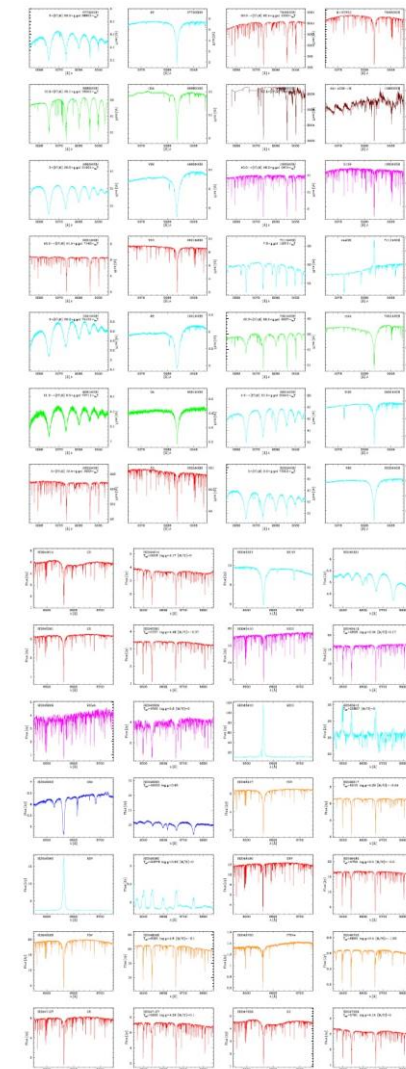
MEGASTAR: Paper I, covering:

- The introduction of the MEGARA-GTC spectral library, detailing the rationale behind the building of this catalogue.

- HR-R and HR-I spectra of 97 stars (21 individual stars and 56 members of the globular cluster M15, which are both subsamples taken during the commissioning runs, and 20 stars from our ongoing GTC Open-Time program).

- The description of data reduction and analysis.

- The determination of the best-fitting MUN05 theoretical models to each spectrum through a $\chi2$ minimization technique, to derive the stellar physical parameters.

- The measurement of some absorption lines and indices.

García-Vargas et al. 2020
https://ui.adsabs.harvard.edu/abs/2020MNRAS.493..871G/abstract

MEGARA-GTC stellar spectral library: I

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ABSTRACT

MEGARA (Multi Espectrógrafo en GTC de Alta Resolución para Astronomía) is an optical (3650–9750 Å), fibre-fed, medium-high spectral resolution ($R = 6000$, $12\,000$ and $20\,000$) instrument for the Gran Telescopio CANARIAS (GTC) 10.4-m telescope, commissioned in the summer of 2017, and currently in operation. The scientific exploitation of MEGARA requires a stellar spectra library to interpret galaxy data and to estimate the contribution of the stellar populations. In this paper, we introduce the MEGARA-GTC spectral library, detailing the rationale behind the building of this catalogue. We present the spectra of 97 stars (21 individual stars and 56 members of the globular cluster M15, which are both subsamples taken during the commissioning runs, and 20 stars from our ongoing GTC Open-Time programme). The spectra have $R = 20\,000$ in the HR-R and HR-I set-ups, centred at 6563 and 8633 Å, respectively. We describe the procedures to reduce and analyse the data. Then, we determine the best-fitting theoretical models to each spectrum through a χ^2 minimization technique, to derive the stellar physical parameters, and we discuss the results. We have also measured some absorption lines and indices. Finally, we introduce our project to complete the library and the data base in order to make the spectra available to the community.

Key words: atlases – catalogues – stars: abundances – stars: fundamental parameters – globular clusters: individual: M15.
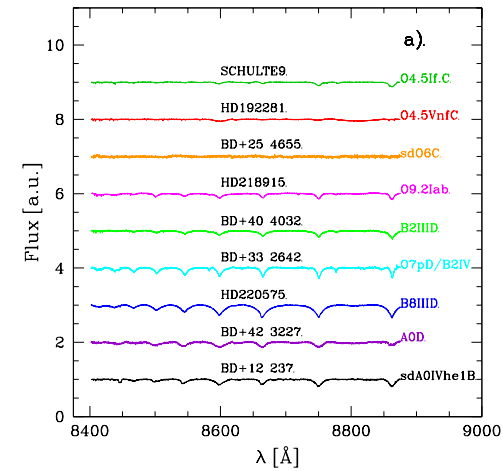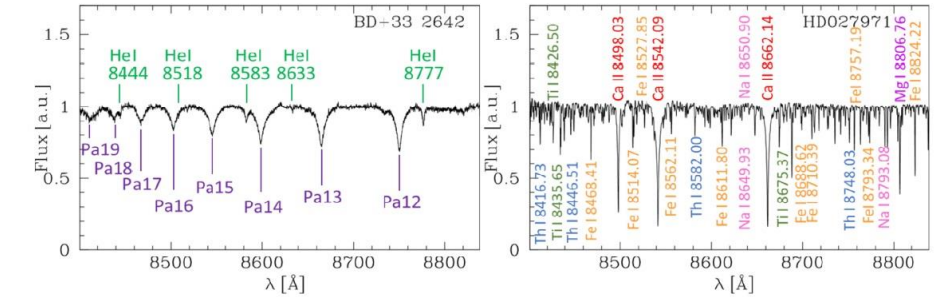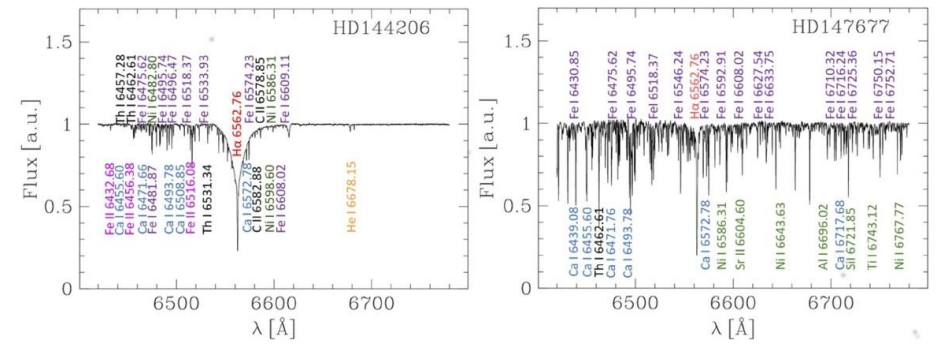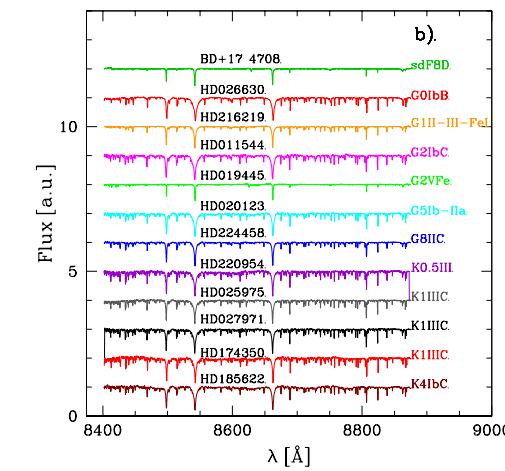
MEGASTAR: Paper I
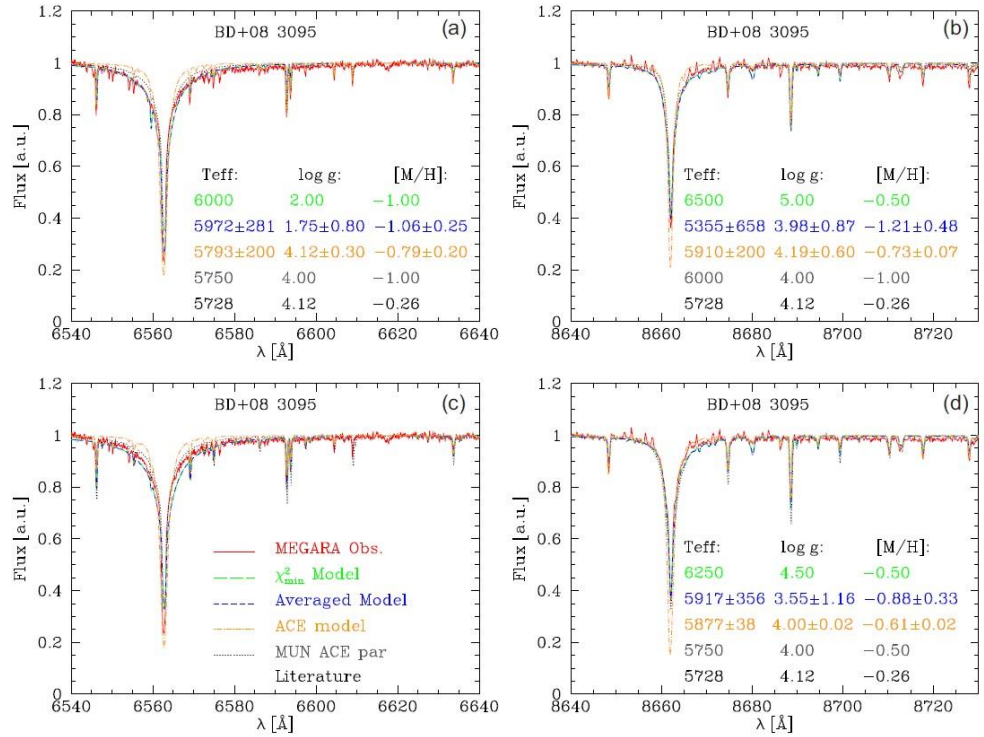
The spectra for the OT star BD+08 3095 (red line) in HR-R (panels a and c) and in HR-(panels b and d), compared with our best models obtained with the χ2 min (green long-dashed line) and the averaged (blue short-dashed line) models, and with the spectrum fitting using the SP ACE model (orange dot-dashed line). The dotted black line is the MUNARI model for the closest stellar parameters to the SP_ACE model estimates. Top panels represent the best fits obtained separately for each set-up, while the bottom panels represent the best fit obtained simultaneously with both HR-R and HR-I spectra.
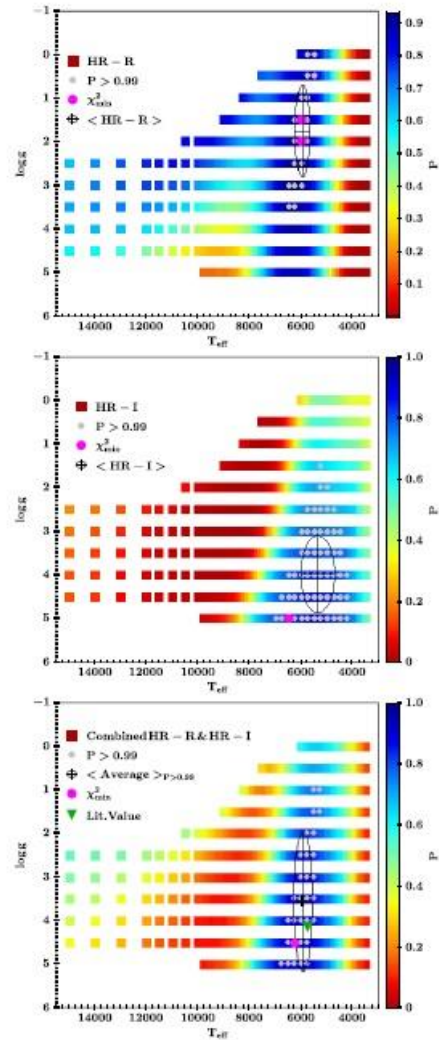
Probability maps logg-Teff of models fitted to the observed HR-R spectrum (top), HR-I (medium), and the combined HR-R-HR-I spectrum (bottom) of the star BD+08 3095.

HR-I spectra for: (a) the hottest and (b) coldest commissioning stars

MEGASTAR: Paper II, covering:

MEGARA-GTC Stellar Spectral Library (II). First Release

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- The description of the content of the release 1.0 with 838 spectra from 414 stars (5 of them with multiple observations) in both HR-R and HR-I set-ups.

- Data come from granted not-guaranteed filler-type program from semesters 2018B, 2019A and 2019B. The awarded and finally observed GTC time is shown in Table 1 below.

- The description of the database.

ABSTRACT
MEGARA is an optical integral field and multi-object fibre-based spectrograph for the 10.4m Gran Telescopio Canarias that offers medium to high spectral resolutions of R = 6000, 12000, 20000. Commissioned at the telescope in 2017, it started as a common user instrument in 2018. We are creating an instrument-oriented empirical library from star observations crucial for the correct interpretation of MEGARA data. This paper describes the first release of MEGARA-GTC spectral library. We present a database of 838 spectra of 419 stars obtained with R = 20000 in the spectral intervals 6420 – 6790 Å and 8370 – 8885 Å with S/N around 200 (TBC). We describe the observations, the data reduction, the analysis and the spectra database now available to the community.

Key words: Astronomical data bases: atlases – Astronomical data bases:catalogues stars: abundance – stars: fundamental parameters (Galaxy:) globular clusters: individual: M15
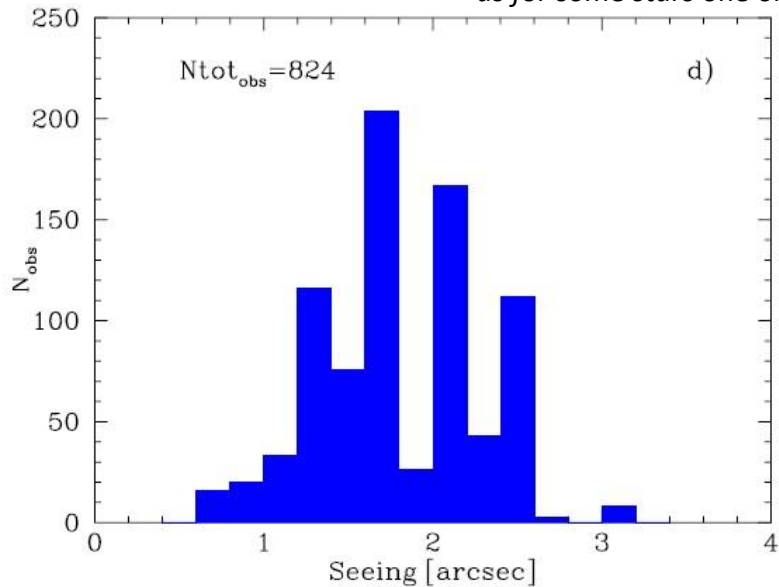
Semester	Requested h	Granted h	Observed h	Star observed
2018B	50	50	63.85	176
2019A	50	50	11.66	32
2019B	75	75	76.73	206
Total	250	250	152.24	414

MEGARA spectrograph installed on the GTC Nasmyth-A platform
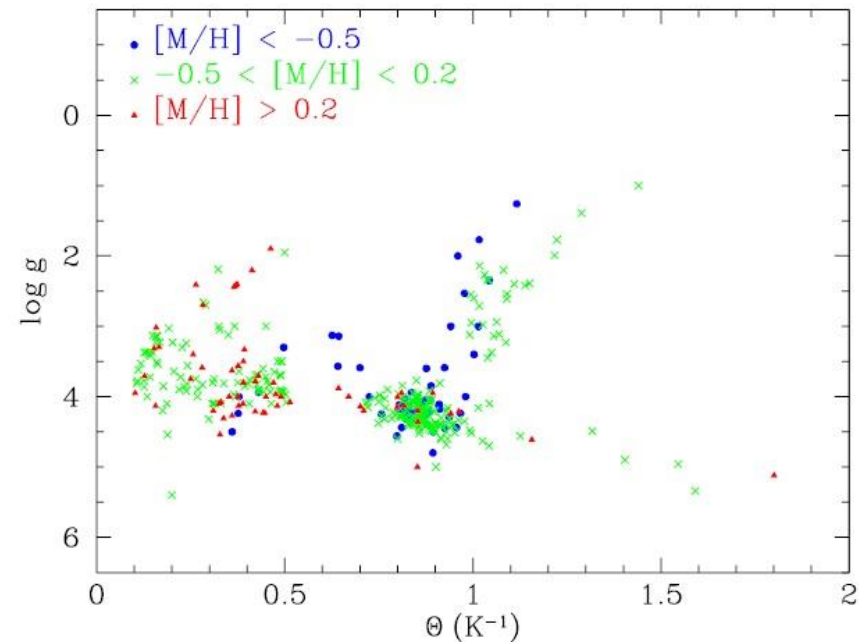
MEGASTAR: Release 1.0. The sample

414 stars

838 spectra

HR-R and **HR-I**
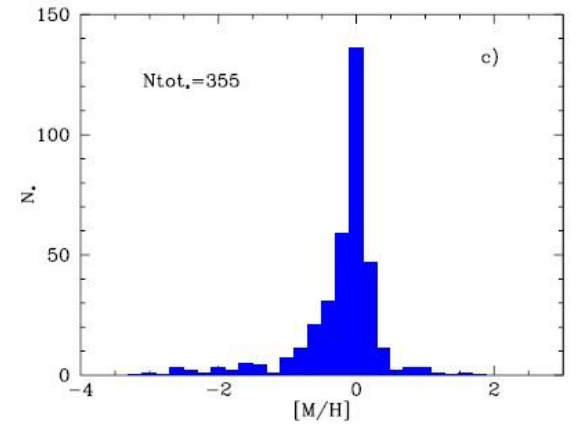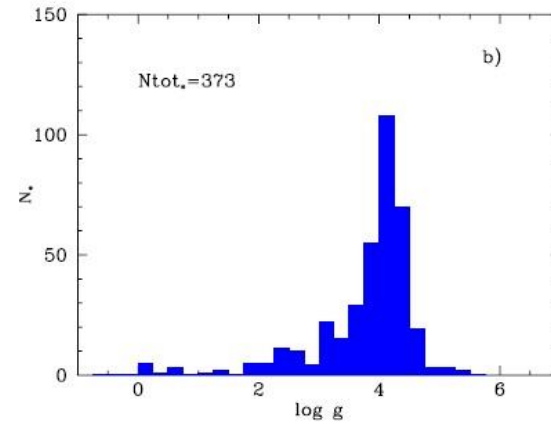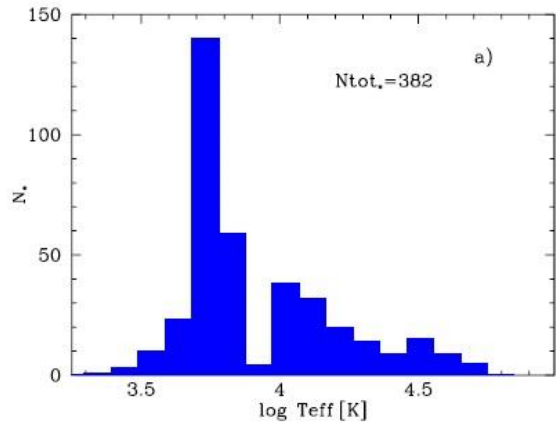
Histogram of the number of stars in this release as a function of Teff (a); log g (b) and [M=H] (c). Ntot indicates the number of points in each graph as for some stars one or more stellar parameters were not reported in the literature at the time we elaborated the MEGARA-GTC library catalogue.

Surface gravity, log g, vs. Θ (5040/Teff) of the stars in our release. Stars in different abundance ranges have been plotted with different symbols and colors.
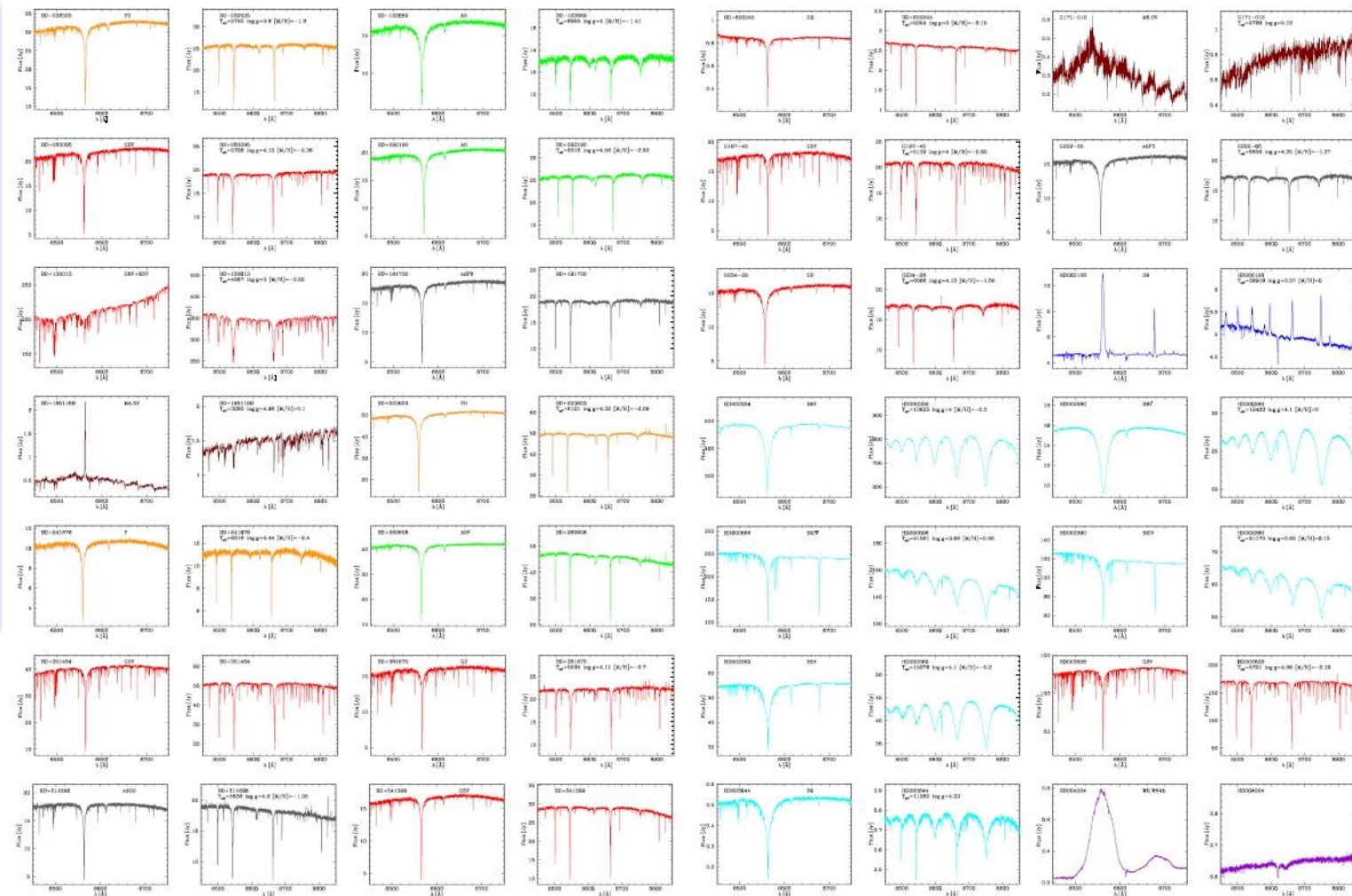
Histogram of the seeing conditions during the observations. The values of first quartile, the median and the third quartile of the seeing distribution are 1.5, 1.8 and 2.0, respectively.

MEGASTAR: Database

Release 1.0 Atlas (example)

Impact and prospects for the future

- 2020A filler observations on-going

- Paper II: release 1.0, imminent submission

- Paper III: stellar parameters determination, line and indices analyses in progress

As electronic appendix of paper II, we present the Stellar Atlas (HR-R and HR-I spectra) ordered by star name.

Thanks!

https://www.fractal-es.com/megaragtc-stellarlibrary/private/home