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Design, construction, and scientific exploitation of a large-scale massive star spectroscopic database.

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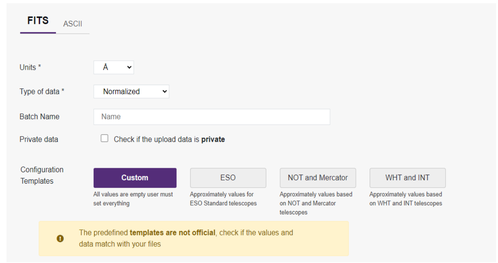
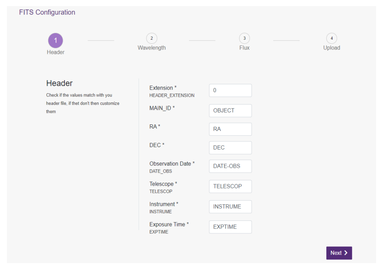
Introduction

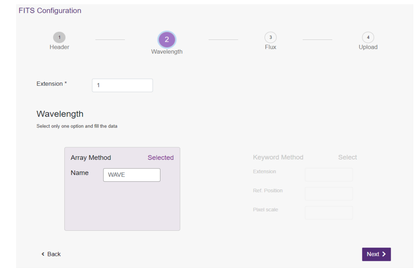
Massive stars are the objects that condition the evolution of the interstellar medium by the amount of energy released during their lives and especially by their death as a supernova explosion. The amount of data provided by previous and ongoing missions by ground and space telescopes have crowded us with a massive amount of information that is no longer easy to process daily by human routines. To this end, we present the development of a massive stars spectroscopic and interactive database designed for scientific investigation.

Upload

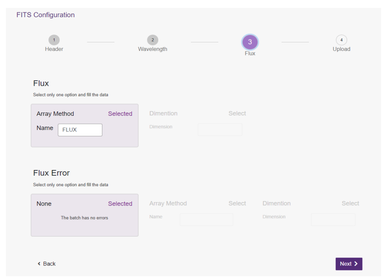
Our application is divided into two main parts, the upload and the science. Within the first we find the upload process, the tracking of the upload and a visualization to corroborate that the spectra have been uploaded correctly. In this first part, the user will be able to upload both FITS and ASCII format spectra.

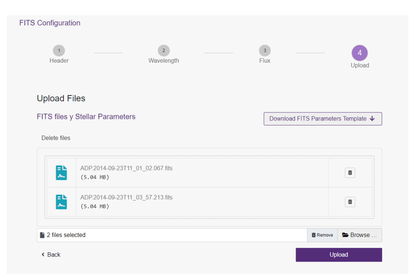






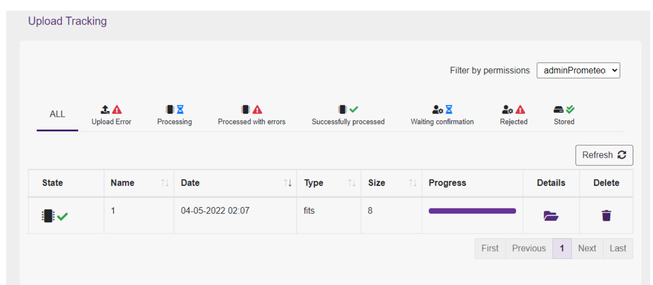
As we know, different telescopes and pipelines provide us with different types of FITS configurations (array, binary data, etc.), that is why we have created a friendly and easy to use interface allowing the user to set the FITS configuration. On the other hand, the ASCII upload is quite simple, a separate header and spectrum need to be provided, following the standard template required.
As an extra feature you can also upload spectrum-derived parameters at the time of upload, following the required template.



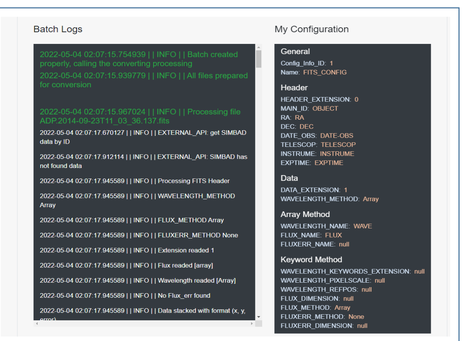


Upload Tracking

Once the upload is done, we go to the upload tracking, where you can correct if any error has been generated, for each of the batches.

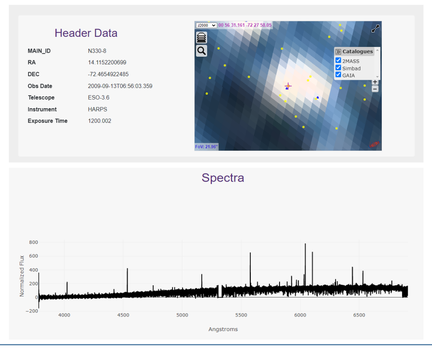


For easy identification if an error has occurred, the log and the entered parameters can be analyzed, allowing the user to reprocess the already uploaded file without the need to re-upload the files and then submit the upload for review.

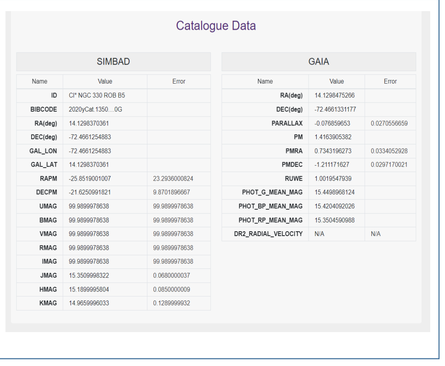


Visualization

It is important to inspect if the spectrum has been uploaded correctly, for that, we provide a nice and easy way to visualize the spectrum, complemented with the visual identification using Aladin API.

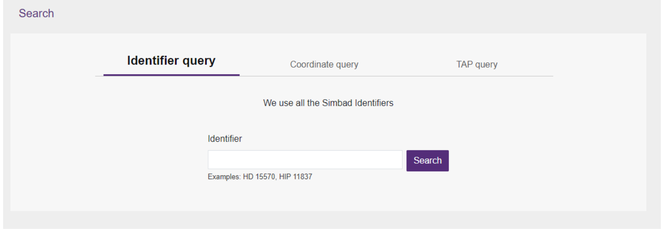


We add a the data from Simbad and Gaia databases, through a correlation base on ID or coordinates, obtaining the main stellar parameters and provide the user with another way to check if the star was correctly identified. From Simbad we also adopt the name of the star as the main identification ID to our database.

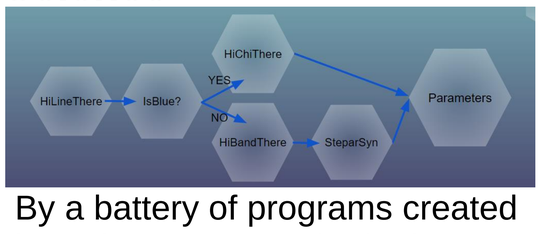


Search

One of our main features is the possibility for users to access to the will be able to use the search tool, where they can search though the available spectra in the database by ID, coordinates or using SQL syntax to search for more specific star types, such as stellar derivative parameters, Teff, logg, spectral type, etc.

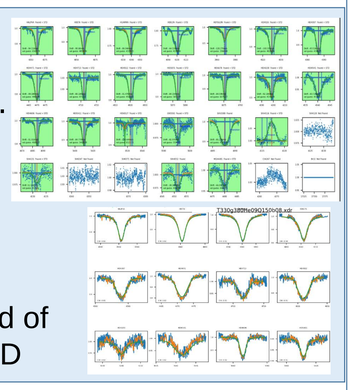


Science

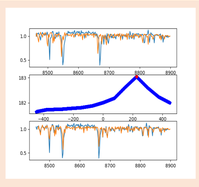


By a battery of programs created in Python, we can obtain the most critical parameters, such as Vrad, Vsini, Teff and logg, in a completely automatic way, for early or late massive stars. We are now contrasting preliminary results for Blue stars with those obtained by Holgado, G. et al 2018. of which we are finding errors within the expected, Teff ~1000 K and logg ~0.3 dex.

HiLineThere is a program that determines and identifies the existence of lines in the spectrum.
IsBlue gets the above output and analyzes whether it is a blue or a late blue star base on H/HeI/HeII lines.
HiChiThere is a routine that compares the spectrum with a grid of models calculated with FASTWIND

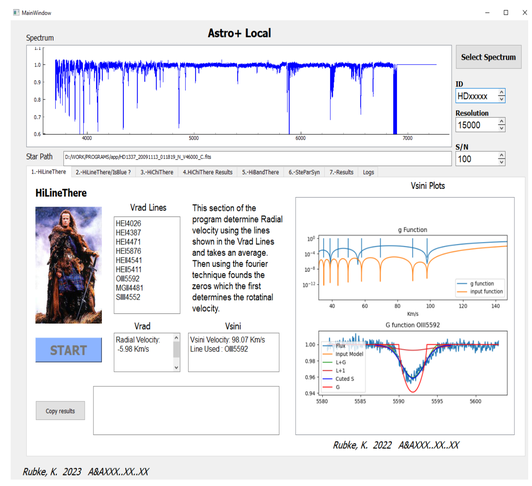


HiBandThere is a program that determines the radial velocity of the star and an approximate model to narrow down the search range for the best model in the next step.
STEPARSYN. an automatic code designed by Tabernero et al. 2022, which infer the stellar atmospheric parameters T_{eff}, log g, and [Fe/H]



Local App & IA/ML

At the same time, a local application is being developed using the python QT visual library, following the same methodology of the database, for testing purposes, quick star analysis and future possible needs within the research group



In our next step we foresee the implementation of neural networks, parameter clustering and new training methods that will be, first compared with the current results and will help us to investigate new patterns of the massive star properties.

Acknowledgement
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