Massive Stars Near and Far
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Access platform to our database of CMFGEN spectra for atmospheric studies of massive stars

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Abstract. We have collected a database of more than 43,000 spectra of atmospheres of massive stars. These spectra have been generated with the CMFGEN code of Hillier & Miller (1998) by systematically varying stellar parameters: effective temperature, luminosity, metallicity and mass loss rate for stars from 9 to 120 solar masses (Zsargó et al. 2020) In this work we present a web-based platform for accessing the database. The platform allows an online comparison between an observed and a synthetic spectrum to quickly assess the stellar and wind parameters. The platform will be available without cost to the astronomical community and will be hosted on servers shared between Mexican Universities.

Keywords. stars: atmospheres, stars:mass loss, catalogs.

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1. Our atmosphere grid: 43,340 synthetic spectra

Synthetic spectra were generated with CMFGEN (Hillier & Miller 1998, 1999), a non-LTE radiative transfer, fully line-blanketed atmosphere code, designed to solve the statistical equilibrium and radiative transfer equations in spherical geometry. In order to properly constrain the input parameters, we used stellar evolutionary tracks and isochrones for both rotating and stationary stellar models reported by Ekström et al. (2012). Considered parameters are luminosity L, surface temperature T_{eff}, mass M, mass-loss rate $\dot{M}$ and surface chemical composition. Nine evolutionary tracks were included (initial mass from 12 to 120 $M_{\odot}$) as well as eight isochrones (log age in years from 6.5 to 7.2). To describe the wind structure, we estimated V_{∞} using V_{esc}. For each stellar model we generated 28 atmosphere models using combinations of the wind clumping factor $F_{cl} = 0.05$, 0.3, 0.6 and 1.0, and the type velocity law of the wind $\beta = 0.5$, 0.8, 1.1, 1.4, 1.7, 2.0 and 2.3. Chemical elements included in our models are H, He, C, N, and O in initial abundances as reported by Ekström et al. (2012). The solar metallicity assumed was the one reported by Asplund et al. (2009) for Si, P, S, and Fe, in all models. A database has been constructed with all synthetic spectra.

2. User interface

Written using the Python web development framework *Dash*, the application will allow users to search the database for stars with parameters within the inputs, search for stars

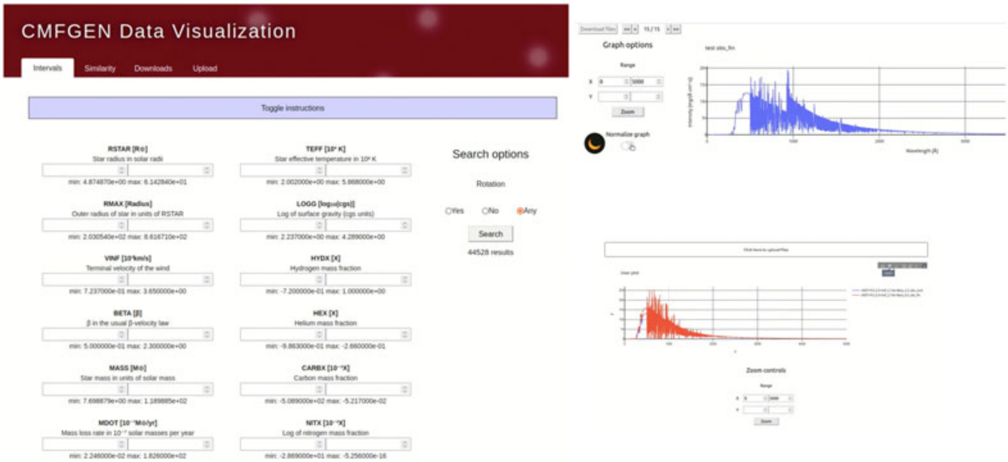

Figure 1. Online appearance of the access platform to the database.

by how similar they are to the parameters entered, upload multiple files with tabular data to compare their graphs in a single window, visualize the spectra of every star in our database, and even download the data. Figure 1 shows the online appearance of the access platform to the database:

• Entering values in boxes, user can search for stars with physical parameters between those values (Figure 1, left).

• The number of results will be displayed. When looking at the results of a search, the spectrum can be visualized as is or in normalized form in a fully interactive graph (Figure 1, top right). The figure can be saved as a .png image and zoomed in and out. The graph can be switched by selecting another star; by selecting stars in the table and pressing the download button, their data can be downloaded. When searching stars by similarity, the parameters by the user are transformed into a vector, normalized alongside the database data, and compared with every other star by taking their differences. The star with the highest similarity score is returned first, with all other stars following by order of similarity score.

• By uploading up to three files containing tabular data, their graphs can be visualized in a single window (Figure 1, bottom right). As in the case of the search results page, this graph is also fully interactive, and its figure can be saved in .png format.

The database will be hosted on servers at our institutions in México (Instituto Politécnico Nacional, Universidad Iberoamericana and CINVESTAV) and will be available soon.

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