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The Galactic O-Star Spectral Survey (GOSSS) Project status and first results

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Abstract: The Galactic O-Star Spectroscopic Survey (GOSSS) is a project that is observing all known Galactic O stars with $B < 13$ (∼2000 objects) in the blue-violet part of the spectrum with R∼2500. It also includes two companion surveys (a spectroscopic one at R∼1500 and a high resolution imaging one). It is based on v2.0 of the Galactic O star catalog (v1, Maíz-Apellániz et al. 2004; v2, Sota et al. 2008). We have completed the first part of the main project. Here we present results on the first 400 objects of the sample.

1 Description

The Northern part of the survey is being carried out from the Sierra Nevada and Calar Alto observatories (Spain) and the Southern part from Las Campanas (Chile). Although the data have been acquired at three different observatories, they have nearly identical characteristics: uniform and high signal to noise ratio (200-300), same spectral resolution (R ∼2500), and similar spectral coverage (∼3900 to 5100 Å). To date, we have completed the first part of the project (observing the first 400 objects of the sample). The main objective is to publish a new Galactic O-Star Atlas as well as the spectrograms for all stars. Figures 1 and 2 show two atlas sheet with the same luminosity class and the same spectral type. We have also observed more than 300 objects from the second part of the project, a number that is increasing in current campaigns. For each star, we typically have two or more epochs. The survey will be used for a number of purposes, such as a precise determination of the IMF for massive stars, the measurement of radial velocities for Galactic kinematical studies, and the detection of unknown massive binaries. Results will be made available through a dedicated web server, will be incorporated into the Virtual Observatory, and will include the most complete spectral library of massive stars to date. A paper with the first ∼180 northern stars of the survey, including a new spectral classification atlas, will be presented by Sota et al. (2010, submitted to ApJS). Another paper with ∼200 southern stars will follow next year.

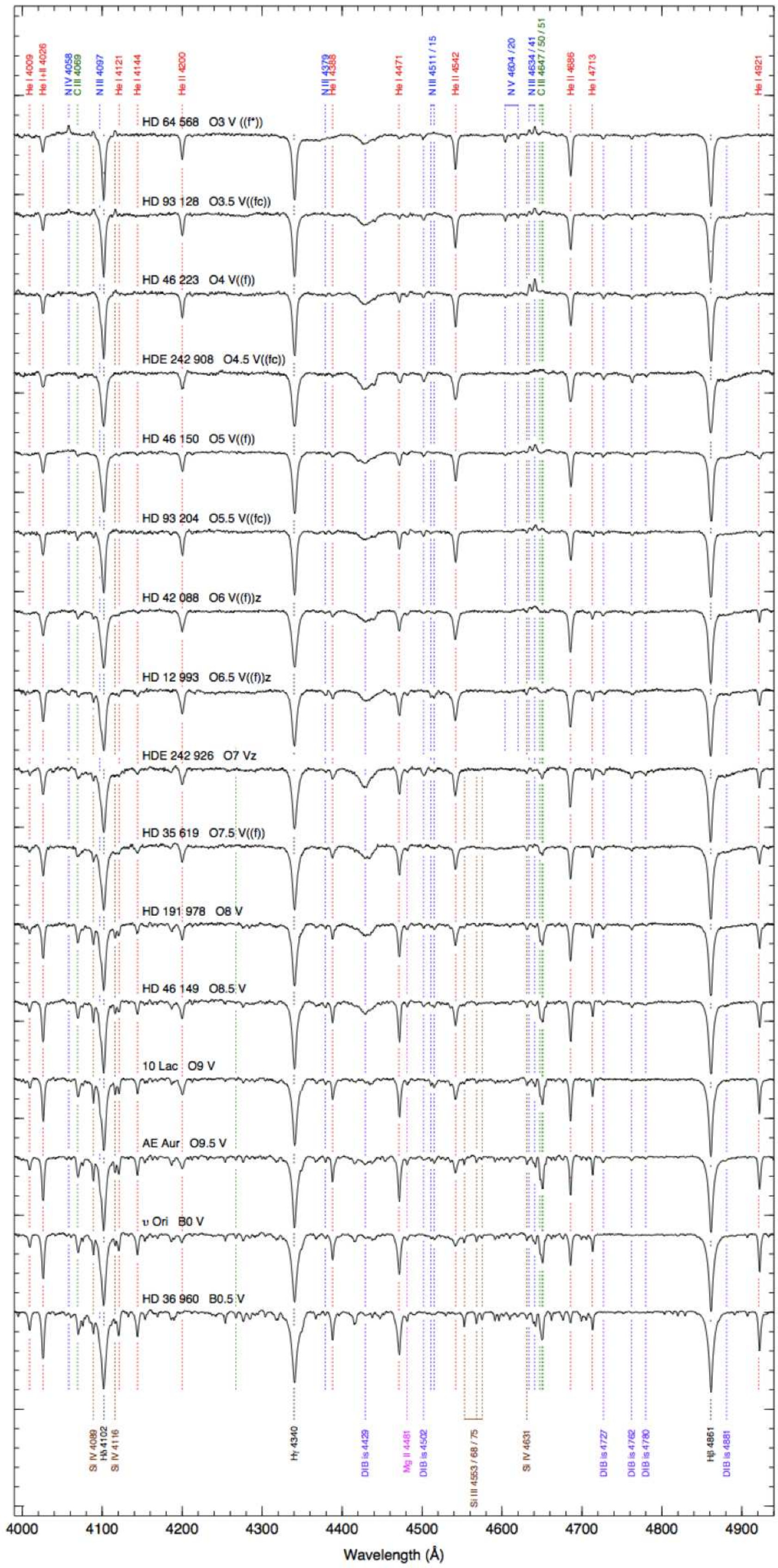


Figure 1: Spectrograms for luminosity class V of Galactic O stars.

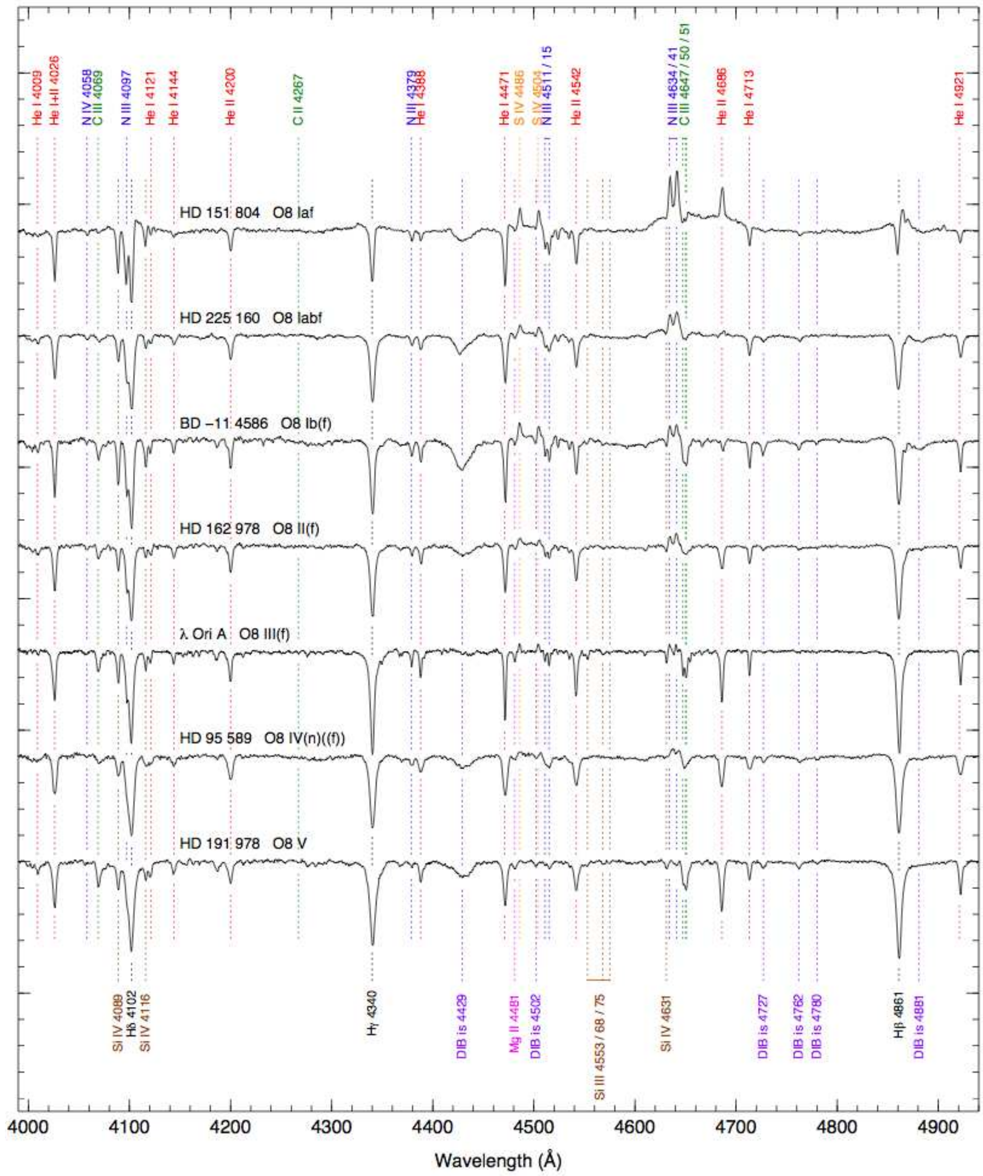
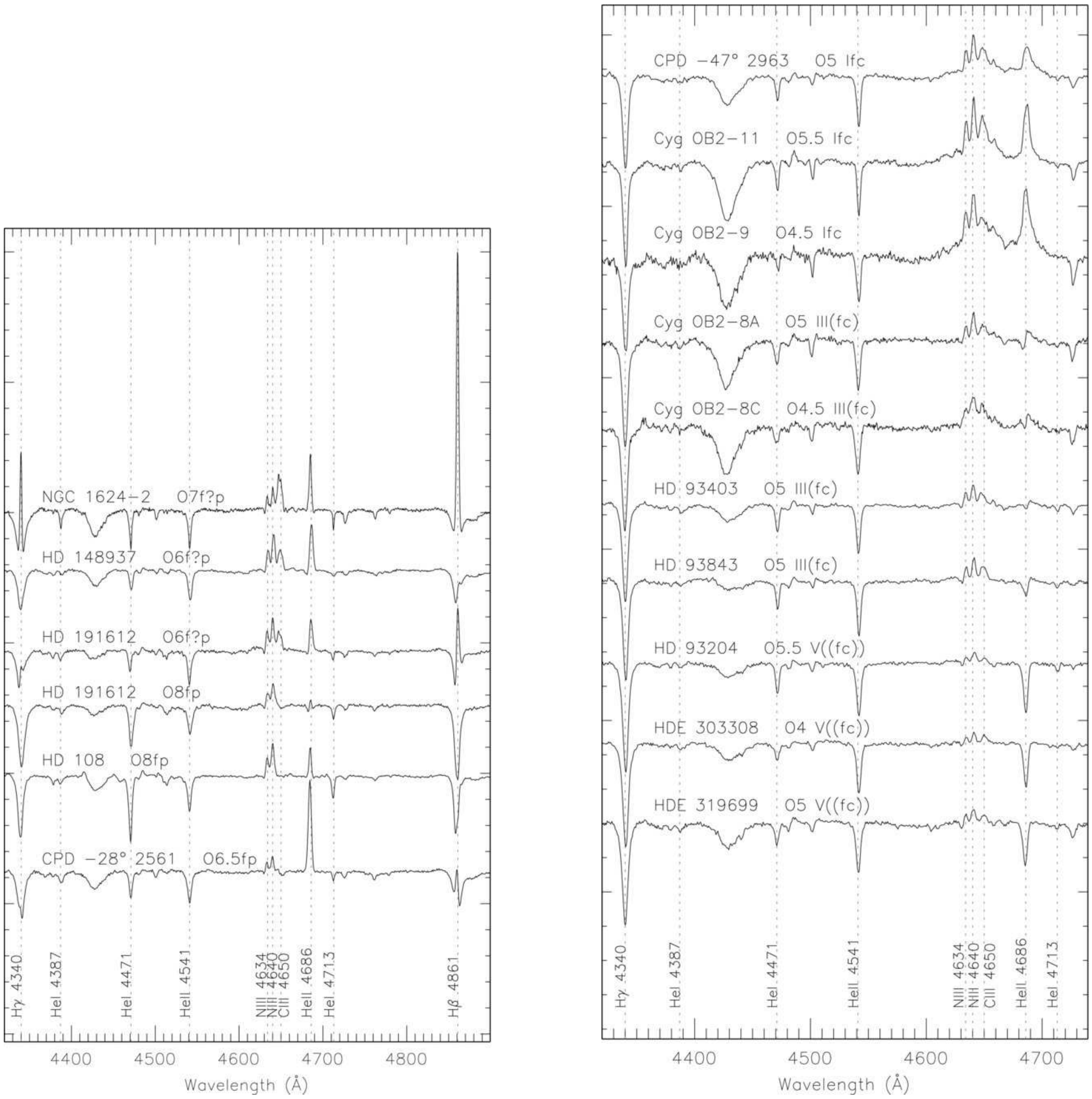


Figure 2: Luminosity effects at spectral type O8.

2 C III Emission Lines in Of Spectra

We introduce the Ofc category, which consists of normal spectra with C III $\lambda\lambda$4647-4650-4652 emission lines of comparable intensity to those of the Of defining lines N III $\lambda\lambda$4634-4640-4642 (Figure 3b). The former feature is strongly peaked to spectral type O5, at all luminosity classes, but preferentially in some associations or clusters and not others. This behavior contrasts with that of the selective C III λ5696 emission, which has a much wider spectral-type distribution. It is also distinct from that of the Of?p stars, which have C III $\lambda\lambda$4647-4650-4652 emission (localized to some particular region of the unknown circumstellar structures), but otherwise peculiar and variable spectra. Magnetic fields have recently been detected on three members of the latter category. We present two new extreme Of?p stars, NGC 1624-2 and CPD -28° 2561, bringing the number known in the Galaxy to five (Figure 3a). Modeling of the behavior of these spectral features can be expected to better define the physical parameters of both normal and peculiar objects, as well as the atomic physics involved (see Walborn, et al. 2010).



(a) (b)

Figure 3: a) Spectra of the Galactic Of?p stars in the blue-green region, and b) Luminosity sequence of Ofc spectra in the blue-green region.

3 Data Reduction

Due to the large amount of data that we are collecting, we have developed a pipeline for the automatic (quicklook) or semi-automatic (full) data reduction. In quicklook mode, we are able to get the rectified and calibrated spectrograms for all the stars that we have observed in a single night just in a few minutes after the observations. The pipeline can identify every kind of file and apply the standard reduction to the images (bias subtraction, flat-fielding, bad pixel mask, ...). It also extracts the spectrograms from the images (including close visual binaries; see Figure 4), aligns and combines all the spectrogram from the same star (to increase the signal to noise ratio and correct defects like cosmic rays), calibrates in wavelength and rectifies to the continuum. The same operations are performed in full mode with the user being able to tweak the files and parameters used.

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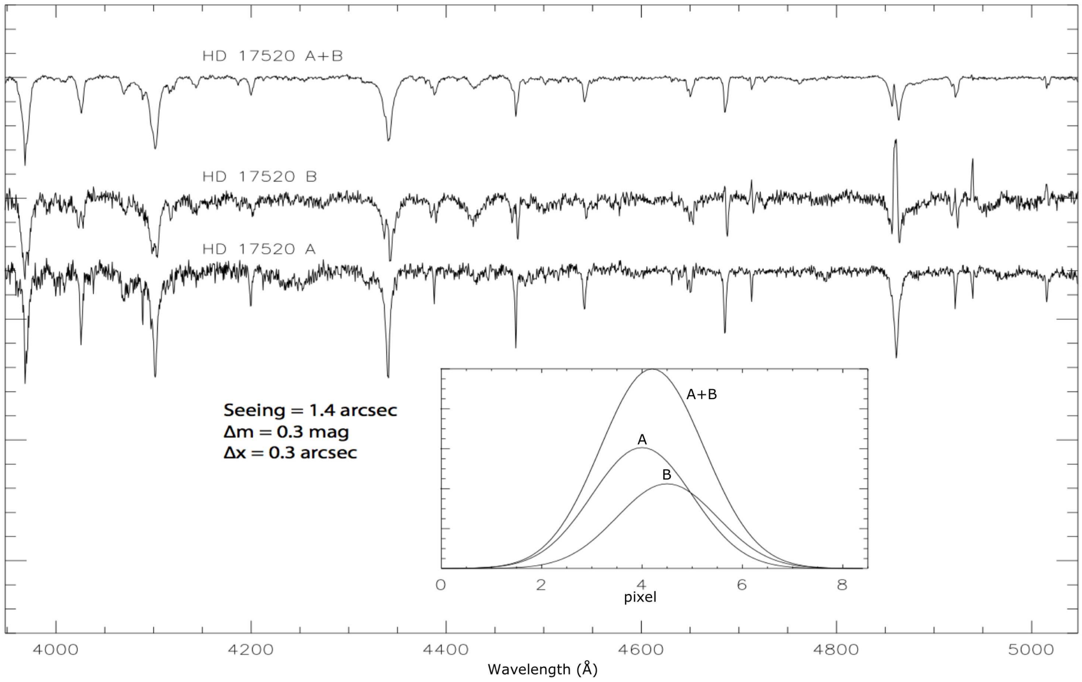

Figure 4: Example of disentangling. The visual binary HD 17520 A+B is separated by only $0\farcs3$, a fraction of the seeing in this exposure. This is the most extreme case in our sample. We are able to disentangle the two pair components to show an O type spectrum and a Be type spectrum (pay attention to the emission lines in the Be star). The inner figure shows the spatial distribution of the combined spectra.

Acknowledgements

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