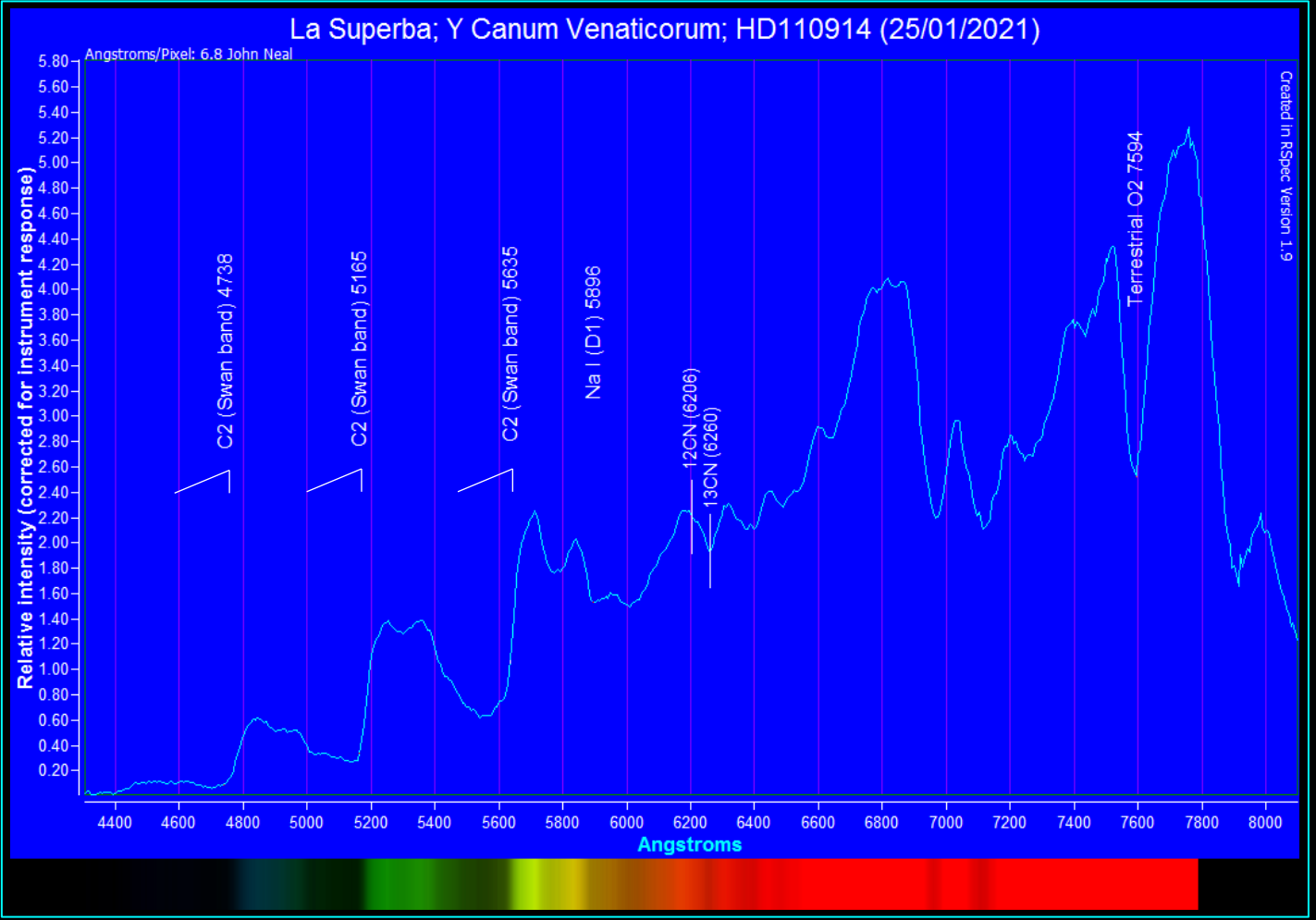
Low resolution spectroscopy of La Superba (Y Canum Venaticorum; HD110914)

Spectral image

Imaged with Celestron EdgeHD 8 / SA 200 / Atik 414EXM



Object notes:

Y CVn is an intensely red star - one of the reddest known - but with a T_{eff} of 2,760 K it is also one of the coolest. It is a red giant on the Asymptotic Giant Branch (AGB) of its evolutionary track - nearing the end of its life. Typical of AGB stars, it is losing mass, in this case at a rate about a million times more than the solar wind. This has generated a detached shell of gas and soot from the carbon compounds created above its Carbon/Oxygen core. It will eventually form a planetary nebula leaving its core exposed as a white dwarf. However, there is more to this star.

In the AGB phase, 'Classical' Carbon stars synthesize their Carbon through Helium burning via the triple-alpha process. This carbon is dredged up to the surface by strong convection. But Y CVn is a rare C-J (non-Classical) carbon star; these have a higher proportion of ^{13}C compared to ^{12}C. The astrophysical origin of C-J Carbon stars is not clear, and researchers consider a number of explanations. Some postulate they arise from binary systems where material (including Carbon) dredged up from the core of the more evolved member is accreted onto the less evolved member which later evolves to the AGB as a Carbon star. Other research raises the possibility that C-J stars are rapidly rotating, low mass AGB stars, which between phases of mass loss, mix products of the s-process (the ^{13}C) from the core into the convective layer outside the core.

Spectrum notes

As a very cool star Y CVn's spectrum is skewed to the longer (red) end. It is dominated by molecular absorptions with almost complete obliteration of the blue end of the spectrum with the spectral continuum difficult to perceive. The most prominent features are the strong molecular carbon (C_2)'Swan' bands. Note these fade slowly to longer wavelengths whereas the similar bands in cool K and M stars fade to longer wavelengths. The low temperature also means many other carbon molecules can exist. Note the two cyanogen wavelengths shown and one of these shows good absorption for the ^{13}C variant (6260Å) - ^{13}C being a significant feature of the C-J star type.