

Figure 5.5a – Several typical H α line profiles observed in 2007 and 2008. The label in each profile indicates the observation date in the format of year, month and day: yyyymmdd.

In February 2008, the single-peak profile transformed into a double-peak profile (Figure 5.5a: 20080217). The violet peak then evolved and dominated the profile and a red asymmetric flank appeared on its red wing that can be considered as a peak (Figure 5.5a: 20080703 and 20080830).

All data in 2009 appeared with a violet asymmetric line profile whereby the red peak became superior. Most of the data from the database for this year have been carried out using an instrument that has a spectral dispersion of 0.24 or 0.25 Å/pixel. Only a few spectra have been taken using an Echelle type spectrograph with a higher spectral dispersion of 0.1 Å/pixel. The H α profile for this period often exhibited a single-peak profile, which is shown in Table 5.1 with no measurement on the relative disc radius Rd/R^* from February 2009 until the end of May 2009; after 29th May 2009 the double-peak profile appeared again. There are few reasons for this appearance and disappearance of the double-peaked profile of H α . One suggestion is that the disc of the H α emitting region undergoes an extension to a very large disc and that the double-peak profile of the very wide disc cannot be resolved by instruments with maximum resolution up to $R\sim 16000$.

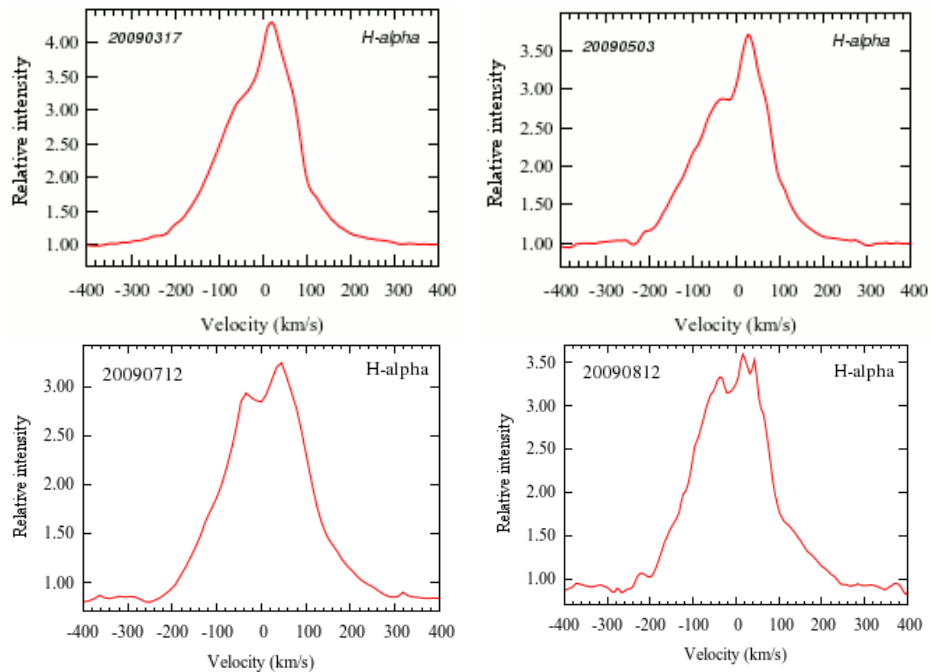


Figure 5.5b – Red asymmetric H α line profiles observed in 2009. They were suspected to emit from an increasing region. Only profile on 20090712 had dw of 0.2 Å/pixel, the others were 0.1 Å/pixel.

On the 17th March and 18th April 2009, the H α line shows the same profile as in Figure 5.5b – 20090317. Even though the spectrum was taken using a high-resolution spectrograph with $R \sim 10000$ and dispersion of $0.1 \text{ \AA}/\text{pixel}$, the profile still appeared as a single peak with violet asymmetric flanks; however, on the 3rd May 2009, the profile exhibits a ‘shoulder’ shape on the blue side of the single-peak profile. We had expected the outer disc of the H α emitting region from February 2009 until the end of April 2009 supposed $> 30R^*$ based from the largest disc size measured in Table 5.1. Another possible reason for the transformation of the double peak into a single peak is changes of the structure in the outer disc region.

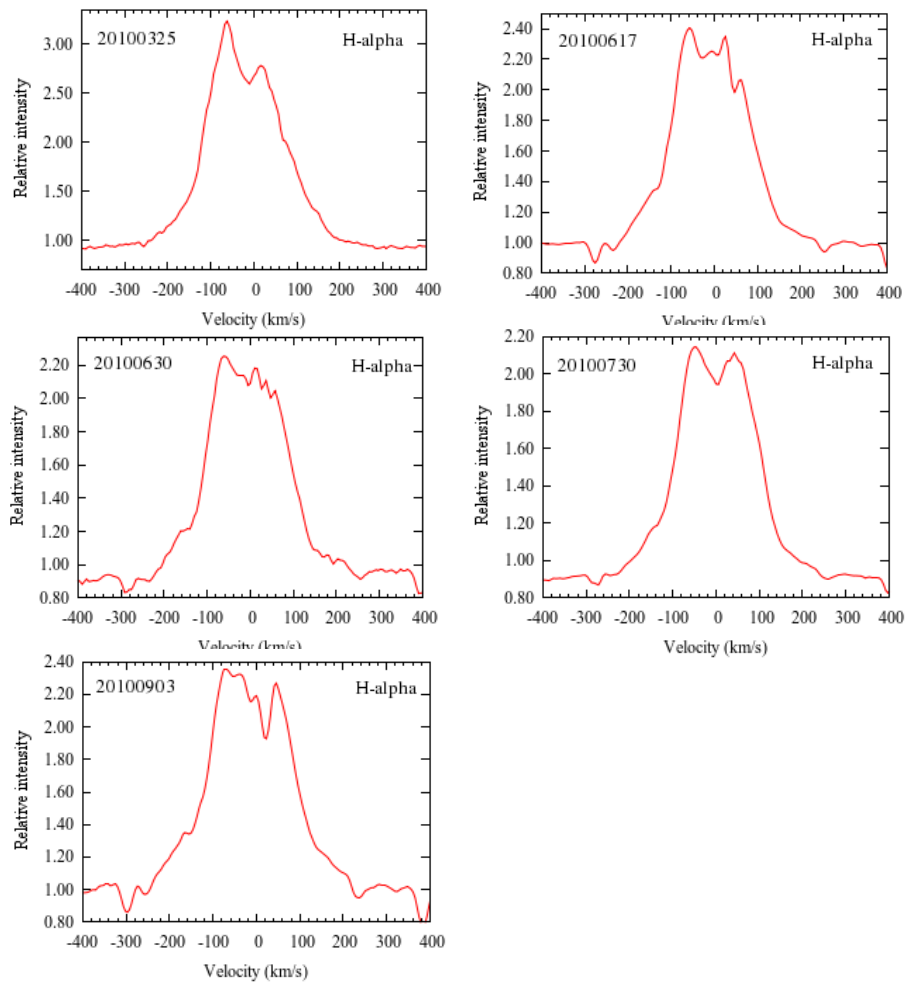


Figure 5.5c – Violet asymmetric H α line profiles in 2010. The profiles in 20100617, 20100630 and 20100903 show clearly the signature of a multiple system. The relative intensity was found weaker than in observing runs of previous years.

It was noticed from Figure 5.9 that in 2010, the violet peak of H_α returned to dominate the line profile ($V>R$). The sizes of the relative disc radii were noticed to be smaller than in the previous observing runs in 2009, as well as the EWs (Figure 5.7a and 5.7b). We believe that there was such a contraction movement that occurred from the last observing runs in 2009 to the next runs in 2010, which had not been observed. The increasing of the disc size indicates the growth of activities inside the emitting region, which cause the line from the region to broaden. In Figure 5.6b, the correlation of relative disc size was found consistent with the EW values.

The line-broadening parameters, such as $FWHM$ and line width can be used to indicate the consequences caused by the growing of the disc. In Figure 5.6 (top), the $FWHM$ values were plotted over the relative stellar disc radii. The graph shows that when R_d/R^* is less than ~ 15 , the $FWHM$ increased. The $FWHM$ values, however, were found decreased as R_d/R^* increased larger than ~ 15 . The increasing R_d/R^* of H_α has been measured as consistent with the line strength (Figure 5.6 (bottom)). The green line in both graphs is to find the correlations among the parameters of each graph. The explanation for the anti-correlation of $FWHM$ with a disc larger than $\sim 15R^*$ (for this study) is that when the envelope produces a weak emission line, the disc radii were smaller and thus, closer to the central star where effects like thermal motion and the star's rotation might strongly induce the line to broaden. Hence, the $FWHM$ value increases with the increasing disc radii. Halonen et al.(2008) found that the temperature of the Be disc of δ -Sco decreases as it moves further from the central star along the equatorial region. Thus, based on these data, this shows that for the distance of $15 R^*$ the effects of thermal motion are not applicable. The factors that contribute to the line broadening in this case are mainly due to the thermal

broadening, which describes the microscopic motion of individual particles in the region and the macroscopic turbulence caused by the rotation of the star.

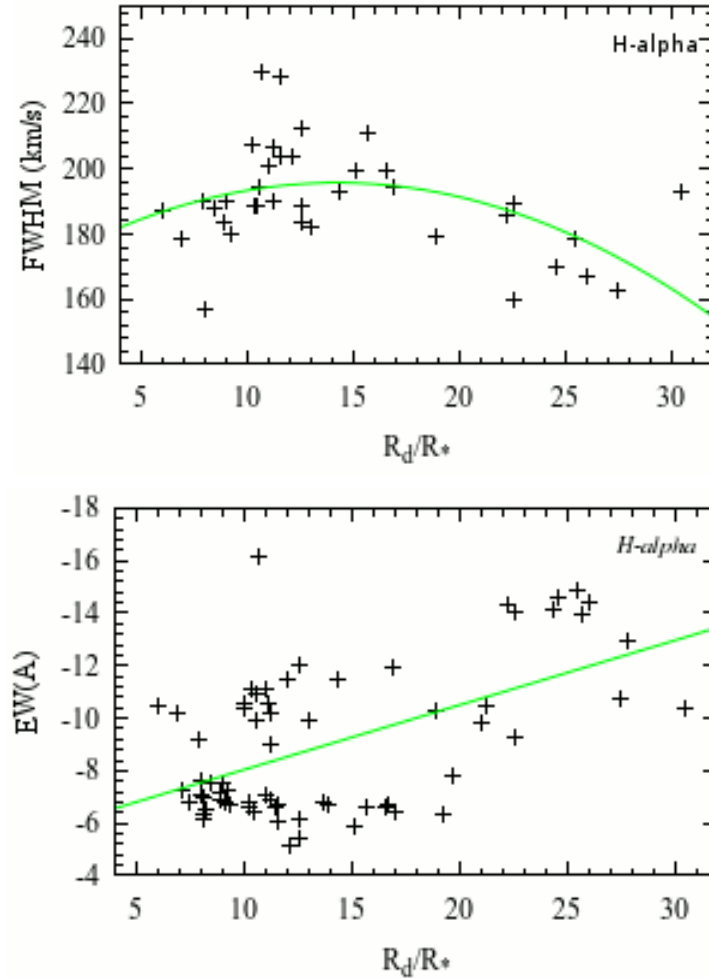


Figure 5.6 – Correlations of $FWHM$ with relative disc radii (top) and EW with relative disc radii of H_α emitting region shown by the green line.

The evolution of H_α line profile from 2007 to 2010 of this star is shown in figure 5.8. From 2007 to 2008 the profile usually shows $V > R$ but in 2009 $V < R$ and in 2010 the both peaks seems to be almost the same height. From this figure we noticed some missing parts of the observations due to the star rise in the day time. A continuous monitoring of this star in this region can give a whole view of the outer disc dynamical behaviour.

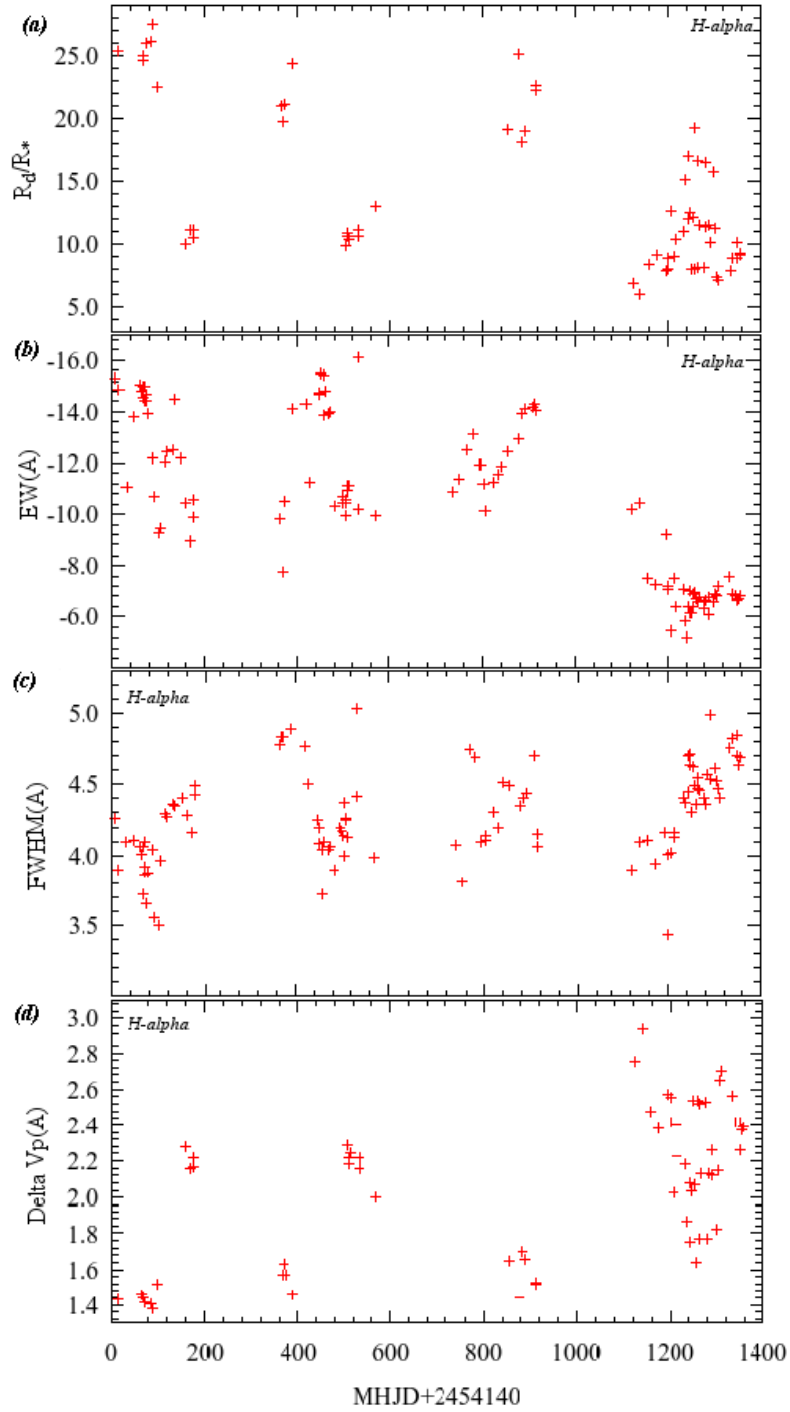


Figure 5.7 – Behaviors of parameters in the H_α emitting region from 2007 to 2010: a) the relative disc radii R_d/R_* ; b) the line strength EW ; c) the line broadening $FWHM$; d) the peak separation ΔV_p .

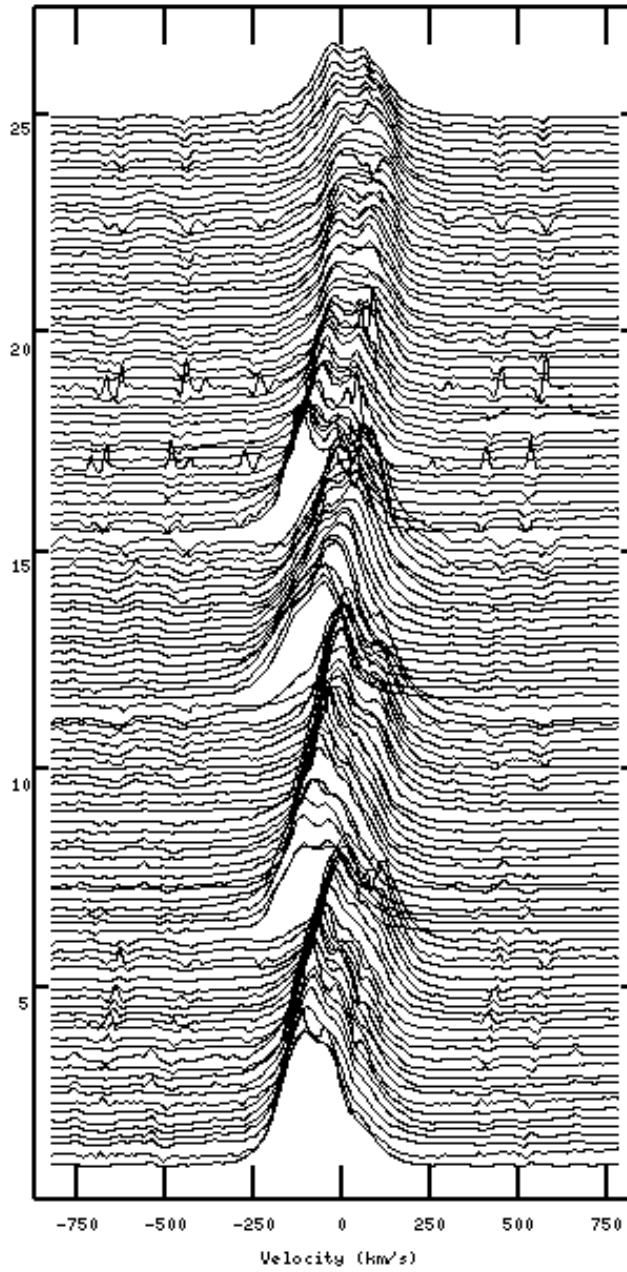


Figure 5.8- Evolution with time of H α line profile variation from 2007 to 2010.