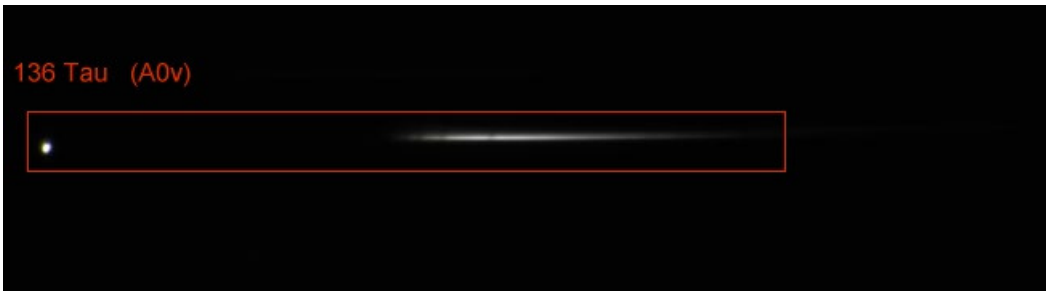
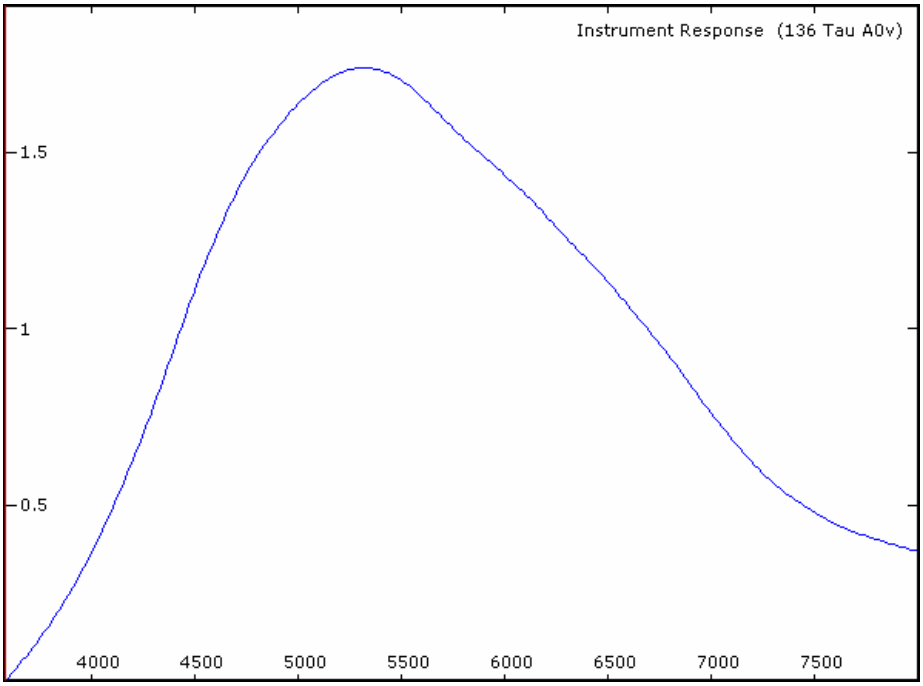
Measuring T Tauri stars using the Star Analyser 2012 12 05

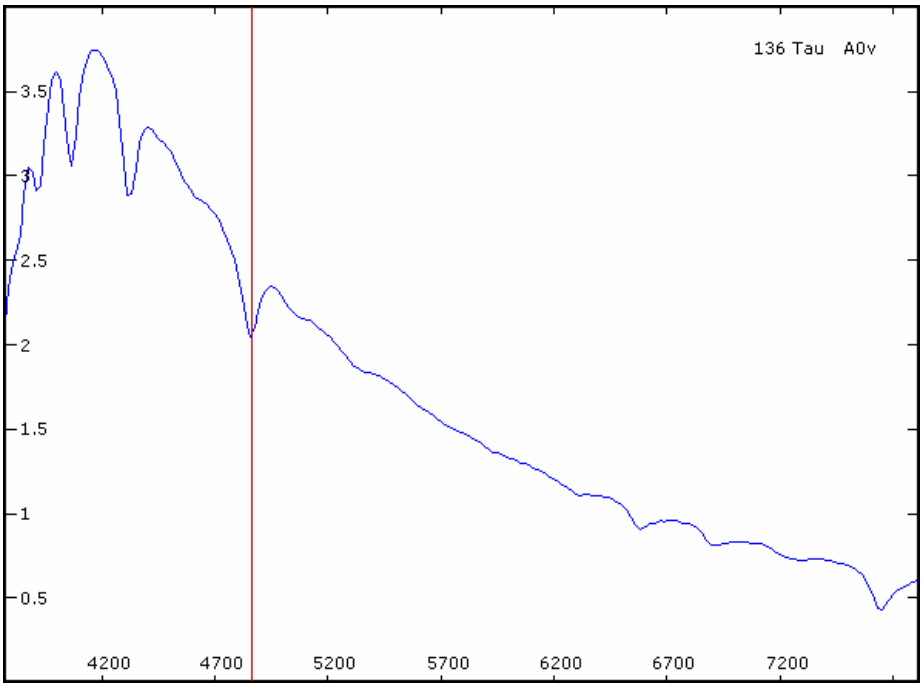
The system was first calibrated using a known star in the same part of the sky as the other targets (136 Tau A0v)
On this occasion only one measurement was made. In future at least 2 measurements should be made at different elevations so the effect of the atmosphere can be measured and corrected for. It is also hoped in the future that standard stars in the same field as the target can be found to use as cross checks.



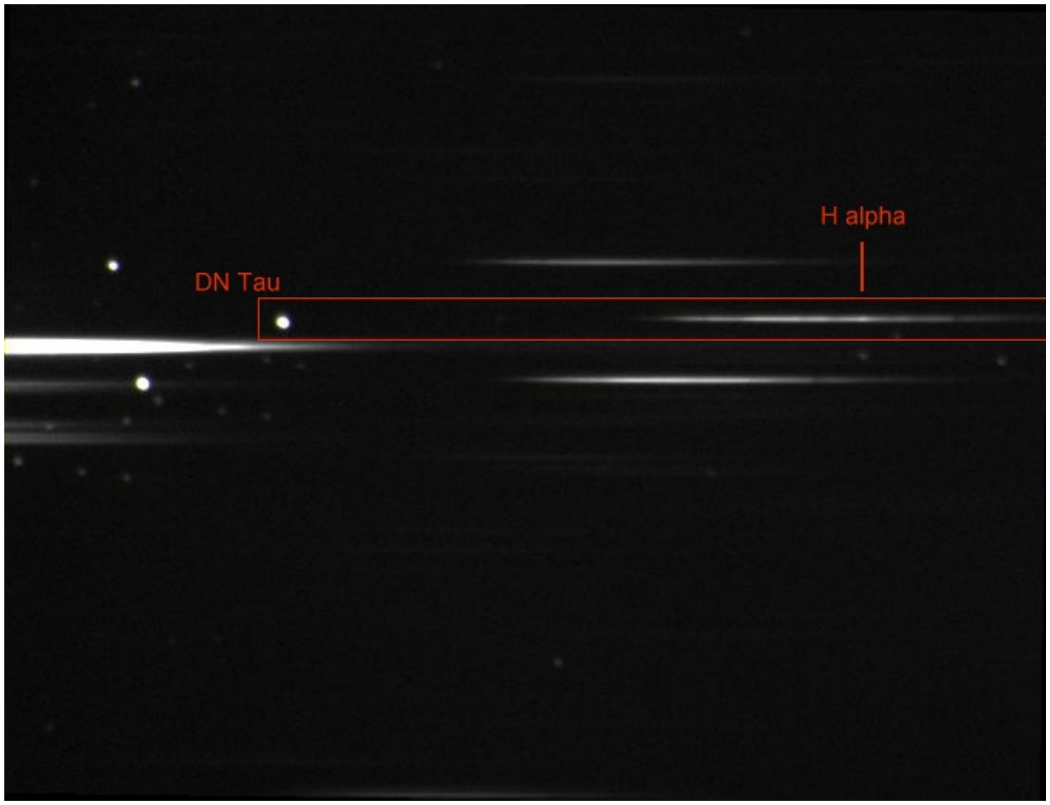
This is a bright star and the 50 sharpest out of 80 x 1 sec exposures were aligned and summed so the noise and the background is very low which means that the instrument response measurement will be of good quality even at the extreme ends of the wavelength range. (Careful background subtraction is critical here). The Balmer lines are also very clear so a good wavelength calibration can be made. (A linear calibration using the zero order and H beta was used giving 17.503A/pixel) The dispersion is lower than the maximum which could be used with the camera (an ATIK 16IC-S) but this is deliberate as we are looking for low noise and accurate spectrum continuum shape on faint objects down to mag 13. Even at this low dispersion, 4-5 Balmer lines are clear in the spectrum (The telescope is a 280mm C11 used with a f6.3 focal reducer to keep the star image size small to help resolution with this low dispersion setup.



This is the resulting instrument response. A typical shape. Mostly due to the combined effect of the camera and grating response.

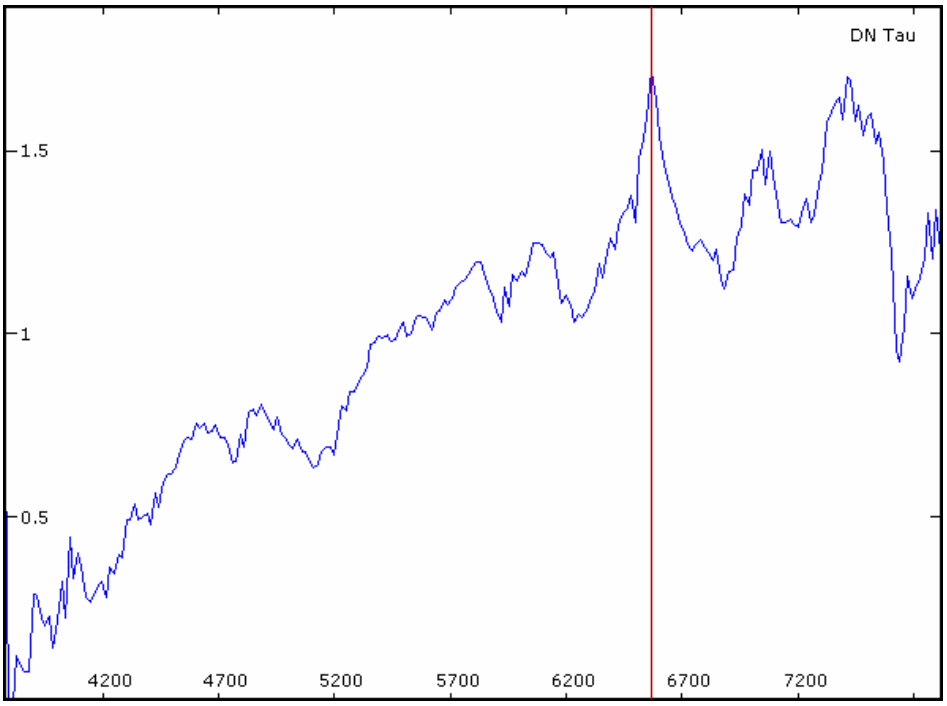


For interest this is the instrument response corrected spectrum of our standard A0v star 136 Tau. 5 Balmer lines and several Telluric bands are clear. By focussing using this star first, it is possible to move to the much fainter targets with less clear lines confident that we have good focus

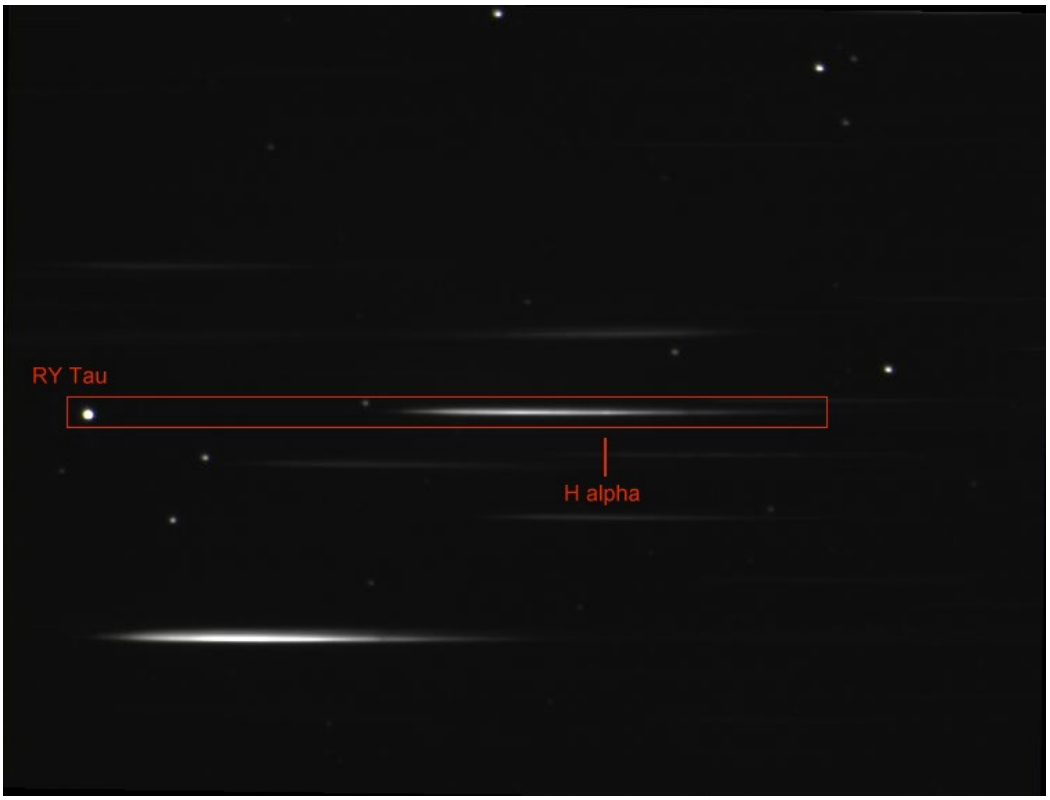


Here is our first target, DN Tau ~ Vmag 12.5. This is a sum of 45 x 20 sec exposures. (20 sec is the maximum without trailing with this unguided setup)

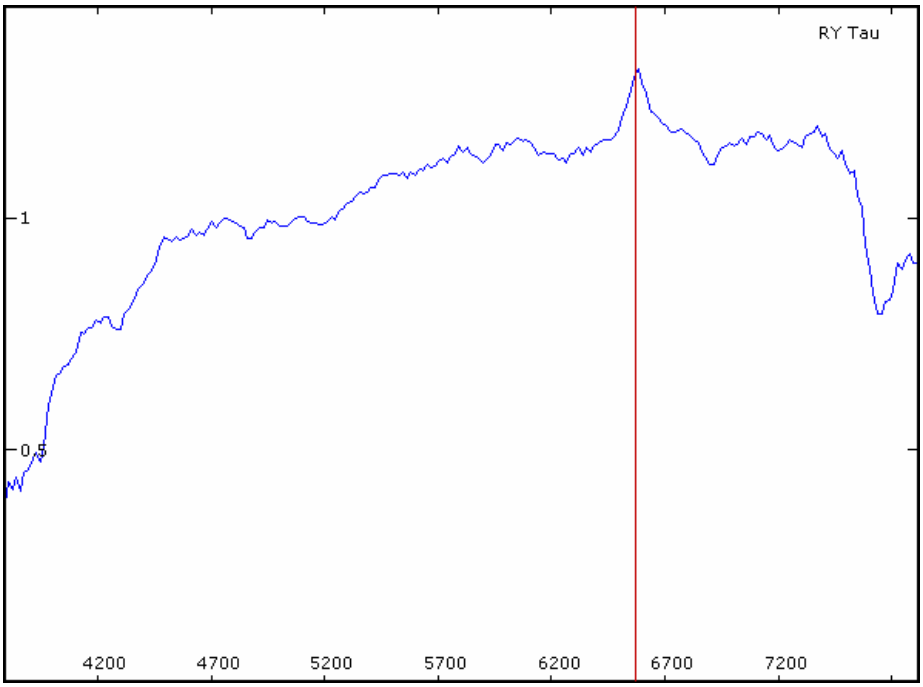
Several molecular bands and a bright spot at about the H alpha position are immediately obvious in the image. (Typical of T Tauri stars) Care needs to be taken to make sure that there is no intereference from other stars and spectra (hopefully avoided by rotating the camera + grating – Careful planning is needed to find a good solution with faint stars in crowed fields like these) Great care is also needed when selecting the regions for background subtraction (These also must not contain stars and spectra)



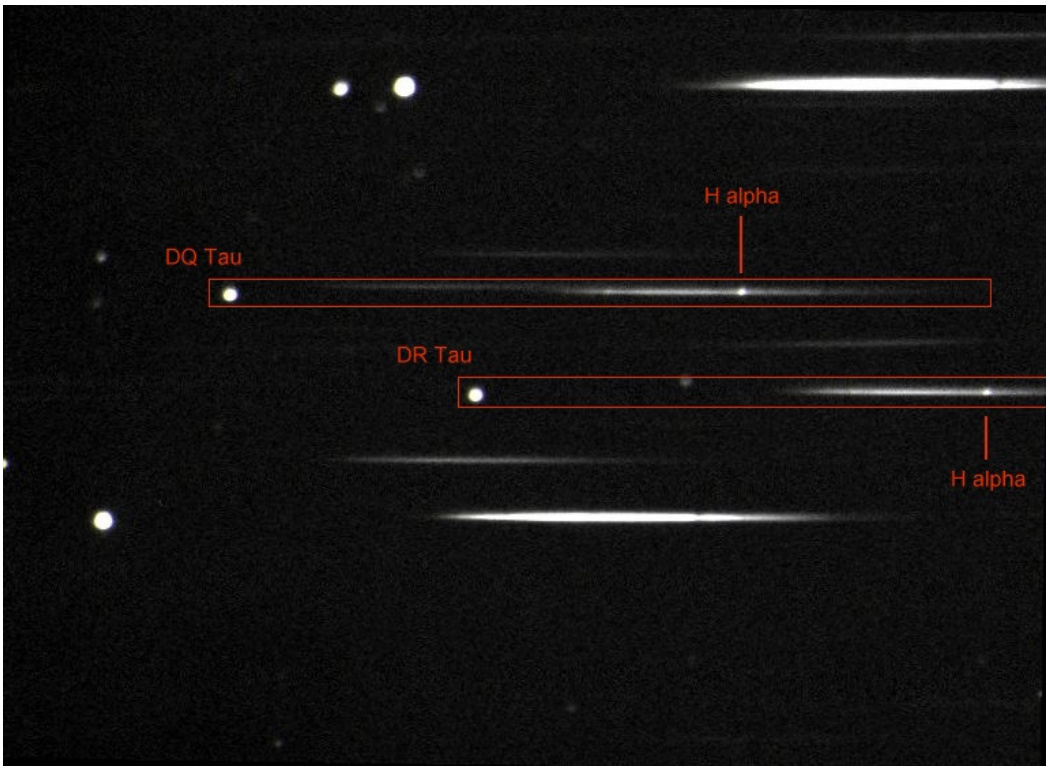
Here is the wavelength calibrated, instrument response corrected spectrum. The molecular bands and increasing flux towards the red are typical of a cool M star and the emission line is confirmed as being at the H alpha wavelength



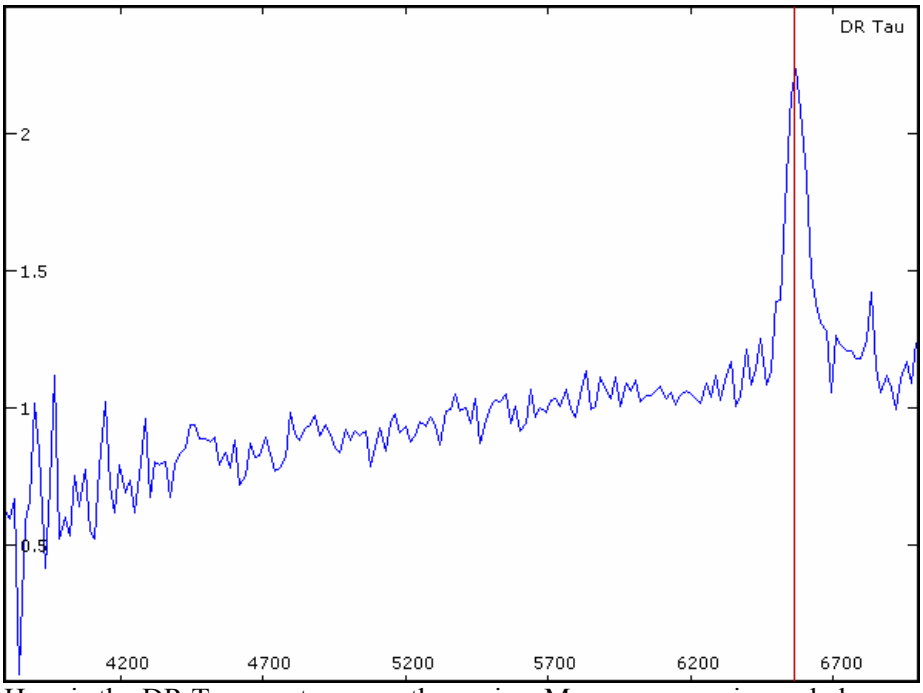
Here is our second target. RY Tau, brighter at ~Vmag 10.5. This means the background is lower and with a similar exposure (45x 20 sec) The noise should be lower. Note the absence of molecular lines suggesting this star is hotter (perhaps type K rather than M) and a perhaps just detectable H alpha emission



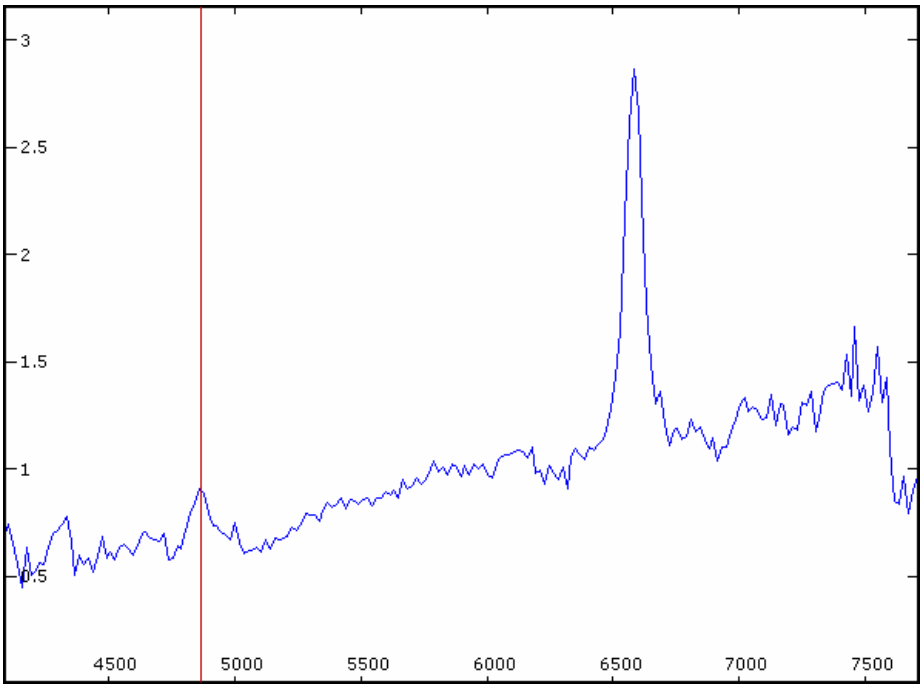
Here is the wavelength calibrated spectrum. Note the different continuum shape and lack of molecular bands compared with DN Tau. The emission at H alpha is confirmed.



The next target was DR Tau (30 x 20 sec) but the positioning was not quite right so the far red end is missed off. The H alpha emission is very pronounced. Note the other star above it, also showing H alpha (and other lines) in emission. I was not expecting this. Checking the catalogues, I found it was another T Tauri star DQ Tau. Two for the price of one! - a potential advantage of the slitless spectrograph. Both these stars are ~Vmag 12.5



Here is the DR Tau spectrum – rather noisy. More exposure is needed



Here is the bonus DQ Tau spectrum. Note emission at H alpha, beta and gamma

For more information on amateur spectroscopy for the T Tauri campaign see the ARAS website
http://www.astrosurf.com/aras/Aras_TTauri/T_Tauri_Campaign.html

And forum
http://www.spectro-aras.com/forum/viewforum.php?f=28

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