WHY CHI CYG FADES...

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Chi Cyg was in the news last summer, being at the highest maximum for over a century and reaching mv3.7 about Aug 1st 2006 [ref:AAVSO]. Indeed my wide-field photo taken with an IR pass filter showed it was the brightest star in the constellation at this time!

My low-resolution spectra taken on Aug 1 [right] when near maximum light, and on Oct 16 [left], together with the combination of the two [centre] show a marked drop in intensity of the light in visible wavelengths [shaded area] between these dates. The near infrared [right of the H-alpha @ 656nm eg vertical line] is essentially unchanged but invisible to the human eye. CCDs typically retain sensitivity in near-IR.

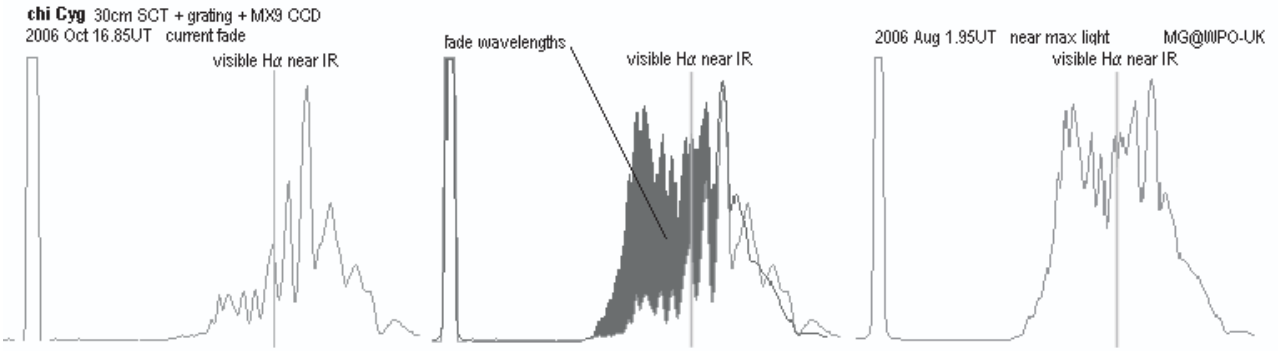

Figure 1: Low resolution spectra of Chi Cyg from October 16th (left), August 1st (right) and combined at centre

The standard view why Mira type variables change brightness is because the star expands [gets fainter] and contracts [gets brighter], but my spectra hopefully add an additional dimension to the discussion.

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A Danish amateur offered this additional explanation (opposite) on-line, and gave us permission to reproduce here. He is Poul Hansen, of Aalborg, in Denmark, who has written around 10 articles for Danish amateur astronomical publications, and has given presentations at about 25 local club meetings. His main interest in astronomy is observing Deep Sky and Variable Stars, though he does occasionally observe the sun.

He has access to the Urania Observatory in Aalborg, where he uses a 10" F/16 refractor from 1897 for some of his observations. The observatory also has a 90mm Coronado filter for viewing the sun in H-alpha light. He personally owns a 17.5" Dobsonian (at the moment mothballed), a 4" refractor, an 80 mm short-tube refractor, binoculars and lots of other stuff!

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The peak visual brightness of a Mira star during its cycle occurs at the time of highest temperature and weakest TiO band strength (i.e. earliest spectral type).

After the (visual) maximum the star expands in size, and the temperature begins to drop. A reduced amount of energy is radiated per surface area, and the emitted light is shifted away from the visible part of the spectrum towards (invisible) infrared light.

But that is not the whole story. The strength of the TiO bands in the spectrum is also highly sensitive to changes in temperature. Colder temperatures result in stronger absorption by the TiO bands (i.e. later spectral type).

At spectral type M0, practically no light is removed by the TiO bands. But at spectral type M8 the TiO bands are so strong, that they absorb 2.75 magnitudes of the visible light, and 0.50 magnitudes of the infrared red light. The removal of light away from the visible region, when the temperature drops, is noticeably amplified because of this effect.

In your spectra of Chi Cyg, it is clearly visible, that the TiO bands are getting stronger (deeper) after the maximum in August. The spectrum is changing towards a later type. The answer to your question about why Chi Cyg is getting fainter, is a colder temperature (that shifts the energy away from the visible region) and stronger TiO bands (that absorb light in the visible region).

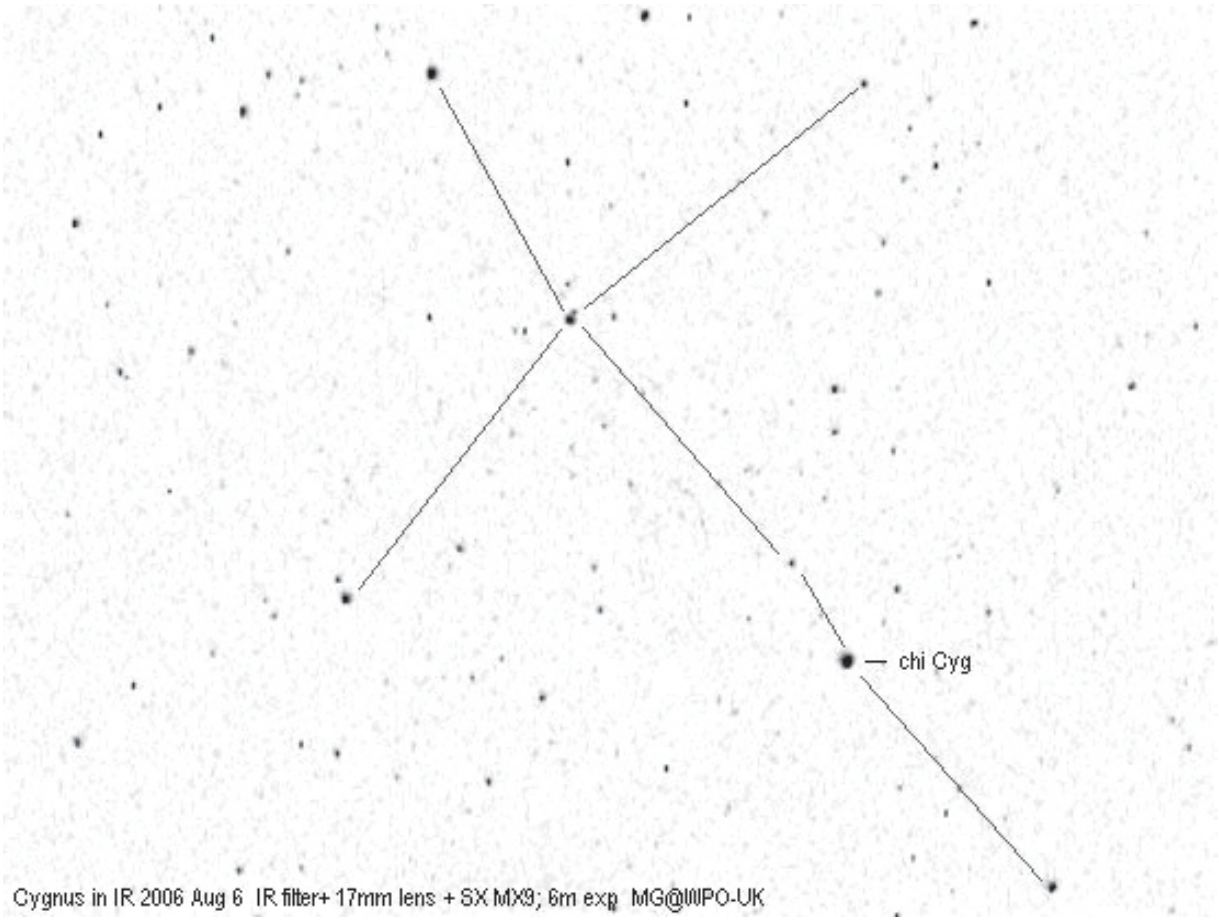

Figure 2: The position of Chi Cyg in Cygnus