CCD and spectroscopic observations of Nova Cephei 2013

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Nova Cep 2013 was discovered by two Japanese astronomers, Koichi Nishiyama and Fujio Kabashima, on CCD images taken on February 2nd at approximately 9.50 UT. Their discovery was reported shortly afterwards on the IAU Transient Objects Confirmation Page as PNV J23080471+6046521. I heard about it via a message on an AAVSO Forum which I received at 11.17 UT the same day. This is a good example of how the internet has reduced an information dissemination process which used to take days to just a few minutes. At a reported magnitude of 10.3 it was bright enough for both photometric and spectroscopic observation with amateur equipment.

Fortunately it was clear that night so I recorded a sequence of images using B, V, R and I photometric filters on a 0.35-m SCT with an SXVR-H9 CCD camera. By using filters it is possible to transform your measured magnitudes to photometric standard magnitudes and also to deduce the colour as well as the magnitude of an object. I was just starting to experiment with a Star Analyser diffraction grating in my filter wheel so I also recorded a series of low resolution spectra of the nova. Over the coming weeks, whenever weather permitted, I obtained further photometry and spectroscopy. The nova appeared to reach peak brightness around February 4th and has since gradually faded.

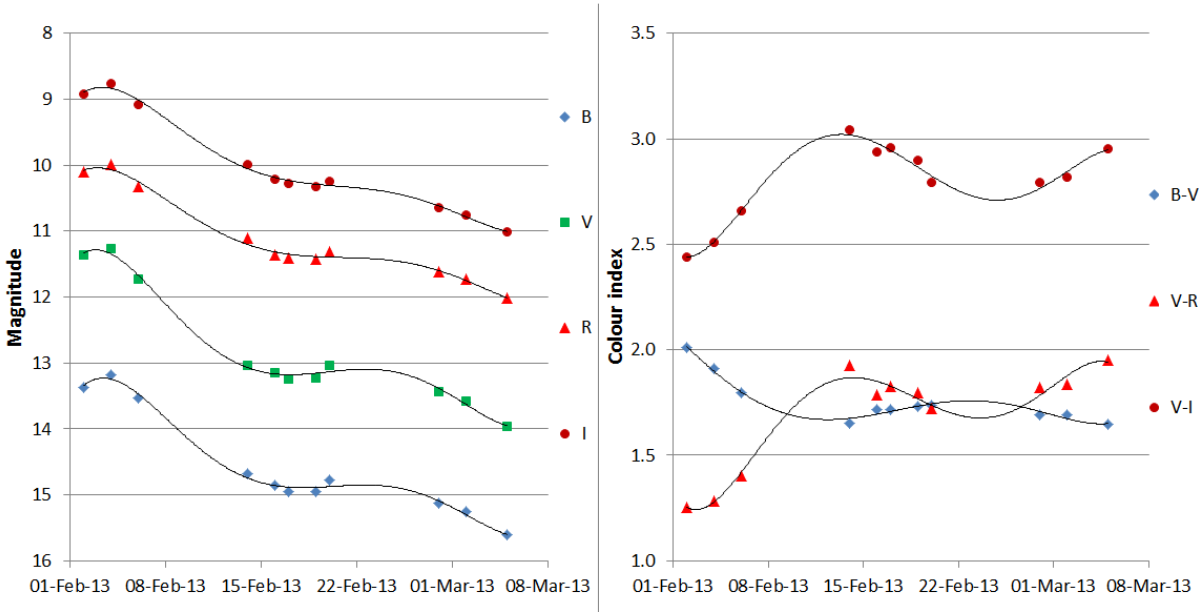

Figure 1. Filtered photometric observations of Nova Cep 2013.

Figure 1 shows how the magnitude and colour of the nova have changed during the month since discovery. An increase in colour index indicates a reddening of the nova. The lines are purely to aid the eye and have no physical significance.

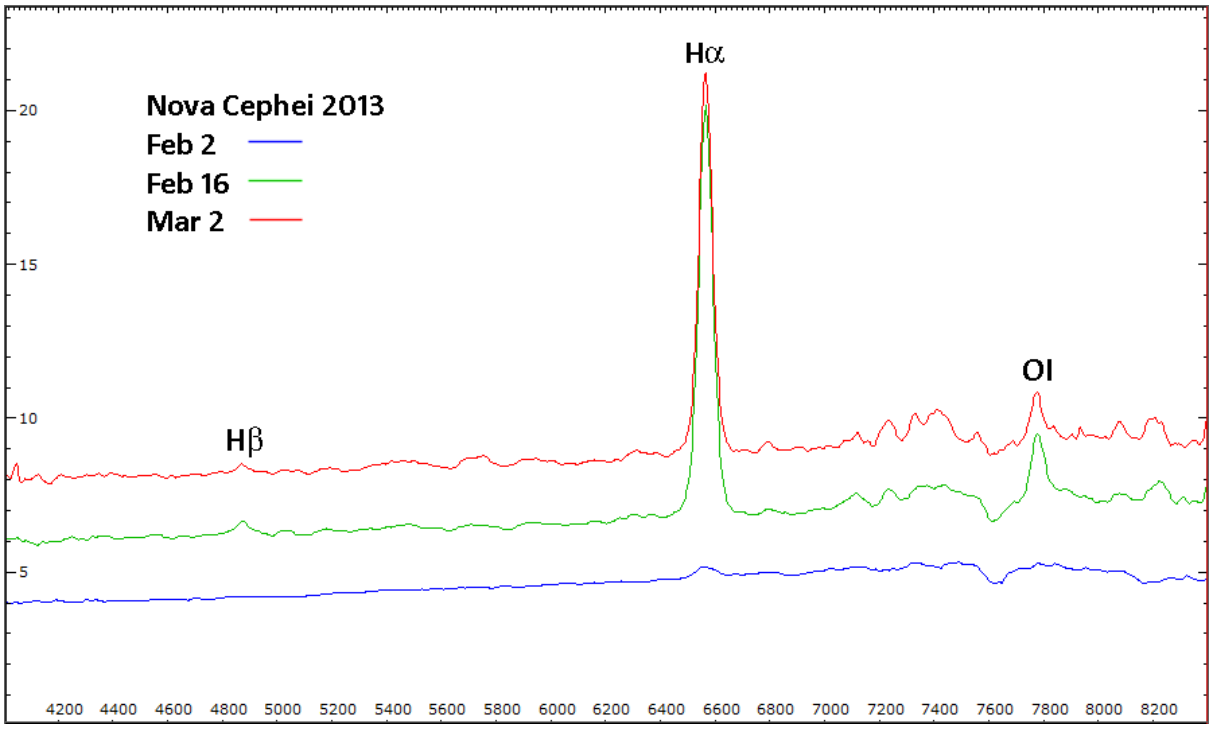

Figure 2. Spectra of Nova Cep 2013.

Figure 2 shows three spectra taken at two week intervals. The H alpha emission line was very weak on the day of discovery but increased in strength over the next two weeks through radiative de-excitation of ionised hydrogen. Figure 1 shows there was a corresponding reddening of the nova around mid-February. In the second half of February the H alpha peak has reduced slightly. The spectra in Figure 2 have been displaced vertically so they can be seen more clearly. In practice the continuum level is the same for all three spectra. There is little other resolved structure in the spectrum at this stage of the nova's evolution. It will be interesting to see how this changes over the coming months.

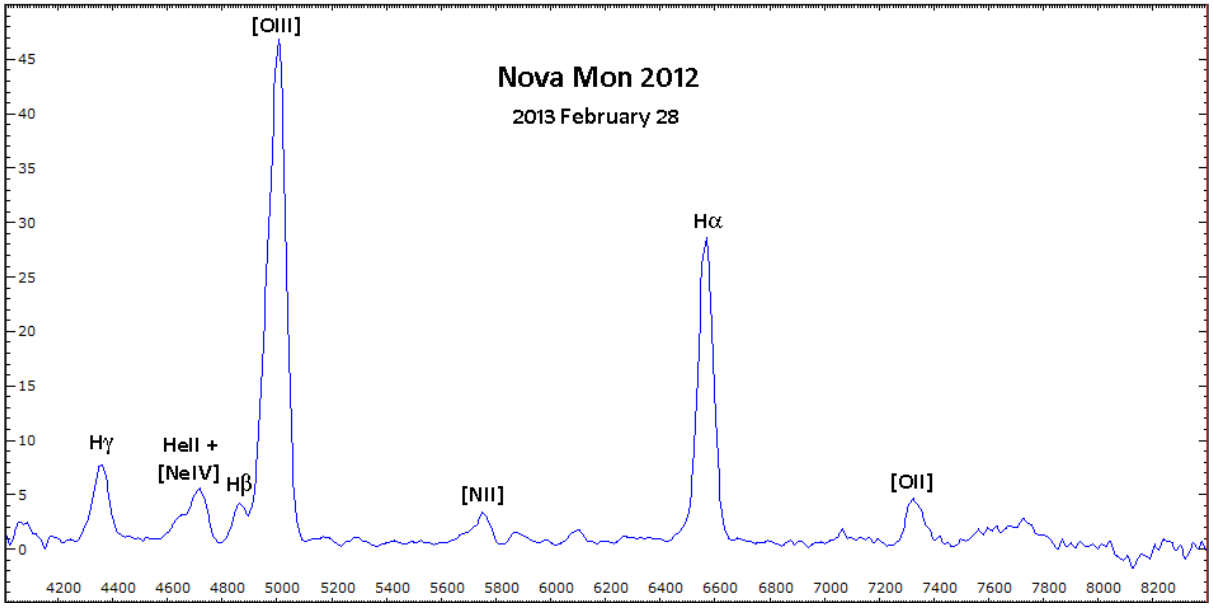

Figure 3. Spectrum of Nova Mon 2012.

By way of contrast, Figure 3 shows a spectrum of the older Nova Mon 2012 taken with the same equipment on February 28th. This Neon nova shows a more complex spectrum with a particularly strong [OIII] line. The main spectral lines are identified in Astronomer's Telegram ATEL 4709.

This is my first attempt at low resolution spectroscopy and it has been an interesting challenge getting to grips with the software and processing techniques involved. I used the Be star Gamma Cassiopeiae, which has strong H alpha emission, to focus on the H alpha spectral line. Because the diffraction grating produces a cylindrical focal plane, it was necessary to move the CCD closer to the telescope compared to its normal focal position. Each night I recorded a series of spectral images which I then stacked with Astroart. I used ISIS to extract a wavelength calibrated and instrument response corrected spectrum from the stacked image and Visual Spec for displaying the spectral profile.

Low resolution spectroscopy adds an interesting extra dimension to observing such objects and reveals more about them than does photometry alone. I would particularly like to acknowledge the help given to me by Robin Leadbeater as I have struggled up the spectroscopic learning curve.

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