

Photometry and spectroscopy of V838 Mon at outburst maximum in February 2002

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Abstract

It was undoubtedly the rapid second outburst of V838 Mon which increased the interest of the wide astronomical community in this unusual object. It is less known that this discovery on the 2nd February 2002 was made by MEDUZA, the group of amateur variable star observers in the Czech Republic. Their members have triggered thanks to modern communication technologies a number of world-wide observations during the same night followed by media campaign on Czech TV, radio and newspapers.

As one of the results of this increased publicity the star had been investigated spectroscopically with the coude and echelle spectrograph of the Ondřejov Observatory 2m telescope. We give the short overview of the history of the discovery as well as the results of these observations.

1 Discovery of the Second Outburst

It was mainly the second outburst of V838 Mon that attracted the attention of wide astronomical community to this extraordinary object. Its discovery story is, however, less known and erroneously presented in the astronomical literature. According to IAUC 7816 the first report of the second outburst belongs to (Kimeswenger et al., 2002). But, as it will be shown, the discovery was done by Czech amateur observers from the MEDUZA group.

The first CCD photometry after the outburst was taken by O. Pejcha and P. Sobotka on Feb. 2, 2002 at 17:45 UT (Feb. 2.740), however they did not noticed the brightening. O. Pejcha had been observing for the first time with CCD doing VRI photometry at N. Copernicus Observatory and Planetarium in Brno. They early turned the 40cm telescope to V838 Mon. The first frame in I filter resulted in saturated star so they decreased the exposure, but then the comparison stars were too faint. Hence they changed to V filter at 17:45 UT, where the star looked reasonably bright. They did not reduce the frame and moved to another star.

L. Šmelcer from Valašské Meziříčí Observatory, who had been observing long period variable stars since 1998, started the observation of V838 Mon in CCD V filter at 18:47 UT (Feb. 2.783) and immediately reduced it. The magnitude of the star was surprisingly 8.17 and it was much brighter than on the preceding frame from January 31-st

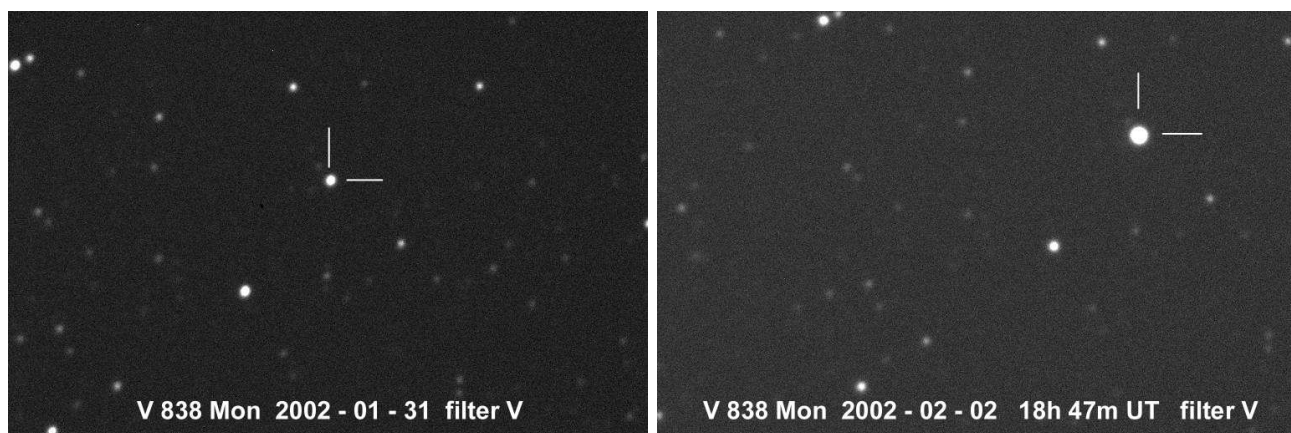


Fig. 1. The V838 Mon in CCD V filter before outburst.

Fig. 2. The first analyzed CCD frame of the second outburst secured by L. Šmelcer. It started the story.

So L. Šmelcer called one of the best MEDUZA observer, L. Brát from Pec pod Sněžkou to confirm this. His visual estimate at 19:19 UT really confirmed the outburst. He called O. Pejcha and P. Sobotka in Brno at 19:25 UT and then he ran home to sent alerts to VSNET and MEDUZA mailing lists at 19:29 UT.

P. Sobotka and O. Pejcha regretted they had stopped the observation of V838 Mon and they immediately returned to V838 Mon starting the CCD V frame at 19:33 UT. Then they reduced the first frame taken at 17:45 UT and the result was 8.23 mag. During acquisition of new images they had been simultaneously reducing data and so they were able to see in real time the brightening with the unbelievable rate of 0.1 mag per hour. They have sent their report to IAUC at 22:15 UT, but due to unknown reasons it was never published. So the first observation in IAUC after the outburst is that of Kimeswenger's group taken on Feb. 2.799 (8.193 mag). Thanks to Brát's alert in VSNET list many other observers around the globe were involved in the observation during several following days.

Next day the press announcement of the Czech Astronomical Society (CAS) about the discovery of the outburst by MEDUZA group (part of CAS) was released resulting in the information of the Czech Press Agency. This triggered a media campaign in many Czech radios, newspapers and magazines including the prime time interviews on both main Czech TV's. So almost everybody in Czech Republic was informed about this discovery of Czech amateurs.

2 The MEDUZA Photometry

The photometrical behaviour of V838 Mon was monitored by MEDUZA group observers just after its discovery in January 2002 (Brown, 2002), and when second outburst was noticed by L. Šmelcer and announced in VSNET list by Brát (2002) a lot of observers became involved in the measurements and visual estimates on the scale of minutes after the discovery.

The light curve is thus well covered. The principal results are summarized on Figs. 3 and 4. More details are given by Sobotka et al. (2002).

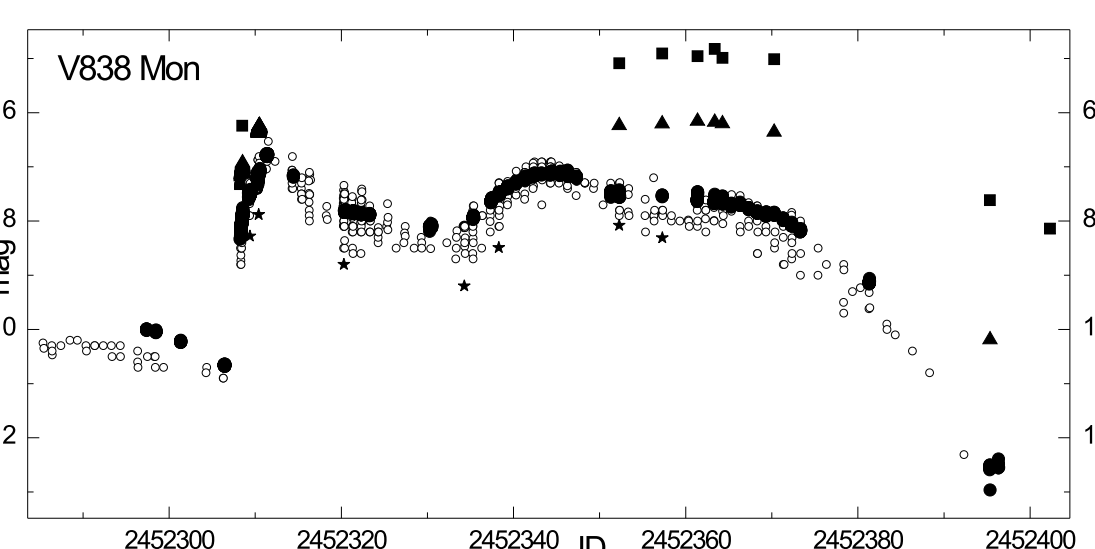


Fig. 3. The complete light curve of V838 Mon constructed from all 4217 observations of MEDUZA group. Filled circles represent CCD V, stars CCD B, triangles CCD R, squares CCD I and open circles visual observations, respectively.

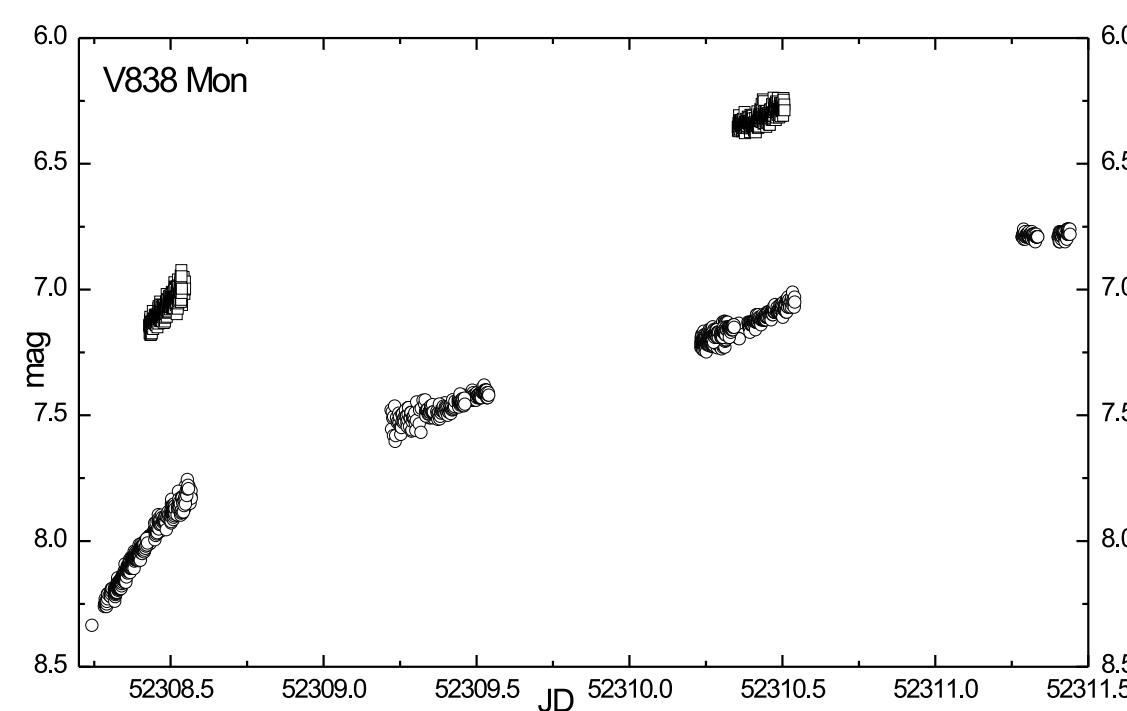


Fig. 4. MEDUZA CCD V (open circles) and CCD R (squares) observations of the second outburst.

Conclusions

The outburst of V838 Mon was a really outstanding experience both for the amateur observers and professional astronomers showing interesting astrophysical behaviour. Its rapid evolution required the immediate action to be taken after the discovery to allow the quick follow-up observations. This was achieved thanks to modern communication means as mobile phones and Internet discussion lists. This case has again confirmed the important position of experienced amateur observers of variable stars in the contemporary astrophysical research.

Acknowledgements

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References

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3 Spectroscopy at Ondřejov

The research in Ondřejov Stellar Department is primarily focused on variability of hot and mainly Be stars and so the outburst of a "ordinary" nova was out of the scope of interest of most Ondřejov astronomers until the 14-th February when P. Škoda wanted to use the part of his observing night to check the performance of a newly installed low dispersion spectrograph with 400mm camera and LORAL CCD. He had selected V838 Mon as the first target, mainly under the influence of the recent media campaign. As the spectra looked well, he switched to the main instrument of the 2m telescope, the 700mm camera equipped with the excellent SITE chip. The V838 Mon had been the faintest object observed with it so far, but the spectra obtained were still of excellent quality showing a number of P-Cyg type line profiles.

3.1 Coudé Single Order Spectrograph

Several spectra of V838 Mon were obtained on 14-th and 28-th February and 4-th March with 700mm camera of Ondřejov Coudé spectrograph (estimated resolution about 12000, wavelength coverage 6350–6800 Å). See the Fig. 5 and 6.

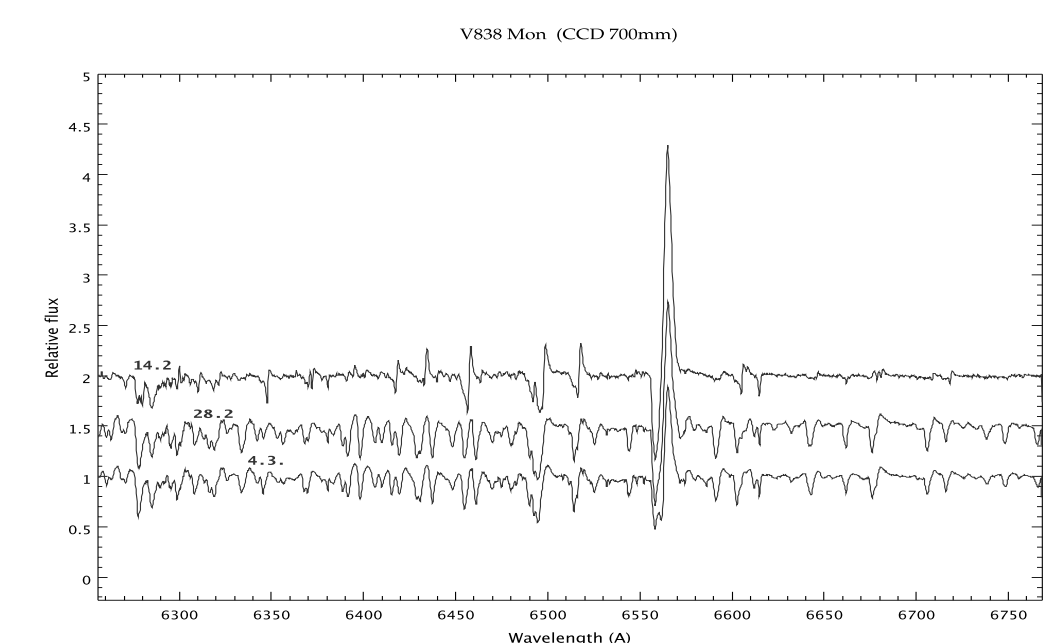


Fig. 5. Changes of V838 Mon from 14-th Feb. to 4-th March. Spectra obtained with 700mm camera of Ondřejov coudé spectrograph.

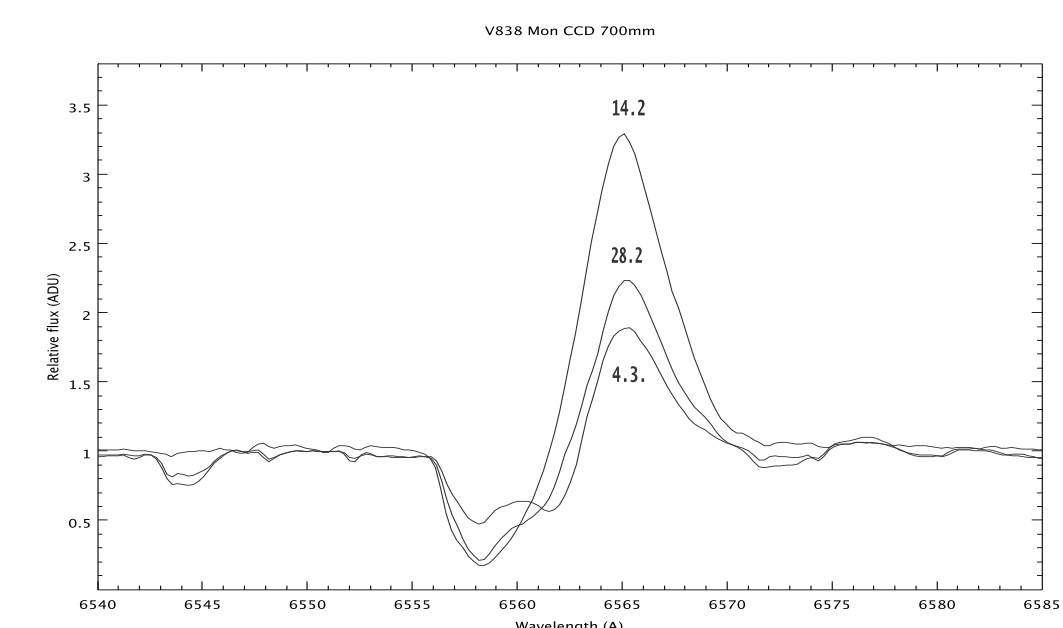


Fig. 6. Details of V838 Mon spectra around the H α region

3.2 HEROS Echelle Spectrograph

The HEROS echelle spectrograph was on a long term loan from Landessternwarte Heidelberg since half 2000 to 2004 but it had not been used due to its low efficiency during the bad seeing time in winter. Since the 7-th March 2002 it was installed again at the Cassegrain focus of 2m telescope and so reasonably good echelle spectra could be obtained on 8-th and 18-th March after the third outburst, when the expanding shell became visible. HEROS has two channels — the red (5800–8300Å) and blue (3900–5700Å) with the resolution power about 25000. The blue channel spectra were, however, very faint to process them correctly. Thus only red spectra were used for further processing and abundance analysis (Kipper et al., 2004).

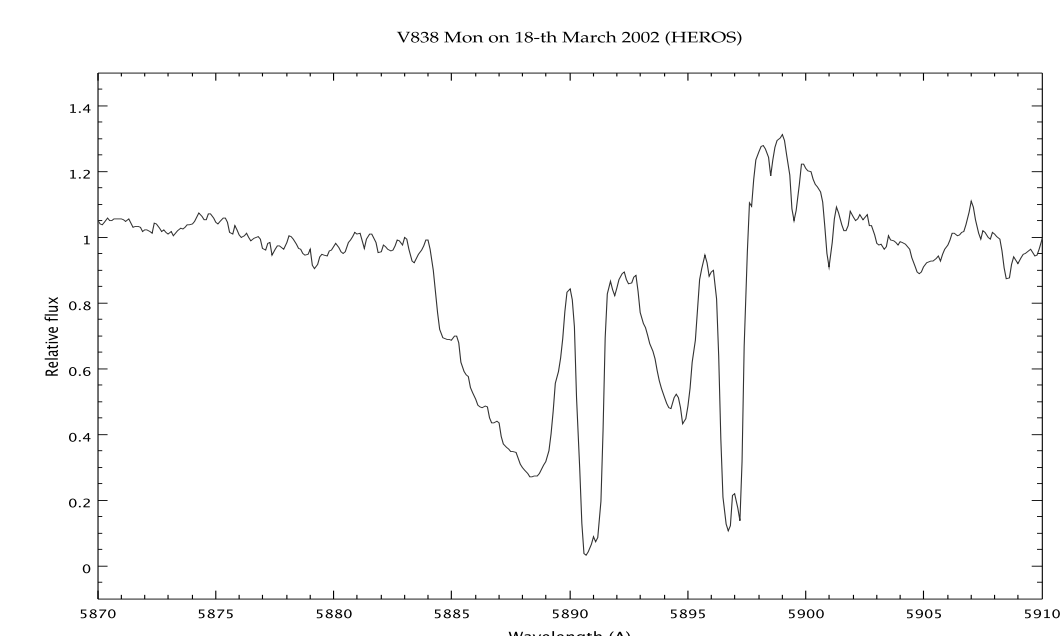


Fig. 7. The Na D region in HEROS spectrum taken on 18-th March 2002.