THE RELIABILITY OF PHOTOMETRIC AND SPECTROSCOPIC DATA OF NOVAE

(Abstract)

J. TREMKO

Astronomical Institute of Slovak Academy of Sciences, Skalnaté Pleso, Czechoslovakia

1. Introduction

The photoelectric observations of novae, obtained by different photoelectric photometers, show systematic differences. These systematic differences are the consequence of bright emission lines in the spectrum at the limits of spectral bands of the wide-band photometries, and the existing differences of the spectral performance of the instruments used in the corresponding photometric system. The results, which were achieved, do not correspond to the possibilities, which the photoelectric photometry gives us. On the other hand it is very important to know the mutual relations between the changes of the brightness of the central star and the shell of the nova and its spectral characteristics. The systematic differences among various series of the photoelectric observations of novae can be excluded by suitable choice of detectors and mainly by choice of spectral filters. By this means it will be possible to study the behaviour of the central star and the shell separately and will allow a better study of the mutual relations of the physical characteristics of novae.

2. The Method of Obtaining the More Precise Data About the Radiation of the Central Star and that of the Shell of Nova

In present time, the most commonly used photometric system is the UBV one, which is most frequently used for observation of novae, too. In the case of novae the following problem arises: all three spectral bands of the UBV photometric system include both components of the radiation of the nova, the continuum which belongs to the central star and the emission lines of the shell. Further, the bright spectral lines are situated at the borders of spectral bands, which are defined in the UBV photometric system.

We can see, that from the reasons above mentioned, the UBV photometric system is not very suitable for the photoelectric observations of novae. This is the reason why recently I have checked the possibility of using of 18 various photometric systems for the photometry of novae. The results were not satisfactory as no one photometric system fulfils sufficiently the conditions for the photoelectric photometry of novae (Tremko, 1973). The main reason consists in the fact, that in the spectral region from 3600 Å to 6500 Å, in which the electron multiplier phototubes with antimony caesium photocathodes are sensitive, there are many emission lines. Thus it is very difficult

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to find a sufficiently wide region with pure continuum. The types of the photomultiplier tubes with other photosensitive surfaces, which are now used in astronomical photometry, have usually lower integral sensitivity.

The recent technical progress in the branch of the development of the photosensitive surfaces and photomultiplier tubes gives us new possibilities for solving this problem. The electron photomultiplier tubes with gallium-arsenide photocathode guarantee high quantum efficiency and spectral sensitivity in a wide spectral region. For example the photomultiplier tube of the type Quantacon has extremely high sensitivity in the region from 2000 Å to 9300 Å, very low dark current and very fast time response. The maximum relative sensitivity is at 8300 Å (*RCA Bulletin*, 1971).

The new photomultipliers tubes can fully substitute in the photographic and visual region the photomultiplier tubes used to this time, and more, they give us a possibility of observation in the near infrared region. Just in the near infrared region there are few regions without emission lines in the spectrum of novae.

In principle the observations in two spectral bands would be sufficient. One of them should include the chosen emission line and the other one the continuum without emission lines. The problem consists in choosing the bands. According to Chalonge *et al.* (1964) the narrow bands of the continuum without emission lines exist near 3900 Å, 3950 Å and 6000 Å. The last mentioned region is bordered by the lines N II 5942 Å and by the forbidden line [Fe X] at 6300 Å. It is necessary to point out, that in the later stages of the development of a nova spectrum, this region can be influenced by the forbidden line [Fe VII] at 6086 Å. The useful band width of about 400 Å is located on the red side of the Hα line. It is bordered by the spectral line He I 6678 Å and He I 7065 Å. The only disturbing factor in the later stages of the nova evolution can be the line of [A XI] at 6919 Å. The widest band is between the spectral lines O I 7772 Å and O I 8216 Å, but this region is disturbed by several very faint emission lines, among them the brightest is the forbidden line [Ni XV] at 8024 Å. The narrower sections, about 200 Å wide, without emission lines are located at 7460 Å and 8340 Å.

The selection of the emission lines is not so difficult and it may be simple to realise by using the narrow band filters.

3. Conclusion

The analysis of the photoelectric observations has shown, that the UBV photometric system is not the most suitable one for the observation of novae. The use of the medium-band and narrow-band filters for the separated measuring of the continuum and emission bands in the near infrared region would be desirable and would bring much more representative results.

References

Bulletin RCA: 1971.

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