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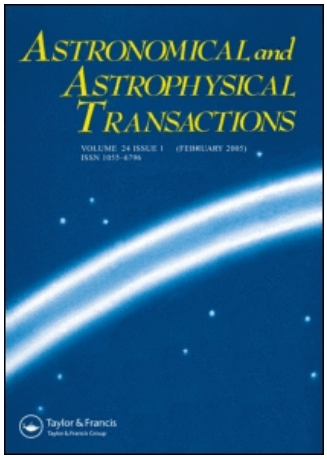

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
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The physical parameters of the preliminary determination of the multiple system HD 222326

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Online Publication Date: 01 April 2006
To cite this Article: Zhuchkov, R. Ya. (2006) 'The physical parameters of the preliminary determination of the multiple system HD 222326', Astronomical & Astrophysical Transactions, 25:2, 229 - 231
To link to this article: DOI: 10.1080/10556790600918497
URL: http://dx.doi.org/10.1080/10556790600918497

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Astronomical and Astrophysical Transactions
Vol. 25, Nos. 2–3, April–June 2006, 229–231

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The physical parameters of the preliminary determination of the multiple system HD 222326

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In this work we determine some parameters of the triple star HD 222326. The result is based on high-resolution spectra obtained at the coudé echelle spectrograph of the 1.5 m Russian–Turkish telescope RTT150 (AZT22). We redetermined the spectral class of the whole system and found high-amplitude short-time (relative to the known orbital period) variability of its radial velocity. This could be explained by the presence of the fourth component. Its nature is also discussed.

Keywords: Multiple stars; Spectroscopy; HD 222326

Here, we present the results on the preliminary determination of the physical parameters of the multiple system HD 222326. This system is probably unstable at times less than 10^6 years as follows from its dynamic properties, so that accurate determination of the physical parameters of this system is of great interest [1].

During 2004–2005 we obtained a number of high-resolution spectra for HD 222326. Analysing the relative intensities of the spectral lines, we arrived at the conclusion that the previous spectral classification (À2V + A2V + F0V, according to Balega *et al.* [2]) is incorrect. This is illustrated in figure 1. The spectral types of the components F2 + F2 + G2 (with precision ±(2–3) subclasses) shows better agreement with observed spectra. Alternative spectral classification, satisfying the observed spectra is: G0∼III+G0∼IV+B∼VIII.

The second surprising feature was the difference between the radial velocity according to our spectra and that due to the previous measurements of Grenier [5], who obtained $V_r = -17.5 \pm 5.3\,\mathrm{km\,s^{-1}}$. Furthermore, we found that V_r changes on the timescale of approximately 200 days (table 1). In this work, we measured V_r by the cross-correlation method. In fact, each spectral line in the HD 222326 spectra consists of three lines with a small shift (less than 5–8 $\mathrm{km\,s^{-1}}$) and different relative intensity. Measurement of V_r for individual components is a special task. However, owing to the large orbital periods (about 150 years and about 15 years, according to Balega *et al.* [2]) the relative velocities of the components are small and we can easily measure some kind of 'effective' velocity $V_{r\mathrm{eff}}$; for this system this quantity is close to V_r with an accuracy of less than 5–8 $\mathrm{km\,s^{-1}}$. It is more important for this work that, on the timescale of approximately 100–500 days, $V_{r\mathrm{eff}}$ should be constant.

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Astronomical and Astrophysical Transactions
ISSN 1055-6796 print/ISSN 1476-3540 online © 2006 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/10556790600918497

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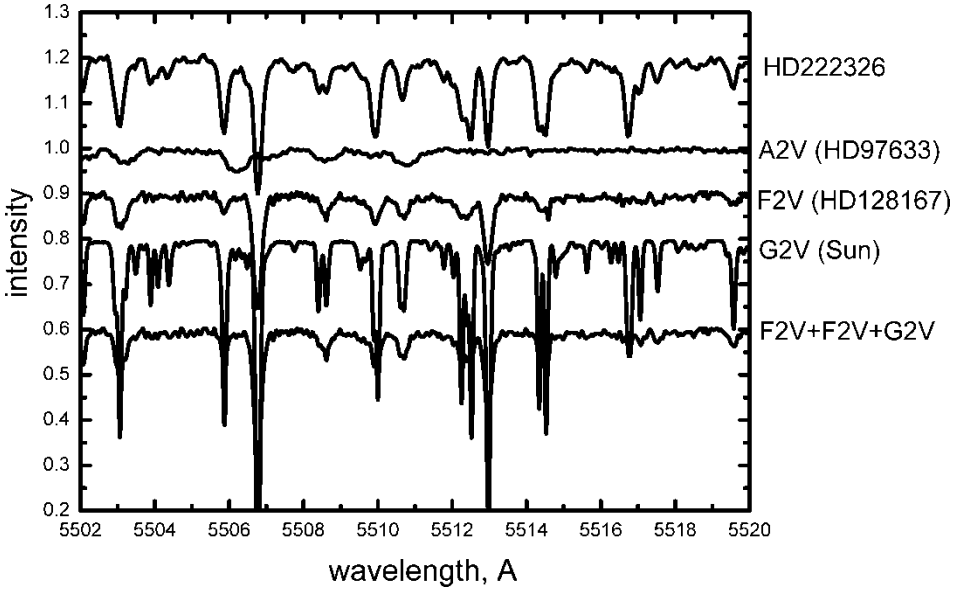

Figure 1. HD 222326 and spectral standards from Garcia's [3] catalogue of spectra. The composite spectrum modelling this multiple system is also shown. The spectral resolution $R = 40\,000$ and $S = N > 150$ [4]) It is clear that HD 222326 could not consist of the spectral classes A2V + F2V.

Table 1. Radial velocity $V_{r\mathrm{eff}}$ of HD 222326.

Date	$V_{r\mathrm{eff}}$ (km s^{-1})
29 October 2004	8.4 ± 0.4
30 October 2004	7.7 ± 0.3
19 September 2005	-1.2 ± 0.2
20 December 2005	-0.3 ± 0.3

Th variability of $V_{r\mathrm{eff}}$ on such a short timescale could not be explained in the existing model of the system. We suspect the presence of the fourth component with $P < 10$ years and the stellar mass. However, in the spectra we did not find traces of the fourth star. So, the new component could be a white dwarf. This hypothesis explains all the strange features of the system. Low luminosity makes it invisible; it is the influence of its orbital rotation on V_r that we can measure. The birth of a white dwarf 10^5–10^6 years ago could shift stable, but close to the border of the stability system into the space of instability.

These are preliminary results only and they should be confirmed by a more precise investigation, but it is evident even now that all the 'strange' features of HD 222326 should have a united and simple explanation.

Acknowledgements

This work was supported by a grant from the Russian Foundation for Basic Research (RFBR 05-02-17744-a), and also by grant NSh-784.2006.2.

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