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Spectroscopic Observations of Algol-type Binaries RZ Cas and AS Eri

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Abstract

We performed spectroscopic observations of RZ Cas and AS Eri to see if there is any sign of chemical anomaly in these stars. We conclude that the pulsating components in systems RZ Cas and AS Eri are not typical Ap stars but similar to normal A stars.

Key words: Spectroscopy – Algol type binary – Delta Sct stars – roAp

Recent photometric observations revealed that some Algol-type binaries have pulsating primary components. The A3V components of RZ Cas and AS Eri are examples of such short period pulsators. The pulsation periods of RZ Cas and AS Eri are about 22 minutes (Ohshima et al. 2001) and 24 minutes (Mkrtichian et al. 2004), respectively. These pulsation periods are somewhat short as the δ Sct type oscillation (Rodriguez et al. 2000). On the other hand, the typical period of roAp stars is about 10 minutes and not so far from observed pulsation period of RZ Cas and AS Eri. Hence, we performed spectroscopic observations of RZ Cas and AS Eri to see if there is any sign of chemical anomaly in these stars.

Our observations were carried out on Jan 8 in 2000 for RZ Cas (orbital phases 0.49-0.51) and Oct 21 in 2000 for AS Eri (orbital phases 0.15-0.21) with 101cm reflector at Bisei Astronomical Observatory. Spectrograph was attached to the Bent Cassegrain focus of this telescope and the spectral resolution was about 5355 at 4080$\mathring{A}$, over the wavelength range of 3850-4250$\mathring{A}$. We also observed 4 normal A type stars; β Ari(A3V), γ Gem(A0IV), θ Leo(A2V) and 95 Leo(A3V) and 4 Fp-Ap stars; HR4369(F0pSrCr), 21 Com(A2pSrCr), 17 Com A(A0pCrSrEu) and 53 Cam(A2pSrCrEu) to compare with RZ Cas and AS Eri.

We used IRAF† packages for data reduction. The wavelength calibration was performed with a Fe-Ne lamp spectra. All spectra were normalized to continuum of unity. These are shown in figure 1.

One can clearly notice that spectra of RZ Cas and AS Eri do not show the Ap features. For example, lines of Sr II λ4078 and Cr II λ4172 are strong in Ap stars but such lines are weak in Algols. The features of Ca II 3934 λ in RZ Cas and AS Eri are similar to those of normal A stars. We conclude that the pulsating components in systems RZ Cas and AS Eri are not typical Ap stars but similar to normal A stars. Spectral properties of δ Sct stars are not chemically peculiar. Therefore, RZ Cas and AS Eri are may locate at the shortest period edge of the δ Sct-type stars.

Recently, Mkrtichian et al. (2002) proposed a new type of pulsating stars, "the (B)A-F spectral type mass-accreting main-sequence pulsating stars in semi-detached Algol-type binaries (oEA)". They mention about RZ Cas and AS Eri are members of this type. On the other hand, Elkin et al. (2005) discovered a new roAp oscillation in HD116114 and its period is 21 minutes. In any case, to examine excitation mechanisms and features of pulsations in A type dwarfs, further investigations are necessary on these short period oscillations in the close binary systems.

Finally, we analyzed the H_δ profile of RZ Cas, and derived the surface temperature of the primary component to be 8500K and log g = 4.0- 4.5. This result is consistent with that the primary component of RZ Cas is really A3V.

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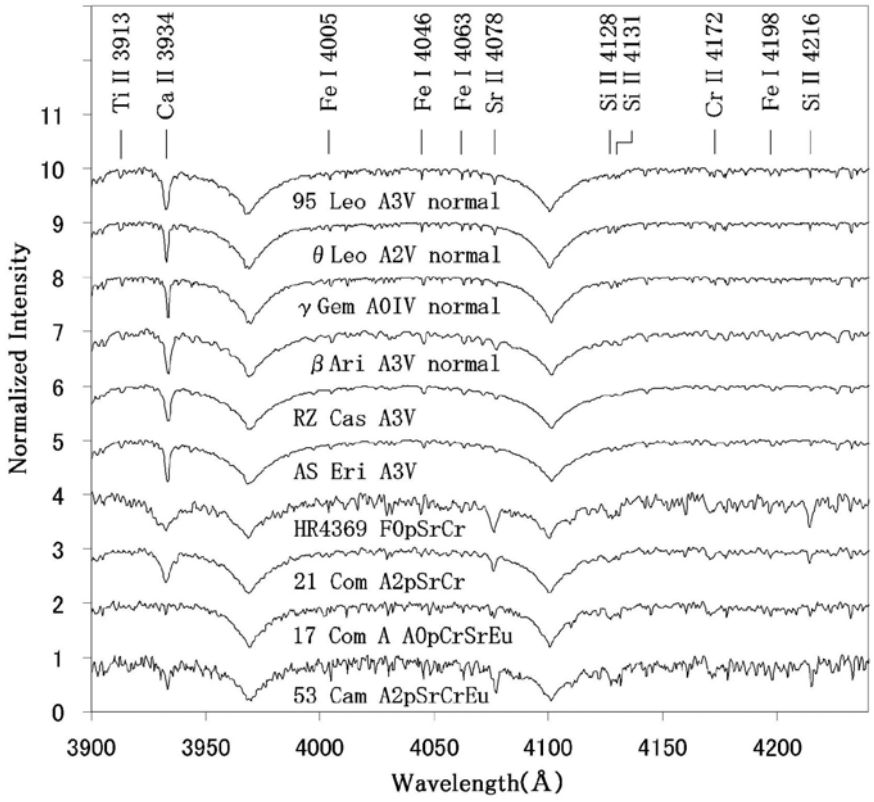

Fig. 1. The spectra of RZ Cas and AS Eri. For comparison, the spectra of 4 normal A stars and 4 Fp-Ap stars are also shown.

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References

Elkin, V. G., Riley, J. D., Cunha, M. S., Kurtz, D. W. & Mathys, G. 2005, *MNRAS*, **358**, 665

Mkrtichian, D. E., Kusakin, A. V., Gamarova, A. Yu & Nazarenko, V. 2002, *Radial and Nonradial Pulsations as Probes of Stellar Physics IAU Colloquium 18*, eds. C. Aerts, T. R. Bedding, & J. Christensen-Dalsgaard, ASP Conf. Ser., **259**, 96

Mkrtichian, D. E., Kusakin, A. V., Rodriguez, E., Gamarova, A. Yu., Kim, C., Kim, S.-L., Lee, J. W., Youn, J. -H., Kang, Y. W., Olson, E. C. & Grankin, K. 2004, *A&A*, **419**, 1015

Ohshima, O., Narusawa, S., Akazawa, H., Arai, K., Fujii, M., Kawabata, T., Morikawa, K., Ohkura, N. & Takeuti, M. 2001, *AJ*, **122**, 418

Rodriguez, E., Lopez-Gonzalez, M. J. & Lopez de Coca, P. 2000, *Delta Scuti and Related Stars Reference Handbook and Proceedings of the 6th Vienna Workshop in Astrophysics*, eds. M. Breger & M.H. Montgomery, ASP Conf. Ser., **210**, 499

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