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NRP Modes in a Be Star Zeta Oph

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Abstract. Two large sinusoidal variations with periods of 3.337 hrs and 2.018 hrs and other smaller variations have been detected from the period analysis of HeI λ 6678 spectra obtained by our multi-site campaign for ζ Oph in May, 1993. The resultant periodgram is considerably improved (aliasing free) from those in previous publications. The periodicity may be consistent with previous studies except ambiguities of aliasing. It is surprising that almost all detected periods have a common superperiodicity of about 10.05 hrs. We emphasise the importance of multi-site campaign for the study of line-profile variations (lpv) in early-type stars.

The precise determination of the periodicity of modes of lpv in Be and related stars is very important to infer the modal nature of the oscillations and their possible physical link to Be phenomenon. Unfortunately, it is not easy to obtain good temporal coverage data from an observing site alone. So, we have carried out a couple of multi-site campaigns of Be stars since 1993 (Hirata 1994). Here we present a preliminary result of an analysis of spectroscopic observation which is a part of a multi-site campaign of ζOph in May, 1993. The detailed result including photometric observations and others will be published elsewhere soon.

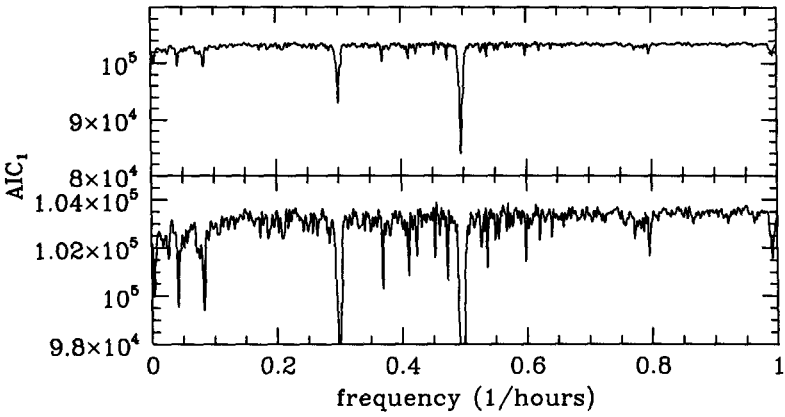

Figure 1. The periodgram of one sinusoid fitting. See text for detail.

The spectroscopic data were monitored at four sites (Okayama, Crimea, ESO/CAT, and Dominion) and 411 HeI λ 6678 spectra were obtained in 15 nights during the campaign. The resolution of the spectra (slit width) is 0.1A-0.33A and the typical signal to noise ratio of the spectra is 300-500.

The result of the period analysis is shown in Fig. 1. The AIC_1 corresponds to the residual of the least-square fitting of one sinusoid to the data in temporal domain (see Kambe et al. 1993 for the period analysis in detail). The periodgram is much more aliasing free than in previous studies. The lower panel of the figure is the magnified diagram of AIC_1, where less significant peaks are seen with aliasings of the two main periods. The longer periods are likely to be due to the systematic errors of the reduction. In summary, we could detect at least two strong periodicities in the data, i.e., 2.018hr and 3.337hr, with other possible periods of 1.008 hr, 1.256 hr, and 1.668 hr. All these periods have a common superperiod of about 10.05 hrs.

The result may consistent with previous studies by Kambe et al. 1993 and Reid et al. 1993 except for an ambiguity of aliasing, in which periodicity of 2.43 hrs and 3.33 hrs are detected as lpv with two largest amplitudes. If the true periodicity is 2.018 hrs instead of 2.43 hrs, it is clear that multi-site campaigns are very important to establish the true periods of the lpv.

The extensive discussion of the new periodicity will be published soon. Although we still have not made any satisfactory understanding of the lpv in Be stars, multi-site campaigns will bring us some significant progress in understanding the feature and cause of lpv in Be stars and other related stars.

References

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