Radial and Nonradial Pulsations as Probes of Stellar Physics
ASP Conference Series, Vol. 259, 2002
C. Aerts, T.R. Bedding, & J. Christensen-Dalsgaard, eds.

Rapid Variations of the Hα Line of the Be Star o And

D. Briot[1], J.Chauville[1], G.Guerrero[2]

[1]*Observatoire de Paris-Meudon, France,* [2]*Osservatorio di Brera, Italy*

1. Introduction

Omicron Andromedae is a multiple system composed of at least four components. The main component "A" is a variable Be star (B5II-III). The variations of this star are multiform: the circumstellar emission and absorption can vary drastically and can even disappear and reappear later, whereas changes in magnitude are also observed (see e.g. Sareyan et al., 1998). Rapid spectroscopic and photometric variations are observed as well. As explained below, the rapid spectroscopic variations of the Hα line observed in 1992 during a phase of moderate emission are very special (Briot et al., 2001). Then the emission of o And increased, so another program of observations of the Hα line was performed to investigate its rapid variations during different emission phases. We present here some preliminary results.

2. Observations and results

The observations were collected at the Haute Provence Observatory, in 1992, 1997, 1998 and 1999, using the Aurélie spectrograph, applied to the 1.52m telescope; and at San Pedro Martir Observatory (UNAM), only for the 1992 observations, using the 2.10m telescope.

- General description of the Hα line during each observing season

The profile of the Hα line shows a broad photospheric line, and superimposed on it, a central narrow absorption core surrounded by two emission wings. In 1992, emission was moderate in each wing whereas the central absorption was striking. In 1997, both emissions increased so that the emission peaks were well defined, but they did not yet rise to the continuum level. The central absorption did not clearly change (see also Harmanec (1994) and Arellano-Ferro et al. (1994) who reported an increase of the emission in 1994). In 1998, both emissions increased again as did the central absorption. This increase of emission was also pointed out by Mc David (1998). In 1999, intensities of the emission peaks did not change, but emission decreased in external part of each wing and the central absorption markedly decreased. In the hypothesis of a keplerian circumstellar envelope, this result means that the internal part of the envelope, i.e. the part close to the central star, weakens or vanishes, which could explain the decreasing of the central absorption component corresponding to a decrease in the optical depth along the sight line.

- Rapid Hα variations

During every observing night, whatever the state of emission, some rapid variations of each emission wing are observed, as well as of the central narrow ab-

sorption component. In 1992, these variations were in phase, both emissions and central absorption increasing and decreasing simultaneously. This coordinated behaviour was particularly striking in a case where the change of the direction of the variations happens during the observing time. During phases of stronger emission in 1997, 1998 and 1999, rapid variations still observed in each emission and absorption component are no longer synchronized. In fact, a general outline of all these variations is hardly detectable. The search for the possible periodicities present in the variations has been performed using the Stellingwerf (1978) method. In 1992, the periods around 1.38 d and 1.65 d can be found for each component of the line when the variations of the three components are synchronous, the period of 1.38 d being one of the secondary photometric periods for the same observing season (Sareyan et al., 1998). Analogous periodicities for each component can hardly be detected in 1997 and 1999, maybe because of the quite short observing time (for the 1998 observations the analysis was not performed because of the scarceness of observations due to bad weather conditions). For 1997, we can suggest a period around 2.4 d for the three absorption and emission components. For 1999, two periods of about 0.6 d and 0.75 d are well defined only for two components of the Hα line.

3. Discussion

During the first observing season, i.e. in 1992, a very important point, which constrains the physical interpretation, is the total simultaneity of the variations in the central absorption and in the emission components of the Hα line. If these variations were in any way related to the rotation, a phase shift should be observed for the variations of the three components. These kinds of variation can be more easily explained by some axisymmetric changes in the circumstellar envelope. These changes could be due to nonradial pulsations of the central star, with an azimuthal quantum number $m = 0$ (zonal mode), and a low value for the quantum number ℓ. Nevertheless this model is not able to explain the variations of the Hα line obtained from 1997 to 1999. These features of the *o* And variability pattern deserve a more thorough investigation.

References

Arellano-Ferro, A., Bossi, M., & Guerrero, G. 1994, Be Star Newsletter, 29

Briot, D., Chauville, J., Sareyan, J.P. et al., 2001, A&A, in press

Harmanec, P. 1994, Be Star Newsletter, 29

McDavid, D. 1998, Be Star Newsletter, 34

Sareyan, J.P., Gonzalez-Bedola, S., Guerrero, G., et al. 1998, A&A 332, 155

Stellingwerf, R.F. 1978, ApJ, 224, 953