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A SEARCH FOR SHORT-TERM RADIAL-VELOCITY VARIATIONS OF o And

o And is one of the most frequently observed Be stars. A very detailed spectroscopic investigation was published in a series of papers by Gulliver and Bolton (1978), Gulliver, Bolton, and Poeckert (1980) and Poeckert, Gulliver, and Marlborough (1981). In their extensive analysis they expressly payed little attention to the short-term variability which is one of the most puzzling properties of o And and which had been speculated about by several other authors before. This variability has been found by quite a number of observers in photometric as well as in spectroscopic data (for references see Horn et al. 1982, Baade 1981). The derived quasi periods cluster around 0.8d and 1.6d, but a real periodicity is apparently not maintained (Horn et al. 1982).

The time resolution of the available spectroscopic observations is not in all cases sufficient to study a variability which is not strictly periodic. Therefore we attempted to observe o And frequently during a number of consecutive nights. Unfortunately unfavourable weather conditions at Hoher List observatory during the 1981 observing season prevented us from obtaining a sufficient number of spectrograms required for a thorough analysis. In the meantime Bossi et al. (1982) announced that o And might again have entered a shell state. They claim that this

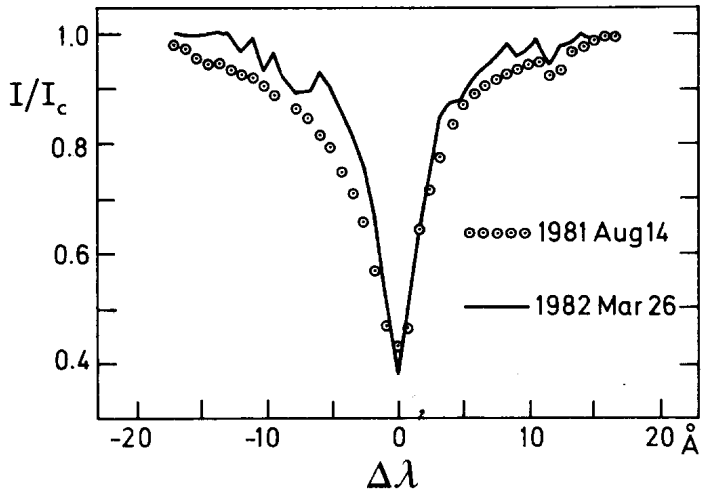

Fig. 1: Hβ profiles of o And

was predicted by a preceding light decrease, and one may wonder whether such a phase is characterized also by the above mentioned short-term RV variabilities. Because our last observations in 1981 were obtained during the light decrease observed by Bossi et al. and just 2 1/2 months before Bossi et al. discovered the H_α shell absorption , we report our observations and publish the results of the RV measurements.

First, however, we describe the spectroscopic evolution of o And as we found it in our observations which were obtained within the last 2 1/2 years. To ensure compatibility we include only spectrograms recorded on IIa-O plates with the Cassegrain spectrograph attached to the 106 cm reflector of Hoher List observatory. The dispersion is 31 Å/mm. The most recent observations are of March 26, 1982. Fig. 1 shows the change of the H_β profile since Aug. 1981. The line is now slightly deeper, but noticably narrower. Both trends can be traced back even further on 2 additional plates taken on Oct. 21, 1980. From Aug. 1981 to March 1982 the FWHM of H_β and H_γ dropped from 230 to 170 km/s and from 400 to 300 km/s, respectively. The wings of the lines are presumably filled in by emission.

Table I

Radial velocities of o And, Aug./Sept. 1981 and March 1982

J.D.-2 44Ø ØØØ	H_β	H_γ	$H_\delta - H_{11}$	HeI,T	Qual.
4834.358	-31.6	-64.3	-43.3	-49.Ø	A
.377	-24.4	-36.Ø	-39.5	-51.7	A
.397	-25.3	-31.Ø	-37.Ø	-43.7	A
.415	-27.3	-29.Ø	-38.3	-47.3	A
.462	-25.9	-32.9	-32.1	-34.1	A
.48Ø	-25.6	-27.9	-3Ø.8	-3Ø.4	A
.498	-25.9	-28.4	-33.2	-23.Ø	A
.517	-23.4	-26.7	-26.3	-31.4	A
.535	-22.1	-24.8	-27.4	-26.3	A
.568	-2Ø.7	-25.9	-25.4	-25.2	A
.586	-2Ø.6	-29.4	-22.5	-16.1	A
.61Ø	-18.Ø	-27.1		-39.5	C
4857.3Ø5	-29.5	-29.5	-5Ø.5	-38.6	A
.331	-21.4	-3Ø.3	-48.6	-43.2	B
.36Ø	-21.3	-38.Ø	-42.5:	-43.1	B
.458	-2Ø.1	-25.4	-3Ø.Ø:	-38.2:	A
.475	-19.8	-31.Ø	-34.8	-43.6	B
.492	-21.2	-25.1	-28.9	-34.5	A
.5Ø8	-3Ø.4	-26.1	-3Ø.9	-17.1	A
.555	-33.8	-2Ø.9	-32.1	-32.7:	B
.644	-42.2	-36.4	-5Ø.1:	-52.8:	C
4858.287	-4Ø.2	-57.1	-72.4	-63.2:	B
.3Ø5	-39.2	-43.Ø	-64.3	-64.Ø:	A
.323	-37.1	-37.5	-54.6	-63.4	A
.411	-4Ø.3	-35.9	-56.7:	-69.3	A
.427	-37.Ø	-37.7	-4Ø.9	-57.2	A
.488	-29.Ø	-29.9	-4Ø.7	-59.5	A
.5Ø2	-35.Ø	-39.4	-43.9		C
.519	-33.6	-39.7	-39.7	-42.9	A
.537	-46.Ø	-43.Ø	-5Ø.2		C
.555	-3Ø.1	-32.9	-39.3	-25.1	A
.573	-32.3	-36.6	-45.5	-28.8:	A
.591	-14.9	-33.6	-3Ø.9	-29.4:	A
.6Ø9	-3Ø.5	-4Ø.3	-34.2	-22.4	A
.627	-26.5	-36.Ø			C
.645	-5Ø.Ø	-52.Ø	-5Ø.Ø:		C
4859.3Ø5	-29.Ø	-31.Ø	-4Ø.3	-33.8	A
.322	-31.8	-42.Ø	-47.Ø	-58.4	B
.34Ø	-32.7	-25.7	-48.3:	-49.6	B
.471	-32.3	-29.5	-37.7	-42.3	A
.541	-16.9	-15.Ø	-44.8	-34.2	A
.566	-36.Ø	-31.9	-45.9	-6Ø.7:	A
.587	-23.4	-42.Ø	-39.6	-49.2	A
.6Ø7	-3Ø.1	-35.Ø	-49.2		A
.628	-19.3	-38.Ø	-47.4		A
.651	-4Ø.Ø	-39.Ø			C
5Ø55.677	-2Ø.1	-12.8	-29.2	-49.1	A
.683	-2Ø.1	-13.2	-29.5	-62.1:	A
.688	-16.4	-11.5		-42.6:	C

A - good, B - somewhat weak, C - underexposed

Another change concerns the Ca II K line. In Aug. 1981 it was not visible, but now we clearly see a broad absorption line, about 5 Å wide (FWHM). The presence of the Ca H line is indicated by a systematic shift of H_ε by about -10 km/s. This is reminiscent of the beginning of Pleione's latest shell phase (Hirata and Kogure, 1976). Since Ca II absorptions are not in agreement with the spectral type, B 6, they are very likely broad shell features as they were found by Gulliver, Bolton and Poeckert (1980).

Altogether, our observations confirm Bossi's et al. result that o And is again in a shell state. All shell indicators are, however, still weak and, therefore, not necessarily a serious contradiction to the possible quasi periodicity of shell phases which was suggested by Fracassini et al. (1977) and Horn et al. (1982).

In 1981 a total of 46 spectrograms on Kodak IIIa-J plates were obtained during 4 nights with the same instrumentation. Passing clouds forced us to stop some exposures. The plates have to be divided into three classes according to their quality. The classifications are given together with the RVs in Table I. RV measurements were made with the ESO Grant machine. Most of the plates were measured twice. A comparison yielded as typical deviations of a single line: Balmer lines 2 - 5 km/s, He I triplet lines ($\lambda\lambda$ 3820, 4026, 4472 Å) 3 - 7 km/s. The RV of the interstellar Ca II was determined to -7.8 ± 3.1 km/s in reasonable agreement with Adams' (1949) result (-8.7 km/s, adopting a rest wavelength of 3933.664 Å).

The spectra cover the range between H_β and the Balmer limit, the description of the Aug. 1981 IIa-O plate holds for them as well. There was no variation. The highest Balmer member visible is H_{16}. At the dispersion of 31 A/mm it was not possible to search for the suspected variability of the absorption line profiles (Baade 1981). At least, the line profiles displayed during the RV measurements on the oscilloscope screen did not look unusual.

The observed range of the RV is just large enough to state that the RV was variable. We were not able to discover any regular pattern in the RV curves. Plots versus phase of all previously suggested periods

yielded negative results. A frequency spectrum obtained by means of the PDM technique does not show any conspicious features.

We conclude that short-term, quasiperiodic RV variations are not present during the initial stage of the new, weak shell phase. All RV variations on timescales of about 1 day are probably of temporary nature only. A comparison of the 1981 and 1982 data shows an apparently significant change of the RVs derived from the Balmer lines. But one has to keep in mind that the 1982 observations were obtained within 15 minutes only. An interpretation whether this is related to the evolution of the shell has to await further observations.

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