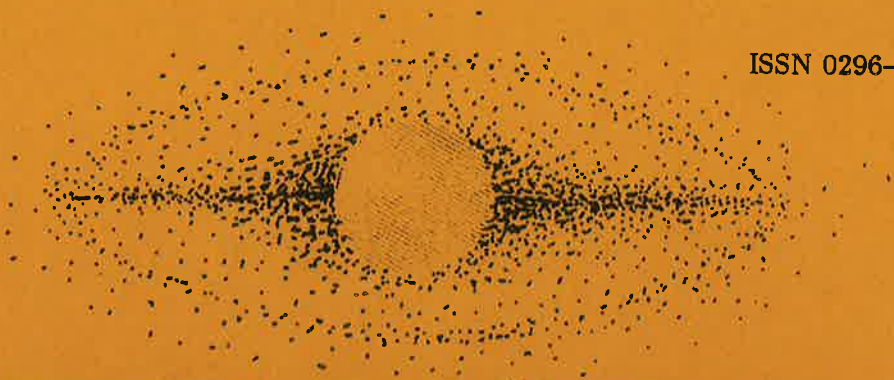

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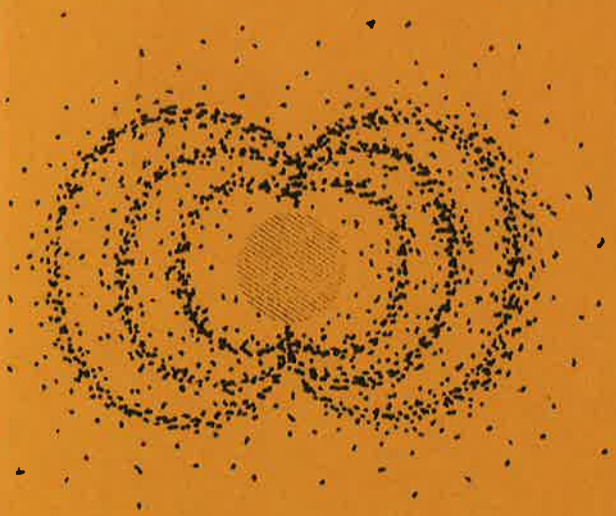

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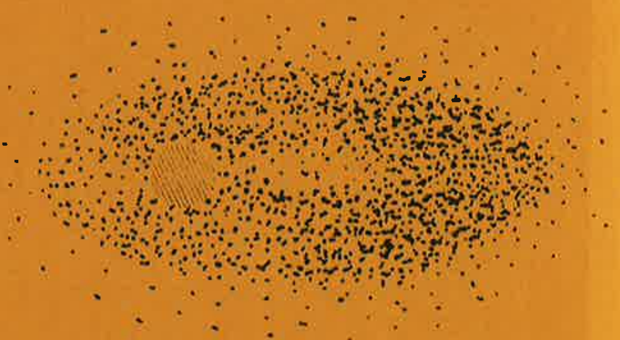

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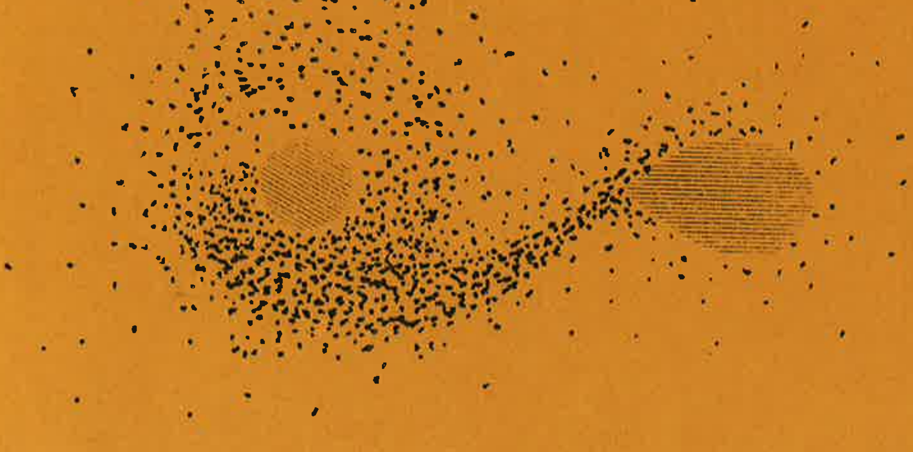

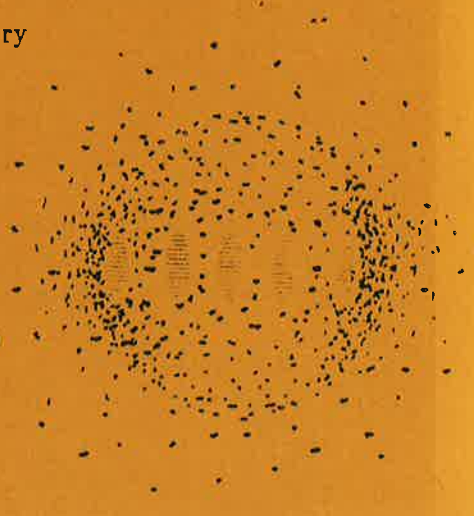

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The Be Star Newsletter is open to all contributions concerning early-type stars. Please send manuscripts and all correspondence to the editor's address given on the front page. In the case of very urgent late contributions directly contact the technical editor via one of the fast links listed below. The Newsletter is distributed free of charge to all astronomical institutions which request it. If you wish that the Newsletter is also received at your institute, write to the technical editor:

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Acknowledgements: The Be Star Newsletter is produced at and financially supported by the European Southern Observatory. We thank again Britt Sjöberg and Harry Neumann for their active help in administrative and technical matters.

E D I T O R I A L

* * * * *

It is my pleasure to send you the third issue of the *Be Star Newsletter* to be published in 1988. Highlights of the recent meeting of the Working Group on Be stars held during the IAU General Assembly in Baltimore on August 6 are included in this issue as well as summaries of the invited talks which were presented during the meeting. This issue also contains the usual sections Working Group Matters, Contributions, What's Active/Inactive?, Observations.... ...Theoretical Support Wanted/Available, Preprints Received, and Bibliography. I would like to again extend my thanks to all the researchers who contributed to this issue and especially those who helped with bibliography. Please let me know if a recent paper of your's is not listed (or cited incorrectly), and I will correct the oversight in the next issue. I am grateful for your continuing comments on the *Newsletter*

I am especially enthusiastic about the contributed papers for this issue. Observations in spectral regions toward either side of the optical band continue to reveal important information on the nature of the mass loss in Be stars and the structure of their envelopes. Contributions in this issue include reports on UV/wind activity and new data on various IR features. Updates are given on the Paschen series, O I 8446Å, the IR Ca II triplet, and the IR N I lines (is the print familiar?). We are also introduced to Fe II 9997Å and shown new observations of He I 10,830Å. Pleione's recent activity has attracted a great deal of attention in the Be star community. Significant optical and UV spectral variations in this star are described in a contributed manuscript and in the *Preprints* section.

I would like to encourage the readership to take advantage of our *Observations...Theoretical Support...Wanted/Available* section. In this era of "multispectral consciousness" and the awareness of the importance of considering long-term behavior, it is virtually impossible for a single researcher to possess all the data that might be desirable to complete an investigation. I know from personal experience that it is very likely that one will receive responses to their "advertisements".

Since I anticipate that the next issue of the *Newsletter* will be published in late March or early April of next year, your contributions for Issue No. 20 should be received by:

March 1, 1989

Lengthy contributions should be submitted in a camera-ready format (see Issue No. 14 for instructions), but for short communications I recommend FAX mail (telephone number: 213-746-5684), Electronic Mail (SPAN, temporary address: CYGNUS::PETERS), or telex (4720490 USC LSA).

I would like to wish you, in advance, a happy holiday season and a happy and scientifically productive new year.

I thank the European Southern Observatory for their continued financial support.

Gerrie Peters, Editor

WORKING GROUP MATTERS

* * * * *

The main subject of this section of the *Newsletter* is of course the meeting of our Working Group (WG) during the IAU XXth General Assembly in Baltimore. It took place on the morning of Saturday, August 6, 1988 with about 40-50 participants. The agenda was as announced in the last *Newsletter*. Of the three hours available, the first 30 minutes were devoted to general matters concerning the WG. After a brief summary of the activities of the past three year period (concerning mainly IAU Coll. 92 *Physics of Be Stars* in Boulder, 1986, and the Be Star Newsletter which now is received by about 200 institutes and individuals), the undersigned also raised a number of points concerning the scope and framework of the continuation of the work. We shall return to this point below.

The readers of the *Newsletter* will be glad to hear that Gerrie Peters will continue her very successful work as its editor. All of us are grateful for her efforts during the past three-year period. There is some hope that we can also in future count on the technical and financial support by the European Southern Observatory. Except for the next issue, final clarification is still pending, however.

As the last topic of the business session, the ballot for the new Organizing Committee (OC) was conducted. The votes, including those that had been mailed to Arne Slettebak by Working Group members who were unable to come to Baltimore, were kindly counted by Drs. A.B. Underhill and L.A. Balona. The result is that the OC now consists of Luis Balona (Observatory), Joachim Dachs (Bochum), Vera Doazan (Paris), Mike Marlborough (London, Ontario), John Percy (Toronto), Gerrie Peters (Los Angeles), and the undersigned. The new OC determined the latter as its chairman. A. Slettebak is not any more a member of the OC because he asked that after so many years he no longer be considered. Of course, we have to respect this wish, not at last because we know that there are more profound ways of having an impact on Be star research than just by being on the OC. We thank him and Ted Snow (who, too, left the OC) for their efforts in support of our Working Group.

During the remainder of the first 30 minutes, J.R. Percy, C.A. Grady, and G.J. Peters gave progress reports on photometric, UV spectroscopy, and multi-frequency observing campaigns, respectively.

The main part of the meeting was chaired by J.M. Marlborough and saw five talks clustered around *Empirircal Correlations of Observational Quantities in Be Stars*. I shall nevertheless skip over it here because summaries of the talks presented are given by their respective authors on pages 6–15 of this *Newsletter*. As was mentioned in the last issue of the *Newsletter*, the speakers had been asked to put the emphasis on well-structured presentations of the rich observing material to resolve confusions which result from the large variety of phenomena but also from the occasionally obliterating effects of the models and interpretations applied to the data. This effect was well achieved by the speakers and further amplified during the discussions for which nearly half of the time had been reserved.

After the WG meeting the new OC took advantage of the fact, that with the exception of J. Dachs all its members were present in Baltimore, and met to discuss future WG activities. The question of a new Be star meeting had already been raised on Aug. 6 and was now investigated in more detail. A majority supported the view that it was still too early for plans at the level of an IAU Symposium or Colloquium, but a workshop appears highly desirable. Several specific topics were mentioned and reflected the general consensus that such a workshop should not focus too exclusively on topics that may be endemic to Be stars.

This guideline was thought to be useful also for the practical definition of the WG. Having a Working Group Be Stars makes sense because Be stars are in various ways different from other early-type stars. But for a given object or subject this distinction often proves to be somewhat artificial. The existence of a rigidly defined Working Group Be Stars *may* therefore be counterproductive *if* its effect is to isolate Be stars and their terrestric friends from the rest of their respective communities.

The OC has discussed ways to prevent this to happen. As a first step towards putting the WG on a somewhat broader basis, it was decided to seek a closer affiliation with additional IAU commissions. To remind you, the WG Be Stars has so far been supported by Commissions 29 (Stellar Spectra) and 45 (Spectral Classification). Through letters by its chairman to the presidents of Commissions 27 (Variable Stars) and 36 (Theory of Stellar Atmospheres), the OC has now requested sponsorship also by these commissions. Meanwhile, positive replies have been received by Profs. M. Breger (Comm. 27) and D. Gray (Comm. 36).

It must be clear, however, that this step as such is a mere formality and has no consequences whatsoever. It will be the task of the whole WG to further intensify and broaden the contacts with related branches of astronomy and to enhance its visibility. There are many problems that Be stars share with other objects although in Be stars they may be more strongly felt. The OC will continue to appreciate your suggestions concerning these matters. If you already have some specific ideas, another very good one would be to write them down and send them to the editor of the *Newsletter* so that all of us can participate in them.

Let me conclude with my best personal wishes to all of you for a happy and successful year 1989!

Dietrich Baade

SUMMARIES OF TALKS PRESENTED AT THE SPECIAL SESSION

"Empirical Correlations between Observational Quantities in Be Stars"

HELD ON 1988 AUGUST 6 DURING THE MEETING OF THE WORKING GROUP ON Be STARS

AT THE IAU GENERAL ASSEMBLY IN BALTIMORE, MARYLAND; USA

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* * * * *

Stellar $v \sin i$ and optical emission line widths of Be stars

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Introduction. Be stars exhibit both stellar and circumstellar features in their spectra. Broadening of absorption lines provides information about the projected stellar rotational velocity, while the width of emission lines contains information about the line broadening mechanisms in the envelope. Any correlation between these parameters implies that the width of emission lines is, at least to a certain degree, of kinematic origin. Although Struve (1931) already found a correlation between $v \sin i$ and FWHM(Hβ) in Be stars and concluded that a Be star envelope must be rotationally supported, there is a long-standing controversy about the nature and implications of such correlations. This is partly due to instrumental bias, partly due to different choices of emission line width parameters.

Emission line width parameters. According to Slettebak (1976), the following emission line width parameters (ELW) are useful to define: the full width at half maximum (FWHM), the full width at the base (Δv_{tot}), and the separation of double peaks (Δv_{peak}). These parameters depend in different degrees on signal-to-noise ratio, resolution and underlying photospheric absorption profile. The easiest-to-measure and most widely investigated ELW parameter is the FWHM.

Full width at half maximum. In order to re-investigate the (FWHM - $v \sin i$) relation, we have collected a sample of the 115 brightest Be stars (extending to $V \approx 7^m$ and covering the epoch ≈1974-1987) with at least one, more often several measurements of Hα and, for many stars, of Hβ, Hγ and Fe II lines (the sources are marked by abbreviations in the list of references). The resolution of these data sets ranges from 0.07 Å to 1-2 Å. All $v \sin i$ values are from the list of Slettebak (1982).

Fig. 1 shows a plot of FWHM(Hα) vs. $v \sin i$ for all 115 program stars, with more than one entry for stars showing significant variations within the past decade. We find a general trend rather than a strict correlation. While there is considerable scatter towards large FWHM values (some of them are larger than $2\ v \sin i$), there are remarkably sharp lower limits: all observed FWHM(Hα) are larger than $v \sin i$, and no FWHM(Hα) exists below ≈110 km s^{-1} (a limit established by the pole-on Be star HR 2825 observed in 1985 and 1987 [Ha86, DHH88]). A least-square fit to all data yields

$$\mathrm{FWHM(H\alpha)} \approx 0.87\ v \sin i \pm 160\ \mathrm{km\ s^{-1}} \quad , \qquad (1)$$

while a fit disregarding the labeled data points is steeper and gives a smaller offset value

[FWHM(Hα) $\approx$ 1.4 $v \sin i \pm$ 50 km s^{-1}].

Except for a few pole-on stars, for which $v \sin i$ values almost certainly are too low (HR 6819, HR 6397), the observed scatter indicates that there is a significant non-kinematical contribution to line broadening in Hα, predominantly by radiation transfer effects (cf., e.g., Fig. 1 in Poeckert & Marlborough 1978), and also by electron scattering, turbulence, or insufficient resolution. The first two of these effects are expected to be, by far, less important in higher-order Balmer and in Fe II emission lines. This is indeed observed (for Hβ, see, e.g., Fig. 4 of Sl76; for Fe II, cf. Fig. 4b of Ha87).

Total width at the base. The total width of Hα emission lines has been investigated by Doazan (1970) and An83. This parameter is hardly unambiguous to define and to measure, a least for Hα. On the average, it is found to be much larger than 2 $v \sin i$ (up to 3000 km s^{-1}), and any correlation with $v \sin i$ is lacking. This is not too surprising as the extended Hα wings observed in most Be stars are mainly caused by electron scattering.

Double peak separation Δv_{peak}. From an Hα sample of 49 Be stars measured at 0.13 Å resolution (Ha86, HKK88, DHH88), we find 70 % of them exhibiting double peak profiles. Hα peak separations are essentially uncorrelated with $v \sin i$. Most are smaller than $v \sin i$. Normalized peak separations are correlated with W_α (cf Fig. 8c of HKK88):

$$\log [\Delta v_{peak}/2 \; v \sin i\,] = -0.32 \log W_\alpha - 0.20 \,. \tag{2}$$

According to simple models of optically thin rotating disk-like or cylindric envelopes (Huang, 1972), normalized peak separation is a measure for the outer emitting region radius, viz. $\Delta v_{peak}/2v \sin i = r_d^{-j}$, with the rotational velocity law index j. The observed slope in Eq. (2) then gives $j \approx 0.6$.

Conclusions. There can be no doubt about correlations between some ELW parameters and $v \sin i$, especially for FWHM and Δv_{peak}. We conclude that

(1) the basic origin of emission-line broadening is kinematic and specifically rotational (with a non-kinematical contribution of the order of 100 km s^{-1} in Hα);

(2) a coupling of photospheric and envelope rotation exists and the envelope matter in the equatorial plane (and to a certain degree perpendicular to it in any axisymmetric configuration) is rotationally supported;

(3) from the observed correlations alone no restrictions can be derived for the envelope geometry between the disk-like case and any elliptical or cylindrical configuration (however, the spherical case can be rejected).

Acknowledgements. It is a pleasure to thank the IAU and its General Secretary, Dr. J.-P. Swings, for generous travel and accomodation support. Prof. J. Dachs and Wolfgang Hummel made available some results of the 1987 CAT data before publication which is

gratefully acknowledged.

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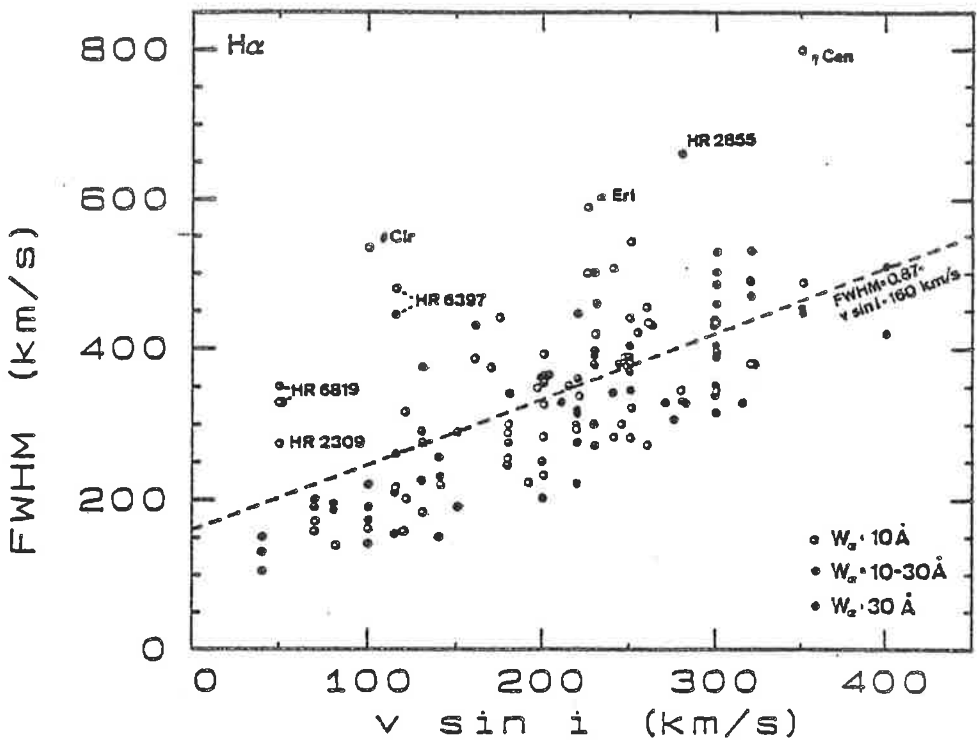

Fig. 1: FWHM(Hα) vs. *v* sin *i* for 115 Be stars. Symbols are coded for different equivalent widths. Data are taken from Da81, AF82, An83, Ha85, Da86, Ha86, DHH88 and HKK88.

The $V\,Sin\,I$ Threshold for Detection of Highly Ionized Stellar Winds in Be Stars

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and
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Studies of stellar winds in Be stars have been a major area of emphasis in IUE studies of hot stars. Most of the bright Be stars have been observed at least once by IUE, and several of the stars have been monitored repeatedly, over the last 7-10 years. Studies of individual stars have shown that in many cases the winds are dramatically variable. As a result, identifying systematic trends in the behavior of the highly ionized stellar winds in these stars requires both observations of large numbers of objects, and multiple observations, preferably over long temporal baselines, of as many of the objects as feasible.

Some B0.5-B5e stars, at some times show excess absorption in the lines of N V, C IV, and Si IV when compared with normal stars of the same spectral type, luminosity class, and $v \sin i$. The excess absorption occurs as one or more shortward-shifted discrete absorption components, which are variable in number, distribution in radial velocity, and strength both from star to star, and in individual stars. Henrichs (1984) first noted that the excess absorption was found only in the stars with $v \sin i \geq 150$ km s^{-1}. Similar results were noted by Marlborough and Peters (1987). Grady, Bjorkman, and Snow (1987), using a sample of more than 600 spectra of 62 Be stars, confirmed the reality of a threshold for the detection of highly ionized winds in early-type Be stars at 150 km s^{-1}. Comparison with published $H\alpha$ line profile data, IRAS [12] data, optical polarimetry, and detections of low ℓ non-radial pulsation modes, indicated that most of the signatures of the Be phenomenon also showed a threshold at or near 150 km s^{-1}.

Historically the later-type Be stars have been much less well observed in the ultraviolet than the early-type stars. Slettebak and Carpenter (1983) found in a sample including 7 late-type Be stars that C IV and Si IV were present to later spectral types than had been anticipated. They also found an indication that the highest $v \sin i$ and most luminous stars had stronger C IV and Si IV absoption. Grady *et al.* (1988) have expanded upon this initial survey with observations of 40 B6-B9.5e stars. For these stars, no photospheric C IV is expected, any C IV present is likely to be weak, and potentially blended with other absorption features, primarily those due to Fe II. Detection of C IV in the spectra of some stars, particularly those which are veiled by a strong circumstellar shell is at best difficult. Grady *et al.* found C IV present in luminosity class IV and III stars only for $v \sin i \geq 140$ km s^{-1}. C IV was detected in the luminosity class Ve stars only for $v \sin i \geq 200$ km s^{-1}. Wind variability is present in several stars in this sample, as are shortward-shifted discrete absorption features. Inspection of the available optical and IR data suggests that the behavior of the Be phenomenon in these cooler stars is similar to that observed in the B0.5-B5e stars, and hence that the same mechanism is likely to be responsible.

Recent work by Bruhweiler, Grady, and Chiu (1988) suggests that highly ionized winds in Be stars may extend to objects with spectral types as late as A1. They have noted C IV and Si IV absorption in 2 ostensibly normal A0 stars and 1 A1 star. The 2 A0 stars also show circumstellar shell features in Si II, and are most likely previously unidentified A shell stars, rather than being truly "normal" stars. All of the stars with C IV absorption in Bruhweiler *et al*'s sample have $v \sin i \geq 200$ km s^{-1}, which is consistent with the threshold noted by Grady *et al.* (1988). Work is in progress to extend the Be wind surveys to cooler A shell stars. At present, undisplaced or shortward-shifted C IV, Si IV, and Al III have not been detected in A shell stars with spectral types later than A1. The dataset is limited to a few stars and a few observations of each star (Slettebak and Carpenter, 1983; work in progress by Grady, Bruhweiler, and Chiu).

The strength of the C IV absorption is a strong function of spectral type or T_{eff} for the B0.5-B5 stars. From B6-A 1 the C IV absorption strengths are considerably smaller than are observed in the earlier type stars. The C IV absorption strength does not depend upon spectral type in these stars. There is a tendency for the luminosity class III stars with wind detections to have slightly greater C IV equivalent widths than the less luminous stars. Bjorkman and Snow (1988) have found that Be stars having IR excesses, mostly at 12 μm tend to have stronger C IV and Si IV equivalent widths than Be stars without IR excesses. However, no direct correlation is observed between the IR excess and the C IV equivalent widths.

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ASSOCIATED VARIABLE BEHAVIOUR BETWEEN THE HIGHLY IONIZED FAR UV RESONANCE LINES AND THE BALMER EMISSION-LINES

V. Doazan, Observatoire de Paris

The observations presented here are part of a long term program based on coordinated far UV and visual observations of a few Be stars, which was initiated in 1978 and continues until now. This program has produced a set of far UV and visual observations which allows us to investigate, for the first time, the variable behaviour of both the superionized and subionized atmospheric regions of Be stars over more than one decade, i.e. a time-scale which begins to be adequate for delineating long term variability patterns.
The combination of these far UV and visual observations shows the existence of an associated behaviour between far UV and visual variability. In this talk, I will focus on two of our program stars - γ Cas and 59 Cyg - for which the highly ionized resonance lines and the Balmer emission-lines exhibit an associated long term variable behaviour. Other types of associations occurring through phase transitions, which have been observed for Pleione, 88 Her and θ Cr B, will be presented at the Workshop "Variable mass-outflow from stars" (Space Telescope Institute, Baltimore, 11-13 Aug. 1988).

γ Cas (B0.5 IVe, v sini = 230 km s^{-1})
γ Cas has exhibited various types of spectra since 1865 - Be, Be-shell, normal B. After an episode of spectacular changes, which ended in a normal B phase, the star entered into a new Be phase in 1945. After having shown a quasi-constant behaviour (V/R~1), the V/R of the Balmer emission-lines began to exhibit large cyclic changes, from <1 to >1 and vice versa, on a time-scale of 4-5 yrs.

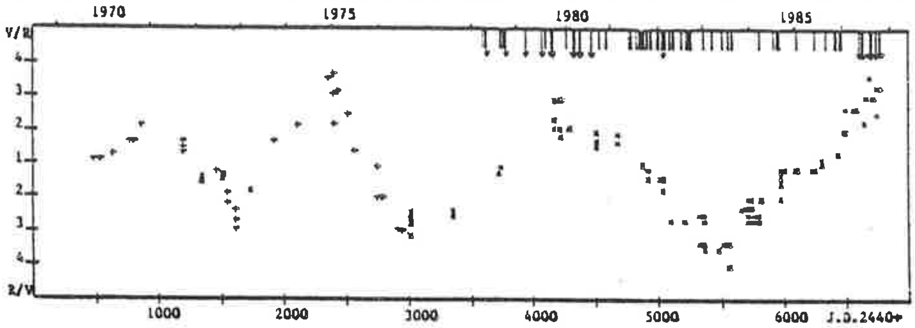

Fig.1. V/R variations of the Hβ emission-line of γ Cas in 1969-1986 from [1]. Dates of far UV observations are indicated by tic marks. An arrow is added when high velocity components are present.

During the last decade, γ Cas showed one striking variable characteristic in the far UV: the episodic appearance of strong, variable, high velocity (~ -1200 to ~ -1500 km s^{-1}), absorption components in the SiIV, CIV, and NV resonance lines, which seemed to occur in an erratic way.
However, by combining the far UV and visual observations [1], an associated long term behaviour between the occurrence of these components and the V/R variations of the Balmer emission-lines is clearly seen (Fig. 1). That is: the short term changes observed in the far UV show a long term behaviour associated with the long term V/R variations of the Balmer emission-lines.

59 Cyg (B1.5 Ve, v sini = 260 km s^{-1})
59 Cyg has also exhibited various types of spectra: Be, Be-shell, normal B. We noted that 59 Cyg and γ Cas show remarkable similarities in their long term behaviour in the visual region [2]. However, unlike γ Cas, whose Be phase began

40 yrs. before, 59 Cyg entered into a new Be phase in 1977. Therefore, the last decade corresponds to the first stages of development of a new cool envelope in 59 Cyg, while we observe later stages of envelope formation in γ Cas.
In 1978-87, 59 Cyg showed an irregularly increasing Be phase during which the star exhibited an entire episode of cyclic changes of the V/R at Hα, its beginning, and its end.
At the same time, striking variations in line-profile, velocity, and strength of the CIV and NV resonance lines were observed in the far UV. By combining the far UV and visual data, a remarkable associated variable behaviour between the V/R at Hα and the E.W. of CIV is observed (Fig. 2). A detailed discussion of these data and modelling implications are given in [3].

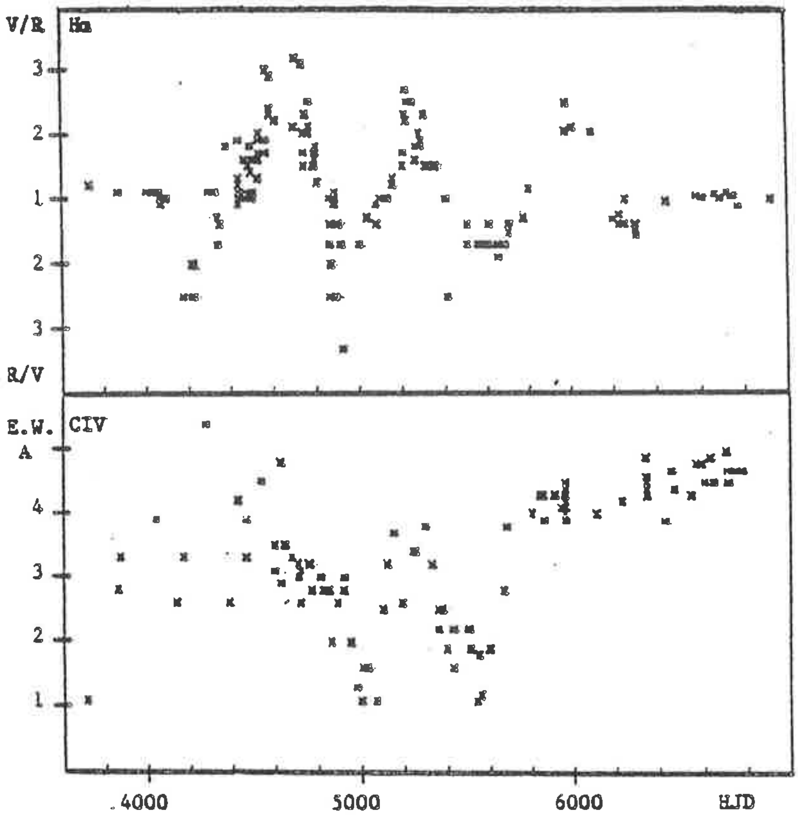

Fig. 2. Long term variability pattern of optical and far UV spectral features in 59 Cyg in 1978-87 [3]. Top: V/R ar Hα. Bottom: E.W. of the CIV resonance lines.

Concluding remarks

Over the last decade, our long term program of coordinated far UV and visual observations of a few Be stars has shown the existence of an associated variable behaviour of far UV and visual spectral features which originate in different regions of the Be star atmosphere. However, for each star, the nature of the association is different. These differences probably reflect the fact that we observe, for each star, different stages of development of the cool envelope. It seems likely that other types of associations exist at other stages of cool envelope formation. It is clear that any interpretation of Be star variability must be able to interpret the variability of the **entire** Be star atmosphere - superionized regions **and** cool envelope - and not only one of these atmospheric region.

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Correlations between Linear Continuum Polarization and H-alpha Emission Strength in Be Stars

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The University of Texas at San Antonio

D.R. Gies
Astronomy Department
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We have monitored the bright Be stars Gamma Cas, Phi Per, 48 Per, and Zeta Tau annually since January 1986 from The University of Texas McDonald Observatory, obtaining UBVRI continuum linear polarimetry with the Breger polarimeter on the 36-inch telescope simultaneously with high resolution, high signal-to-noise spectroscopy of the H-alpha and He I 6678 lines with the coude Reticon spectrograph at the 82-inch telescope.

The intent of our study is to investigate correlations between changes in the polarization and the emission line profiles, which might be suspected since most Be star models account for both the polarization and the line emission as being produced in a somewhat flattened, cool circumstellar envelope (CSE). We hope to improve our knowledge of the CSE structure and physical conditions by comparing the two different kinds of data simultaneously acquired.

We have found some evidence for rapid variability (hours to days), but discuss here only the changes from year to year, which are more pronounced. It should be mentioned that our observing program is not suited to the study of variations occurring on intermediate time scales (tens to few hundreds of days), which may be very interesting since they correspond to the suspected binary periods of some Be stars (e.g. Phi Per and Zeta Tau). These variations can potentially cause confusion in the interpretation of year-to-year changes, so it is important that they be studied carefully. This may be difficult since it will require scheduling of telescope time in an unusual way.

From January 1986 to January 1988, Zeta Tauri and Gamma Cas have shown the largest changes in polarization, and we will confine our discussion to only the year-to-year variability of those two stars. In both cases, analysis of the polarization variation is simpified by the fact that there is little if any interstellar component.

The polarization of Zeta Tauri strongly decreased from 1986 to 1987, then decreased by a smaller amount from 1987 to 1988. For Gamma Cas, we noted a large increase in polarization from 1986 to 1987, followed by a decrease of about the same amount from 1987 to 1988.

In looking for an emission line profile parameter to correlate with the polarization, we have so far considered only the grossest features. For the H-alpha line of Zeta Tauri, the peak intensity and the equivalent width are not well defined, because of the presence of a deep central absorption component. Also, the changes in the inner part of the line profile appear very complicated. Theoretically, the model of Poeckert and Marlborough (1978) for the H-alpha line profile and polarization of Gamma Cas indicates that 70% of the continuum polarization arises from the inner part of a flattened disk component of the CSE within 3 stellar radii of the star. The model shows that this region of the CSE is also the source of the H-alpha emission line wings, so that in comparing the continuum polarization with the wing intensity, we may in fact be observing the same material. It should be noted that Baade (1987) reported a correlation between a transient change in continuum polarization and a small feature in the H-alpha emission line wing in Omega Orionis.

We find that the two polarization decreases of Zeta Tau are indeed matched by decreases in emission wing strength of corresponding amounts. Unfortunately, this simple interpretation does not fit our observational data for Gamma Cas. The polarization increase of 1986-1987 is accompanied by an increase in the H-alpha wing intensity, but the wing intensity continues to increase from 1987 to 1988 while the polarization drops. One possible explanation for the absence of a correlation may be that the CSE electron density of Gamma Cas is now much greater than at the time of the PM model fit, as evidenced by an increase in the H-alpha peak intensity by almost a factor of two. For very high electron densities, multiple scattering (not included in the model) could decrease the polarization by removing singly scattered polarized photons from the line of sight. However, we have not yet subjected this idea to a rigorous quantitative test.

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"Be-like" phenomena observed in early-type non-Be stars

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It is tempting to think of Be stars as something special, given their numerous pathologies:

- variable spectral flux distribution;
- infrared excess;
- variable strength of emission and circumstellar absorption lines;
- strong (up to 1-2%) and variable continuum polarization;
- variable mass loss rates, including events;
- ionization stages both below and above the photospheric one(s) under LTE;
- discrete components of wind lines;
- cyclic V/R variations of double-peak emission lines;
- super-Keplerian width of Hα emission profiles;
- variable photospheric line profiles with traveling multiple components (LPV);
- periods and timescales from hours to years.

If a star fulfills *all* these criteria, there is a good chance that it will be rather similar to γ Cas and other 'classical' Be stars (but note that the latter may be a philosophical ideal rather than physical reality). A more interesting question would be which minimal subsets would have an equivalent filtering effect on a representative sample of early-type stars. As single criteria, only the collinear variability of the polarization and the occurrence of variable-amplitude, low-order LPV have been named in addition to the characteristic phase transitions such as Be ⇒ shell ⇒ B-normal. But a systematic observational check on the two former suggestions is still pending. Among all three, LPV is the only non-circumstellar phenomenon and has only been claimed relative to Bn stars. This shows how important it may be to study both Be and non-Be stars.

The purpose of this little note is to emphasize this point and, in particular, serve as a reminder that every single one of the above pecularities is also found in other early-type stars. It is very instructive to verify this long-known fact from a detailed comparison of actual observations for which the space available here unfortunately is insufficient. An attractive further step is to construct from this comparison new combinations of models and objects. Here only two examples shall be given, but a systematic survey, also involving more than two of the items above, may prove very inspiring.

- The variability of the polarization is for a given (single) Be star usually collinear in the Stokes Q-U plane. This is usually attributed to a flat equatorial envelope. In many OB supergiants, however, the polarization vector seems to follow a random path in the Q-U diagram. Most Be stars undergo cyclic long-term V/R variations of their doubly peaked emission lines. Some models explain this as being due the precession of a geometrically thin elliptical ring of circumstellar material. Similar variations of the Hα emission line profile can be seen in some much more slowly rotating mid- to late B supergiants. For them, there is no compelling reason to suspect a disk as the place of formation of the line emission. Corotating structures, too, do not appear very likely as a general explanation. Can, then, this comparison be used to suggest a radial rather than azimuthal perturbation as the cause of the V/R variability in Be stars?
- Some of the more rapidly rotating early-type supergiants display in their Hα emission also short-term V/R variations which seem to be coupled to the photospheric line profile variability. In Be stars this phenomenon is ubiquitous, and all attempts of an explanation place the action in a circumequatorial region. Since at least in some of those supergiants the Hα emission is rather broad, one may well ask if the disk concept is also applicable to some supergiants.

If the answers to these questions have to be negative, interesting repercussions may still arise for those stars whose interpretation had been thought to be the more secure one.

CONTRIBUTIONS

* * * * *

UV Monitoring of Bright Be Stars

C. A. Grady
Astronomy Programs, Computer Sciences Corporation

IUE observations of a small group of bright Be stars resumed on 1988 September 9, and will continue into early 1989. The primary target for the current season is HD 58978 (HR 2855, FY CMa). Our goal for the this campaign is to confirm the 138-139 day period inferred from N V and Fe III variability. We will be observing on October 24, November 13, and December 18, 19, 21, 22, and 23. The remaining IUE observing time will be scheduled in January through March 1989.

Quick-look inspection of the 1988 September 9 data showed that 59 Cygni is still in a strong wind state. λ Eri shows only weak wind absorption. 66 Oph showed moderately strong wind absorption, but still weaker than has been typical of past strong wind episodes. 6 Cep showed strong high velocity discrete absorption components.

HD 58978: Our current analysis is focussed on determining how much of the complex line profile variability is tied to the 138-139 day period determined from the low velocity N V and Fe III equivalent widths. Analysis of the continuum fluxes near 1250 Å has shown that the stellar flux has varied by 50%. The mean flux distribution from 1150-1950 Åis indistinguishable from normal B0.5 stars, except for the strength of the N V, C IV, Si IV, and Si III resonance lines and some of the metastable lines which are dominated by absorption from the circumstellar region. An IUE spectrum taken on 1988 March 20 was 24% below the mean continuum flux at 1250 Å, showed a larger flux deficit at shorter wavelengths, and a smaller deficit at longer wavelengths. The line spectrum in this observation showed lower ionization stages than are normally observed, with Fe III, C II, and Al III showing outflow (normally only stationary or infalling absorption is present) with velocities up to -100 km s^{-1}. The more highly ionized resonance lines also showed a decrease in overall wind ionization, with weak N V, and stronger C IV and Si IV than are typically seen. Inspection of the continuum fluxes in the 1987 March 6 and 1987 May 3 observations reported by Peters (1988) shows that the continuum flux was brighter than expected for a normal B0.5 star from approximately 1987 January through 1987 May. The flux distribution had returned to a normal B0.5 distribution by 1987 September.

With the focus on HD 58978 for the remainder of 1988, and the addition of low dispersion monitoring to obtain accurate spectrophotometry for this interesting star, we will be unable to acquire observations of additional Be stars, unless the star is undergoing truly spectacular variations.

A STUDY OF Be AND B SHELL STARS IN THE NEAR INFRARED

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This work is a continuation of our paper in Astron. Astrophys. Suppl. **72**, 129 (1988). Some thirty Be and B shell stars were observed at the Haute-Provence Observatory with the 193 cm telescope, with the Carelec spectrograph and a CCD receiver in February 1988. The plate factor is 33 $A.mm^{-1}$ and the wavelength region covered $\lambda\lambda$ 8300-8800 A.

A detailed discussion confirms and extends the results of our previous paper which was based on a somewhat lower plate factor, namely 50 $A.mm^{-1}$, and reported results on forty stars.

The main conclusion drawn from the seventy five stars may be summarized as follows.

Paschen series. Emissions are concentrated mostly in early-type stars as the following table shows

	N	E	%
B0 - B2.5	29	25	86
B3 - B5	20	11	55
B6 - B9	19	2	10

with N = total number ; E = number of stars showing emissions.

Usually emissions show a double structure, but in later type stars only weak emissions are seen which do not reach the level of the continuous spectrum. The comparison between the Paschen and Balmer series emission shows that in general emission is visible in higher Paschen lines than in Balmer lines: emission in n = 7 corresponds approximately to emission in P25 and n = 3 to P17.

Neutral oxygen. λ 8446 is seen in emission in 70% of the stars; the percentage is somewhat larger in the early-type stars. The strength of the OI emission is correlated positively with that of H-alpha, confirming thus the result of Kitchin and Meadows (1970). A correlation seems to exist also with the strength of the IRAS infrared excess as given by Cote and Waters (1987), larger excesses corresponding to the stronger emissions.

Ionized calcium. This species is only seen sporadically in emission ($\lambda\lambda$ 8498, 8542 and 8662). We find it in 29% of all stars, with a somewhat larger percentage in early B-types ($\leqslant$ B5). If Ca II emission is seen, Paschen is also in emission (but not vice-versa). In an earlier paper (Jaschek et al., 1988) we found a positive correlation between the presence of Ca II emissions and the amount of IRAS infrared excess; when the excess is large, Ca II is present and when the excess is small ($\leqslant 0^m6$) no Ca II is present. With more material this correlation is well confirmed. We find:

Infrared excess > 0^m6 in 33 stars
- with ca II in emission : 22
- impossible to conclude: 11
- Ca II definitely absent: 0

Infrared excess < 0^m6 in 31 stars
- with Ca II in emission : 2
- impossible to conclude: 1
- Ca II definitely absent : 28

Neutral nitrogen is represented in this region by a number of rather weak lines from M.1 and M.8. It is found in emission in about 30% of the stars, but a detailed breakdown shows the proportion to be larger in early-type stars.

	N_T	E	%
B0 - B2.5	29	17	59
B3 - B5	20	5	25
B6 - B9	19	0	0

Variability. From a comparison of our observations of 1982-83 taken with a lower plate factor (230 A.mm^{-1}) and the present ones we conclude tentatively that seven stars out of nineteen show a significant variation. Six of these are of early-type ($\leqslant$ B3) -the only later one is Pleione. This is somewhat contrary to what is seen in the blue where variations are most frequently seen in B3-B5 stars (Jaschek et al., 1980).

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INFRARED SPECTRA OF Be STARS

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A group of bright B and Be stars($m_v < 6$) was observed in the visible and infrared spectral ranges at the 160cm telescope of the LABORATORIO NACIONAL DE ASTROFISICA (LNA/ON/CNPq/MCT) with the CCD-GEC of INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS (INPE/MCT). The dispersion was 0.4 A/pixel, the spectral coverage 220 A and the resolution 10000. The S/N attained 500 at H-alpha and 30 at 11000 A.

I measured the following features: H-alpha, H-beta, the most prominent FeII lines, OI 8446A together with the neighboring CaII lines and higher members of the Paschen series, and other lines not systematically surveyed.

In the Infrared, the most interesting result was the discovery of a very prominet FeII emission line at 9997A, that seems to be stronghly correlated with Paschen delta (fig. 1).

The HeI 10830A was seen in emission in some early Be stars, but its intensity does not appear to correlate with Paschen gamma (fig. 2).

The spectral range 10850-11000A was surveyed in other bright early type stars. The measurements could be done also during the day, but the 14 optical surfaces of our Coude spectrograph, not optimized to the infrared, prevented us from performing a more complete survey.

The reduced spectrum of Eta Cen= HD127972 (fig.3), taken when the Sun was well above the horizon, shows a prominent shell feature in HeI 10830A, besides Paschen gamma and other unidentified photospheric lines.

Present adress: Consiglio Nazionale delle Ricerche
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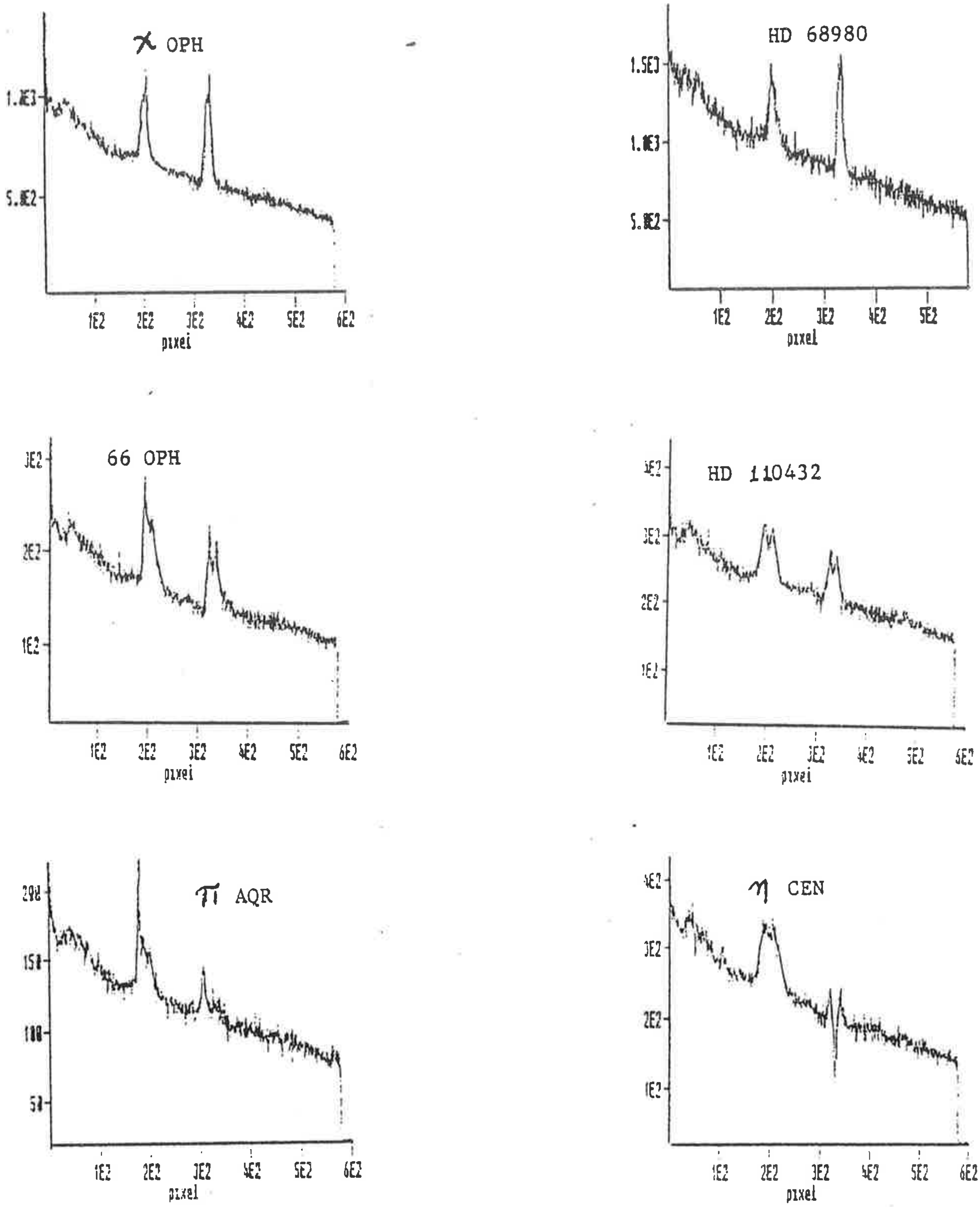

Fig. 1 - The FeII 9997Å and Pδ 10049Å lines.

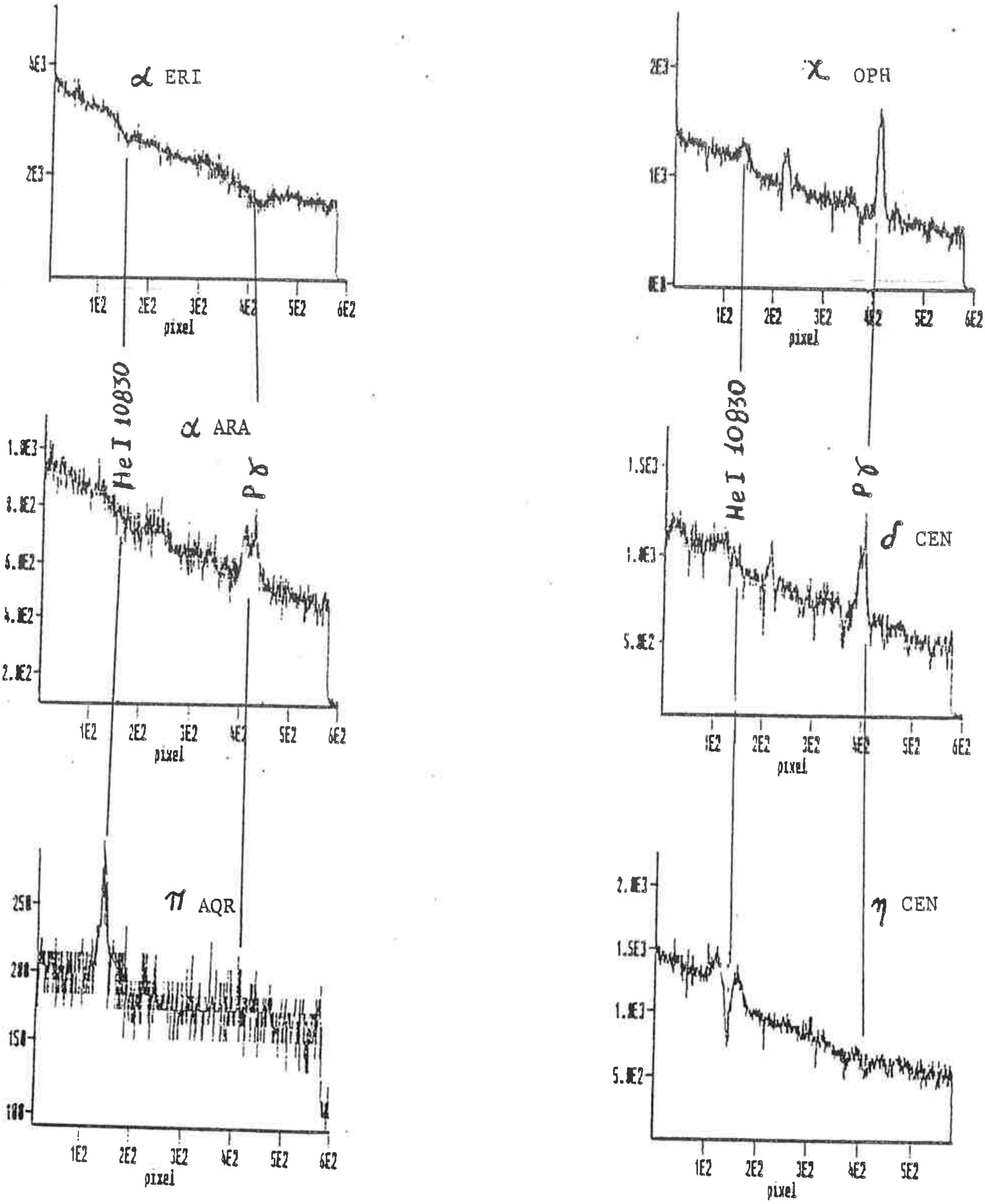

Fig. 2- The HeI 10830Å and Pγ 10938Å lines.

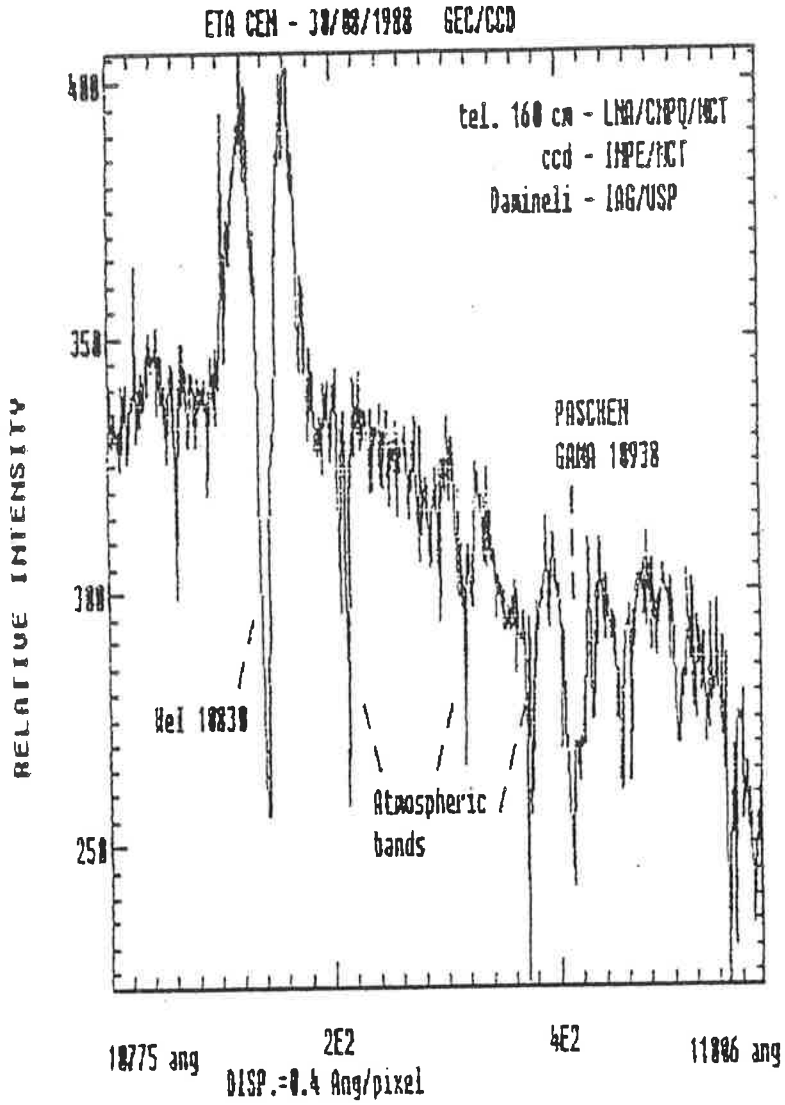

Fig. 3 - The spectrum of Eta Cen in the range 10775-11006Å.

The Spectrum Variations of Pleione During 1983-1987

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Beijing Astronomical observatory

Academia Sinica

Pleione is one of the most well known Be stars in the northern sky. Since late in the 19th century the star has passed successively through its Be, B, Shell and Be phases before the present shell stage (see Pickering, 1889-90; Frost, 1906; Mohler, 1938; McLaughlin, 1938; Delplace and Hubert, 1973; Morgan, White and Tapscott, 1973). The current shell phase of Pleione started in 1972-73 (see Garrison and Gulliver, 1973; and Morgan, White and Tapscott, 1973).

The Be star group of Beijing Observatory has been monitoring Pleione with the grating spectrogroph attached to the 60/90 cm Schmidt telescope of the Beijing Observatory since the end of 1983. 27 spectrograms of the star at 50Å/mm were obtained to date. They cover a wavelength range of $\lambda\lambda$3500-6500Å. To illustrate the spectral changes three spectragrams have been chosen from the whole material available. These have been digitized with the PDS microdensitometer of the Purple Mountain Observatory with a step of 3μ, then the densities have been converted into intensities on the PDP computer of the Observatory with the Tololo-Vienna interactive image processing system.

From our observations it can readily be seen that the spectra of Pleione showed conspicuous variations during 1983-1987:

1. The metallic shell lines were strong in Dec. 1983. Then

the lines gradually weakened. Most of them became almost invisible in Dec. 1987 (see Figs.1,2).

2. The Balmer absorption lines gradually became diffuse, and the lines of higher quantum numbers were the first to do so. The intensity of the shell components also apparently decreased with time(see Fig.1).

3. the shell absorption components of the H_β lines were strong between 1983 - 1985. The shell absorption component weakened considerably with time because of the strengthening of H_β emission. The H_β shell absorption completely disappeared while its emission component became prominen in Dec. 1987(see Fig.2).

4. The emission at H_α turned out to be double and became appreciably stronger during the same time interval. Its central reversal became, however, steadily more shallow in the same period(see Table 1).

It can be seen from the above description that the current shell phase of Pleione which began from 1972-73 appears to be ending slowly. Pleione seems to be in a transition stage from a shell towards a Be phase. Continued observation and analysis would be of great interest.

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TABLE 1

The variations of V and R components and central reversal of the H_α emission line

Plate No.	Date (UT)	Iv	Ir	Ic
SA 1334	1983 Dec 18	2.37	2.37	0.86
SA 1449	1985 Jan 19	2.58	2.44	1.11
SA 1485	1987 Dec 7	2.97	2.78	1.99

Iv, Ir, and Ic represent intensities in the unit of the continuum.

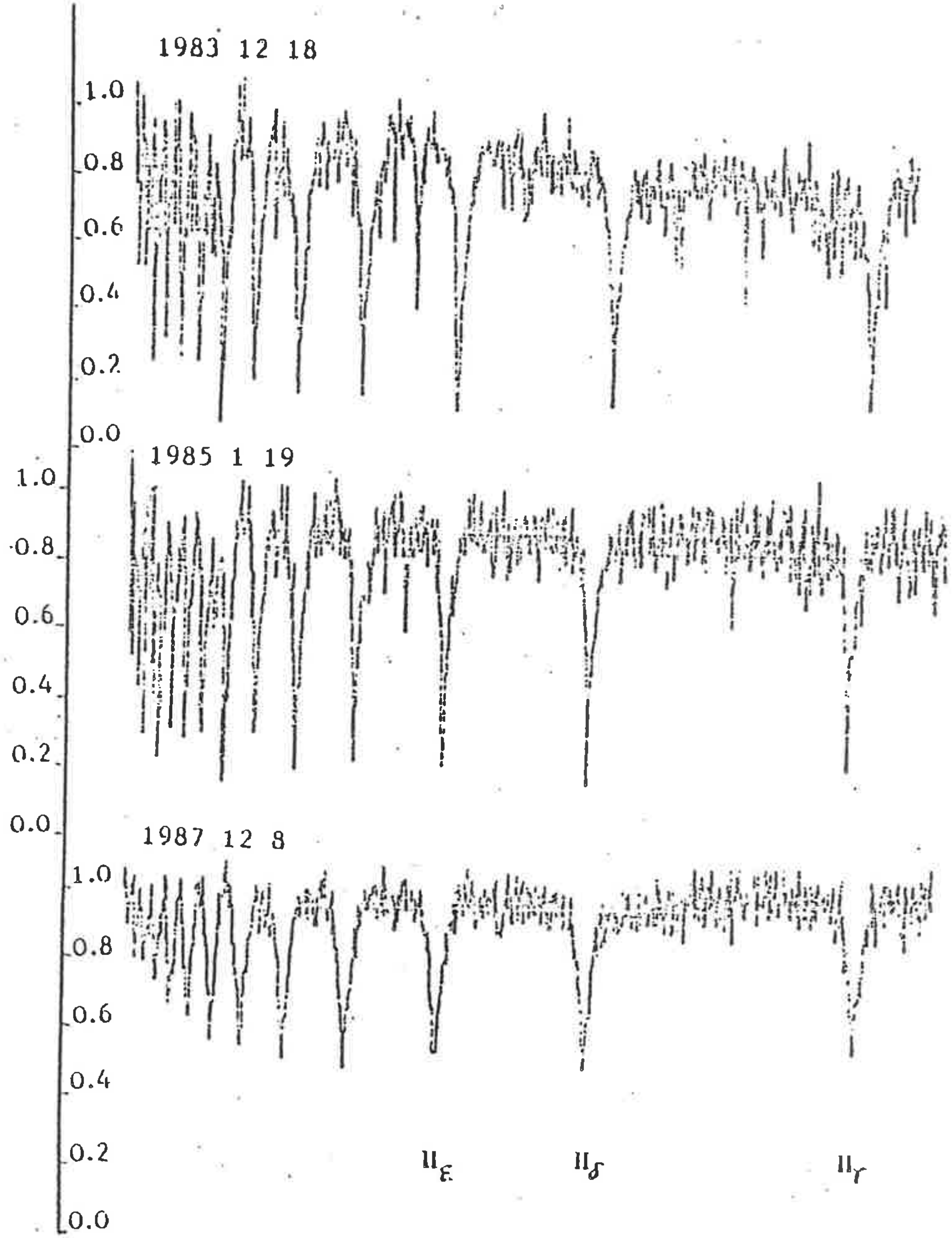


Fig. 1. Intensity tracing of the spectra of Pleione, λλ3690–4390Å

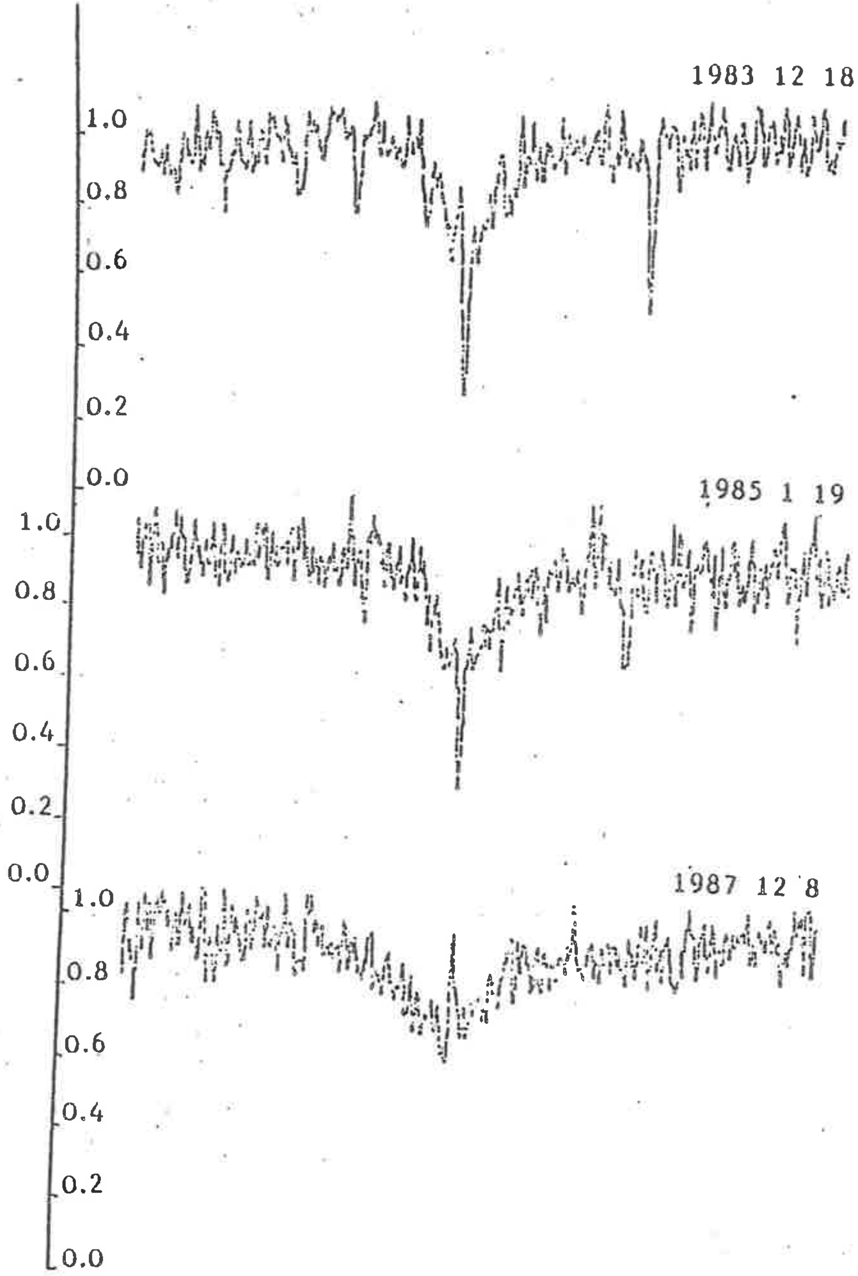


Fig. 2. The H_β profiles Of Pleione

W H A T ' S   A C T I V E / I N A C T I V E ?

* * * * *

RECENT Hα OBSERVATIONS AT KITT PEAK NATIONAL OBSERVATORY

This report represents a continuation of a series of updates on the changes in Hα and He I 6678 in selected Be stars of current interest to the community. Observations were made with the Coude Feed Telescope at KPNO from 1988 November 4 - 8 with the RCA2 CCD detector and camera No. 5. The RCA2 CCD gives half the spectral resolution and a larger readout noise than does the TI3 CCD detector, which was used for the observations reported in previous issues of the *Newsletter*. The resolution for a line width of 2 pixels is 0.89Å, while the S/N for the observations range from 50 - 125 averaged over twenty pixels. The observations described below will be compared with those reported in Issue No. 18 of the *Be Star Newsletter* (*BSN18*) from an observing run in 1988 May.

γ Cas - The peak intensity of Hα was 4.3±0.1, comparable with its value in 1987 August and 1988 May (*BSN18*). The profile of the emission feature continues to be triangular and a weak core or inflection is still evident on its red side. He I 6678 is completely filled with emission, however there is V component with a peak intensity of 1.035 ± 0.01. The emission in both lines appears to be *slightly* weaker than reported in *BSN18*.

28 Tau - Strong, double Hα emission, 5.0 I_c, was observed. The profile was symmetrical with a central core at 3.3 I_c (the actual core might be deeper, see comments above on the detector used for the observations). He I 6678 was a shallow absorption feature flanked by very weak, double emission (1.01 I_c).

HR 2855 (FY CMa) - Hα was a symmetrical, double emission feature with V = R = 1.85 I_c. He I 6678 showed an inverse P Cygni profile with V = 1.05 I_c and a core with a depth of 0.93. No statistically significant variations were seen throughout the observing run; the star appeared to be unusually quiescent.

66 Oph - The Hα emission in this star continued to increase, even though its wind (seen in the C IV resonance line) was weak in 1988. A peak intensity of 8.4 ± 0.1 was observed, compared with 8.1 in 1988 May. The line was fairly symmetrical, except for some absorption on its red side. R. C. Dempsey, University of Toledo, observed Hα to decrease from 8.6-7.0 I_c between early May and early July (during which the wind showed a minimum presence). The feature remained at its minimum strength throughout July, then grew to an intensity of 8.1 I_c by mid-September. The latter data were obtained at the Ritter Observatory with an intensified Reticon detector. The KPNO observations in November showed He I 6678 to have a P Cygni profile with R = 1.04 I_c.

59 Cyg - The Hα emission feature continued to show a peak intensity of 1.8 I_c with V/R = 0.9. Weak double emission is still evident in He I 6678 with R > V. On November 5, R = 1.02 I_c, but on November 8 the R component had increased to 1.05 I_c. Variability on a time scale of days continues to be observed in the He I line. Violet-shifted absorption extended to -500 km s^{-1}.

ε Cap - This Be-shell star shows a double Hα emission feature with V = R = 1.30 I_c and a core depth of 0.48. Compared with the observation reported in *BSN18*, it appears that the shell is again strengthening. The He I feature was slightly narrower than reported in *BSN18* (FWHM was 8.25 Å, compared to 9 Å seen in May) and its central intensity had increased to ≈ 0.84. The profile displayed nightly variations indicative of nonradial pulsations or azimuthal asymmetry in the shell.

π Aqr - The spectrum of this star has definitely undergone a change since 1988 May. The Hα emission feature has weakened a bit (4.5 ± 0.1 I_c), a weak core has developed, and there is substantial absorption on its red edge. He I 6678 is now a rather impressive double emission feature with V/R = 1.05 ± .01. Nightly variations in the line were evident and V = 1.13 I_c.

ο And - It appears as if this star is entering another major shell phase - see below.

* *

ANOTHER SHELL PHASE FOR ο ANDROMEDAE

After a number of minor emission line episodes, ο And A appears to be entering another major shell phase similar to the one that began in mid-1975. One of my observations obtained at KPNO on November 5 is shown below. Note the conspicuous emission in Hα and the deep core (r_ν=0.41). Comparing the recent observation with one obtained with the TI3 CCD at KPNO in 1988 May (also shown below), one can see that the core in Hα has become deeper. While emission filling was evident in May, no emission at or above the continuum was seen. Further compare the 1988 observations with a representative one from 1987 August (below) in which the core in Hα was 0.6 I_c.

IUE observations of ο And also confirm that it is in a shell phase. Observations on 1988 August 19 revealed enhanced shell absorption in all moderately ionized species (e.g. Si II, Fe III), C IV emission, and a lower FUV flux level (about 0.90 its value in 1987 August). A slight color dependence is evident (the flux is more depressed at the shorter wavelengths, ranging from 0.87 - 0.92 between λ1250-3200).

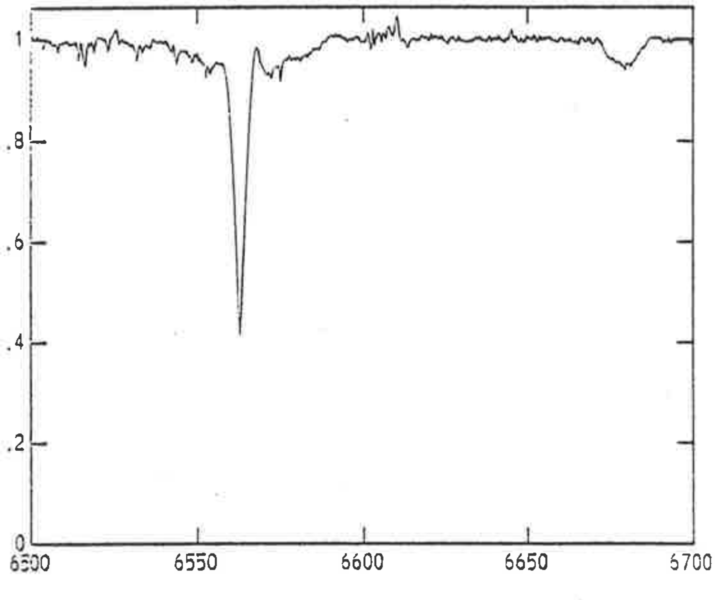
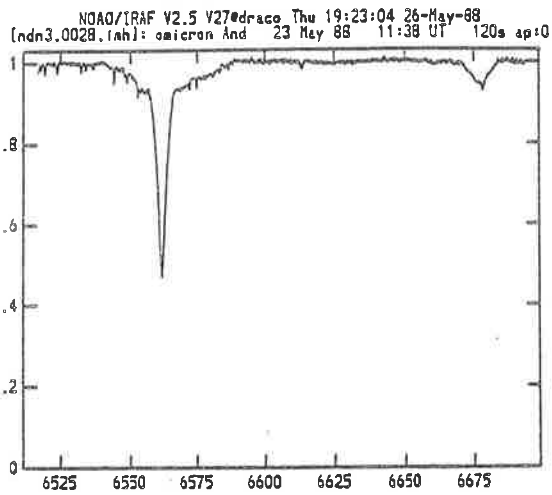
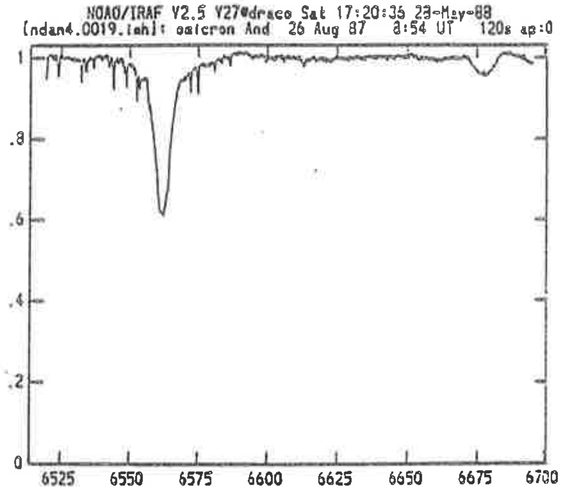


Fig. 1 - Hα and He I 6678 observed in ο And at KPNO on 1988 November 5. A similar observation a day later showed stronger Hα emission overall with a conspicuous V component and an R intensity reaching the level of the continuum.





Wavelength (Å)

Figs. 2 and 3 - Hα observations of *o* And in 1988 May and 1987 August show the early stage of the shell development and the spectrum before the recent activity. Data are from the Ti3 CCD detector.

G. J. Peters, Space Sciences Center, USC, Los Angeles, CA 90089-1341; USA.

* *

More on *o* And: Only hours before the mastercopy of this issue of the *Newsletter* prepared by Gerrie Peters arrived in Garching, I received a copy of a manuscript submitted by P. Harmanec, P. Hadrava, Ž. Ružić, K. Pavlovski, H. Božić, J. Horn, and P. Koubský to the *IAU Comm. 27 Inf. Bull. Var. Stars*. They diagnose the probable development of a new shell phase from V-band photometry obtained in 1988 July, August, and October at the Hvar Observatory in Yugoslavia. The authors report a change from initially erratic variations to a double-wave lightcurve (P = 1.557 day) of increasing amplitude. (But with only between 15 and 22 observations the three light-curves shown are not very well defined.) Since the authors had previously found that the short-term variability of this complicated multiple system attains the largest amplitude during shell phases, this announcement, which is still described as preliminary, appears as one of the most interesting ones for Be stars within the past couple of years. Detailed further observations of all kinds are extremely important.

Dietrich Baade.

* *

Myron Smith (Astronomy Programs/Computer Sciences Corporation, Goddard Space Flight Center, Greenbelt, MD 20771, USA) reports: "Observations of the B8Ia star β Orionis obtained with the Ti4 CCD detector and the McMath telescope at Kitt Peak National Observatory on November 13, 14, and 15 reveal the presence of P Cygni H-alpha emission with a peak strength of 1.12 I_c, and they show no change over that 48 hour period. No changes were observed in the C II doublet at λλ6578-82, which are conspicuously in absorption." An observation which I obtained eight days earlier with the RCA2 CCD and the Coude Feed Telescope showed an R emission component of 1.04 I_c (*ed*).

OBSERVATIONS....THEORETICAL SUPPORT....WANTED/AVAILABLE

* * * * *

S. M. Dougherty, Department of Physics, University of Calgary, 2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4, writes:

Russ Taylor, Rens Waters and I have recently detected Beta CMi (HD 58715) at 2cm using the VLA. We are interested in any information on the strength and profiles of the Hα emission line in Beta CMi between 1980 and the present day. Information should be forwarded to me at the above address or by electronic mail to SMDougherty@UNCAMULT.BITNET.

* *

I continue to be interested in any information on the strength and profile of the Hα emission line in 66 Oph and HR 2855 (FY CMa) during the past twenty years. I would also appreciate any photometric data that are available.

Gerrie Peters

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PREPRINTS RECEIVED

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The Vanishing Shell Phase of Pleione in the Far UV in 1988

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To be published in: *Astronomy and Astrophysics* (1988 October II issue)
Preprints: V. Doazan at the first address.

Abstract: Far UV observations made with the IUE in 1988, when the shell spectrum of Pleione was vanishing in the visible region, are compared with previous IUE observations made when the shell was strong (1979) and when it began to weaken (1985). Between the epochs of strong shell and vanishing shell: (i) The continuum level increases in all the observed far UV spectral range (1200-3000 Å), the largest increase occurring at shortest wavelengths. (ii) The C IV and Si IV resonance lines, which were not detectable during the epoch of strong shell, are identified without ambiguity in this B8Ve star when the shell spectrum vanishes. (iii) When the shell spectrum is strong, the Mg II resonance lines exhibit a strong, broad absorption. When the shell spectrum vanishes, this absorption is much weaker and the Mg II doublet shows double emission peaks with deep absorption cores, as is often observed in Be/shell spectra.

The First Decade of Envelope Formation in 59 Cygni in the Far UV and Optical Regions. II.

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To be published in: *Astronomy and Astrophysics*
Preprints: V. Doazan, at the first address.

Abstract: This paper II presents coordinated far UV and optical observations of 59 Cyg made in 1983-87. These observations, combined with those published in Paper I, describe the behavior of the entire atmosphere of 59 Cyg during the first decade of formation and evolution of a new cool Hα-emitting envelope. These data delineate an entire episode composed of a series of organized changes in: (a) the size of the mass outflow from the star - as diagnosed from the C IV resonance lines observed in the far UV; (b) the mass content of the cool Hα emitting envelope - as diagnosed from the emission at Hα; (c) the kinematic behavior of the cool envelope - as diagnosed from the V/R changes of the Hα emission line. Between the beginning and the end of this episode, there is a net increase in both the mass outflow from the star and the envelope's mass content. This increase did not proceed in a smooth and regular way but through a sequence of cyclic changes of the mass outflow from the star, the envelope's velocity distribution and mass content.We discuss the modelling implications of the variability patterns delineated by the subionized and superionized spectral features and show that these patterns can be understood if: (i) the mass outflow from the star is strongly time-dependent; (ii) there exists a strong interaction between the mass outflow from the star and the cool Hα-emitting envelope. These two conclusions are the basic assumptions of the Doazan and Thomas model.

Atlas of Far UV and Optical Spectra of Be Stars
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To be published by: European Space Agency in 1989.
Preprints: V. Doazan, at the first address.

Abstract: An atlas based on all the high resolution IUE archived spectra (≈1200) of Be stars is in preparation. It will be published by ESA in 1989. This atlas is intended to be a tool for future research and planning new ground-based and space observations. It will contain information on about 120 Be stars. It will present for each Be star observed on the high resolution mode with IUE: (i) A summary of its long-term variability and references, (ii) Several figures illustrating the variability of the far UV spectrum, and (iii) Balmer emission-line profiles.

Highly Ionized Stellar Winds in Be Stars: II. Winds in B6-B9.5e Stars
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To be published in: *Astrophysical Journal* (1989 April 1 issue).
Preprints: C. A. Grady, at the first address.

Abstract: We present the results of an ultraviolet survey of stellar winds and circumstellar shells in 40 B6-B9.5e stars covering luminosity classes V-III. We find a continuation of the $v \sin i$ threshold for the detection of C IV reported by Grady, Bjorkman, and Snow (1987), with C IV detected only in luminosity class V stars with $v \sin i \geq 200$ km s^{-1}, and in luminosity class IV-III stars with $v \sin i \geq 140$–160 km s^{-1}. Narrow absorption cores in the excited state line of Si II λ1533.4, which are indicative of the presence of a cool circumstellar envelope or "shell" are found in several of the program stars. With the exception of HD 23630, all of the detections occur in stars with $v \sin i \geq 200$ km s^{-1}. Comparison of the ultraviolet data with published infrared color excesses, optical polarization data, and optical line profile atlases shows that these datasets have similar thresholds in the vicinity of 150-200 km s^{-1}, indicating that the Be phenomenon in B6-B9.5e stars is similar to that observed in hotter and more luminous stars. The C IV absorption in nine of the program stars is produced in one or more shortward-shifted discrete absorption components, similar to those seen in earlier-type Be stars. Three of the program stars have shown unambiguous variability in C IV in the course of IUE monitoring, suggesting that the highly ionized material is produced in a stellar wind.

Towards Understanding Rapid Line-Profile and Light Variations of Early-Type Stars. 1. General Considerations and a Critical Reanalysis of the Data on 13 Oph and 45 Per

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Submitted to: *Bulletin of the Astronomical Institutes of Czechoslovakia*
Preprints: P. Harmanec at the above address.

Abstract: The problem of rapid spectroscopic and photometric variability of OB star is briefly reviewed and critically discussed. Two different interpretations of these variations are nonradial oscillations and star spots or patches. While the proponents of the nonradial pulsation model mainly argue from spectroscopic evidence, the critics of the model have chiefly dealt with contraindications based on the character of the photometric variations observed. This paper is devoted to a detailed critical reexamination of available observational data on the two well-observed OB line-profile variables 13 Oph and 45 Per with emphasis on the spectroscopic results. It is argued that the original approach of investigating the radial velocity curves of the individual travelling features seen in the line profiles is the most appropriate method of first-level analysis and leads to a simple, unique determination of the true period(s) of variability with the following results: (i) Seven separate travelling features were identified for 13 Oph, which regularly reappear in the line profile with a period of 0.64308 days, with their spacing being approximately, but not exactly regular. (ii) Similarly, three strong features, with another three (weaker) "inter-features" regularly reappear in the line profiles of 45 Per with a period of 0.56664 days. The appearance of the three strong features seems to be accompanied by decreased of continuum light from the star. (iii) The four different spectroscopic periods, previously reported for 45 Per, are shown to belong to a family of frequencies associated with the 0.56664 day period. They probably result from the slightly uneven spacing and intensities of the travelling features. There is thus no strong reason to postulate multiperiodicity for the spectral variations of this star. (iv) Analysis of available velocity data indicates that 45 Per could possibly be a 14 day spectroscopic binary in a highly eccentric orbit, but a verification of this result from more high dispersion data is needed. (v) A detailed discussion of the most probable masses and radii for both investigated stars leads to the conclusion that the recurrent periods of the features found could be identified with the rotational periods of the stars in question, provided both objects are rotating near break-up (which is not so improbable given the presence of unusually strong travelling features in the line profiles of both stars). In this sense, the travelling features can be phenomenologically identified with (at least temporarily) stable surface equatorial (or nearly equatorial) "spots" carried over the stellar disk by rotation. (vi) It is suggested that these "spots" are, or may from time to time become, roots of "hills" or "spokes" of more (or less) dense circumstellar material, which is responsible for the spiralling inhomogeneities leading to the recurrent formation of the discrete absorption components seen in the UV resonance lines. They could also be responsible for the occasionally seen "extended wings" of the line. This highly speculative concept if tentatively proposed as a general working model for OB line profiles variables since its predictions can, in principle, be tested by simultaneous optical and UV observations.

The Possible Multiperiodic Variable Be Star KY Andromedae

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To be published in: *Astronomy and Astrophysics, Supplement Series*
Preprints: K. Pavlovski at the above address.

Abstract: Broad-band UBV photometric measurements of the variable Be star KY Andromedae obtained in September 1982 have been analyzed in search of possible periodicity. Periodogram analysis has shown that one dominant period of 0.751 day is present in the data. Further periods are tentatively identified, but possible multiperiodicity will still have to be confirmed with a larger data set. Besides the claimed multiperiodic variations, the color behavior is also similar to that of nonradial pulsators of the 53 Persei type. At least one other explanation is possible in terms of stellar rotation combined with irregular intrinsic circumstellar variations.

Rapid Photometric Variability of the Interacting Binary KX Andromedae

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To be published in: *Astrophysics and Space Science*
Preprints: K. Pavlovski at the above address.

Abstract: A frequency analysis of the broad band UBV photometric observations of the interacting binary KX And has been performed in order to disclose claimed rapid periodic variations. Our analysis confirms existence of rapid variability, but disagrees with the period. In discussion we rejected rotation as the possible cause of the rapid photometric variations, and found that some kind of pulsations offer a plausible explanation.

Photoelectric Monitoring of Bright Be Stars

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To be published in: *Publ. Astronomical Society of the Pacific*
Preprints: J. R. Percy at the above address.

Abstract: We describe and summarize our BV photometric observations of 34 bright, active Be stars, made at various times between 1981 and 1987 with a 0.4 m telescope at the University of Toronto. These observations demonstrate the photometric variability of Be stars on time scales of hours to years. Observers who wish to compare or combine these observations with other data on these stars may obtain them from the IAU Archives of Unpublished Photoelectric Observation of Variable Stars.

The Hα Emitting Regions of the Accretion Disks in Algols

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To be published in: *Algols (IAU Colloquium No. 107)*, ed. A. H. Batten (1989)
Preprints: G. J. Peters at the above address.

Abstract: The circumstellar plasma that produces Hα emission in Algol binaries has been investigated using phase-resolved, high dispersion data acquired from CCD and image tube detectors. Results are summarized in this paper, including discussions of the disk geometry and size, asymmetry in the distribution of material, long-term or non-phase dependent variability, mass outflow, the mean electron density, and how the latter properties vary with the system's period or location in the r - q diagram. Five systems which display permanent emission with periods ranging from 4.5 to 261 days (SW Cyg, UX Mon, TT Hya, AD Her, and RZ Oph) are intercompared. If $P < 4.5$ days, no permanent disks are observed, while if $P > 6$ days, stable disks with only slight long-term variations in their Hα brightness are seen. The most variable systems appear to be those in the 5-6 day range, but the star's position in the r - q diagram has the largest influence on its behavior. The *trailing* side of the accretion disk, where the gas stream impacts the inner disk, is usually brighter, and the *leading* side is often times more extended. The disk extends out to at least 95%of the Roche surface of the primary and is highly flattened ($\leq R_p$). Mass outflow near phase 0.5 is commonplace.

A Model for a Stellar Wind Driven by Acoustic Waves

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To be published in: *Astronomy and Astrophysics*
Preprints: F. P. Pijpers at the above address.

Abstract: A model for a stellar wind driven by acoustic waves in the linear regime is proposed. An equation of transport of momentum is constructed and its topology in the (distance, velocity)-plane investigated. For certain values of the parameters α, expressing the ratio of wave energy flux to thermal energy flux, and λ, the dissipation length of the waves, there are three critical points, one of which is an attractor. Velocity profiles are calculated for a star of $M = 16\ M_\odot$, $R = 400\ R_\odot$, and $T = 10^4$ K. Mass-loss rates ranging from 10^{-28} to $10^{-4}\ M_\odot\ yr^{-1}$ are obtained. Outflow velocities at 150 R_* range from 20 to 290 km s^{-1}.

B I B L I O G R A P H Y

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(Compiled by A. M. Hubert, J. Jugaku, P. Koubsky, G. J. Peters, and A. Slettebak)

Time-Resolved High-Resolution Spectroscopy of an H Alpha Outburst of Mu Centauri (B2IV-Ve)
BAADE D.- DACHS J.- VAN DE WEYGAERT R.- STEEMAN F.: AA **198**, 211 (1988)

The Shell Spectrum of Pleione: Radial Velocity Evolution between 1978 and 1987
BALLEREAU D.- CHAUVILLE J.- MEKKAS A.: AA Suppl. 75, 139 (1988)

Photoelectric Observations of γ Cas, X Per and BU Tau
BOEHME D.: IBVS No. 3222 (1988)

Ultraviolet Properties of IRAS-Selected Be Stars
BJORKMAN K.S. - SNOW T.P.: IUE10, Vol. 1, 401 (1988)

A Ten-Year "Active" Episode of Mass-Outflow from the Be Star 59 Cyg: Facts and Implications
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Spectroscopic Observations of H-alpha Emission Stars from the Stephenson and Stephenson-Sanduleak Lists
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Recurrent Shell Infall Events in a B0.5e Star HD 58978 1979-1988
GRADY C.A. - PETERS G.J. - BJORKMAN K.S. - HENRICHS H.F.: IUE10, Vol. 1, 257 (1988)

Mass Loss and Non-Radial Pulsations in Be Stars
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Rapid Variability in O Star Winds
HENRICHS H.F. - KAPAR L. - ZWARTHOED: IUE10, Vol. 2, 145 (1988)

A Quantitative UV Survey of O Star Winds
HOWARTH I.D. - PRINJA R.K.: IUE10, Vol 2, 141 (1988)

Pleione Again without Shell
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Optical Spectroscopy of the Be Star Associated With the X-Ray Transient EXO 2030+375 (RN)
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The Effect of Rotation on Stellar Wind Emission Lines
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Short-Term Wind Variability in the Nonradially Pulsating Be Star 28 Cygni
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Ultraviolet Spectra of Algol Binaries
PLAVEC M.J.: TERAM, 193 (1987)

On the Nature of the Component Stars in Beta Lyrae
PLAVEC M.J.: TERAM, 301 (1987)

Superionized Plasmas in Algol Binaries
PLAVEC M.J.: IUE10, Vol. 1, 221 (1988)

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Non Radial Pulsations and Early Be Stars: Angular Momentum Considerations
SMITH M.: ASSL. 148, 251 (1988)

A Unified Formula for Mass-Loss Rates of O to M Stars
TARAFDAR S.P.: APJ 331, 932 (1988)

Photographic UBV Photometry of Hα Emission in the Gamma Cygni Region
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51 Ophiuchi (B9.5Ve): A Be Star in the Class of Beta Pictoris Stars?
WATERS L.B.F.M.- COTE J.-GEBALLE T.R.: AA 203, 348 (1988)

Matter Streams in Semi-Detached Binary Systems
WONNACOTT D.: IUE10, Vol 1, 209 (1988)

Abbreviations used for the Publications

AA	Astronomy and Astrophysics
AA Suppl.	Astronomy and Astrophysics Supplement
AAS	Acta Astrophysica Sinica
AJ	Astronomical Journal
APJ	Astrophysical Journal
APJ Suppl.	Astrophysical Journal Supplement
ASS	Astrophysics and Space Science
ASSL	Proceedings of a Workshop held in Trieste, Italy, Sept 14-18, 1987, "Pulsation and Mass Loss in Stars", edited by R. Stalio and L. A. Willson (1988 Astrophysics and Space Science Library, Kluwer Academic Publishers)
BAAS	Bulletin of the American Astronomical Society
BAC	Bulletin of the Astronomical Institutes of Czechoslovakia
BASI	Bulletin of the Astronomical Society of India
CRASP	Comptes-Rendus de l'Académie des Sciences de Paris
IAJ	The Irish Astronomical Journal
IAUC	IAU Circular
IBVS	Information Bulletin on Variable Stars
IKAO	Izvestia Krimskoj Astrofiziceskoj Observatorii

IUE10	*A Decade of UV Astronomy with the IUE Satellite*, Proceedings of a celebratory symposium held at the Goddard Space Flight Center, Greenbelt, Maryland, USA (12-15 April 1988), ESA SP-281 (two volumes)
MNRAS	Monthly Notices of the Royal Astronomical Society
MSAI	Memorie della Societa Astronomica Italiana
OBS	The Observatory
PAAO	Publications of the Alma-Ata Observatory
PAJ	Pisma Astronomical Journal
PASJ	Publications of the Astronomical Society of Japan
PASP	Publications of the Astronomical Society of the Pacific
PBAO	Publications of the Beijing Astronomical Observatory
QJRAS	Quarterly Journal of the Royal Astronomical Society
RMAA	Revista Mexicana de Astronomia y Astrofisica
TERAM	Proceedings of the *Tenth European Regional IAU Meeting*, Vol. 5, ed. P. Harmanec, *Publ.Astron.Inst.Czech.Acad.Sci.*, No. 70 (1987)