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CONTENTS

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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Normally only one copy per institute will be mailed. By default, it will be sent to the institute's library; please name a contact person if this is not desirable.

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EDITORIAL

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With this twenty-first issue of the *Be Star Newsletter* we mark the end of the 1980s and nearly a decade of publication of noteworthy discoveries, status reports, timely information, and bibliographical material on Be and related stars for the astronomical community. This issue includes the usual Working Group Matters, Contributions, What's Active/Inactive?, Observations . . . Theoretical Support Wanted/Available, Preprints Received, and Bibliography. Thanks to all who sent contributions for this issue and I continue to be indebted to those who help with the bibliography. As always, if your recent paper is not listed (or cited incorrectly), I will mention it in the next issue if you call my attention to the omission.

Hα variations in several Be stars, including EW Lac, γ Cas, ψ Per, 66 Oph, μ Cen, and others are reported in this issue. We also publish a report on a workshop on Be stars that was held in La Plata, Argentina during the summer. Since the acquisition rate for new stellar data continues to accelerate with some obvious advantages as well as problems, we include a commentary on its distribution.

As we leave the 1980s behind I am reflecting on just how much progress there has been in Be star astronomy in the last decade. This has of course been aided by the availability of data from the *IUE*, *Voyager*, and *IRAS* spacecraft and the new high S/N detectors on ground-based telescopes but it is especially a result of the innovative researchers who have chosen to devote their time to Be stars. Although we entered the 1980s with but a slightly altered concept of the Struve model (with the interacting binary proponents in the wings), we leave the decade with a completely new view of the Be phenomenon and its complexity. I am very intrigued by the new idea that it is perhaps a combination of nonradial pulsation (the landmark model for the past decade), magnetic fields, rapid rotation, and the weak UV radiation field that enable a B star to lose enough mass that it displays a visible Balmer emitting envelope. Very few currently believe in critical (or even near critical) rotation or that all Be stars are mass transfer binaries, but we need to continue to search for the maximum V_{eq}/V_{cr} (and the dispersion in this quantity) and we have a challenge to find the signatures of interacting binaries among the general population of Be stars. We need to investigate whether mass loss induced from exterior processes is any different from that which originates from within.

Observations in the 1980s have revealed the violent nature of mass loss in Be stars. Transients in λ Eri and μ Cen and the high velocity narrow components in 66 Oph, γ Cas, 59 Cyg and others remind us that the surface of a Be star is a place that you would rather observe from a distance than in close proximity! I am encouraged by the theoretical progress that has been made toward explaining the global properties of the mass loss and look forward to further advancements. Since Be stars are one of those most active groups of stars, observations in the next decade are certain to lead to discoveries and provide ample challenges for the theoretical community.

The next *Newsletter* will be our tenth anniversary issue. I invite special

contributions, especially those of a historical nature. I would like to include highlights from the last decade with some insights as to where we are heading in the 1990s. Contributions of a controversial nature are encouraged. We anticipate that the anniversary issue will be distributed in April. Therefore, contributions for Issue No. 22 should be received by:

March 1, 1990

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

I wish you a happy holiday season, success in your research in the 1990s, and look forward to your input for the tenth anniversary issue.

I would like to thank the European Southern Observatory for their continued financial support and Nancy Wu, USC Space Sciences Center, for assistance with some of the typing.

Gerrie Peters, Editor

CONTRIBUTIONS

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ON THE DISSEMINATION OF SPECTRAL DATA

R. Viotti
Instituto Astrofisica Spaziale, CNR,
Frascati, Italy

New observational techniques and the large use of bigger and bigger computers are largely contributing to the progress of Astronomy. New results spur new studies, but frequently we are hindered from our research by the poor availability of the results. For instance, only in recent times papers devoted to the analysis of spectra give extensive lists of line intensities or equivalent widths, which can be used by other researchers for a further analysis of the spectra, and to compare with new theoretical models.

In addition to the still poor availability of quantitative data of good quality, there is also the problem to put these data in our computers, which could represent a real problem in the case of very extensive data sets, unless these data are provided directly by the authors in form of files on tape or on floppy disks.

We therefore think that it should be of the greatest importance to encourage the dissemination of spectroscopic data (including observational data, theoretical models, atomic data, and so on). To perform this aim, these data should be available to interested persons from the authors themselves through the e-mail system, or from some Astronomical Data Centers, such as the CDS of Strasbourg.

Finally, we would like to inform you that the following files are available on request to the writer at the e-Mail address: UVSPACE@IRMIAS.EARN

1. Identification of the UV spectrum of Eta Carinae (1233-3228 A). Ref: Viotti et al. Ap. J. Suppl. in press (1989)

2. The optical emission line spectrum of Eta Carinae in 1949. Ref: Viotti, Internal Report of LAS (1967)

3. Identification of the optical spectrum of the symbiotic nova HBV 475 in 1969 (3238-6678 A). Ref: Baratta and Viotti, Astr. Ap. in press (1989)

4. The FeII lines in the UV spectrum of the VV Cep star KQ Pup (paper in preparation).

5. FeII Reference Catalogue. Ref: Viotti and Baratta, Astr. Ap. Supplem. Vol.75, p.497 (1988). Updated version.

Variation of the Hα line profiles of EW Lac

GUO YULIAN CAO HUILAI

We have been monitoring EW Lac with the grating spectrograph attached to the 60/90-cm Schmidt telescope at Beijing Observatory from 1982 to 1989.The spectrograms were obtained at 50Å/mm.These have been digitized with the PDS microdensitometer of the Purple Mountain Observatory and spectral datum reduced on the VAX 11/780 of the Beijing Observatory with the Starlink Imagine Processing Software.

It is seen from the Figure 1 that the Hα line profiles of the star appeared conspicious variations during our observed season:

(1) The intensity of the Hα line weakened considerable with time.

(2) The V/R radio of the Hα line was graeter than unity before the end of 1984, later smaller than unity.

(3) The Hα line profiles usually show double emission peaks and occasionally like three peaks structure, but the central reversal was sometimes deeper , sometimes shallower, evidently the most shallow on the end of 1984.

Above results show that the emission envelope of the star could be changing during the period of 1983-1988.

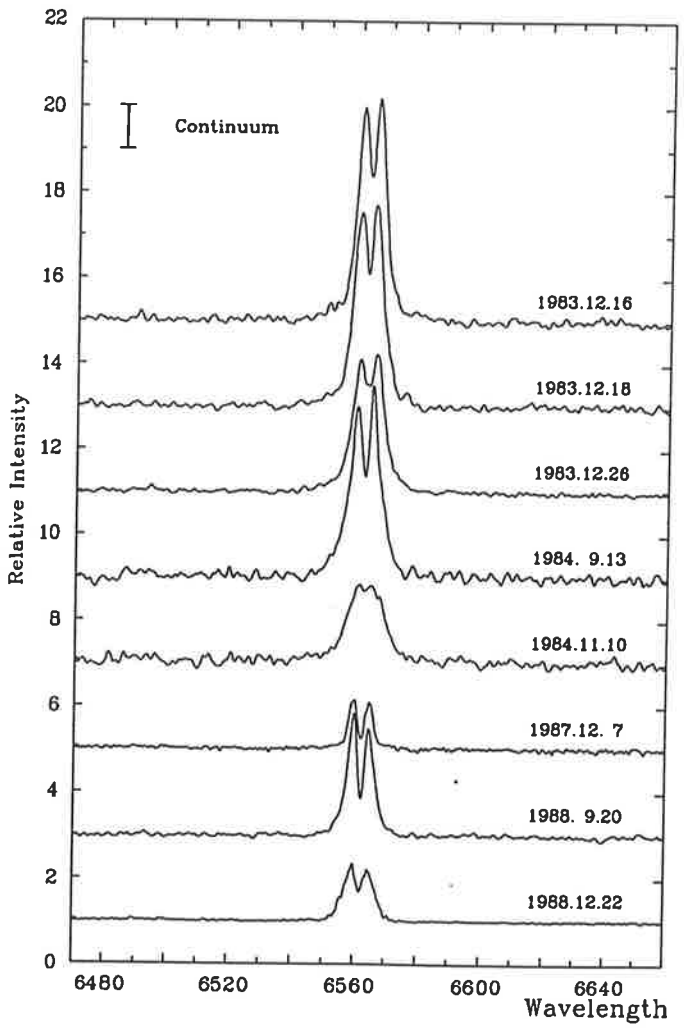

Figure 1. Variation of the Hα line profiles of EW Lac

WORKSHOP MEETING ON Be STARS
1989, JUNE 21-23
ASTRONOMICAL OBSERVATORY LA PLATA, ARGENTINA

Report, prepared by
A. Ringuelet, Observatorio Astronómico, Paseo del Bosque, 1900 La Plata, Argentina
and
N. Vogt, Grupo de Astronomía, Pontificia Universidad Católica de Chile,
Casilla 6014. Santiago, Chile

Argentinean and chilean astronomers working on Be stars held a 3-days informal Workshop in order to exchange information on actual programs and results obtained in each country, and to duscuss future coordinated work and cooperation. The Workshop was organized by A. Ringuelet, with the participation of E. Brandi, L. Cidale, A. Cruzado, M. Cuttela, A. Feinstein. H. Hernatiz, M.E. Iglesias, C. Marañon, L. Martorelli, N. Rotstein, J. Sahade and H. Tignanelli from Argentina and L.H. Barrera, R. Mennickent and N. Vogt from Chile. The meeting begun with a survey of instrumental possibilities in both countries, with reports on the spectroscopic and photometric facilities at Cerro El Leoncito (Argentinean National Observatory: E. Brandi, A. Feinstein) on speckle interferometry (L. Martorelli) and on spectroscopic observations at the Manuel Foster Observatory at Cerro San Cristóbal of the Catholic University in Santiago de Chile (N. Vogt). Further topics were broad band photometry projects, especially concerning Be stars in open star clusters (A. Feinstein) and the classification of Be stars based on IR photometry with the aim to separate them from normal B-type stars. Be stars seem to show an excess in the H filter, but normal emission distribution in all other IR filters (H. Tignanelli). A sample of 21 Be stars revealed a striking coincidence between photometric and rotation period, suggesting that spot structures cause the photometric variability (L.H. Barrera). Furthermore, a critical report was given concerning the classification schemes actualy in use for Be stars, whose value should be judged according to criteria based on information theory (H. Tignanelli).

Binary systems among Be stars may be more common than usually believed; in a sample of four southern Be stars three certain single-line spectroscopic binaries (HR 4009: P = $8\overset{d}{.}6, K_1 = 14\ kms^{-1}$; HR 4823: P = $42\overset{d}{.}2, K_1 = 10\ kms^{-1}$; HR 5683: P = $49\overset{d}{.}6, K_1 = 6\ kms^{-1}$) and one possible candidate for binarity (HR 4140: P = $23\overset{d}{.}6, K_1 = 5\ kms^{-1}$) were found. All companions have masses in the range $0.5 - 2M_{\odot}$. They are suspected to be either white dwarfs or late-type main sequence stars, in the case HR 4009 possibly a

neutron star (L.H. Barrera).

Observations of Balmer line profiles including V/R ratio, peak separation, total line width and equivalent width were analyzed as a function of spectral type, *vsini* and time. Early type Be stars (B0..B3) have envelopes rotating with angular moment conservation while later type stars (B4..B9) have essentially Keplerian orbits in their circumstellar discs. The sizes of the $H\beta$ emitting envelopes of several Be stars were determined, typically between 2 and 5 stellar radii. The V/R variations occur with typical quasi-periodic cycles of 6 years, for all spectral types and all envelope sizes, and < 1 year, only in cases with small envelopes $r_\beta/r_* < 3.5$ (R. Mennickent).

Concerning models of Be stars the argentinean group is investigating the possibility that chromospheric activities - expansion, rotation, dissipation of mechanical energy, etc. - in context with a weak global magnetic field (< 100G) are the principal profile determining mechanisms in the ultraviolet as well as (partly) in the optical spectral region (A. Ringuelet). Brief reports were also given on 3 Pup and HD 190073, (concerning the relation between chromospheric free-free emission and IR excess) on β Mon (analysis of the circumstellar material) and on theoretical calculations (line profiles based on plane parallel and spherical geometries, dissipation of energy in the chromosphere in presence of a magnetic field).

The actual and future perspectives on satellite observatories (IUE, ROSAT, Hubble Space Telescope, AXAF and others) were reviewed with a special emphasis on the possibilities to utilize the extensive data archives at NASA accessible also to latin american astronomers at low cost (J. Sahade).

The Workshop was concluded with an extensive discussion on possible cooperations. It was decided to combine IUE data with spectroscopic observations obtained during the past 5 years in order to discuss the behaviour of a significant sample of Be stars in a more systematic manner than usually done. In addition, joint proposals for observing time at the international observatories in Chile will be submitted in next future.

We acknowledge the support of the "Comisión Nacional de Investigación Científica y Tecnológica" (CONICYT) of Chile (Grant 369/88), the "Consejo Nacional de Investigaciones Científicas y Técnicas" (CONICET) of Argentina (Grant 7-017797/89) and of the La Plata Observatory.

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Hα OBSERVATIONS AT KITT PEAK NATIONAL OBSERVATORY

This report continues 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 1989 April 20 - 24 with the TI3 CCD detector and camera No. 5. The resolution for a line width of 2 pixels is 0.44 Å, and the S/N for the observations range from 100 - 200 averaged over twenty pixels. The observations described below will be compared with those reported in previous issues of the *Be Star Newsletter (BSN)*. As in previous reports, the V/R that is quoted is I_V/I_R (not the historical $(I_V - I_C)/I_R - I_C)$).

λ Eri - The conspicuous Hα emission that was seen in this star from mid-November 1988 to February 1989 (*BSN20*) was essentially gone by 1989 April 21. Only a trace of double emission could be seen in the core. The He I line showed variable structure indicative of high-order nonradial pulsations and/or transients but the advanced hour angle (>4^hW) precluded the intensive observation needed to diagnose the activity.

HR 2855 (FY CMa) - Hα displayed its usual centrally reversed emission profile with a peak intensity of about 1.85 I_C (V ≈ R with only slight variations over the duration of the observing run). He I 6678 showed an impressive P Cygni profile with R = 1.08 I_C (V emission below the continuum was seen).

μ Cen - See discussion below.

χ Oph - The Hα emission appears to have been constant at 8.5 ±0.3 I_C since 1988 May. The usual profile with weak cores flanking both sides of the profile prevailed. Slight emission filling is evident in He I 6678.

66 Oph - The secular increase in the Hα emission intensity continues. The peak intensity observed during 1989 April was a record 9.0 ± 0.1, but an observation at KPNO on 1989 June 7 (request night) revealed a strength of 9.5 ± 0.2 I_C. The red side of the line continues to display conspicuous absorption as reported in *BSN19&20*. CCD observations at the Ritter Observatory (supplied by R. C. Dempsey) during the period June 7 - August 12 show Hα intensities from 8.8 -9.4 I_C. He I 6678 remains unchanged from that reported in *BSN20*.

59 Cyg - The Hα profile was the reverse of that shown in *BSN16* (1987 May 6). V/R=0.94, R=1.84 I_C. The He I line was filled with emission with the V component slightly above the continuum.

π Aqr - Centrally-reversed Hα emission is present with V/R=1.4. The peak intensity of 4.2 ± 0.2 is slightly lower than that reported in *BSN19*. The redward absorption reported in *BSN19* has developed into a weak core. An observation on 1989 June 7 (KPNO request night) reveals no significant change in the feature. Double emission is still evident in He I 6678 but the V/R ratio (V=1.09 I_C, R=1.14 I_C) has reversed since 1988 November (*BSN19*). The June observation shows V=1.05 I_C and R=1.13 I_C.

o And - Hα emission was still present on 1989 June 7 (KPNO request night) but weaker than that reported in *BSN20* (V≈R with a peak intensity at the continuum level). This combined with the weaker core (r_v=0.47) suggests that the current shell phase is on the decline. He I 6678 displayed structure but no emission.

Gerrie Peters

THE VARIABLE BALMER EMISSION IN μ CENTAURI

The Hα emission reported in *BSN20* was essentially gone by 1989 April 20. At best very weak components were seen on the wings of the absorption line (Fig. 1). The deeper core of the line (r_v=0.7 compared with 0.8 in February) was further evidence that the emission had weakened. However, by June 13 strong emission above the continuum had developed (cf. IAU Circ. No. 4816) which was still present by June 24 (Bhattacharyya, IAU Circ. No. 4806). The observation obtained at KPNO on June 13 is shown below.

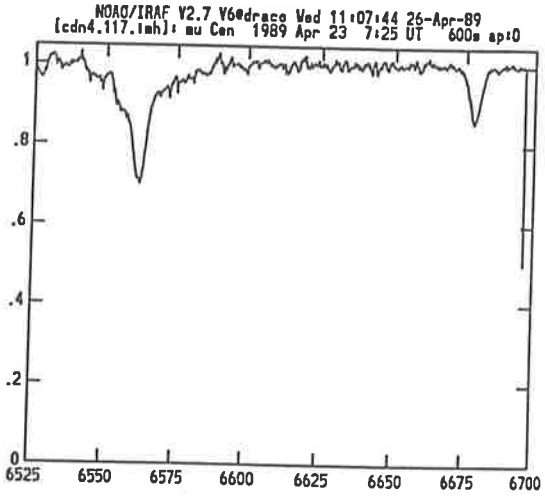

Fig. 1 - One of several observations of μ Cen in the region λλ6525-6700 during 1989 April 20-24. Variable weak emission components were seen in Hα (on the violet wing), but no emission above the continuum. The He I 6678 feature displayed variable structure including several weak transient absorption cores.

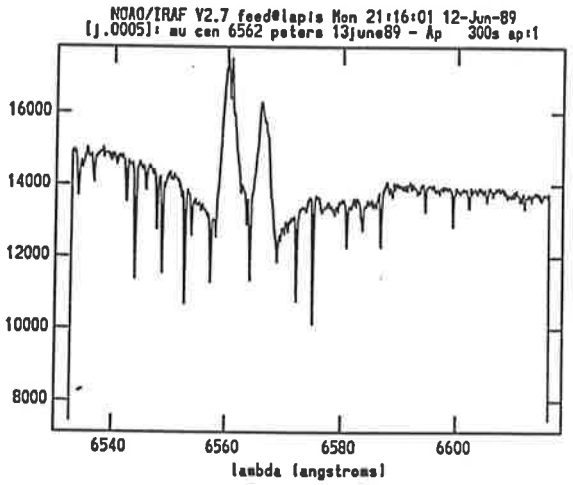

Fig. 2 - An observation of Hα on June 13 shows prominent emission above the continuum (V > R = 1.2 I_c). The sharp lines are telluric water vapor.

Gerrie Peters

Dr. C. C. Huang, Purple Mountain Observatory, Nanking, China writes that his recent spectroscopic observations have revealed probable rapid variations in ψ Per (cf. abstract below in PREPRINTS section) as well as in γ Cas. He reports variations in the Hα profile of γ Cas on a time scale of ten minutes and has sent the illustration shown below from a campaign with T. Kogure and V Doazan in 1989 January.

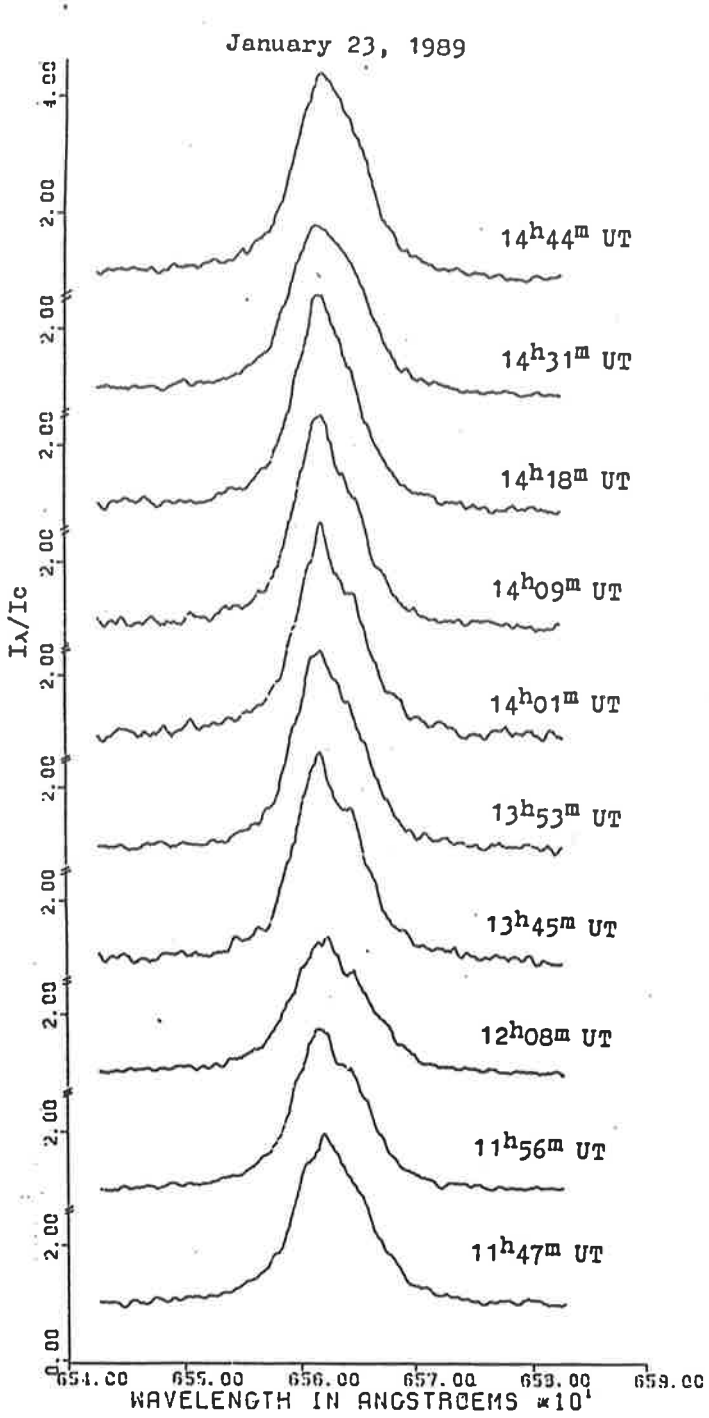

Figure 1. Rapid variations of the Hα profiles of γ Cas.

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MULTI-SITE MULTI-PROGRAM SPECTROSCOPIC CAMPAIGN IN DECEMBER 1989

We are organizing a world-wide multi-site campaign in stellar spectroscopy for December 1989. The goal is to obtain a series of spectra with complete and continuous time coverage over 72 hrs for each of three stars:
- 48 Per (search for nonradial pulsations on a Be star)
- AB Aur (rotational modulation of winds in a pre-main sequence Herbig Ae star)
- HR1099 (Doppler Imaging of active regions & flare monitoring on RS CVn stars)

The sites and telescopes presently involved in this campaign are the following: Mauna Kea 2.2m UH, 3.6m CFHT, Kitt Peak McMath, La Silla 1.4m CAT, France 1.5m OHP, Crimea 2.6m Shajn, China 2.16m Xinglong.

The targets, their coordinates, the desired resolution and S/N ratios, and the prime lines to be observed are given below:

Star	RA(2000)	DEC(2000)	V	Sp	R	S/N	Dates (UT)	lines
48 Per	04 08 39.6	+47 42 45	4.1	B3	40000	>300	7 - 10	He I 6678
AB Aur	04 55 45.8	+30 33 05	7.2	A0	30000	>50	11 - 13	Ca II K 3933
HR 1099	03 36 47.2	+00 35 16	5.7	G9	40000	>200	14 - 17	Hα, Ca II K, FeI,CaI 6430-39

In order to reinforce the outcome of this campaign, we solicit additional spectroscopic and photometric observations of these stars during and around the period mentioned above. A multi-frequency coverage from ground-based and space facilities in the radio, infrared, visible, UV or X-ray ranges would be also a unique opportunity, for understanding the variability due to oscillations, instabilities, winds, active structures or flares. Those interested in participating to this campaign should contact Claude Catala or Bernard Foing.

Claude Catala: Observatoire de Paris, Section de Meudon,
92195 Meudon Principal Cedex, FRANCE
tel: (33-1) 45 07 76 68
telefax: (33-1) 45 07 28 06
telex: 204464 DESPA
SPAN: meudon::catala
EARN-BITNET: catala@frmeu51

Bernard H. Foing: ESA/ESTEC Space Science Dept
P.O. Box 299, 2200 AG Noordwijk, The Netherlands
tel: (31) 1719 8 4958
telefax: (31) 1719 8 4698
telex: 39098
SPAN: estsc1::bfoing
BITNET: bfoing@estec

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PHOTOMETRIC OBSERVING CAMPAIGN FOR 53 PERSEI

Myron Smith is organizing a photometric observing campaign for the prototypical line profile variable, 53 Persei (B4 V), which is thought to show two nonradial pulsation periodicities, each near two days, and which have a beat period of two weeks. Any photometric observations would be very helpful, considering the awkwardness of the 1 cy/day aliases here. Observations from Europe or Asia would be particularly invaluable to supplement those from North America. Some coordinated observations with a high resolution spectrograph and with the *Voyager* spacecraft are anticipated. The campaign will occur sometime in the October-December, 1990 time frame and will last at least two weeks.
---------- Please join us!

Contact Myron at (301) - 794-1471, e-mail (SPAN) at
6890::msmith, or surface mail at: 10000-A Aerospace Rd.,
Lanham-Seabrook MD 20706, U.S.A.

* *

CALL FOR OBSERVATIONS FROM PREVIOUS CAMPAIGNS

We are currently assembling the multiwavelength, multilongitude data from several recent campaigns on the "rapid variable" Be stars and hope to have the paper(s) ready to submit for publication by the end of January 1990. Included are the campaigns on o Andromedae (1987 August), λ Eridani and ω Orionis (1987 November), and ϵ Capricorni (1988 September). If you supported any of these projects and have not yet sent us a report on your observations or a draft of your paper, please contact us as soon as possible. Please send photometry to Dr. John Percy (Dept. of Astronomy, Univ. of Toronto, 60 St. George St., Toronto, ON M5S 1A7, Canada) and spectroscopic results to me. I will soon be mailing a summary of all spectroscopic data that I have received to those who have contributed observations. If you have sent data but do not receive this summary please let me know immediately. Thank you very much for your cooperation.

Gerrie Peters, Space Sciences Center, University of Southern California, Los Angeles, CA 90089-1341, U.S.A.

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PREPRINTS RECEIVED

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A Search for Line Profile Variability in Dwarfs and Giants of Spectral Types B8-B9.5 II. Results and Discussion
BAADE D.; European Southern Observatory, Karl Schwarzschild Str.2, D-8046 Garching, W. Germany
To be Published in: *Astronomy and Astrophysics*
Preprints: D. Baade at the above address.

Abstract: Fifty-six high-resolution spectra, mostly showing He I λ447.1 and Mg II λ448.1, have been obtained at different epochs for 22 stars of spectral types B8-B9.5 and luminosity classes III - V. Of these objects, 15 are more or less normal, four are known emission-line stars, one is a Hg-Mn star, one is He-weak, and one may or may not be another Be star. In none of the sub-categories, line profile variability was detected. A mean upper limit to any profile modulation (1 σ rms) of the Mg II λ448.1 line is 3.5% of the line depth. This figure still includes the high-frequency noise. Radial velocities and improved estimates of the projected rotation velocity on the scale of Slettebak et al. (1975) are provided for all stars of the sample. In two stars stationary, nearly central quasi-emission bumps were detected which had previously been seen in only one or two other stars.

Intensive Photometry of Southern Periodic Be Variables. I Winter Objects
CUYPERS J.[1] - BALONA L.A.[2] - MARANG F.[2]; 1. Koninklijke Sterrenwacht van België, Ringlaan 3, B-1180 Brussels, Belgium; 2. Southern African Astronomical Observatory, P.O. Box 9, Observatory 7935, Cape, South Africa.
To be published in: *Astronomy and Astrophysics (Suppl. Ser.)*
Preprints: J. Cuypers at the first address or L. A. Balona at second address.

Abstract: We present results of an intensive photometric campaign on some bright southern Be stars to search for periodic light variations. In order to obtain good phase coverage, observations were conducted from two sites with different longitude: ESO and SAAO. Most of the stars observed are indeed variable with periods close to one day (the expected rotational period for these stars). We present our results for winter objects.

The Fe II 9997Å Emission Line in Classical Be Stars
DAMINELI-NETO A.; Istituto Atrofisica Spaziale, CNR, V. Enrico Fermi, 21-Box 67 - 00044 - Frascati (Roma) - Italy
Submitted to: *Astronomy and Astrophysics (Letters)*
Preprints: A. Damineli-Neto at the above address.

Abstract: The infrared emission line near Pδ, that appeared in some hot stars with circumstellar shells, was identified as Fe II 9997Å, through high resolution spectroscopy. This line is prominent in emission in classical Be stars, being the strongest Fe II line so far observed in this class of objects. The profile of this

line resembles that of Pδ, indicating a common formation region. As this line has a purely circumstellar origin, we can also attribute to the envelope the V/R asymmetries of the hydrogen lines. We derive constraints for the physical mechanisms that populate the high energy levels of Fe II ($\simeq$7ev), from which many emission lines are formed. As Fe II 9997Å is strong and the circumstellar envelope is transparent to it, it appears of a great value to use this line to diagnose dense gas regions surrounding hot sources such as Be stars and related objects.

Rapid Variability in the Spectrum of ψ Per

HUANG C.C.[1] - DING Y.S.[1] - CHEN L.[2]; 1. Purple Mountain Observatory, Academia Sinica; 2. Nanking Astronomical Instrument Factory, Academia Sinica.
Preprints: C. C. Huang at the first address.

Abstract: Rapid variations of the emission line ratios in Hβ and Hγ and the radial velocities of these emissions in the Be-shell star ψ Per have been detected from spectroscopic observations during three consecutive nights. Possibly there are two spectroscopic periods near 0.30^d and 0.08^d. A short discussion of similarities of ψ Per to the possible nonradial pulsation Be star HR 9070 has been made.

Spectroscopic Mode-Analysis of Nonradial Oscillations in a Rapidly Rotating Early-Type Star ζ Ophiuchi

KAMBE E.[1] - ANDO H.[2] - HIRATA R.[3]; 1. Department of Astronomy, Faculty of Science, University of Tokyo, Bunkyo-Ku, Tokyo, 113; 2. National Astronomical Observatory, Mitaka-shi, Tokyo, 181; 3. Department of Astronomy, Kyoto University, Kitashirakawa, Sakyo-Ku, Kyoto, 606.
To be Published in: *Publ. of the Astronomical Society of Japan*
Preprints: E. Kambe at the first address.

Abstract: The spectroscopic data of ζ Oph obtained in 1987 and 1988 are analyzed, which is known as one of the rapidly rotating early-type line profile variable stars. We have basically modified and extended the method developed by Gies and Kullvanijaya (1988) in the points that the AIC criterion is introduced for the detection of periodicity and that the period analysis is carried out not only in temporal domain but also in wavelength domain. The effectiveness of our method is shown by the numerical simulation of line profile variations caused by NRPs. It is found that k value (i.e., ratio of the horizontal to the radial velocity amplitude of NRP) can be estimated from the period analysis in temporal domain. The limits and constraints of our method are also discussed. Following our method, it is pointed out that at least two NRPs were excited in ζ Oph in 1987 April season and three NRPs in 1988 May season. Two of them are persistent for both seasons corresponding to NRP with $\ell = -m = 4$ and the period of 3.34 hr and NRP with $\ell = -m = 7$ and the period of 2.44 hr. NRP with $\ell = m = 9$ and the period of 1.85 hr probably existed in 1988 May season.

Interacting Binary CX Draconis

KOUBSKY P.[1] - HORN J.[1] - HARMANEC P.[1] - PETERS G.J.[2] - POLIDAN R.S.[3]; 1. Ondrejov Observatory, 25165 Ondrejov, Czechoslovakia; 2. Space Sciences Center, University of Southern California, Los Angeles, CA 90089-1341, U.S.A.; 3. Lunar and Planetary Laboratory-West, University of Arizona, Tucson, AZ 85721, U.S.A..

To be Published in: Proceedings from "Active Close Binaries" (NATO ASI) held in Kusadasi, Turkey (September 11-22, 1989).
Preprints: P. Koubsky at the first address.

Abstract: The circumstellar plasma that produces H emission in CX Dra has been investigated using data acquired from CCD (KPNO), IDS (UWO), and photographic plates (Ondrejov). Conspicuous phase dependent variations were observed which imply that most of the material resides inside the system. The Hα - He I 6678 data suggest two components to the circumstellar material.

A Nonradially Pulsating Be Star 28 Cygni: Results from Photometry

PAVLOVSKI K.[1] - RUZIC Z.[2]; 1. Opservatorij Hvar, Geodetski Fakulet Sveucilista u Zagrebu, Kaciceva 26, 41000 Zagreb, Yugoslavia; 2. Elektrotehnicki Institut, Fallerovo Setaliste bb, 41000 Zagreb. Yugoslavia.

To be Published in: *Astronomy and Astrophysics*
Preprints: K. Pavlovski at the first address.

Abstract: Photometric observations of the Be star 28 Cyg in 1985 revealed light variations with large amplitude (around 0.08 mag in V band) and only marginal color changes. Period analysis yields ambiguous results as from appearance of the light curve alone it is not possible to choose which period is the correct one (P = 0.64^d for a single-wave or its double value for double-wave light curve appearance). This finding corroborate Peters' and Penrod's (1988) results based upon the detailed line-profile analysis. The shorter period is due to pulsations in the low-order nonradial mode $\ell = 2$, but due to wave behavior, the light-curve is expected to be of the double-wave variety. The scatter around the mean light-curve is still larger than the assumed observational error and we suggest that further periodicities are present in the data. We made use of the CLEAN algorithm to extract these frequencies which were further adjusted in a multifrequency fit. Results are discussed in the framework of nonradial pulsation hypothesis.

Detection of Rapid V/R Variations in the Be Star EW Lacertae

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Abstract: We report on the detection of possible rapid periodic variations in the V/R ratio in the double-peaked emission of Hγ for the Be and shell star EW Lac (HD 217050). The analysis is based on the high-resolution CCD spectra with high S/N ratio. A time-series analysis with application of the CLEAN algorithm to remove aliases from periodogram yields a period of about 0.7 d. The same period was previously identified in light variations. These findings are examined in the frameworks of a nonradial pulsation and rotating asymmetric envelope hypothesis.

Catalogue of i and w/w_c Values for Rotating Early Type Stars
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Published in: *Tartu Teated (Contributions from Tartu Observatory)*, accepted in May 1989

Preprints: M. Ruusalepp at the above address.

Abstract: Rotation is a general property of stars and traditionally it is estimated by the values of v sin i. However, rotation is more exactly characterized by separate values of v and i. In the present catalogue the inclination angles of the rotational axis i and the reduced angular velocity w/w_{crit} for about 250 early type stars are given. The data have been compiled from various sources available to us. The plausibility of determined i and w/w_{crit} values (rotational parameters, RPs) is also analyzed.

A Radio Survey of IRAS Selected Be Stars
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To be Published in: *Astronomy and Astrophysics*
Preprints: A. R. Taylor at the first address.

Abstract: We have carried out a radio survey using the Very Large Array, at λ=2 cm, of 21 bright Be stars that have strong excess emission in the 12μ-60μ IRAS photometric bands. Six of the stars were detected. Comparison of the radio data to simultaneous Hα measurements show a clear correlation between radio and Hα luminosity. The radio emission thus arises as a result of the same process responsible for the strong hydrogen line emission seen in these objects. However, there appears to be no simple relationship between the brightness of the far-infrared excess and radio brightness, a result of the fact that the rate of decrease with radius of the density of circumstellar gas varies from star to star. In all cases there is turn down in the continuum spectrum of the emission excess between the far-infrared and the radio, suggesting a change in the structure of the circumstellar disk, outside the far-infrared emission region, that is common to all stars.

Our results demonstrate that in at least some cases the circumstellar disks of Be stars extend to very large distances from the star, at least several hundred to a thousand $R_{\odot}$. Further studies of radio emission from Be stars will provide information on the structure of Be star envelopes at these large radii.

The Ultraviolet Spectrum of Eta Carinae

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ξ ≡ βαθαττα λΦβΦ[4];

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Preprints: R. Viotti at the first address.

Abstract: Among the peculiar emission line stars η Car displays the most complex and intriguing optical and ultraviolet spectrum. To provide a quantitative data base for future studies, we give an *Atlas* of the high resolution ultraviolet spectrum of the star from 1200 to 1974 and from 2200 to 3230 Å, based on observations with the *International Ultraviolet Explorer* satellite made between 1978 and 1980, and give fluxes and equivalent widths of the emission and absorption features, and the stellar continuum in line-free regions. The interstellar spectrum includes lines belonging to a wide energy range, up to C IV, and CO molecular lines as well. The strongest lines show a high velocity component at +100 km s^{-1} formed in the Carina nebula. An *interstellar color excess* of E(B-V) = 0.40±0.05 is derived from the depth of the 2200 Å band in the low resolution UV spectra of the nebular condensations near η Car. The star is also subject to an additional *circumstellar* color excess of about 0.7 mag due to the grains in the envelope which do not produce the 2200 Å feature. The stellar spectrum is represented by both low (O I, C II, Mg II, Aℓ II, Si II, Mn II, and Fe II) and high ionization resonance lines (Aℓ III, Si IV, C IV, and N V) with a P Cygni absorption extending up to about - 800 km s^{-1}, implying the presence of *a wide ionization range throughout the whole wind of the star.* A higher velocity component (-1240 km s^{-1}) is possibly present in the Si IV resonance doublet. The presence of N V with a broad P Cygni profile, and of the He II 1641 Å narrow emission line confirms the existence of a *high temperature region* in the stellar core, which could be associated with the central X-ray source found by the *Einstein* Observatory. The intercombination lines of Si III] λ1892 and N III] λλ1748-54 present a complex profile with emission peaks and extended wings. CIII] λ1909 is very weak or absent in emission, but is possibly represented by an absorption line at 1907.0 Å. The Si III] 1892/C III] 1909 peak emission flux ratio of 10 would imply a carbon underabundance of a factor 3-20, and/or a high electron density of $>3\times10^{10}$ cm^{-3}. However, we note that the resonance O I and C II lines display a broad and saturated P Cygni absorption, and that one must use caution in speaking of chemical abundance in η Car without a proper envelope model. Fe II is represented by a large amount of resonance and excited lines with a variety of P Cygni profiles, which largely affect the stellar energy distribution. The high excitation lines at 1785-88 Å (UV multiplet 191) and at 2506-08 Å are among the most prominent emission features in the UV spectrum of the star. We also identify several other narrow high excitation Fe II lines, probably enhanced by selective pumping processes, or by dielectronic recombination. The latter is suggested by the intense Fe II (multiplet UV 34) emission lines. We consider that the complex profiles displayed by the most intense emissions suggest *line formation in an asymmetric envelope.* The results are finally discussed in the light of possible models. Many of the features can be explained if η Car is an *intermediate, possibly binary, F-type hypergiant* in a short living stage, which holds a *massive wind heated by dissipation of mechanical energy.* The line list (Table 2) is available as a computer file on demand to R.V. at UVSPACE@IRMIAS.EARN.

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Abbreviations used for the Publications

AA	Astronomy and Astrophysics
AASS	Astronomy and Astrophysics Supplement Series
AAS	Acta Astrophysica Sinica
AF	Astrofizika

AJ	Astronomical Journal
APJ	Astrophysical Journal
APJS	Astrophysical Journal Supplement
ASS	Astrophysics and Space Science
BAAS	Bulletin of the American Astronomical Society
BAC	Bulletin of the Astronomical Institutes of Czechoslovakia
BASI	Bulletin of the Astronomical Society of India
FIAPM	Proceedings of the Fourth IAP Astrophysics Meeting in honor of Jean-Claude PECKER "Modeling the Stellar Environment: How and Why?" (Paris, 1988 June 28-30) ed. P. Delache, S. Laloe, C. Magnan, J. Tran Thanh Van
IAJ	The Irish Astronomical Journal
IAUC	IAU Circular
IBVS	Information Bulletin on Variable Stars
IGAOP	Izvestia Glavnoi Astronomiceskoj Observatorii Pulkovo
IKAO	Izvestia Krimskoj Astrofiziceskoj Observatorii
JAA	Journal of Astrophysics and Astronomy
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
QJRAS	Quarterly Journal of the Royal Astronomical Society
SS	Southern Stars
RMAA	Revista Mexicana de Astronomia y Astrofisica