COMMISSION 42: CLOSE BINARY STARS (ETOILES DOUBLES SERREES)

Report of Meetings, 20 and 26 November 1985

PRESIDENT: A.H. Batten SECRETARY: A. Sanyal

The business meetings of the Commission were held in Room D, Vigyan Bhavan, from 11.00-12.30 on November 20 and from 9.00-10.30 on November 26.

The President welcomed all members of the Commission, and others present, and especially three former presidents. He announced that he had appointed Dr. A. Sanyal to act as secretary during the Commission's meetings. He pointed out that a provisional agenda had been mailed to all members, and suggested some additional items. There being no objections, the revised agenda was adopted.

The President asked members to stand in silence while the names of eleven members who had died in the previous three years were read. He drew attention in particular to M.K.V. Bappu, former President of the Union and D.J.K. O'Connell S.J., former President of the Commission.

A letter from J.A. Mattei was read expressing thanks for the Commission's support of the publication of the AAVSO's archival observations of cataclysmic variables. Funds (including an IAU grant) had been found, and extracts from the first monograph of the series (on SS Cyg) were available for inspection at the meeting.

The President announced that, after considerable discussion, the Organizing Committee had recommended to the IAU Executive that the new President should be J. Smak and the new Vice-President R.H. Koch. These recommendations were endorsed by the Commission. The composition of the new Organizing Committee was discussed and the following was agreed to: K.D. Abhyankar, J. Andersen, E. Budding, A.M. Cherepashchuk, D.M. Gibson, M. Kitamura, Y. Kondo, K.-C. Leung, J. Rahe, M. Rodonó and G. Shaviv, with A.H. Batten as past-president, remaining for one more term. Nearly sixty people had indicated an interest in becoming members of the Commission. This large number was partly caused by the revision of the IAU files, which revealed several persons with obvious claims to membership whose formal election had been overlooked. The President suggested that detailed consideration of these names should be delegated the Organizing Committee which would meet in Delhi. This course was adopted and, at the second session, forty-one names were recommended to the Commission, which endorsed them.

The President noted some comments he had received on the Report published in IAU Transactions **XIXA** (pp. 583-606). D.M. Popper requested that the first sentence of the paragraph OB Binaries (p. 597) be replaced by the following:

> Popper (ApJ **262**, p. 641) pointed out that the luminosity ratios in O-type double-lined binaries, all probably contact systems, are much closer to unity than expected from their mass-ratios. These systems, superficially at least, are high-mass counterparts of the W-UMa systems.

J. Sahade points out that the lines and transitions named in the paragraph on β Lyrae (p. 597) are not forbidden, but intercombination. P. Harmanec draws attention to his work on Be stars (p. 597) in BAC **34**, 324, **35**, 164, 193; Hvar Obs. Bull. **7** (1), 55. S. Rucinski suggests references to the X-ray survey of

W UMa stars (Cruddace and Dupree ApJ **277**, 263) and to work on uv emissions (Vilhu and Rucinski AAp **127**, 5; MN **202**, 1221) should be added (pp. 600-1). He emphasizes the relevance of work discussed on pp. 603 and 605 to W UMa systems and draws attention to Duerbeck's determination (IAU Coll. **80**, 363) of the galactic density and scale height of these systems.

The President also invited discussion of the form of the report, particularly questioning the value of the two lengthy tables (nos. 2 and 5 in the present report). Several members found these tables useful and the consensus was that they should be retained. Some reorganization of the report might be necessary and should be left to the incoming Organizing Committee.

T. Herczeg discussed the form and content of the Bibliography and Program Notes. Members of the Commission felt that it should continue in substantially its present form, and that it does not duplicate the work of CDS Strasbourg. Nevertheless close cooperation with CDS seems very desirable. The existence of alternative designations for many objects creates problems. The Commission felt that extensive cross-indexing is desirable. The Commission approved a resolution seeking a subsidy of $500 from the IAU for the publication of the Bibliography and expressed its appreciation to Prof. Herczeg for his work as Editor.

The President reported on correspondence with Dr. Paul Schmidtke about the on-line data centre that the IAPPP wishes to set up in conjunction with automatic photoelectric telescopes both operating and planned. Several members of the Commission reported that they were impressed by this group, and a motion of support for their efforts was passed unanimously.

There was some discussion of the Commission's proposal for an IAU symposium on "Circumstellar Matter in Close Binary Systems". The meeting had been proposed for Victoria, B.C. in June 1987, (or possibly Europe later the same summer) but had not been accepted in its original form by the Executive. The committee set up to formulate the proposal will continue its work and the Commission will be informed as soon as definite decisions have been made. The Executive proposal to combine Commissions 42 and 26 was also discussed; the majority of those present opposed the plan.

The preparation of catalogues of both photometric and spectroscopic orbital elements was discussed. A motion was passed supporting the preparation by A.H. Batten of an Eighth Catalogue of Orbital Elements of Spectroscopic Binary Systems.

The President reported that he had had some correspondence about the inclusion of a representative list of eclipsing binaries (with current coordinates) in the Astronomical Ephemeris. He invited suggestions from Commission members. M. Rodonó reported on the meeting that considered the setting up of a working group on coordinated multisite observations. He felt that personal contact between interested parties would be more useful than formal Commission involvement, but agreed to keep the Commission informed. K.-C. Leung reported briefly on the meeting just concluded in Beijing on close binaries. A letter from A.J. Wesselink proposing coordinated observations of SZ Cam and AL Vel was read.

At the end of the second business session, short scientific contributions were made by T.J. Herczeg, A. Gimenez, L.P.R. Vaz, F. Vakili and Z. Kviz.

Report of Scientific Session "New Techniques in the Observation and Analysis of Close Binary Systems" held on 23 November, 1985.

PRESIDENT: A.H. Batten SECRETARY: A. Sanyal

Abstracts of Papers

Observations of Close Binaries in Planetary Nebulae

E. Budding

Study of those central stars of planetary nebulae that happen to be binaries is useful for three main reasons: (i) determination of parameters of the nebulae, (ii) possible detection of certain "exhibitionist" phases in binary evolution, (iii) study of the production and properties of hot subdwarfs. The observations described provide an example of the application of two-dimensional CCD arrays to the study of close binaries and were made with the 1.9-m Mt. Stromlo telescope. Only preliminary results are available from the survey, but the spectrum of the known binary in the centre of NGC 2346 has been studied.

W Ursae Majoris Stars: Observations and Analysis

Albert P. Linnell

High speed UBVRI photometry provides improved discrimination among proposed models for W Ursae Majoris. From among proposed models for W-type light curves, only the Rucinski hot secondary model and a model which combines a warm secondary with a fixed backside spot on the larger component acceptably simulate the observational data. Both models are consistent with the Webbink mass-circulation scenario. They are inconsistent with a barotropic photosphere. The best-fitting UBVRI model does not represent the ANS data by Eaton, Wu, and Rucinski. An unreasonable change in T_{eff} does provide a representation of the ANS data, but that resolution undoubtedly is spurious. If the far-uv characteristics of other W-type systems mimic W UMa, and if the model difficulty persists after introduction of synthetic spectra, the observational indication is that there is an excess in the uv surface brightnesses of the primary components.

The Use of the Cross-Correlation Technique to Obtain Radial Velocities of Contact Binaries

B.J. Hrivnak and E.F. Milone

Radial velocity studies are seriously lacking for contact binaries, and most of the older studies are of poor quality. This is due to the faintness of the systems for time-resolved spectroscopy and the broad-lined, blended nature of the spectra. The cross-correlation technique permits one to overcome this latter difficulty, as was initially demonstrated by McLean (1981). In this paper we present a detailed discussion of the procedure for reducing data obtained with photographic plates or a Reticon detector. Several cross-correlation function profiles are illustrated for light ratios of 1 and 6, and the importance of excluding the broad lines and bands is demonstrated. Examples of the good velocity curves presently being obtained are presented. Tests indicate the internal consistency of the technique. In contrast to some earlier reported discrepancies, good agreement is now found between these new spectroscopic mass-ratios and the photometric mass-ratios for totally eclipsing systems. At least 22 systems have now been studied spectroscopically by this technique, and a promising data base is emerging with which to compare models of the structure and evolution of the contact binaries.

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Accretion-Disk Structure in Algols and Cataclysmics from Time-Resolved Spectrophotometry

R.K. Honeycutt, R. Kaitchuk and E. Schlegel

The techniques of data acquisition, data reduction, and data display for time-resolved spectrophotometry are described, with particular attention to the use of image-analysis tools. We give the results of a survey with these techniques of 104 eclipses in 52 short-period Algol systems. It is found that when the relative radius of the primary star is plotted versus mass ratio, the systems with permanent disks, transient disks and without disks segregate into three distinct regions of the plot, indicating that the location of the stream impact is responsible for these three kinds of behavior. We also report evidence that several Algols with transient disk systems have a bifurcation on the leading side of the disk. For the cataclysmics we show characteristic time-resolved spectrophotometry of nova-like and of U Gem-type systems, with emphasis on the S-wave phenomenon. We derive the distribution of stream impact positions based on S-wave phasing, and point out the systematic changes in the S-wave in WZ Sge. Finally it is shown that many of the puzzling kinds of behavior in the time-resolved spectrophotometry of nova-like systems can be understood by assuming that the emission-line profiles arise not only from a rotating disk but also from an accretion-disk wind.

Applications of the Reticon to Observations of Binaries

M. Parthasarathy

Recent work on various binary systems undertaken with Reticon detectors was described. Particular emphasis was laid on the possibility of discovering weak secondary spectra in (e.g.) Algol-type systems. The value of this work for the determination of accurate masses and dimensions was pointed out. Also discussed was the potential for making accurate abundance analyses and its value in the study of binary evolution.

Cross-Correlation Radial Velocities of Early-type Binaries

J. Andersen and G. Hill

Cross-correlation techniques for determining radial-velocity curves of early-type binaries have been explored in a well-studied system. Deep-lined synthetic template spectra and noise filtering are found to be essential.

Voyager Observations of Close Binaries

R.S. Polidan (presented by J. Holberg)

The value of spacecraft for the observation of close binaries - especially in the uv - was illustrated by a discussion of the systems observed with Voyager. Particular reference was made to observations of ϵ Aur during the recent eclipse.

Doppler-Imaging Techniques

D. Gibson

The recently developed Doppler-imaging technique was described. It has proved particularly useful in the study of RSCVn systems, confirming the spot interpretation of their out-of-eclipse variability. The study of plages on the surface of the components of AR Lac was described in some detail.

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