

COMMISSION 26: DOUBLE AND MULTIPLE STARS

(ÉTOILES DOUBLES ET MULTIPLES)

PRESIDENT: C. D. Scarfe

VICE-PRESIDENT: W. I. Hartkopf

**ORGANIZING COMMITTEE: J. T. Armstrong, F. C. Fekel, P. Lampens,
J. F. Ling, R. D. Mathieu, M. J. Valtonen, H. Zinnecker (past-president)**

1. Introduction

This is the report of the Commission 26 business meeting which took place on 2003 July 18 during the twenty-fifth General Assembly of the IAU in Sydney, Australia. The meeting was chaired by C. Scarfe, the outgoing president, and was attended by the following members: C. Allen, F. Arenou, R. Argyle, A. Boden, J. Davis, F. Fekel, W. Hartkopf, J. Kubát, J. Ling, B. Mason, T. Oswalt, T. Pauls, D. Pourbaix, W. Tango, T. ten Brummelaar, A. Tokovinin, N. Turner, W. van Altena, E. Weis, and H. Zinnecker.

2. President's report

2.1. Membership

The following members have died during the past three years.

Name	Country	Date of death (if known)
N. Argue	United Kingdom	2001 February 9
E. Cabrita	Portugal	2002 June 17
M. Herrera Andrade	Mexico	2002 July 29
K. Strand	United States	2000 October 31

In addition, the death of D. Zulevic (Yugoslavia) in 1998, had not been previously reported. That omission is corrected here. A few moments of silence were observed in memory of these deceased colleagues. It was noted that Dr. Strand served as president of the Commission from 1964 to 1967.

Twenty new members have joined the Commission this year. They are:

Name	Country	Name	Country
F. Arenou	France	A. Boden	United States
J. Budaj	Slovakia	J. Fernandes	Portugal
P. Hartigan	United States	W. Heacox	United States
E. Horch	United States	R. Jurdana-Sepic	Croatia
S. Maddison	Australia	T. Pauls	United States
C. Pereira	Brazil	E. Pluzhnik	Russia
D. Pourbaix	Belgium	J.-L. Prieur	France
M. Schöller	Germany	N. Shakht	Russia
V. Tamazian	Armenia	W. Tango	Australia
T. ten Brummelaar	United States	N. Turner	United States

The total number of members now stands at 128, from 34 countries.

2.2. Election

For the 2003-2006 triennium, W. Hartkopf (United States) succeeds to the presidency, and F. Fekel (United States), J. Ling (Spain) and P. Lampens (Belgium) continue as members of the Organizing Committee (OC). More than half of the members of the Commission voted in the recently conducted election for a vice-president and three new members of the OC. The new vice-president is C. Allen (Mexico) and the new OC members are J. Davis (Australia), E. Oblak (France) and T. Oswalt (United States).

2.3. Activities

The principal activity of the commission over the past three years was the organization of IAU Colloquium 191, held from 2003 February 3 to 9 in the delightful city of Mérida, Yucatán, México. The Colloquium was concerned with the environment and evolution of binary and multiple stars, and was in several senses a sequel to Symposium 200, held in Potsdam, Germany, during the previous triennium. The meeting honoured the contributions of Arcadio Poveda to binary star research and to Mexican astronomy in general, over several decades. It was attended by over 70 people, from more than 20 countries, and generated much lively discussion in very pleasant surroundings. In addition to that of the IAU, support was provided by the following Mexican institutions: Universidad Nacional Autónoma de México, Universidad Autónoma de Yucatán, Instituto Nacional de Astrofísica, Óptica y Electrónica, Consejo Nacional de Ciencias y Tecnología, the state of Yucatán and the city of Mérida. The scientific organizing committee was chaired jointly by C. Allen and C. Scarfe, and the local organizing committee by C. Allen. The proceedings will be published in *Revista Mexicana de Astronomía y Astrofísica, Serie de Conferencias*, edited by C. Allen and C. Scarfe.

Other proposals sponsored by this Commission were, unfortunately, not taken up by the Executive Committee. In particular, a fine proposal for a symposium at this GA on science with high angular resolution optical/infrared interferometry, originated by J. Davis and strongly supported by this Commission, did not succeed; the same happened to a proposal for a joint discussion on the determination of stellar masses. However, our proposal for a special session on nomenclature, which arose out of the multi-commission meeting on that topic held three years ago in Manchester, was accepted, and took place shortly before the meeting reported here.

2.4. New rules

There followed a short discussion of the new IAU working rules for Divisions and Commissions. There was general approval of the apparent trend toward greater democracy, but some concern as to how well the redistribution of power would work over the next few years.

3. Commission website

W. Hartkopf gave a short report on the Commission's website. It includes an address list for members and others interested in double star astronomy, a bibliography of recent papers (mostly from J. Ling and colleagues), copies of IAU Commission 26 Circulars dating back to 1993, particulars on upcoming meetings, and links to double star catalogs, other IAU Commissions, and other related sites. Suggestions for improving the site were requested. The website's url is <http://ad.usno.navy.mil/wds/dsl.html#iau>.

4. Special Session 3

B. Mason summarized the discussions of Special Session 3 on A New Classification Scheme for Double Stars, which had taken place in the morning of the same day. Commission 26 ratified the C Type Resolution which is described in the proceedings of Special Session 3, on the subject of double star nomenclature (refer to Highlights of Astronomy article).

5. Information Circulars

J. Ling reported on the current status of the Information Circulars. She gave a brief review of their history, which now spans almost fifty years. Until 1993 they were published in French, but since then, in English. Their distribution has been successfully converted to electronic mail in the past triennium, and they are posted on the Commission's website. The back issues of the past ten years are also available there.

New orbits and new discoveries of double stars are the primary material of the Circulars, but their contents have become increasingly diverse in recent years. They include reports of Commission meetings, announcements of Symposia, Colloquia and other meetings, announcements about preparation and publication of new catalogues, and an annual list of papers published on double stars. They also include occasional obituaries and historical notes.

Since 1998 the Circulars have had ISSN number 1024-7769. They are also now included in the NASA Astrophysics Data System (ADS) with the bibliographic code IAUDS, which should be used in bibliographic references to them.

The possibility was raised of using the Circulars to draw attention to binaries nearing periastron or requiring special action for other reasons, and this was met with general approval. Also discussed was the idea of making the annual reference list more complete, but it was noted that this would be too large a job for one person and would require the active collaboration of several people, as is the case for Commission 42's semiannual Bibliography of Close Binaries.

6. The next three years

W. Hartkopf then took the floor. He thanked C. Scarfe for his service as Commission president for the past triennium. Thanks were also given to retiring Organizing Committee members T. Armstrong, R. Mathieu, and M. Valtonen. New OC members J. Davis, E. Oblak, and T. Oswalt were welcomed. Goals mentioned for the upcoming three years included a colloquium in 2005 or thereabouts (with possible topics and sites discussed later in the meeting), improvements to the website, more involvement by amateurs, and recruitment of new members. Several upcoming catalogs were mentioned, as well as a planned second CDROM of double star catalogs to be published in early 2004.

7. Observing facilities under development

Reports were then presented on development of some new major observing facilities, and additions to established ones.

7.1. Sydney University Stellar Interferometer (SUSI)

J. Davis described recent work with SUSI, a long-baseline optical interferometer with baselines covering the range from 5m to 640m (currently 5-160m operational) and a wavelength range from 425-950nm. It has been used to establish the orbit of β Centauri,

classified as a bright early B giant, first discovered to be a binary, with components of approximately equal brightness, with the Narrabri Stellar Intensity Interferometer in the 1960s. It has subsequently been shown to be a double-lined spectroscopic binary. The orbital parameters in common between the SUSI interferometric study and spectroscopy are in good agreement and the combination of the interferometric inclination with the spectroscopic mass functions leads to masses of the component stars with accuracies of 3% for the primary and 2.5% for the secondary. The results are being prepared for publication. Several other spectroscopic binaries are being observed to determine orbital parameters and brightness ratios. Observations to date have been at the blue end of the visual spectrum with a limiting magnitude of about +2.5 but a newly commissioned “red” beam-combination and detection system has a limiting magnitude of +5 in the I band and is expected to reach +6. Binary stars, particularly double-lined spectroscopic systems, will be a major component of the future SUSI observational programme.

7.2. The CHARA Array

T. ten Brummelaar reported on the progress of the Center for High Angular Resolution Astronomy (CHARA) Array on Mt. Wilson. The Array now has 5 of 6 telescopes operating in interferometric mode with the sixth due for commissioning in late 2003. The CHARA Array has the three largest baselines in the world currently operating and the scientific program, largely consisting of the study of spectroscopic binary stars, is now underway.

7.3. The Navy Prototype Optical Interferometer (NPOI)

T. Pauls gave an account of recent progress at the Navy Prototype Optical Interferometer (NPOI). The vacuum feed system, used to transport starlight from the individual array elements to the beam combiner has been completed, and the long delay lines needed for imaging have been installed. Two additional siderostats have been brought on line, giving the array a total of six elements. The first observations ever obtained with a co-phased six-element optical interferometer were made with the NPOI of the triple system η Virginis, and published by Hummel et al. (AJ 125, 2630, 2003).

7.4. The ESO Very Large Telescope Interferometer (VLTI)

H. Zinnecker drew attention to the fact that ESO’s VLTI at Cerro Paranal has become operational; first results were obtained with the 10μ mid-IR instrument (MIDI) in June 2003. The light from two 8.2m telescopes was combined over a 102m baseline, and fringes of various targets were recorded; visibilities as a function of wavelength between 8μ and 13μ were derived for the infrared companion of VV CrA, a T Tau star (see the contribution of Leinert et al. to IAU Symposium 221).

Interferometric beam combination at near-IR wavelengths with an instrument working between 1.0μ and 2.4μ (AMBER) is scheduled for next year. A key goal for AMBER is resolving pre-Main Sequence spectroscopic binary systems, to obtain component masses and orbital parallaxes. This will ultimately lead to testing and calibration of pre-Main Sequence stellar evolutionary tracks.

8. Catalogues and databases

8.1. Washington Double Star Catalog (WDS)

B. Mason reported that over the triennium the WDS increased in size by 40,000 measures and 15,000 systems. The second USNO Double Star CD was announced, and will include

these new systems, enhancements to all four catalogs, a linear motion catalog, and a new neglected doubles lists to reflect all the work in this area over the past three years. Over 7000 systems, previously qualified as neglected, will be removed from the new list.

8.2. UCAC and AGK2

W. Hartkopf described the USNO CCD Astrographic Catalog (UCAC), which will be an all-sky astrometric catalog, over the magnitude range $7.5 < R < 16$, with positions to 20 mas for $10 < R < 14$ and proper motions to $1 - 3$ mas/year to $R \sim 12$. The telescope, a twin 0.2-m astrograph, completed observations at CTIO (to declination +30 degrees) in 2001, and should complete northern observations in Flagstaff by June 2004. Double stars will be addressed in the final data reduction, with separations down to $\sim 1''$ (for magnitude differences $< 2 - 3$ mag), and improved coordinates for many fainter systems expected.

The epoch-1930 astrometric plates taken at Bonn and Hamburg for the AGK2 catalog are being rescanned using the Starscan measuring machine at USNO. The catalog will increase from about 250,000 to over 2 million stars, with limiting V magnitude improved from about 11 to about 12.5 and errors reduced from about 200 mas to the range 70-100 mas. The final reduction should give data for many wider pairs, plus improved proper motions.

8.3. BDB - a database for all types of binaries

A report was presented by D. Pourbaix on behalf of E. Oblak and the BDB team. Unlike other catalogs and databases, BDB, which stands for "Base de données des étoiles doubles et multiples de Besançon" (France), is a SIMBAD-like database of catalogs (<http://bdb.obs-besancon.fr>). In just one click, one queries several catalogs, local or not, and receives all the information they hold about a specific object. Besides the data thus made available, BDB also provides tools to make sense out of these data (e.g. JAVA plotting tools). The Besançon team is also working towards the integration of BDB into the Virtual Observatory project.

8.4. Spectroscopic binary orbit catalogue

Three years ago, Commission 30 took over the responsibility of compiling the Ninth Catalogue of Spectroscopic Binary Orbits (SB9) and of making it accessible through the web rather than as a printed version like its predecessors. D. Pourbaix reported on the progress of this work, which is also of great interest to Commission 26. Although the compilation is still "work in progress", SB9 can already be browsed at <http://sb9.astro.ulb.ac.be>. It contains orbits for over 1980 systems. A major difference with respect to its predecessors is the availability of the radial velocities of all new orbits. Colleagues interested in supplying SB9 with their orbits and data are invited to contact D. Pourbaix (pourbaix@astro.ulb.ac.be).

9. Amateur work on double stars

R. Argyle spoke about amateur projects in double star measurement during the 2000-2003 triennium. Measurement of visual double stars by amateur observers is becoming more widespread. During the period under report some 11,000 mean measurements were added to the USNO Observations Catalogue. These consist mainly of micrometer measures, CCD astrometry and graticule eyepiece observations. In addition, A. Alzner has contributed 17 orbits to refereed publications and Commission 26 Circulars. A very large project, by M. Nicholson, consisting of astrometry and photometry of 80,000

wide and faint pairs taken from archive Schmidt plate astrometry, is being assessed. At least one large database of 10,000 measures by Spanish observers is being prepared for publication. The work done by USNO in pointing out systems which require attention is vital to focus future activity. The almost complete lack of observations in the southern hemisphere was noted.

10. Planets in binary systems

H. Zinnecker reported about a recent list of 16 giant planets in 12 wide binary systems, discovered by the radial-velocity method and compiled by Eggenberger, Udry and Mayor. In each case the host star's membership in the system has been confirmed by orbital or common proper motion. A famous example is 16 Cyg B; however no giant planet has been found around 16 Cyg A. The semi-major axis of the 16 Cyg system is 850 AU. Two other systems, 55 Cyg and ν And, with similar component separations, host systems of three planets, all around the primary in the latter case and around the secondary in the former.

Searches for giant planets around the components of about 100 single-lined binaries with periods longer than about two years are also under way by the same Geneva group.

11. Availability of observing facilities

A letter was read from P. Lampens, who was unable to attend the General Assembly, expressing concern about the increasing lack of access to telescopes by double star observers, and about publication of data, and requesting a statement on these matters. The following was accepted by the meeting as such an expression from the Commission.

Commission 26 views with concern the severe difficulty, faced by members in recent years, in obtaining access to telescopes with which to continue long-term observing programmes. Those programmes have in the past been highly productive, with scientifically valuable publication records, and their discontinuance will cause gaps in the coverage of many orbits, some of them at critical phases. Moreover, lack of telescope access will discourage currently active workers and impede recruitment of new ones, who will be needed to take advantage of the large databases now under development and those anticipated from future major ground- and space-based surveys.

Commission 26 is concerned to ensure that high-quality data are accepted for publication in widely read journals, even before those data provide orbit coverage adequate for detailed analysis and the derivation of astrophysically useful results. Double-star studies are often very long-term, and such publication makes the data accessible to others who use them for such purposes as planning observing programmes.

12. Adjournment

The meeting was adjourned at approximately 5:30 p.m.

Acknowledgments. Thanks are due to all who contributed to the meeting, and especially to those who summarized their presentations for this report.

C. D. Scarfe
President of the Commission