

Double Stars in Prague

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The recent IAU General Assembly in Prague (2006 Aug 13-25) has gone down in history as the meeting at which it was decided to eject Pluto from the elite family of Solar System planets. However, for the double star observer, there were much more interesting gatherings to attract the attention. During the latter half of the second week, the main event was the first joint Symposium for both the wide and close binary fraternity - Symposium 240 was held in Meeting Hall I and attracted about 200 regular attendees to the three and a half days of varied and stimulating talks.

Before this however, on the previous Thursday, Commission 26 (Double and Multiple Stars) had held its Business Meeting in which members reported on

work carried out over the last 3 years. As always this started with a list of deaths over the preceding triennium. This year was particularly noteworthy, including as it did, Geoff Douglass and Dick Walker from USNO and Wulff Heintz from Swarthmore. On the positive side though 27 new members had joined, making a total increase of 50% over the past 6 years. This was followed by progress reports from various institutions and groups. A photograph of Commission 26 members is shown in Figure 1.

At the suggestion of Brian Mason, and with the help of Kent Clark, I gave a short talk on the activities of amateur double star groups around the world, concentrating on the work of the Webb Society and the JDSO. In addition, the poster board contained a summary of the activities of the Liga Iberoamericana de

Astronomia by Francisco Rica Romero, well-known to readers of this bulletin (and which can be found at the following website: http://www.lanzadera.com/estrellas_dobles_LIADA.htm). Francisco, unfortunately, was not able to attend the Prague meetings. Another poster of interest concerned the work of the Double Star Section of the Societe Astronomique de France. It was authored by Edgar Soulié who did come to the Symposium. Figure 2 summarizes amateur contributions from various sources.

The Webb Society Double Star Section, although founded in 1968, did not start producing instrumental measurements until the early 1980s using objective grating micrometers and again towards the end of that decade when commercially available filar micrometers began to appear, firstly from Ron Darbinian in California, then the RETEL in the UK. At pre-



Figure 1: Commission 26 members at Prague. Photo by McAlister/Hartkopff.

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sent the RETEL is still available and until recently, it was also possible to buy one from van Slyke (the current instrument uses a reticle - see <http://www.observatory.org/bfm.html>). The Meca-Precis double-image micrometer is also still available in France (e-mail: mecaprecis36@wanadoo.fr). Whilst some filar measurement is still being done by Webb Society members, most of the work is concentrated on CCD imaging and astrometry from archival Schmidt plate surveys using such tools as Simbad and Aladin. In the period 2003-2006 members made 7716 measurements using the methods outlined above (the breakdown here is 24% micrometry, 13% CCD astrometry and 63% from archives). Until now, observations have been printed annually in the Section Circulars but from Circular 15 this will be in electronic format and plans are being made to put the previous Circulars on the Society website.

The JDSO which started in 2005, is the successor to the Double Star Observer, founded by Ron Tanguay and which ran between 1993 and 2005. It contains contributions of both research and general interest and is partly peer-reviewed. Dr. Brian Mason from the USNO became an Advisory Editor in summer 2005. JDSO is a freely accessible electronic publication, and a typical issue is between 1 and 3 MBytes - which averages out at about 40 pages. The main observers are David Arnold (578 measures using a 290-mm SCT and reticle eyepiece) and James Daley (measures of 207 pairs using a 9-inch OG and SBIG ST7 CCD). The main thrust of the observations is to re-examine pairs on the WDS neglected pairs list and add some modern measurements to the catalogue. Brian Mason, in his talk at the Symposium pointed out that relative positions, and from these proper motions, of wide pairs can be more reliable than "instantaneous" determinations of proper motion such as those determined by Hipparcos simply because of the leverage afforded by the long time scale. The situation regarding neglected doubles was summarized by Brian in Figure 3.

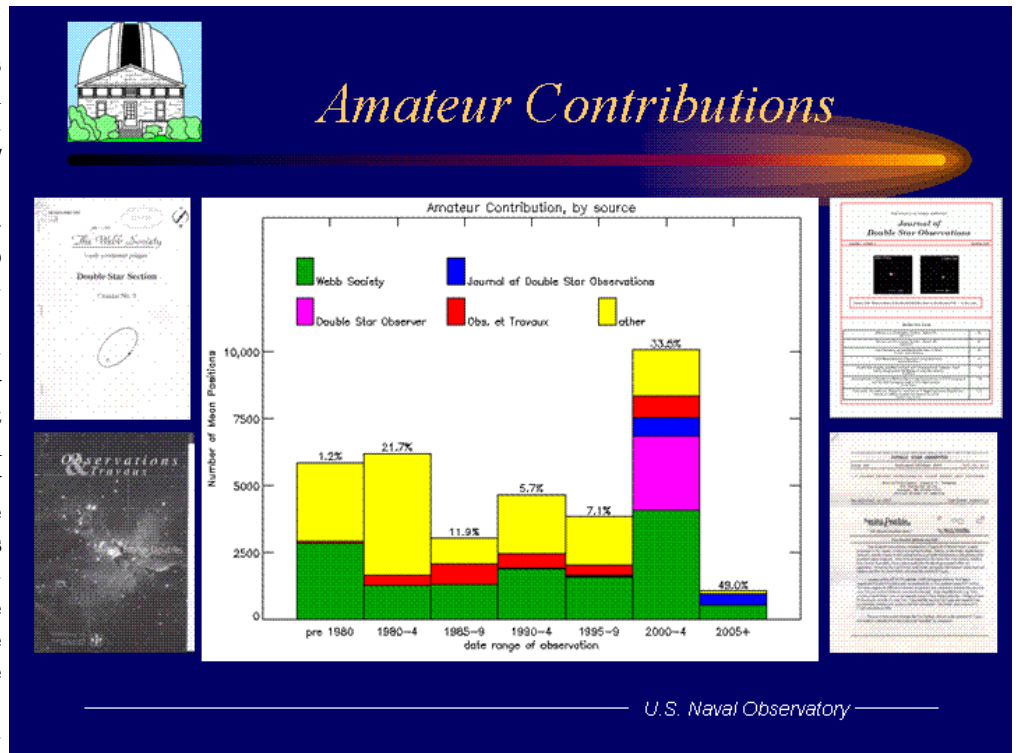
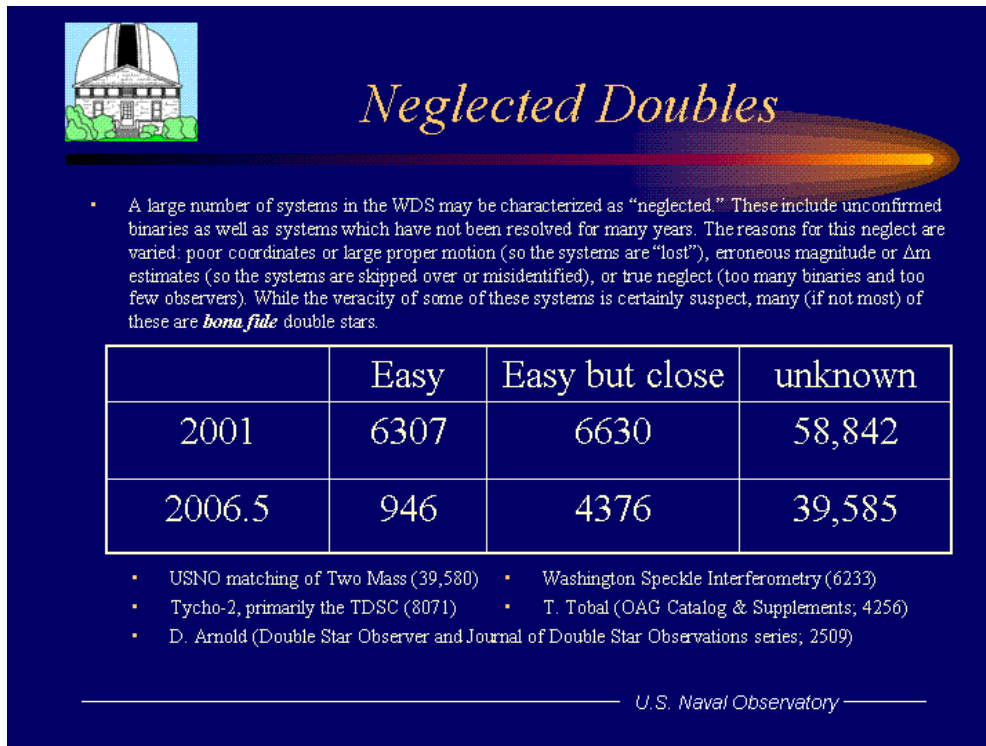


Figure 2: Slide from BDM talk at IAU 240 - Amateur Contributions

Counter-balancing the observational side, Francisco Rica Romero contributes some astrophysical investigations. The observations by Rainer Anton in the Summer 2006 issue highlight the lack of measurement in the southern hemisphere where even bright binaries, such as beta Phoenicis and delta Velorum, are passing through a critical orbital phase largely unobserved. Another productive center is the Garraf Observatory in Spain. The work of Tófol Tobal on neglected pairs has resulted in more than 4000 measures being made - these can be found on the WDS website.

During the second week, an evening Pro-Am meeting had been arranged at the nearby Faculty of Maths and Physics. I repeated the talk given earlier at C26 and the other speakers included Edgar Souliè, President of the Double Star Section of the Société Astronomique de France who described the work being done in that country. The other speakers talked about variable stars, and included Arne Henden from the AAVSO and Katarina Olah from Konkoly Observatory, Hungary. It is clear that there are many active Czech amateur astronomers (for instance, Kamil Hornoch was awarded a prize at the General Assembly for his work in finding previously unknown novae in M31

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Neglected Doubles

- A large number of systems in the WDS may be characterized as "neglected." These include unconfirmed binaries as well as systems which have not been resolved for many years. The reasons for this neglect are varied: poor coordinates or large proper motion (so the systems are "lost"), erroneous magnitude or Δm estimates (so the systems are skipped over or misidentified), or true neglect (too many binaries and too few observers). While the veracity of some of these systems is certainly suspect, many (if not most) of these are *bona fide* double stars.

	Easy	Easy but close	unknown
2001	6307	6630	58,842
2006.5	946	4376	39,585

- USNO matching of Two Mass (39,580)
- Washington Speckle Interferometry (6233)
- Tycho-2, primarily the TDSC (8071)
- T. Tohal (OAG Catalog & Supplements; 4256)
- D. Arnold (Double Star Observer and Journal of Double Star Observations series; 2509)

U.S. Naval Observatory

Figure 3: Slide from BDM talk at IAU 240 - Neglected Doubles.

from archive images) but none yet appeared to be involved in double star astronomy.

The last meeting of the General Assembly was Symposium 240 entitled 'Binary Stars as Critical Tools and Tests in Contemporary Astrophysics'. The first morning was given over to invited reviews including summaries of the current state of long baseline optical interferometry in the northern and southern hemisphere given respectively by Harold McAlister and John Davis. Professor McAlister briefly described the history of stellar interferometry noting that Michelson's pioneering instrument fitted to the 100-inch Hooker reflector early last century would be on display at the American Museum of Natural History in New York City from next year. He then went on to describe the contributions of instruments such as the Palomar Testbed Interferometer, the Navy Prototype Optical Interferometer (NPOI) on Anderson Mesa in Arizona, the no-longer operational Mark III instrument, and COAST at Cambridge in the UK. In the northern hemisphere, the next stage will be the full operation of the Keck Interferometer, using both 10-meter telescopes and the continuing development of the CHARA array on Mount Wilson with which the speaker was intimately familiar having played a ma-

major role in its proposal, design and construction. CHARA has six 1-meter telescopes and all are now in operation. The array is already producing some fascinating science and the possibilities are very exciting. With baselines of a few hundred meters, binaries as distant as 20 pc with periods of a few hours will be resolvable. The current program includes the direct measurement of stellar diameters of stars such as Vega, Regulus, delta Cephei, and nearby red dwarfs, and the resolution of double-line spectroscopic binaries in collaboration with spectroscopists Frank Fekel (Tennessee State) and Jocelyn Tomkin (Texas)

In the south, Professor John Davis (Sydney) recounted the early attempts at stellar interferometry from Narrabri where interferometric and spectroscopic data were first combined in an analysis of the 4 day pair alpha Virginis (Spica). Now the Sydney University Stellar Interferometer (SUSI) has taken over where the Narrabri instrument left off and is pursuing bright double-line binaries such as beta Cen and lambda Sco. In Chile the VLTI will use four of the VLT telescopes with a baseline of 130 meters and in combination with four 1.8-metre outrigger telescopes the baseline can be increased to 202 meters. A number of instruments have been designed to handle this data. VINCI is a test instrument designed for the K band, whilst MIDI operates in the N band (7 - 13 micron) and is thus extremely powerful for looking at circumstellar material as well as pre-main sequence binary stars. AMBER is being used to look at massive hot binaries such as gamma2 Velorum where a late O giant or supergiant is combined with a WC8 star. Both AMBER and SUSI data put the system at a significantly greater distance than that derived by Hipparcos.

Brian Mason, in his talk on "Classical observations of visual binaries and multiple stars", described the growth of the WDS and pointed out areas in which the amateur has done and can do something to help. These include identification of missing pairs, and de-

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termination of parameters which are unknown - there are many components, for instance, with no magnitudes and only 38% of the catalogue currently has proper motions. During the last few years the amateur contribution to the WDS has been a significant part of the work. Figure 2 shows how amateur contributions to the WDS have been made. Pre-1980, the small percentage was mainly due to the great observers such as Dembowski and Baize but from 1980 as interest grew so the amateur contribution became more significant. The rather small fraction between 1990 and 2000 was mostly as a result of a very large influx of data from large surveys such as Hipparcos, Tycho, 2MASS and the UCAC catalogues from USNO - numbering about 150,000 additional observations in all. From 2000 onwards the amateur work is a very significant proportion of the annual contributions.

An example of the innovative approach of the amateur was the observation of the faint comites C and D close to Polaris, described by James Daley in JDSO Vol. 2 No. 2, page 51. As it happens, Nancy Evans later argued that these are not physical companions, because their age precludes that interpretation. She did present evidence for a close companion to Polaris of $V=9$ at a distance of 0.14 arc seconds from HST ACS observations. This is thought to be the 30-year spectroscopic component.

It would take too much space to include notes about all of the interesting talks heard at Symposium 240 but here is one which gave me food for thought. Attempts are now being made to detect exoplanets by measuring the wobble which they inflict on the parent star. This is done by measuring the separation of two stars with time. Using the NACO near-infrared adaptive optics facility on the VLT for example, it is possible to do this with phenomenal precision. The example given was the double star HJ 663 whose mag 5.0 primary (HD 19994 = 94 Cet) has a planetary companion with a period of 454 days. The mag 11.0 stellar companion appears to be in orbital motion and the distance has been closing since discovery in 1836 when it was 5.0 arc sec. The quoted separation for the epoch of observation was $2347.652 \text{ mas} \pm 91 \text{ microarcsecond!}$

A meeting about double stars, of this size and length, at an IAU General Assembly is unprecedented and represents a major increase in the perception of the importance of this subject. The proceedings of the meeting are being edited by Bill Hartkopf from USNO, Ed Guinan (Villanova University) and Petr Harmanec (Ondrejov Observatory, Czech Republic) and will be published by Cambridge University Press in the next 12 months or so. There were about 180 posters in addition to the invited talks.

I am grateful to Brian Mason for permission to use two of the graphs from his talk.

Bob Argyle has been observing visual double stars for almost 40 years, and has been Director of the Webb Society Double Star Section since 1970. He has been making micrometric measurements using an 8-inch refractor since 1990 and edited "Observing and Measuring Visual Double Stars" which was published by Springer in 2004.

