

SPS3

A New Classification Scheme for Double Stars

Chairpersons: W. I. Hartkopf and B. D. Mason

Editors: W. I. Hartkopf and B. D. Mason (Chief-Editor)

An Introduction to the Nomenclature Problem

Brian D. Mason and William I. Hartkopf

United States Naval Observatory

Abstract.

The new observing and reduction techniques available to astronomers have led to remarkable changes in the field of double and multiple stars. New classes of companions, such as brown dwarfs and exoplanets, have been discovered. Binaries which previously constituted distinct classes are now observable by multiple techniques. With many long-baseline optical interferometers operational or planned, with improvements in other techniques, and with astrometric space-based missions in various states of planning and funding, the situation is likely to become more complicated. The result is greater understanding for the scientist, but greater challenges for the cataloger!

The “problem” is that purveyors of different techniques use different nomenclature, both in terms of root designation and component identifier. It is this latter inconsistency which causes the most confusion and is the topic of this Special Session.

This talk will illustrate some of the many designation ambiguities and summarize efforts made during the past few years to address this problem.

1. Introduction: a Welcome “Problem”

The new observing and reduction techniques available to astronomers have led to remarkable changes in the field of double and multiple stars. New classes of companions, such as brown dwarfs and exoplanets, have been discovered. Binaries which previously constituted distinct classes are now observable by multiple techniques (witness, for example, the increasing overlap between the visual and spectroscopic regimes). With many long-baseline optical interferometers operational or planned, with improvements in other techniques (e.g., absorption-cell RV work), and with astrometric space-based missions in various states of planning and funding, the situation is likely to become more complicated. The result is greater understanding for the scientist, but greater challenges for the cataloger!

The “problem” is that purveyors of different techniques use different nomenclature. Visual binaries are given discoverer designations, based on observer’s name (e.g., Σ or STF 13, β or BU 96), while spectroscopic binaries are usually identified by their HD number, eclipsing binaries by their variable star designation, occultation binaries by SAO or ZC number, and so on. Binaries analyzed by multiple methods may wind up with multiple designations.

While multiple designations are confusing, a large cross-reference list (such as SIMBAD) can usually handle these problems. Component confusion is even worse, however, as one person’s **AB** pair may be another’s **ab** or **BA** or **BC** or **primary/secondary**! It is this problem that we wish to address.

2. Addressing the Problem

An electronic discussion among an informal working group began in 1999. Over time, these discussions resulted in four suggested schemes (Dickel & Malkov 2000):

- **KoMa**: a hierarchical scheme developed by D. Kovaleva and O. Malkov (2000). Using a variety of upper/lower case alphabetic, numeric, and Roman numerals, this scheme indicated both hierarchy and type of companion (e.g., stellar, planetary, etc.)
- **UC**: developed by S. Urban and T. Corbin (2000). This is a numeric-only, backside-expandable scheme similar to that used for library call numbers.
- **Sequential**: a non-hierarchical scheme developed by L. Dickel and P. Dubois. In this numeric scheme all components are assigned numbers in the order of their discovery, with no heed given to their relationship with other components.
- **WMC**: the Washington Multiplicity Catalog. This method, while based on the venerable scheme of upper and lower case letters used in the WDS, extends to multiple levels through use of additional numbers and letters.

At IAU Symposium 200 the attendees seemed to favor the WMC, with UC a close second. The sequential scheme, while not favored, was sufficiently different from others so that it continued to be discussed.

At IAU-GA XXIV interested parties held a multi-commission meeting to discuss various methods for clearing up the nomenclature ambiguities (Genova 2000). As a result of those discussions the WMC was endorsed and the following resolution was ratified by Commissions 5 (Documentation & Astronomical Data), 8+24 (Astrometry), 26 (Double & Multiple Stars), 42 (Close Binary Stars), and later 45 (Stellar Classification)¹⁶.

The resolution read as follows:

On Designating Components of Binary and Multiple Star Systems

Recognizing

- the increasing synergy of techniques for the investigation of stellar companions blurring the traditional distinction between astrometric, spectroscopic, and photometric binary and multiple stars;
- the detection of sub-stellar (including planets) as well as stellar components by these techniques and,

¹⁶See http://ad.usno.navy.mil/wds/wmc/iaumcm_old.html, the IAU-GA XXIV MCM archival webpage for more information

- the need for a simple, unambiguous, flexible, and computer friendly designation scheme for components of binary and multiple star systems,
- Noting that future ground and space-based telescope projects have the potential to detect both sub-stellar as well as stellar components in increasingly large numbers,

Recommends that

- a uniform designation scheme, based on expansion of the new WDS system, be developed during the next 3 years to include all types of components and that this be reviewed in time for its adoption to be considered at General Assembly XXV.

Implementation of the scheme was to be as follows:

1. Present a sample of the resulting scheme to Commission 26 at Colloquium 191. This sample was to be in the form of a catalog of all types of binaries found within a particular patch of the sky, complete with component designations based on the new scheme. Details of this presentation are available in Hartkopf & Mason (2004).
2. Present modified scheme to SOC of IAU-GA XXV Seminar, USNO (17 June 2003).
3. Make any needed modifications based on suggestions from above items, then present this modified scheme to the SOC of IAU-GA XXV SPS 3 (Special Session 3: *A New Classification Scheme for Double Stars*).
4. Make additional modifications if necessary, then present the further modified scheme at SPS3, July 18, 2003.
5. If approved, present the all-sky WMC at IAU-GA XXVI in 2006, and continue to update and maintain.

Further details of the discussion of the electronic discussion group and past work are available on the WMC Designation Scheme & Working Group webpage¹⁷.

References

- Dickel, H.R. & Malkov, O.Y. *New IAU Concepts of Binary/Multiple Star Designations*, 2000, in IAU Symposium 200, BIRTH AND EVOLUTION OF BINARY STARS, Potsdam, Germany, B. Reipurth and H. Zinnecker, editors, 220¹⁸
- Genova, F. *Commission 5 Report*, 2001, Transactions of the IAU, XXIV, 237

¹⁷<http://ad.usno.navy.mil/wds/newwds.html>

¹⁸see <http://casa.colorado.edu/reipurth/iau200www/posterbook/index.html>.

- Hartkopf, W.I., & Mason, B. D. *Addressing confusion in double star nomenclature: The Washington Multiplicity Catalog*, 2004, IAU Colloq. 191, THE ENVIRONMENTS AND EVOLUTION OF DOUBLE AND MULTIPLE STARS, Mérida, Yucatán, México, C. Allen and C. Scarfe, editors, RevMexAA(SC)
- Kovaleva, D. & Malkov, O. *KoMa - a scheme for the designation of multiple objects*, 2000, in IAU Symposium 200, BIRTH AND EVOLUTION OF BINARY STARS, Potsdam, Germany, B. Reipurth and H. Zinnecker, editors, 223
- Urban, S.E. & Corbin, T.E. *The Urban/Corbin Multiple System Designation Method*, 2000, in IAU Symposium 200, BIRTH AND EVOLUTION OF BINARY STARS, Potsdam, Germany, B. Reipurth and H. Zinnecker, editors, 225