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A General Catalogue of Close Binary Systems

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1. Introduction

Every astronomer knows that most of our knowledge of the absolute masses, radii, and luminosities of stars beyond our Sun has been derived from the study of binary star systems, and most especially of individual eclipsing spectroscopic binaries. It is also now common knowledge that close binary stars evolve, through mass transfer, in very different ways from single stars. However, theorists often find their efforts at reconstructing the evolutionary history of individual interacting binaries confounded by the lack of rigorous physical models for crucial processes (most especially systemic mass and angular momentum loss) occurring during the course of that evolution. Practically the only reliable way in which to assess and quantify these effects is through the statistical analysis of an empirical sample of systems. A comprehensive catalog of close binary stars is therefore of value both for the study of the fundamental properties of stars and for the exploration and elucidation of evolutionary processes in those systems.

The ongoing effort described in this brief note began as a project of more limited scope in 1985, having become with time more comprehensive. It owes a great deal to a number of predecessors well-known in the binary star community, including (in their most recent editions) the *Eighth Catalogue of the Orbital Elements of Spectroscopic Binary Systems* (Batten, Fletcher & MacCarthy 1989), *A Finding List for Observers of Interacting Binary Stars* (Wood et al. 1980), *A Catalogue of Graded Photometric Studies of Close Binaries* (Koch, Plavec, & Wood 1970), and the *Catalogue of Orbital Elements, Masses, and Luminosities of Close Binary Stars* (Svechnikov 1986), as well as numerous other, more specialized works. It attempts to be broader in scope than these works, in regard both to the number and types of objects included, and to the breadth of observational data in encompasses, but for the most part lasks their detailed descriptions of individual systems.

2. Scope

The criteria for the selection of systems for this catalog have been broadly set to ensure inclusion of those binary systems which could reasonably be considered "close," in the sense that they are capable of interacting within their evolutionary lifetimes. In the current working copy of the catalog these criteria are loosely enough defined to encompass a number of systems, and some classes of systems, of doubtful binarity. However, I have stopped short of including as a matter of course stars only because they show combination spectra (spectrum binaries),

or evidence radial velocity variations, in the absence of even putative orbital elements. The following classes of objects are included:

Spectroscopic binaries (including binary radio and X-ray pulsars) with known or suspected orbital periods;

Variable stars of the following types: eclipsing binaries (types E,EA, EB,EW), ellipsoidal variables (ELL), RS Canum Venaticorum stars (RS), BY Draconis stars (BY), FK Comae stars (FKCOM), classical novae (N,NA,NB,NC), recurrent novae (NR), dwarf novae (UG,UGSS,UGSU,UGZ), AM Herculis binaries (AM), nova-like variables (NL), symbiotic stars (ZAND), reflection variables (R), Optically-variable compact X-ray sources (X), and unique variables (*) suspected to be interacting binaries;

Suspected variable stars of the above types; and other

Interacting binaries (e.g. X-ray binaries, symbiotic stars, and nova-like variables) lacking optically-variable counterparts.

3. Contents

The following is a brief summary of the data included in this catalog. A large fraction of these entries have been or will be derived *ab initio* from the observational data at hand.

Stellar identifications: Variable star designation, Greek letter (principally Bayer & Lacaille) designation, HR, HD, BD, CoD, and CPD numbers, as well as various other identifications, including provisional variable star designations. Also included in the working copy are FK, FK Supplement, SRS, AGK3, SAO, and GC identifications, to be augmented in the final version by those in the current generation of FK5-based catalogs;

Equatorial coordinates (α, δ): Precise positions are given where available, for equinox B1950 in the working copy, to be superseded by J2000 coordinates in the final catalog;

Proper motion (μ_α, μ_δ);

Galactic coordinates (l,b);

Spectral types: MK types for both components, where available;

Spectroscopic orbital elements ($T, P, e, \omega, V_0, K_1, K_2$);

Projected rotational velocities ($v_1 \sin i$, $v_2 \sin i$);

Apparent magnitude and colors (V, B−V, U−B, R−I) at normal light (maximum for eclipsing binaries, quiescence for cataclysmic variables and X-ray binaries);

Color excess (E_{B-V});

Trigonometric parallax (π_{tr});

Cluster or association membership;

Visual binary designation, including relative positions and magnitudes of companions, and their colors and spectral types where known;

Type of variability;

Magnitudes at primary and secondary minima for eclipsing variables;

Eclipse durations (D,d);

Photometric solution (i,r_1,r_2,l_1,q_{ph}): where not available from light curve solutions, values for these parameters derived from visual orbits or polarimetry, or from other indirect methods, are provided;

Absolute elements: orbital separation (A), component masses (M_1, M_2), radii (R_1,R_2), effective temperatures (T_1,T_2), luminosities (L_1,L_2);

Distance (R);

Space velocity (U,V,W); and

Miscellaneous data, including evidence that the system is single, not binary; intrinsic variability of components; visual binary orbits; third light contributions; apsidal motion; alternative light curve solutions; pulsar dispersion measures; component photometric or rotation periods; stellar angular diameters; etc.

Detailed citations are provided for the sources of the spectroscopic and photometric solutions. A cross-index by stellar identification and an extensive bibliography is included with the catalog description.

4. Status

The working copy of this catalog now contains data on more than 9000 objects, including many in the Magellanic Clouds and M31. The identification of galactic binaries of the types enumerated above is essentially complete through mid-1990, but with the data entries for a great many systems still seriously incomplete. The catalog is currently maintained in a large number of machine-readable files, but unfortunately not yet in a format suitable for electronic distribution. It is still a number of years from completion. A printed working copy of the catalog from mid-April 1993 (in 5 volumes, totaling approximately 3000 pages) has been deposited at the U.S. Naval Observatory Library.

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