

A DATABASE FOR TIMES OF MINIMA OF ECLIPSING BINARIES

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*Presented at the First European Meeting of the AAVSO
Brussels, July 24-28, 1990*

Abstract

A comprehensive database for times of minima of eclipsing binaries, comprising over 92,000 entries for 1,401 stars, has been compiled from the literature. Included are all named eclipsing binaries down to 13th magnitude in normal light, within declination zone -20° to $+90^{\circ}$, with no restrictions being applied to amplitude or period.

1. Sources for the Database

The list of objects to be included in our database was compiled from the *General Catalogue of Variable Stars* (Kholopov *et al.* 1985) (GCVS) and from the names lists published afterwards in the IAU Comm. 27 *Inf. Bull. Var. Stars* (IBVS). For all objects, entries from the following works were copied to form a basic bibliography ('Super-GuL'):

1. *Geschichte und Literatur des Lichtwechsels der Veränderlichen Sterne*, eds. E. Hartwig und G. Müller, R. Prager, H. Schneller, Leipzig, Berlin, 1918-1961.

2. *A Finding List for Observers of Eclipsing Variables*, 4th ed., by R. H. Koch, S. Sobieski, and F. B. Wood, 1963. Now: *A Finding List for Observers of Interacting Binaries*, 5th ed., by F. B. Wood, J. P. Oliver, D. R. Florkowski, and R. H. Koch, 1980 (= Publ. Univ. Pennsylvania, Astron. Ser., Vols. IX and XII).

As a guide to the newer literature on eclipsing binaries, we use the IAU Comm. 42 *Bibliography and Program Notes on Close Binaries and Astronomy and Astrophysics Abstracts* (Heidelberg). The IBVS is a most important primary source. A useful source for elements and published and unpublished times of minima of eclipsing binaries is the *Annual International Supplement of the Rocznik Astronom. Obserw. Krakowskiego*, ed. K. Rudnicki (Cracow).

We have systematically scanned about 150 regular journals and institute publications for literature on eclipsing binaries. The following publications by amateur astronomical societies are received regularly and are included in the database:

J. Amer. Assoc. Var. Star Obs.

Bb. erg. d. AKV d. DDR (publ. in *Mitt. Veranderliche Sterne*, Sonneberg)

† Editor's note: The author died since the presentation of this paper.

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Brit. Astron. Assoc. Var. Star Sect. Circ.
BAV Mitt.
BBSAG Bull.
Brno Contrib.
GEOS Circ. (on Eclipsing Binaries)
 Harthaer Bb. Zirk. (HBZ) and Mitt. d. Bruno-H.-Burgel-Stw. Hartha

Unfortunately, the majority of AAVSO data collected since 1978 (several thousands of minima times) is still unpublished and thus currently missing from our database. However, as we heard at this symposium, these data are now being reduced and the first part will be released soon. The AAVSO has kindly agreed to send us a computer disc with the reduced data in advance of publication so that they can be included in the database.

2. Structure of the Database

In its current state, the database is built from sequential data files supplemented with input and retrieval programs (in BASIC) and added graphics support. Within the database, stars are provided with a generic identifier and a number code. For each star, there are two files: one containing elements and other basic star data (not necessarily complete), and the other containing the minima data (heliocentric Julian date, qualifier, observer, and source). The qualifier signifies the type of photometry (plate minima photographic, visual, photoelectric, or of unknown type), possibly followed by : or :: to assign reduced or zero weight. We have always tried to go back to the original source. Particular care has been exercised in getting the correct Julian date, especially for the old days in which different time conventions were used in parallel (e.g., old observations often are given in local mean time, without heliocentric correction). Besides the observer, we also give (in brackets) the name of the computer, if that is not identical. (A lot of minima were newly derived by us and one of our collaborators from hitherto unreduced observations in the literature.)

Table 1. Some Database Statistics as of August 13, 1990

Plate minima:	21982 = 23.8% (P 20308, P: 1369, P:: 305)
Photographic minima:	5170 = 5.6% (F 4533, F: 531, F:: 106)
Visual minima:	56774 = 61.5% (V 50842, V: 3674, V:: 2254)
Photoelectric minima:	8189 = 8.9% (E 7606, E: 489, E:: 94)
Minima of unknown type:	255 = 0.28%
Total number of minima:	92370 on 1401 stars = 65.93 minima per star

3. Using the Database

The retrieval programs allow using the database for various purposes, namely:

- computer-assisted compilation of minima listings with O-C from given elements (usually we take the GCVS as the source for the 'official elements'), using 'beat elements' to assign correct epochs over prolonged time intervals; may handle also eclipsing binaries with shifted secondary minimum and apsidal motion;
- computing instantaneous elements for ephemeris prediction;

- calculating piece-wise linear or parabolic elements;
- plotting O-C diagrams;
- period searches;
- qualifying individual observations by comparison to a whole body of verified data.

From a more global viewpoint, it may be used to:

- select stars neglected by observers;
- select stars suspected of period changes; and
- compile observation statistics.

Within the BAV, the database has been helpful in providing a check on observations before publication and has proved most useful in giving directions on potentially interesting and rewarding objects to observe. This became particularly important with the advent of four dedicated BAV observers using robotic observatories (F. Agerer, photoelectric; P. Frank, W. Moschner, and H. Vielmetter, photographic).

4. Plans and Prospects for the Future

There is much that remains to be done. The database is still incomplete for constellations UMa - Vul. The basic star data are somewhat rudimentary, having been filled in only as the need arose. They will be completed using the electronic edition of the GCVS. The retrieval programs could be amplified and made more elegant and comfortable; we have postponed this because emphasis was on getting a reasonably complete database. In the future, we will convert to a standard database structure, possibly a relational database. An ambitious project to be built on this database will be the compilation of "An Atlas of (O-C)-Diagrams of Eclipsing Binaries".

5. Information Policy

We are already providing interested astronomers with data from our files. However, since some reorganization will become necessary in the near future (our friend F. Agerer has kindly agreed to be our successor in maintaining the database) and such a huge database is difficult to manage for an individual, access will be somewhat restricted until we have found an efficient means of distributing our data. This database will serve both professional and amateur astronomers by providing archival as well as up-to-date information on times of minima of eclipsing binaries. However, this cannot be a one-way-road. We urge people to help by sending us minima data. Researchers using our database are expected to make appropriate acknowledgements.

6. Acknowledgements

Our work would not have been possible without the relentless efforts of H. Schmidt, Berlin, who has over the years, provided us with an enormous amount of photocopies from the libraries of Wilhelm-Foerster-Sternwarte and Staatsbibliothek Berlin. Further thanks are due to the Astronomical Institutes of Bonn University, whose library I was generously allowed to use. There I was helped by B.-C. Kämper in often locating quite exotic literature, and his advice was invaluable in many respects.