

## GCVS: COMPLETION OF THE 4th EDITION AND PROSPECTS OF COMPUTER DATA BASE

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**ABSTRACT.** The work of Moscow astronomers according to the IAU behalf on compilation of the General Catalogue of Variable Stars is reviewed. The 4-th edition is nearly finished. The last, 5-th volume of the Catalogue will contain information on nearly 11000 variable stars in other galaxies. Special attention is paid to work on more precise co-ordinates of the variable stars contained, to the prospects of the automatization of the work and creation of the user-oriented computer database.

**Key words:** Stars: variable.

The 4th edition of the General Catalogue of Variable Stars turned out to be an unlucky project. Since it had been commenced, two leading scientists and key organizers of the work, B.V. Kukarkin and P.N. Kholopov, died. The completion of the work was delayed, but now we are very close to its end. So it is time to review the stages of this work and to discuss prospects.

Before the World War II variable star catalogues were compiled in Germany. After the war, the IAU chose new groups of scientists to continue international projects earlier in German responsibility. So in 1946 the IAU decided to ask two groups of Soviet astronomers (in Sternberg Institute and in Variable Star Commission of the Academy of Science) to be responsible for compilation and publication of variable star catalogues.

The 1st edition of the GCVS was prepared very quickly (Kukarkin & Parenago 1948). Though German variable star catalogues appeared every year, the Soviet compilers decided to publish a new catalogue once in several

years, and in between to publish supplements containing only stars for which the relevant information has changed significantly. Even the first announced interval between GCVS editions (5 years) was too short compared with reality; the 2nd edition appeared after a 10-year interval, the third edition was completed 13 years later, and the 4th edition is not yet ready now, 22 years after the completion of the 3rd one! The main reason is the greatly increased number of known variables: if the first catalogue published by the 'Astronomische Gesellschaft' (Prager 1926) had 2900 stars and the last one (Schneller 1942) contained 9476 variables, the first Soviet GCVS contained 10920 objects, and the 4th GCVS edition has 28435 entries for Galactic variables and will have 11000 stars — extragalactic variables — more. Modern developments in computer data bases give a hope to have a revised computer version of the GCVS very often (see below).

Two major steps had to be taken to start the 4th GCVS edition. First of them was the preparation of the New catalogue of suspected variables (NSV; Kholopov 1982). It was an important step in the GCVS modernization: the main table of the catalogue was computer generated, and a computer-readable version of the catalogue was prepared. The mentality of the compilers was still not ready for deep introduction of computers; they considered a book as the main product of their activity, and the computer version was a slightly modified version of the book, in a not sufficiently unified format and not quite easy to use at computers. This is a general problem with the 4th GCVS

edition, but it became clear for us only at a later stage of its preparation (Samus & Kholopov 1985).

The NSV catalogue contains 14810 stars. A considerable fraction of these stars have now got final GCVS designations, and many new stars have been suspected. E.V. Kazarovets is now working on compilation of the supplement to the NSV catalogue.

The second step consisted in developing an updating the classification for variable stars. The basic contribution here was made by Kholopov (1983). The classification system described in the GCVS (Kholopov 1985) generally follows the same lines. This system is bulky (33 main types, with 70 subtypes in 14 of them) and not quite homogeneous (for example, the classification adopted for young irregular variables is additive — a type is the sum of symbols characterizing different properties, while for many other groups of variables a type is designated by the name of the prototype star). Probably this was the best system possible at that moment, but now it is necessary to reconsider it, maybe with wider use of the additive principle (see Samus 1992, and suggestions by E. Robinson in the discussion session following that talk).

By 1987, three Volumes of the 4th edition appeared. They contained information on variables of our Galaxy in all 88 constellations. It was planned that the next volume would be devoted to extragalactic variables. Preliminary work on it was done by P.N. Kholopov and N.M. Artyukhina. But after Prof. Kholopov's death on April 13, 1988, we had first to issue Volume IV (Reference Tables; Samus 1990), and only now we are practically ready with Volume V (Extragalactic Variables).

The main difficulty in the preparation of Volume V was in its astrometric aspect. The normal accuracy of co-ordinates in the main volumes of the GCVS is to 1s in right ascension and to 0.1' in declination. For external galaxies such co-ordinates are too rough. Though P.N. Kholopov did not want a different accuracy standard for one of the 5 volumes, we decided that to give better co-ordinates for extragalactic variables is absolutely necessary.

The task of co-ordinate determination for thousands of them was undertaken by V.P. Goranskij. He actively used the possibilities connected with the GSC catalog. After this we found a number of earlier overlooked identifications of variables discovered by different authors, especially in the Magellanic Clouds.

The 5th GCVS volume will contain about 7200 stars in the Magellanic Clouds, 1200 stars in the Andromeda Galaxy, 600 stars in the Sculptor dwarf galaxy, 540 stars in M 33, and 1440 stars in other galaxies, the total about 10980 stars. We try to present for the majority of these variables the same information, including remarks, as in Volumes I – III. Now only variables in globular clusters remain outside the scope of the GCVS. To include also them, we need a principal decision of the IAU. The last Canadian catalogue of these variables was published 20 years ago (Sawyer Hogg 1973). It is also necessary to determine equatorial co-ordinates of variables in globular clusters: Sawyer Hogg's catalog gives only rough rectangular co-ordinates relative to cluster centers.

The magnetic tape versions of our catalogues now available contain only main tables of each volume. We have prepared magnetic tape versions of the remarks and reference lists; after necessary editing these files may also be presented to users.

The GCVS system includes the Name-lists of new variables. The 4th GCVS edition Name-lists Nos. 67 – 71 exist in printed form (IBVS) as well as in the computer readable form.

We have started a large scope astrometric work on variable stars, trying to be able in future to present co-ordinates of variables accurate at least to 1". Many variables can be identified with the Hubble Guide Star Catalog, but automatic identification leads to very high percentage of mistakes. So we try either to measure co-ordinate accurately on photographs (here we are actively assisted by Yu.A. Shokin of Sternberg Institute) or to check GSC identifications using published finding charts and the visualization software developed by V.P. Goranskij.

Since the beginning of the eighties, we have

the understanding of the necessity of complete re-organization of our GCVS work, switching from the card catalogue to the computer data base. The volume of information contained in our card catalogue is estimated to be about 0.6 GBytes; several megabytes are added every year. The form of the coming information is highly inhomogeneous, its presentation in a format suitable for further use is not straightforward. A special system for handling variable star data has been developed (Fadeyev & Novikova 1989). It provides access to information contained in the data base through the so-called 'master list' (essentially the main table of the GCVS) and a system of key words. The system does work practically and shows the principal possibility of GCVS automatization. The limits to its everyday use are put by insufficient volume of data already in the data base, we have not yet started converting old data from our card catalogue to the computer readable form and are only able to input into the data base some 20% of newly arriving information on variable stars. And the limits to the rate of this work are put by the absence of a convenient 'envelope' program of data presentation in the necessary form and by insufficient computer park of our group. Nevertheless, we hope that our rich data base will sooner or later become available to every interested user having a computer. Then we shall be able to prepare computer versions of the main catalogue with much better regularity — and maybe

even always have an updated version.

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