

# Catalogs of variable stars, current and future

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**Abstract.** To study effects of stellar variability, it is necessary to have complete lists of variable stars with good coordinates, correct variability ranges, reliable classification. The General Catalogue of Variable Stars (GCVS) is one of the main sources of information of this kind. Recently, the flow of information on stellar variability has increased strongly, requiring new approaches to GCVS compilation. New classification schemes are needed for variable stars, taking into account the development of our knowledge. We present information on the current state of the GCVS, its web data base, new Name-Lists containing thousands of new variables. We also discuss the problems of developing a new classification system for variable stars, of implementing catalogs of variable stars based on automatic surveys into the GCVS, of cooperation and interaction between the GCVS and other important sources of information on variable stars.

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## 1. Introduction

The General Catalogue of Variable Stars (GCVS) is a project under way in USSR/Russia since 1946 on behalf of the International Astronomical Union. It replaced the series of variable-star catalogs that had been published before the World War II in Germany by the Astronomische Gesellschaft. The initiators and leaders of the Soviet GCVS project were Pavel Parenago (1906–1960), B. V. Kukarkin (1909–1977), P. N. Kholopov (1922–1988). Complete lists of variable stars with good coordinates, correct variability ranges, reliable classification are very important for any studies of impact of stellar variability on stars and planets.

The 4th GCVS edition, the last one in the paper form (Kholopov *et al.* 1985–1987) contains about 28 500 variable stars of our Galaxy plus about 14 800 suspected variables in the New Catalogue of Suspected Variable Stars (the NSV catalog, Kukarkin *et al.* 1982). A supplement to the NSV catalog (Kazarovets *et al.* 1998) added about 11 200 stars. With the recent Name-Lists of variable stars, the number of variables named in the GCVS system has become as large as about 41 500. Together with the catalogs of suspected variable stars, our files contain 64 324 stars (by mid-2009). At the same time, automatic surveys announce very many new discoveries. For instance, the ASAS-3 survey (Pojmanski 2002) has announced about 30 000 new discoveries. Very soon, the number of newly discovered variable stars is expected to be millions. Old star-by-star approaches to variable-star catalogs have reached their limit and cannot be continued for very long. Meanwhile, there remain possibilities to improve the contents of the GCVS also for “old” variable stars.

## 2. Recent Improvements of the GCVS

After the fourth GCVS edition, we continue to support and improve the GCVS online version, also including catalogs of suspected variable stars.

The online GCVS version takes into account numerous corrections compared to the printed version. In particular, the coordinates have been greatly improved (see Samus *et al.* 2006 and references therein). Revised information has been provided for about 8000 suspected variables. Several search possibilities are available. Our online catalog can be found at the Sternberg Institute's web site (<http://www.sai.msu.su/gcvs/gcvs/>). This version also includes stars of variable-star Name-Lists published after the 4th GCVS edition. Recently we initiated publishing the Name-Lists, containing several thousand variables each, as complete catalogs of new variable stars (cf., for example, Kazarovets *et al.* 2009). The online information for stars from some of the older Name-Lists is incomplete; the situation is improved in the course of our systematic effort to revise astrophysical information of the GCVS. So far, this work has been completed for the constellations of Andromeda, Antlia, Aquarius, Ara, Auriga, and Telescopium.

The data from automatic surveys in open access in the Internet make it possible to transfer many stars from catalogs of suspected variables to the GCVS. Thus, about 1250 NSV stars were transferred to the GCVS in the recent 79th Name-List of Variable Stars (Kazarovets *et al.* 2008).

## 3. Problems for the Near Future

One of the important first steps leading to new approaches to variable-star catalogs is the improvement of the GCVS classification system. Most automatic surveys have simplified classification systems, not completely meeting the needs of the community; the classification system of the 4th GCVS edition is too complex. We have suggested a revised system to the IAU Commissions 27 and 42 during the IAU XXVI in Prague, it can be found at <http://www.sai.msu.su/gcvs/future/future.html> – the working group created in Prague (and continuing its activity after Rio de Janeiro) will be grateful for any additional suggestions. Note that the GCVS team receives conflicting signals from the community: while experts on particular variability types urge us to make the classification more detailed, most users would prefer a simpler system, easier to understand and remember. Prospects of automatic classification, badly needed for improving productivity, also require a simpler system with not too many different types of variable stars and no need of detailed studies to distinguish them.

One of the problems not permitting to immediately merge variable-star catalogs from automatic surveys with the GCVS is the quality of coordinates in the surveys based on observations with small cameras. Quite often, automatic surveys present good-quality light curves for variables discovered at positions between two stars of comparable brightness, 10–15'' apart. To determine which of the two components really varies, additional observations or other kinds of supplementary information are needed. Note that, typically, the amplitudes quoted in automatic survey in such cases are also too low because of contamination from the non-varying neighbor. The GCVS team is not going to deteriorate its current rather high standard of accuracy of tabulated coordinates (see Section 2), so such stars will remain outside the GCVS until it becomes possible to find out which particular star varies.

One of possible ways to solve such identification problems is to use information contained in photographic plate stacks and still awaiting its evaluation. This information cannot be completely used unless the existing plate collections are digitized. The

Sternberg Institute plate collection (about 60000 plates) is being digitized since 2006 using two CREO EverSmart Supreme II scanners. So far, about 500 new variable stars have been discovered using these scans, almost 300 of them already announced in Kolesnikova *et al.* (2008).

Recently (Samus *et al.* 2009), we have determined sufficiently accurate equatorial coordinates for virtually all stars of the Catalogue of Variable Stars in Globular Clusters (Clement *et al.* 2001). This permits us to consider a possibility to change the obsolete rule to leave globular-cluster variables outside the GCVS, designed to be a catalog of all galactic variable stars.

The ever increasing flow of information on variable stars, including new discoveries, makes it very important to improve international cooperation in the field of variable-star catalogs. The International Variable Star Index (VSX; <http://www.aavso.org/vsx/>), supported by the American Association of Variable Star Observers (AAVSO), has the intention to become the main entry point to the GCVS system. It already provides information for variable stars from sources outside the GCVS, among them catalogs of automatic surveys. In April 2009, the GCVS and VSX teams have agreed to coordinate information provided by the two facilities and invited SIMBAD to join them in this coordination.

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