Confirmation of 177 objects in the New Suspected Variables Catalogue as red long period variables

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Abstract: Colours are derived from online surveys for suspected variables in the NSV having good positions and a red subset of the resultant data is assessed against the ASAS3 online time series database.

Introduction

The electronic combined Catalogue New Suspected Variables (NSV) archived at the Centre de Données astronomiques de Strasbourg (CDS) (Samus et al 2004) is used as a source for gaining positions and colour information from the Second United States Naval Observatory CCD Astrographic Catalogue (Zacharias et al 2004). In colour index plots of near optical against near infrared magnitudes the red dwarf and giant stars diverge from the normal sequence apparently due to the effect of TiO absorption bands upon the background blackbody continuum flux normally measured by these passbands (see, for example, Bessell and Brett, 1988, figure 2 and the text).

Using this colour information a subset of objects likely to be red long period variables can be selected and assessed against the timer series data archived at the All Sky Automated Survey, specifically ASAS3 (Pojmanski 2002) to test to see if the suspects are variable.

In some cases these objects have been identified via automated cross matching of variables published by ASAS3 (see for example Pojmanski 2003) and where those miss objects even in their own survey area, in the Northern Sky Variability Survey’s Red Variables (Williams et al 2004). However, most of these catalogues are not readily available, rarely being in VizieR, and certainly not in SIMBAD, at the CDS. When they are available (eg the recently launched Variable Star Index or VSX, Watson et al 2006) their astrometric accuracy is such that automated cross matching of objects with the NSV, itself prone to astrometric error, can be problematic and incorrect, not only missing matches, but sometimes incorrectly matching the wrong NSV object with an ASAS3 or NSVS variable.

It is in this context that this list is presented, as it provides accurate positions and confirmatory lightcurves together in a medium that will allow SIMBAD linkage to this information for their NSV identities.

Unfortunately at the time of writing the ASAS3 system is having equipment problems, so many lightcurves were not available. Indeed during the processing of the data for this paper a further loss of capability occurred such that an initial 238 objects were further reduced to 177 during the markup of the lightcurves, as data present at the initial stage disappeared as the second batch of lightcurves were regenerated!
Although most have been noted as variable by either ASAS3 or NSVS in the past, albeit independent on any certainty of accurate NSV cross matching in those cases, about ten percent of the following are previously unconfirmed, being fainter objects than those mostly automated variability surveys normally safely deal with.

**Methodology**

The NSV electronic file as archived at the CDS ftp holdings was crossed against the UCAC2 catalogue using a small two arc seconds search radius in VizieR. From this data positions, UCAC2 red magnitude (Zacharias et al 2004) and 2MASS photometry (Skrutskie et al) were taken. The UCAC2 is an astrometric, and not a photometric, catalogue which can have errors of up to +/- 0.3 magnitudes on the global level (Zacharias et al 2004), but is adequate for this purpose as the colour index it is to be used for, red–J, has a large range thus diluting problems normally caused by such errors.

The derived data consisting of some 5,050 datapoints was used to generate the colour indices red–J and J-Ks. A colour - colour diagram of the resultant data was generated with red-J versus J–Ks as shown in figure 1. As noted in Bessell and Brett (1988) there is a turnoff point for the red giants, which for these colours is completely covered by J–Ks > 1 and red–J > 3.

Accordingly those objects were selected as likely to be mostly red long period variables, leading to a subsample of approximately 1,700 objects. As the ASAS3 survey does not currently extend further than +28° Declination objects north of this were further removed from the subsample leaving approximately 850 objects.

![Figure 1: A plot of the 5050 NSV objects as red–J versus J–Ks](image-url)
These were then checked by eye against the ASAS3 online time series archive in order to assess variability. Any object found to be evidently variable by inspection of the light curves was thereby confirmed variable. Many were constant, and not a small few were too faint for the ASAS3 survey to give any data, which combined with the current reduced nature of the ASAS3 archive due to equipment problems of uncertain duration, led to only about 240 objects being readily confirmed. Further reduction in the available dataset for objects of RA > 12 hours during processing led to only 177 cases being able to be provided with evidence.

Results.

The automated cgi data retrieval and light curve generating system provided by the ASAS3 server (http://www.astrouw.edu.pl/~gp/asas/asas.html) was used to create on the fly plots of the confirmed objects showing the evidence of their variability. Each object is identified by its NSV number, an accurate J2000 position given, and the plot of the light curve for that object shown.

The complete ensemble of an NSV position tallying to good accuracy with the position of a accurate astrometric catalogue, said position itself being able to be used to generate a light curve showing variability for an object at that position (within the confines of ASAS3 resolution) gives good confidence that the suspected variables and indeed really variable.

One hundred and seventy seven objects are presented here in an appendix immediately following the references. Most of the objects are semiregular variables, with a handful of Mira, and at some possible RV Tauri variables.

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References

Bessell, M. S., Brett, J. M., 1988, PASP 100, 1134
NSV 5423 J2000 12 00 59.4 -79 46 00

NSV 5443 J2000 12 03 52.0 -69 30 55

NSV 5642 J2000 12 29 01.2 -47 57 39

NSV 5789 J2000 12 37 22.7 -28 02 40

NSV 5870 J2000 12 42 21.3 -58 28 06

NSV 6605 J2000 14 16 40.8 -36 56 18