# 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-$K_s$. A colour - colour diagram of the resultant data was generated with red-J versus J–$K_s$ 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–$K_s$ > 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.

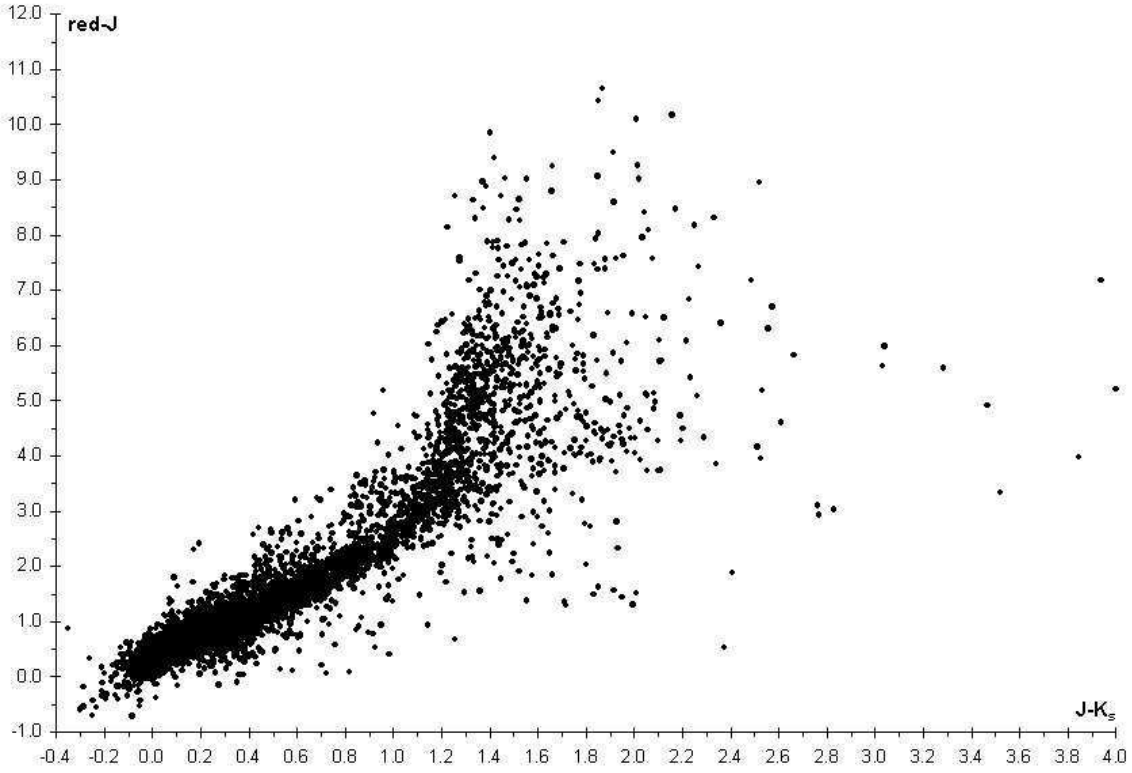


**Figure 1** : *A plot of the 5050 NSV objects as red–J versus J–$K_s$*

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.

**Acknowledgements**

This work used data products generated by the Sternberg Astronimical Institute, Moscow, Russia; the United States Naval Observatory, Washingon DC, USA; and the All Sky Automated Survey (ASAS), Warsaw University, Poland. Archival data and VizieR interactive database facilities, both hosted by the Centre de Données astronomiques de Strasbourg, were also utilised. Some photometric data contained in the UCAC2 catalogue originates from the 2MASS survey, which is a joint project of the University of Massachusetts and The Infrared Processing and Analysis Center of the National Aeronautics and Space Administration, USA. The online ASAS cgi engine was used to generate the plots.

**References**

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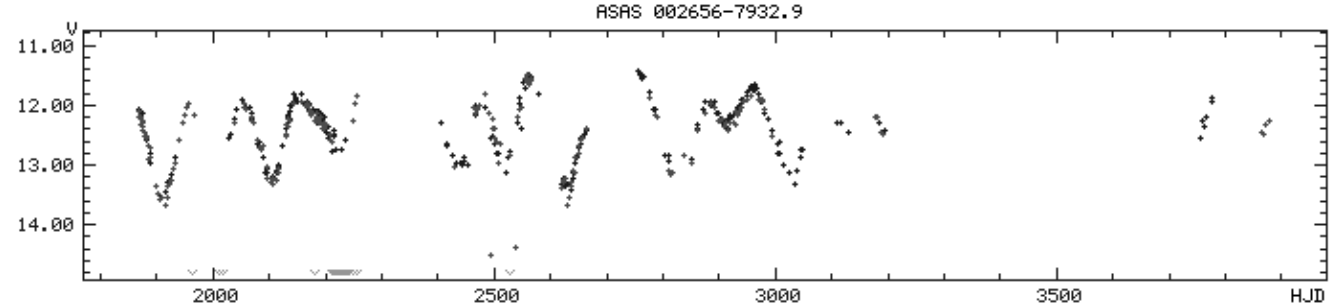
**NSV 166** J2000 00 26 56.3 -79 32 55

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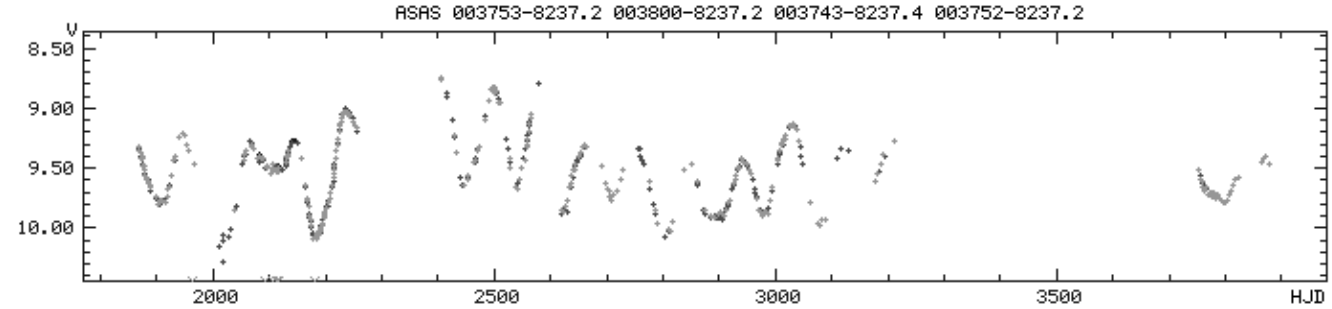


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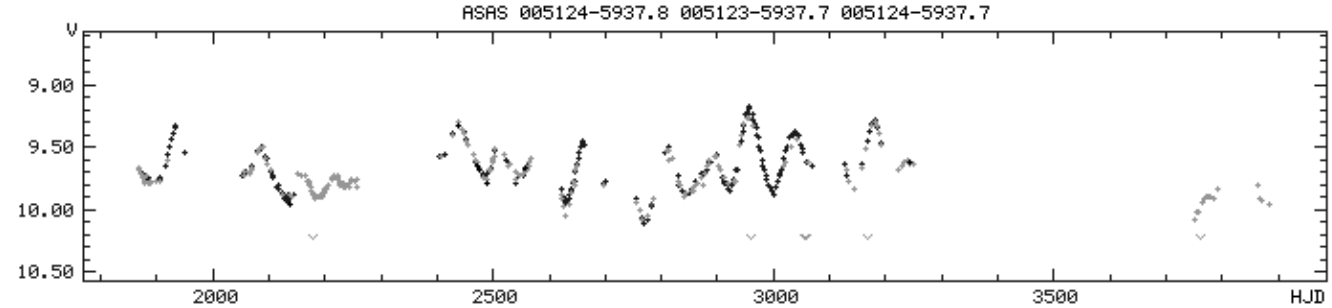


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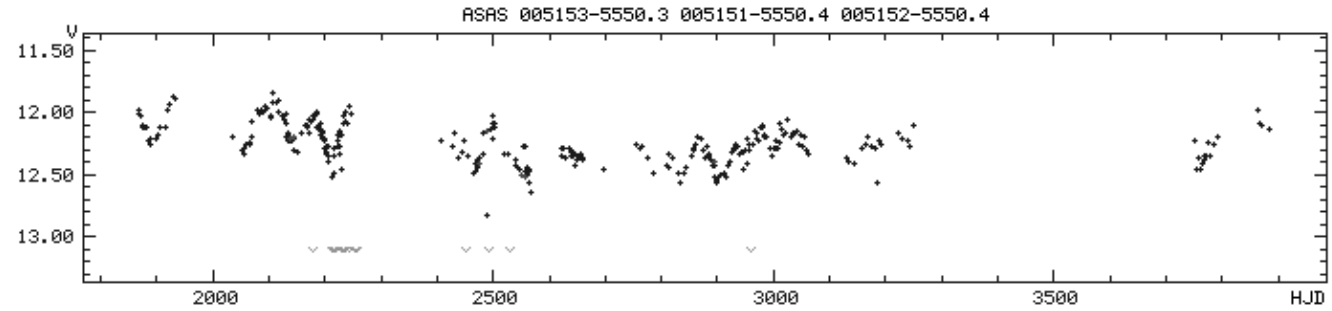


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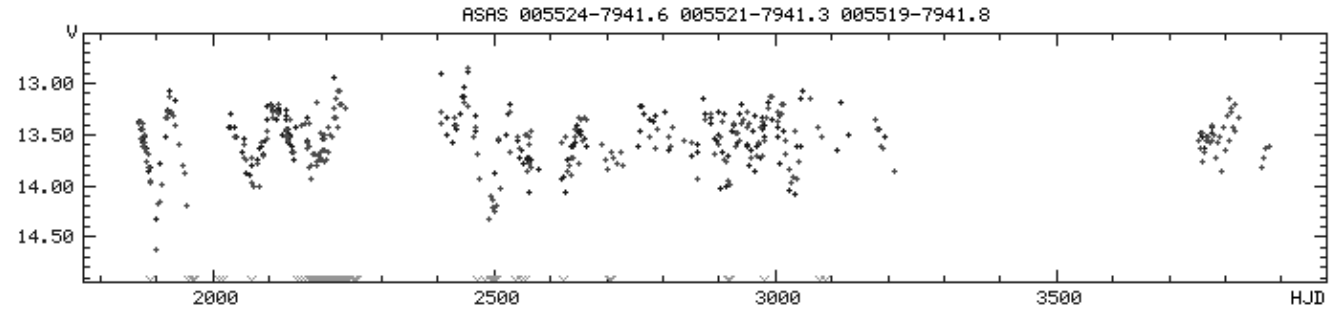


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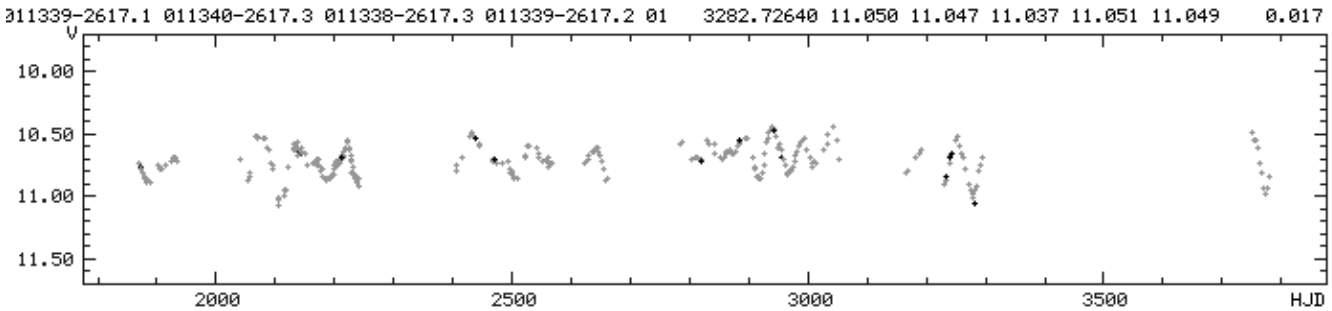

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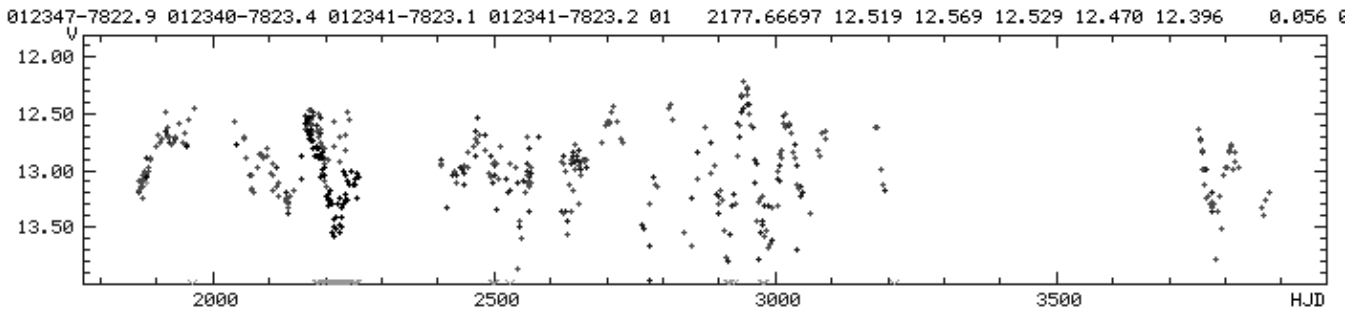


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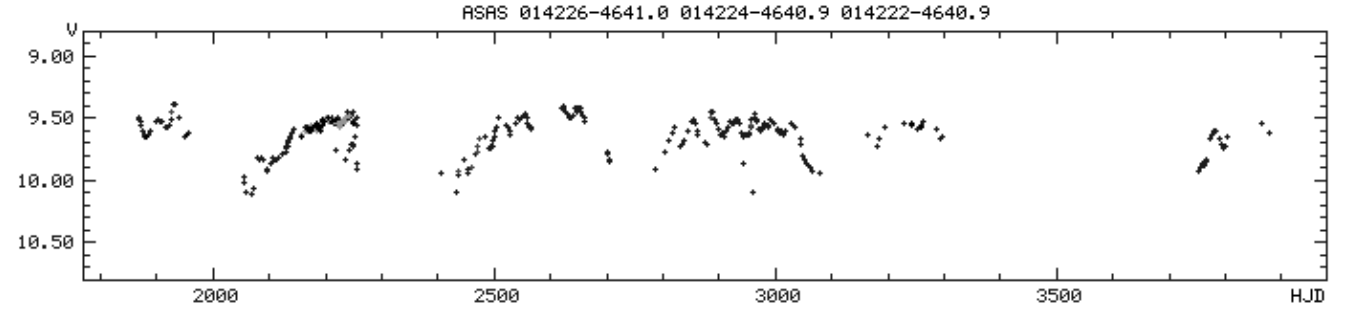


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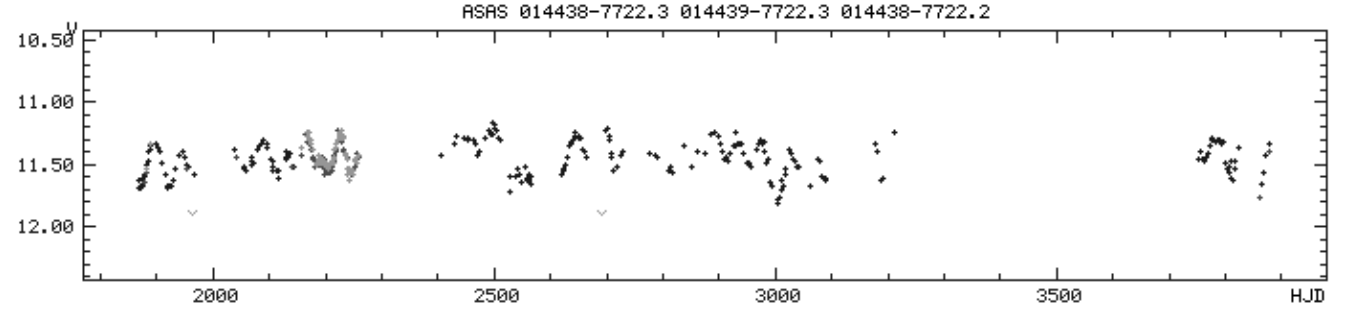


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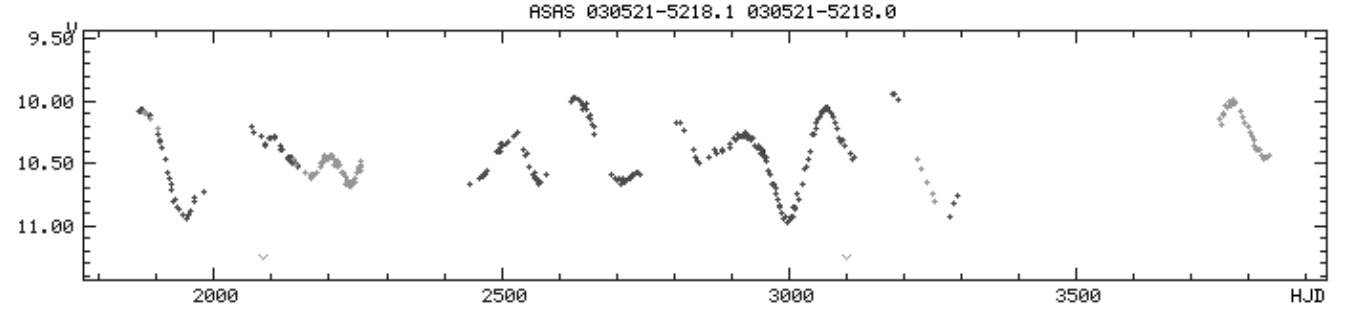


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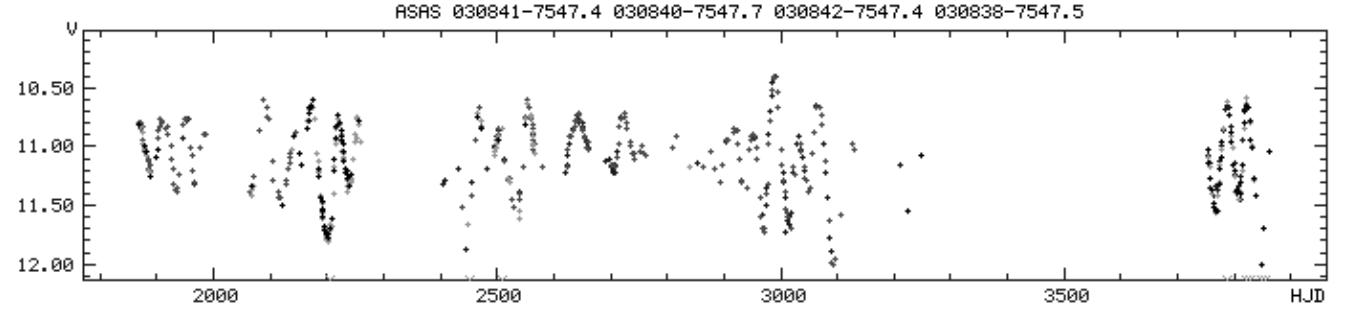


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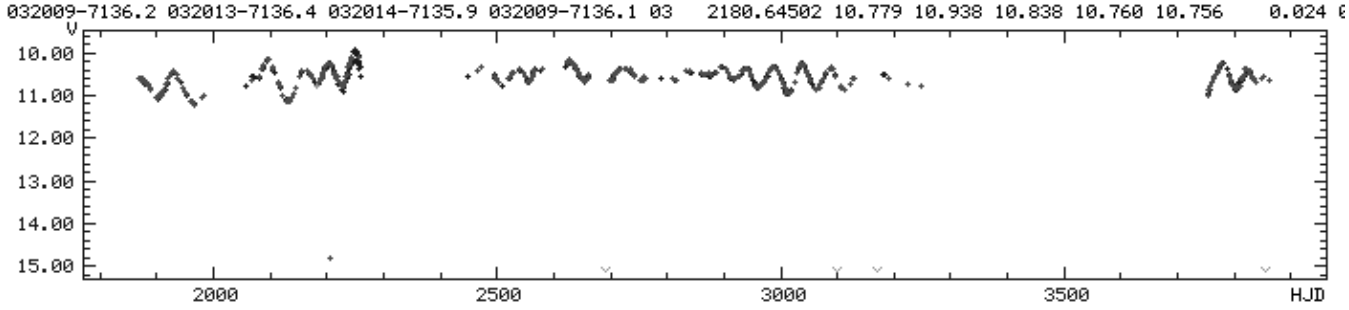

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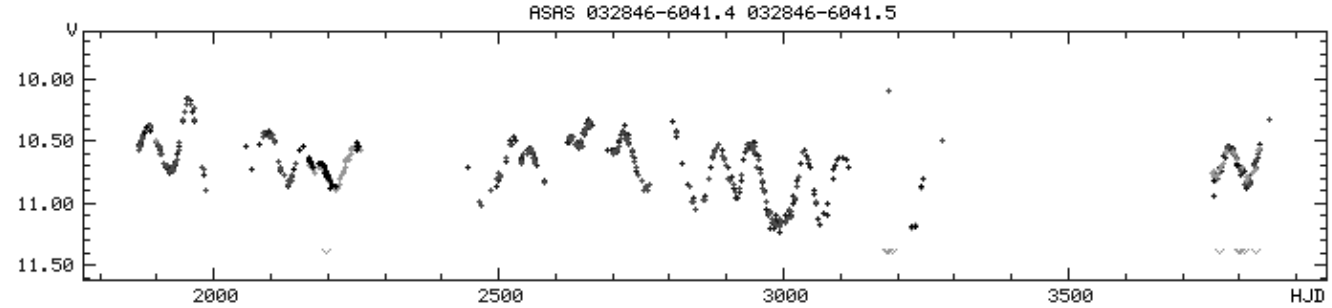


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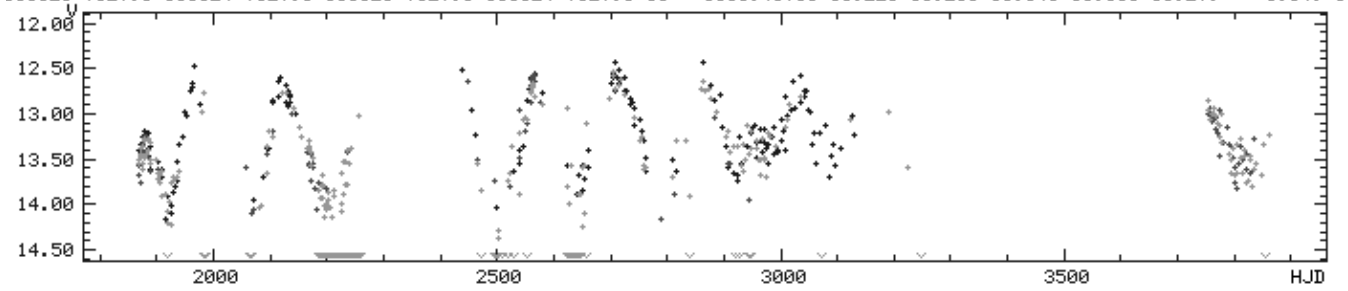


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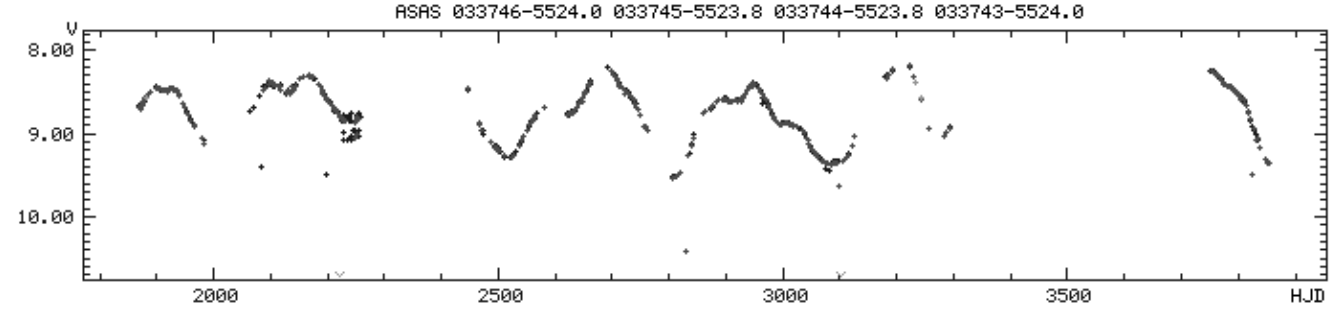


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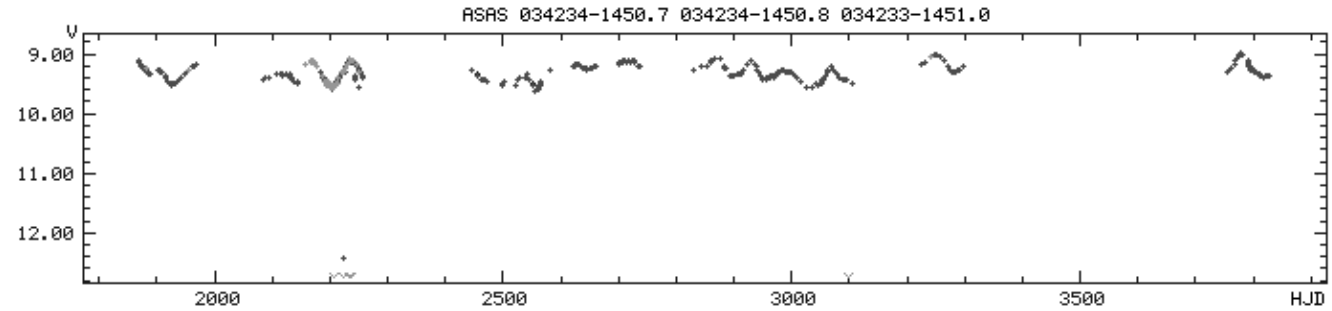


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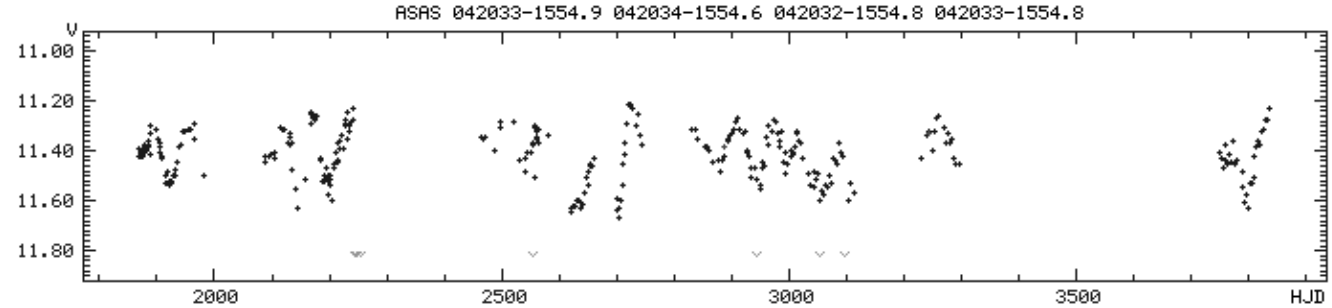


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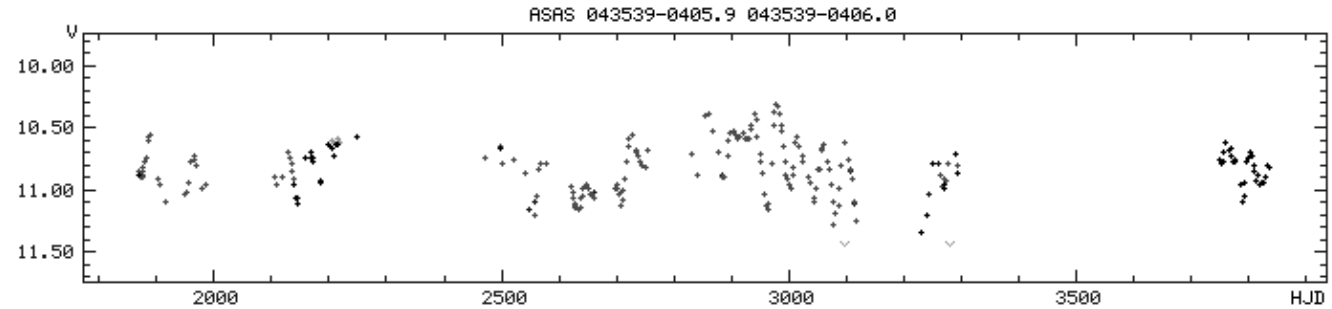

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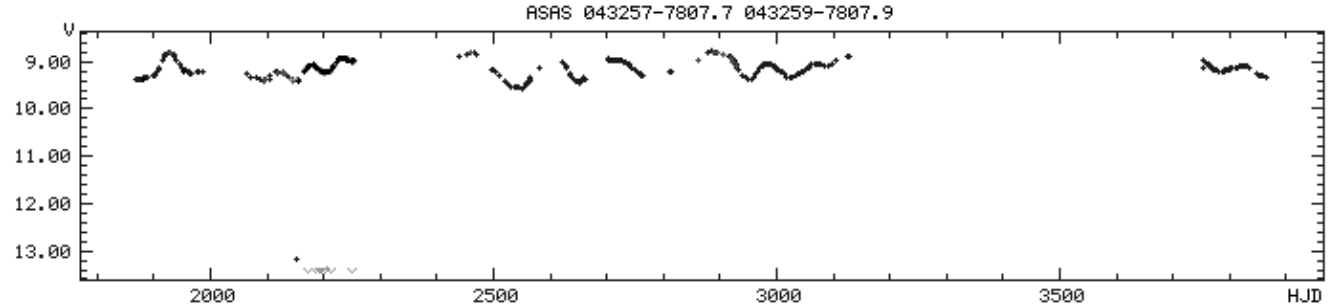


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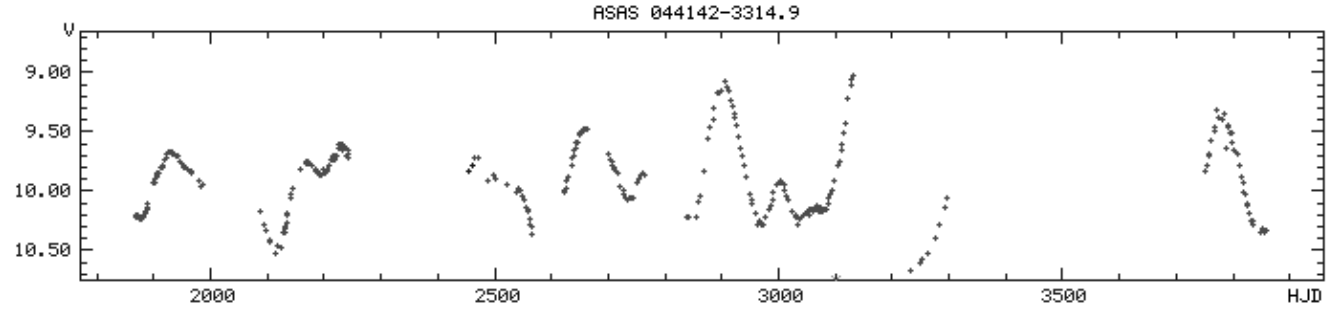


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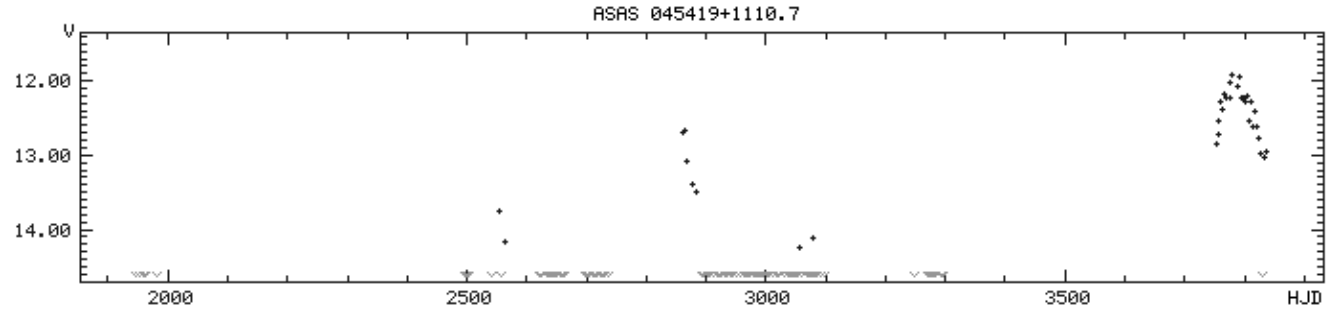


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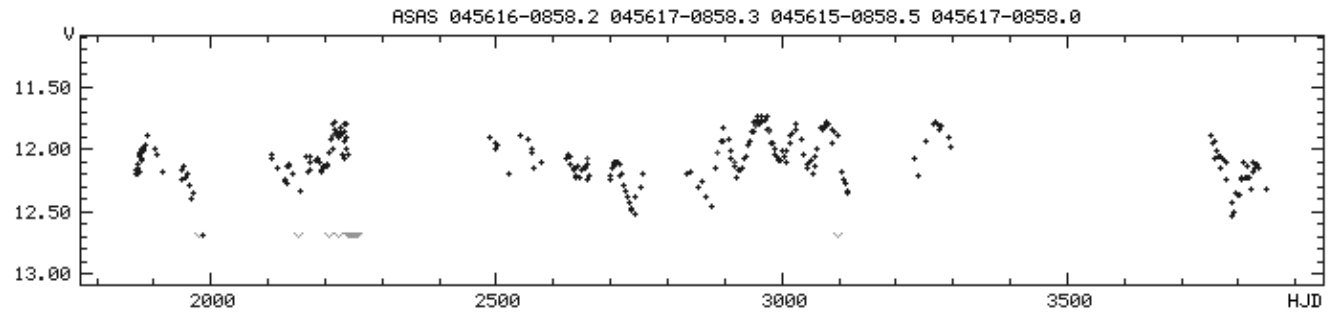


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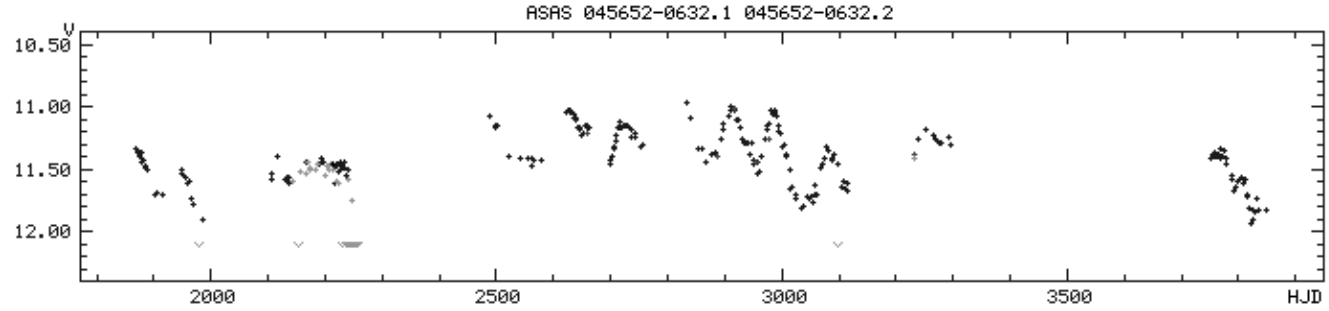


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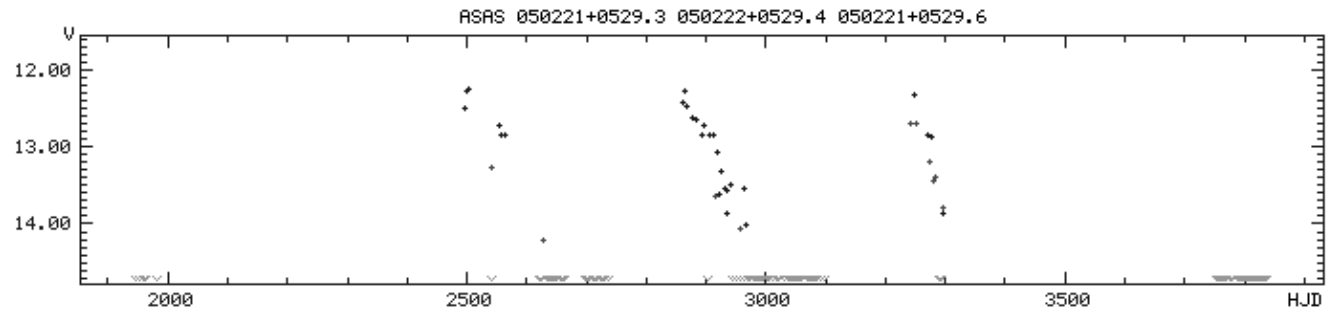

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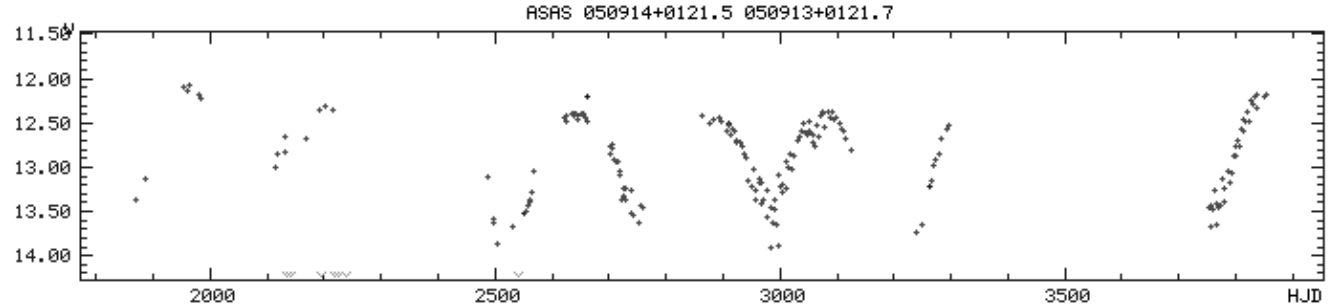


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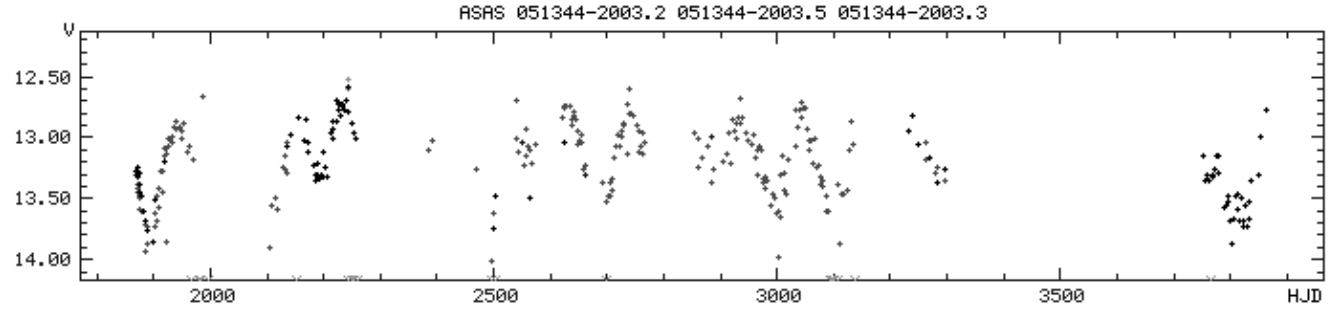


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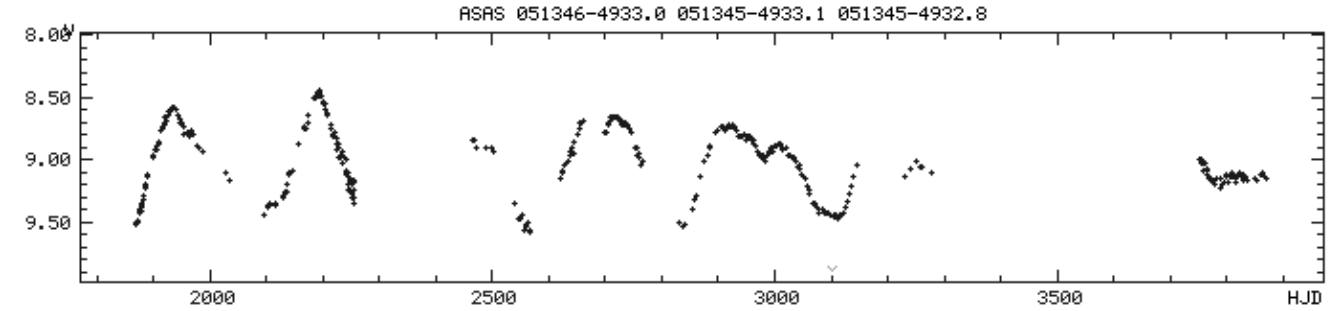


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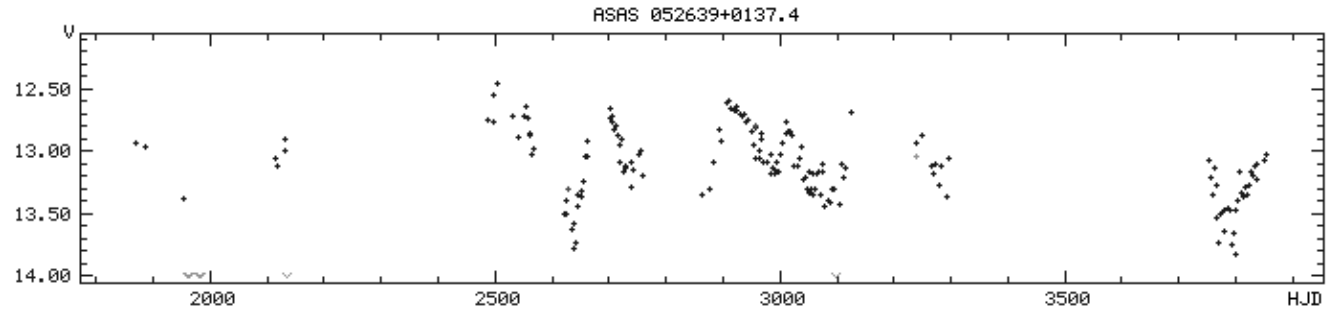


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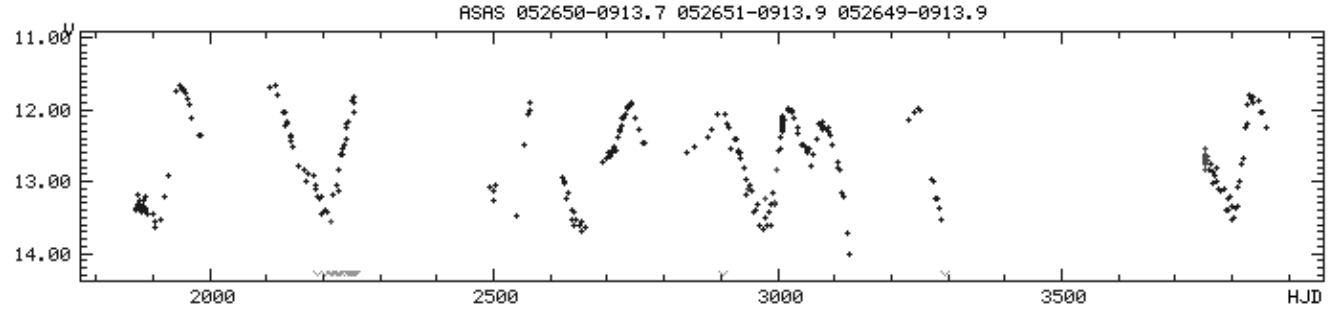


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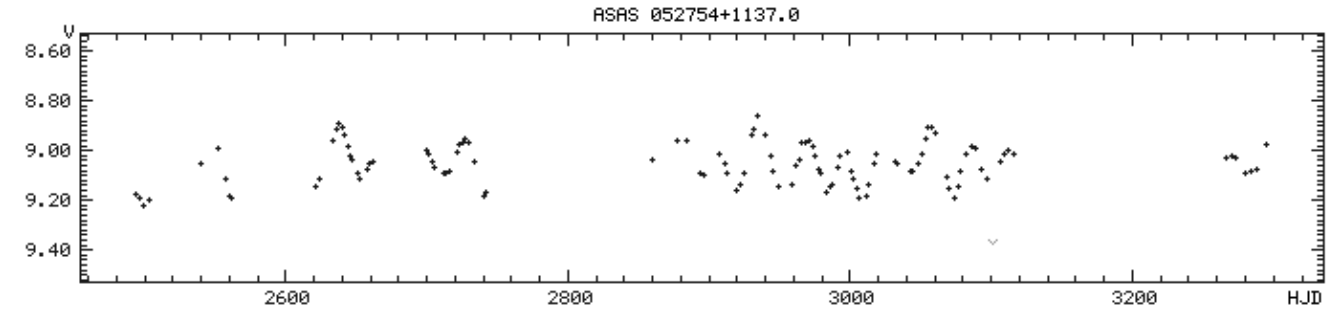

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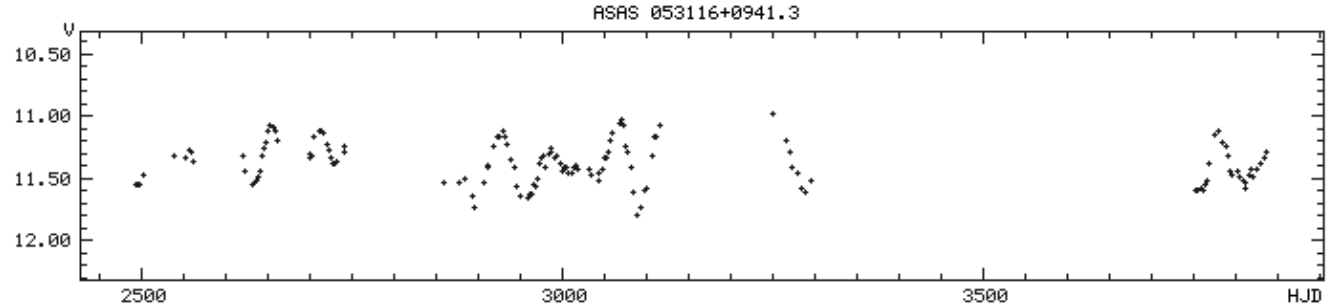


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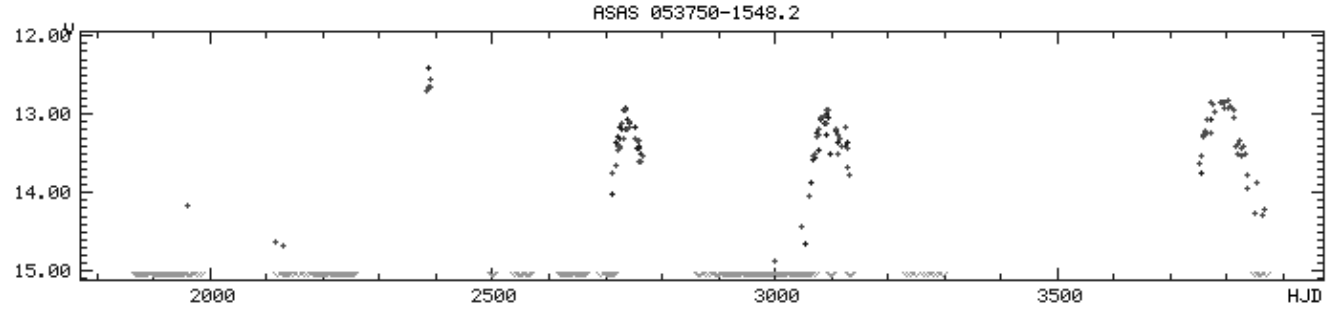


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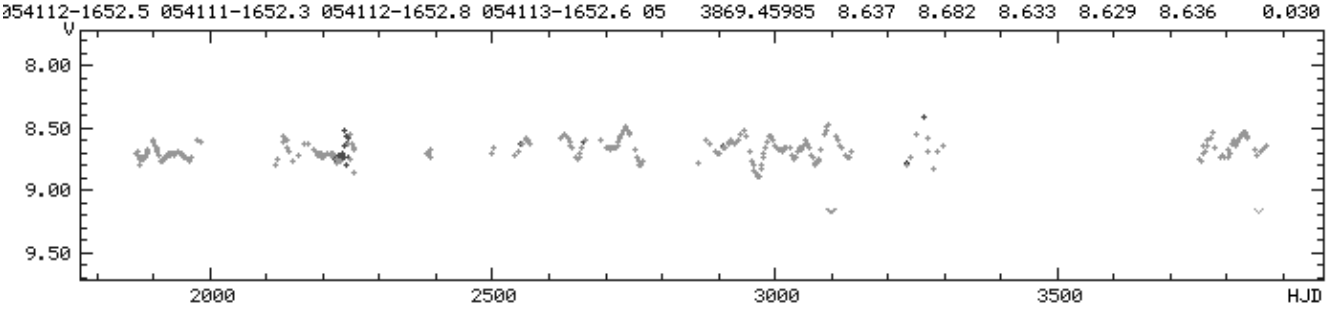


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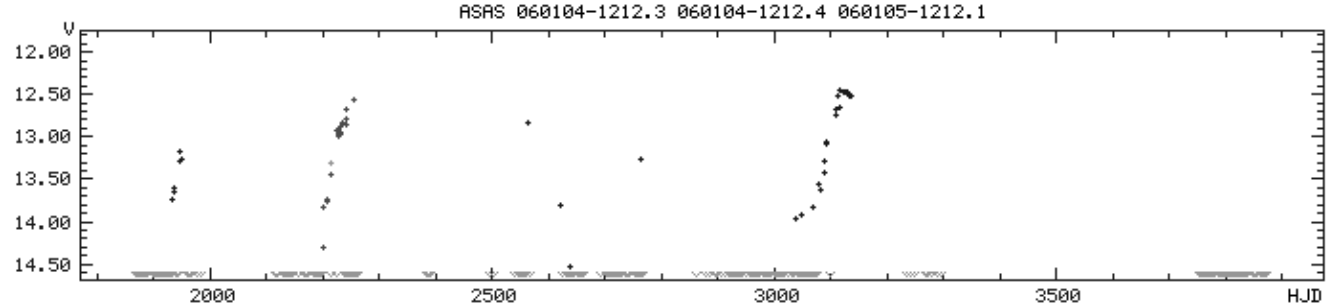


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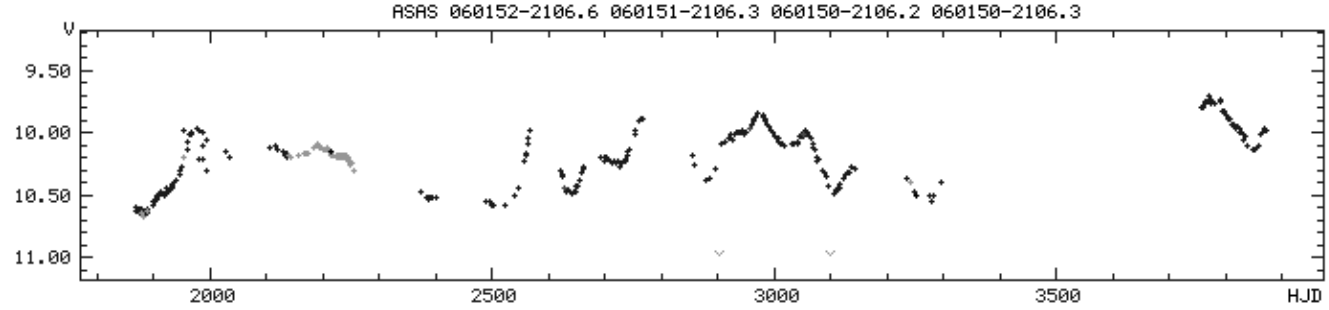


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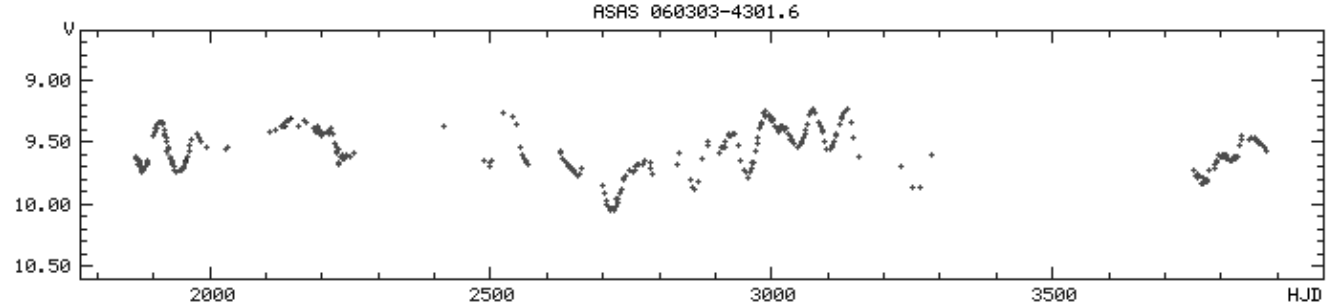

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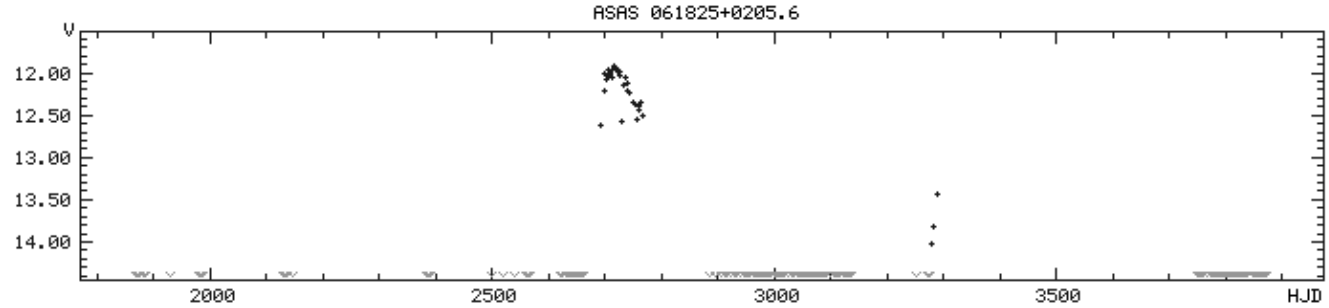


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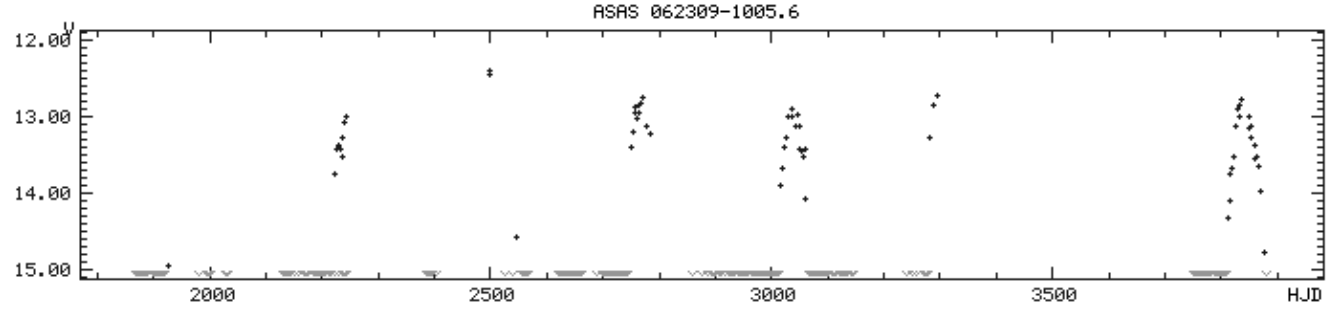


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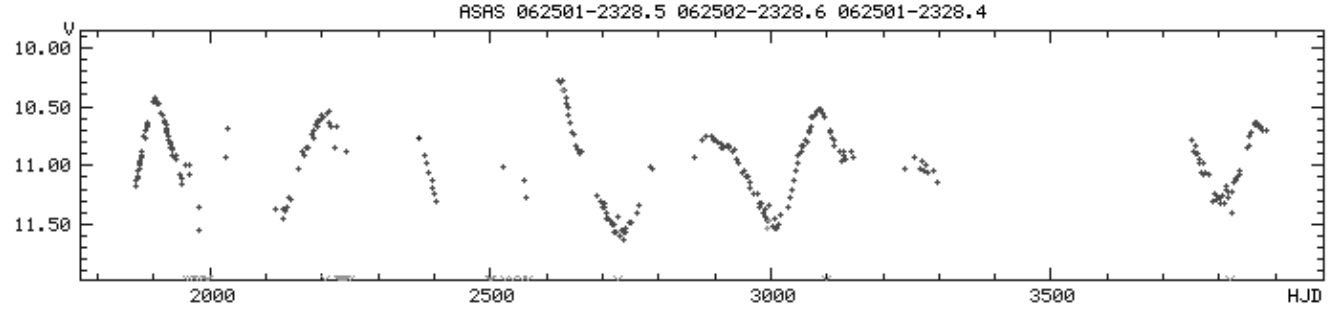


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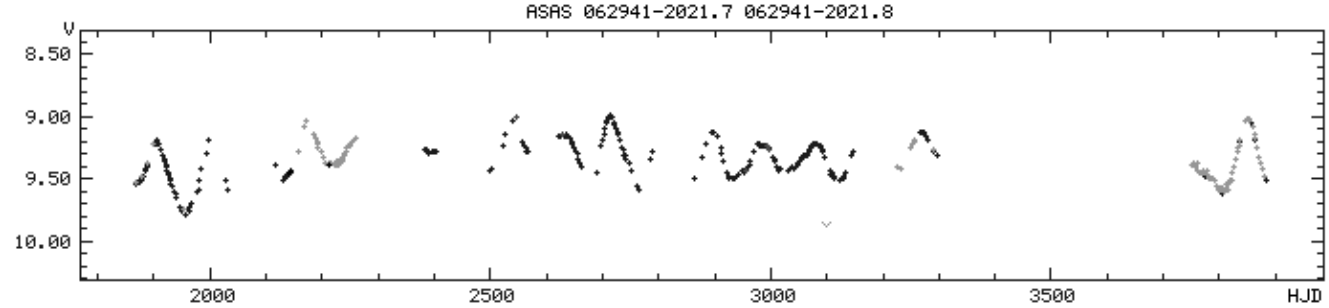


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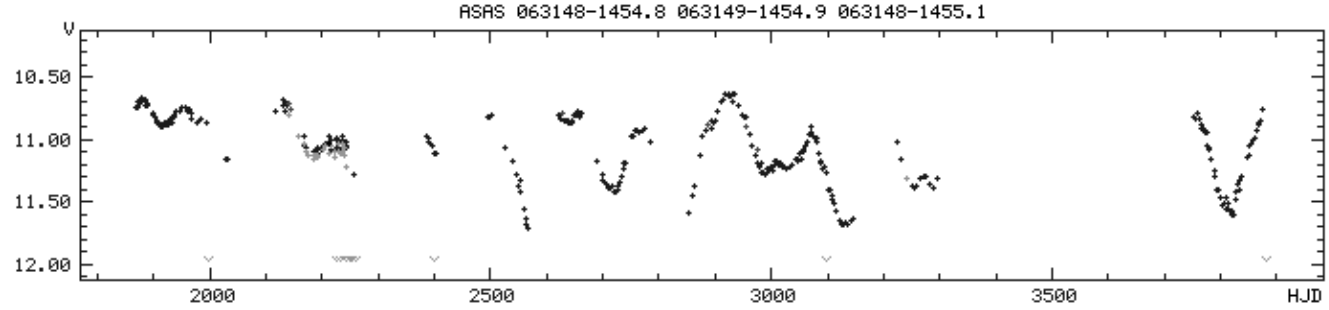
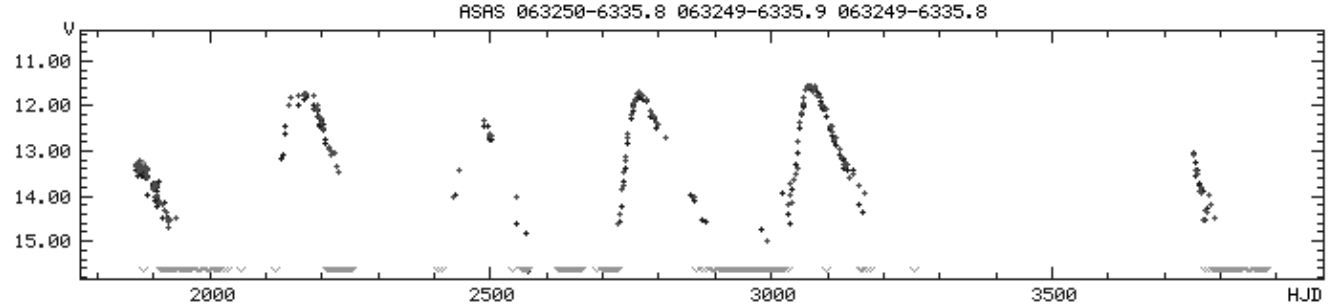
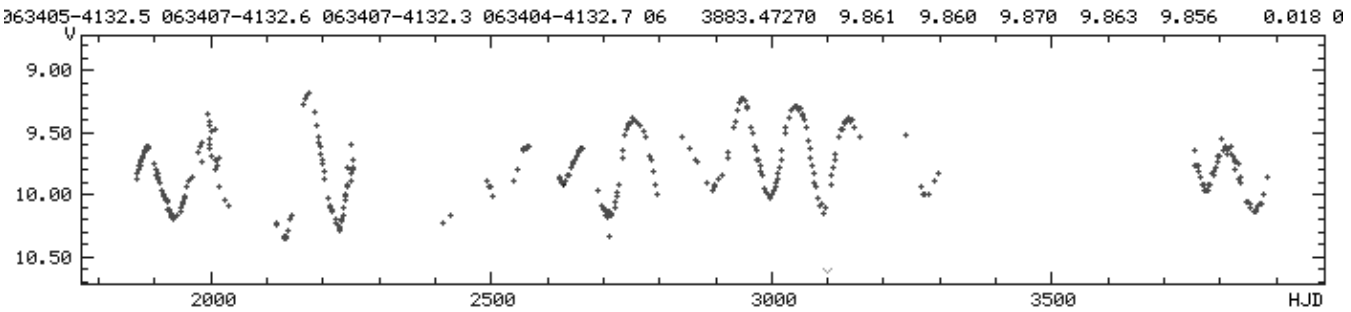


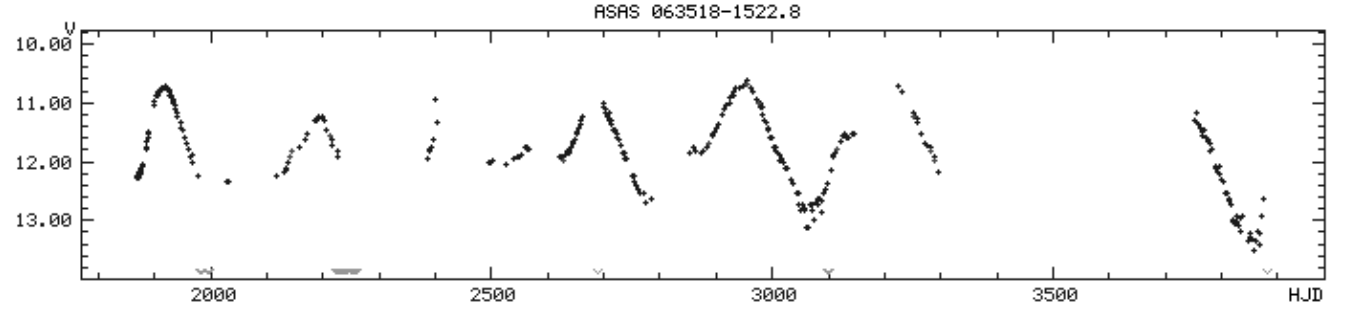

**NSV 3033** J2000 06 32 49.5 -63 35 50



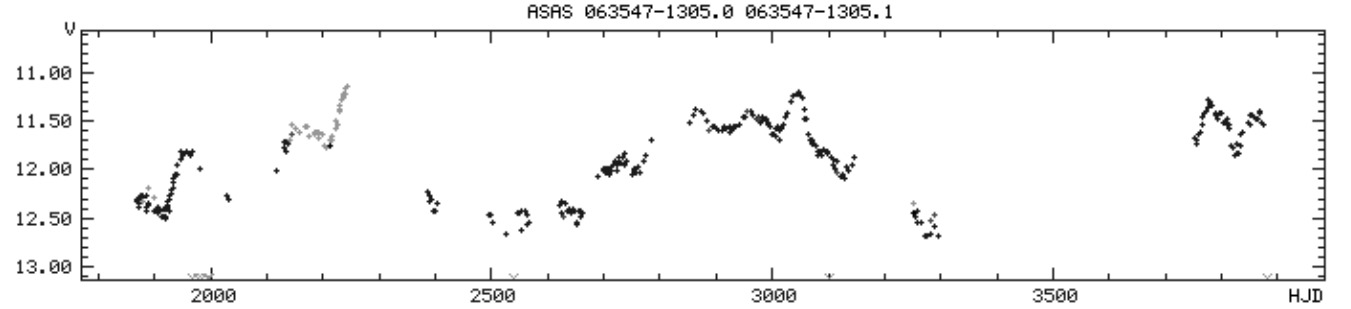
**NSV 3034** J2000 06 34 04.9 -41 32 32



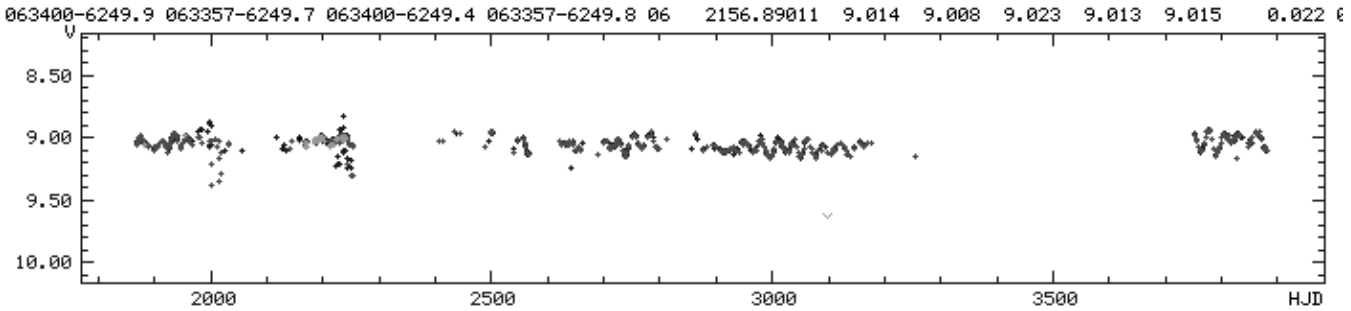

**NSV 3037** J2000 06 35 17.9 -15 22 50



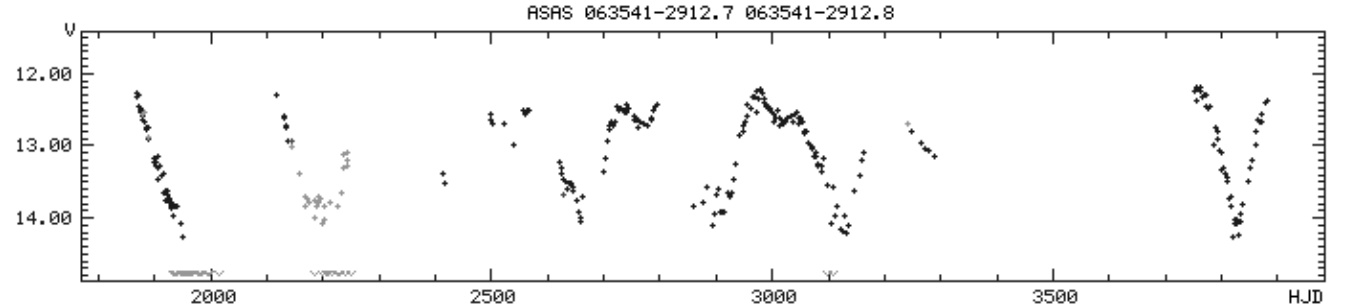

**NSV 3042** J2000 06 35 46.9 -13 05 02



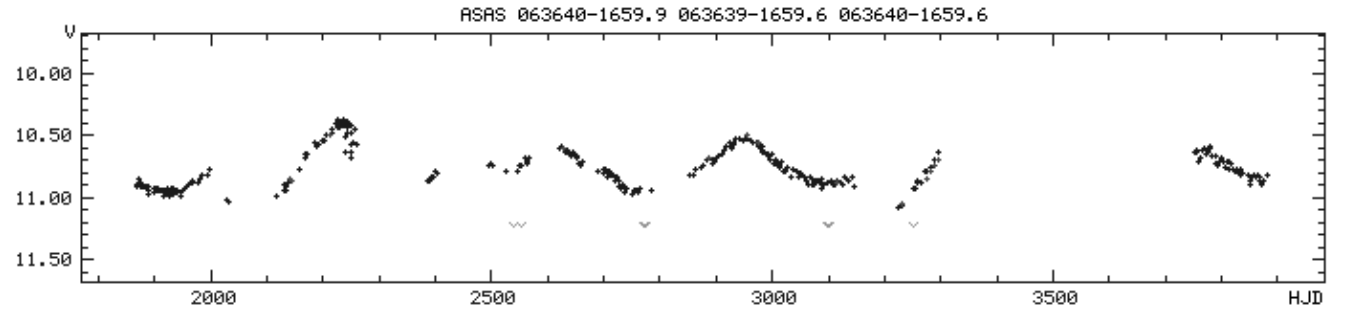

**NSV 3043** J2000 06 33 56.8 -62 49 44



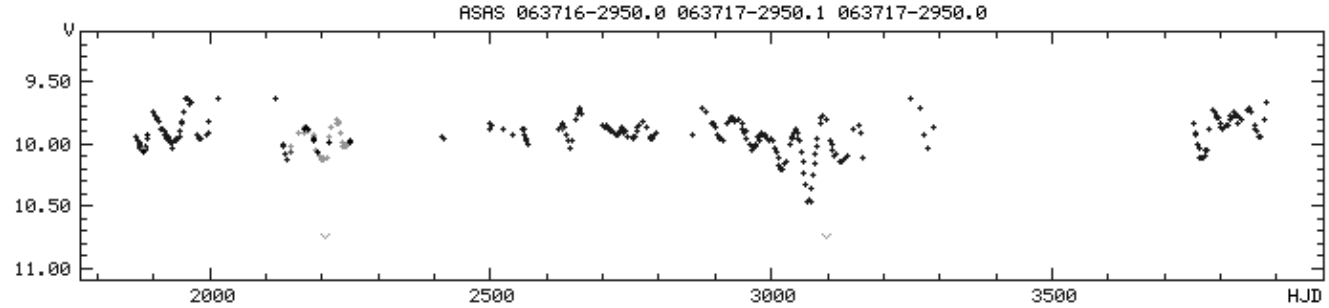

**NSV 3044** J2000 06 35 41.0 -29 12 46



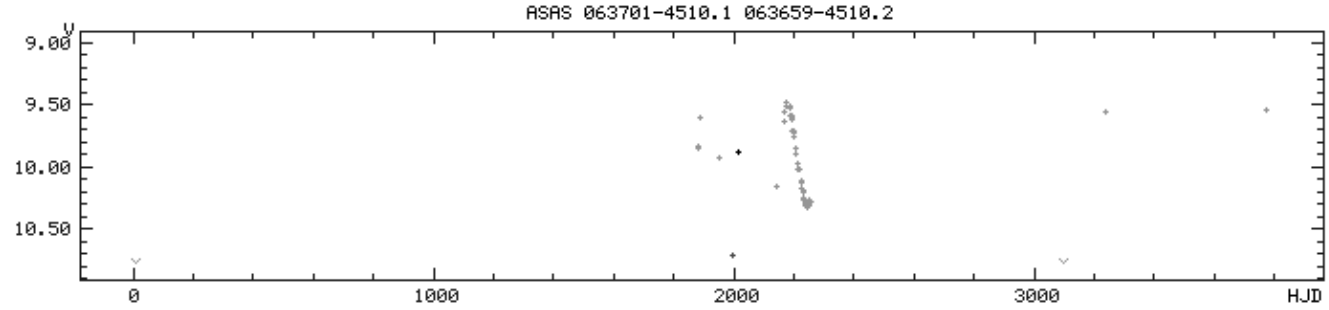

**NSV 3046** J2000 06 36 39.5 -16 59 34



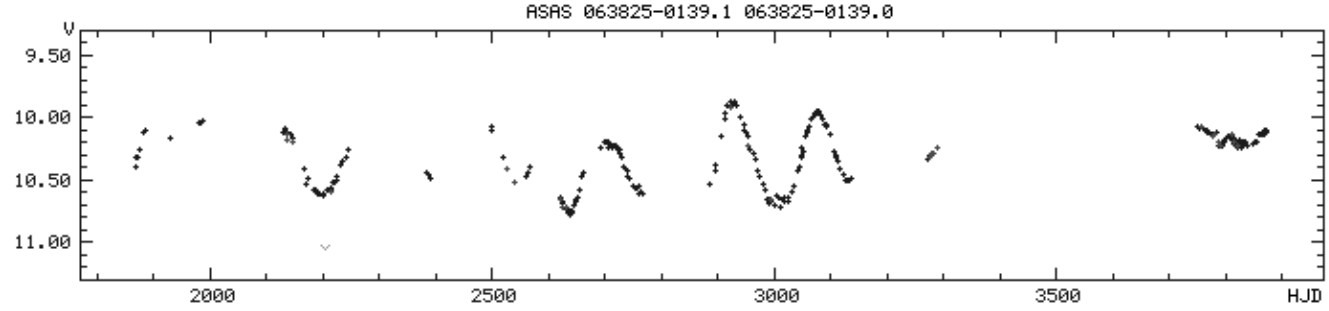
**NSV 3051** J2000 06 37 16.5 -29 50 02



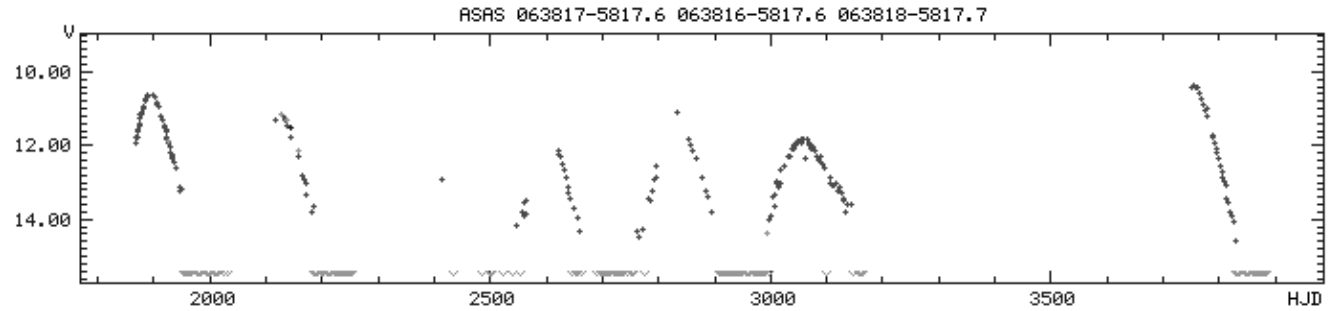

**NSV 3053** J2000 06 36 58.8 -45 10 13




**NSV 3057** J2000 06 38 24.6 -01 39 03




**NSV 3075** J2000 06 38 16.5 -58 17 35




**NSV 3084** J2000 06 40 05.5 -13 55 31

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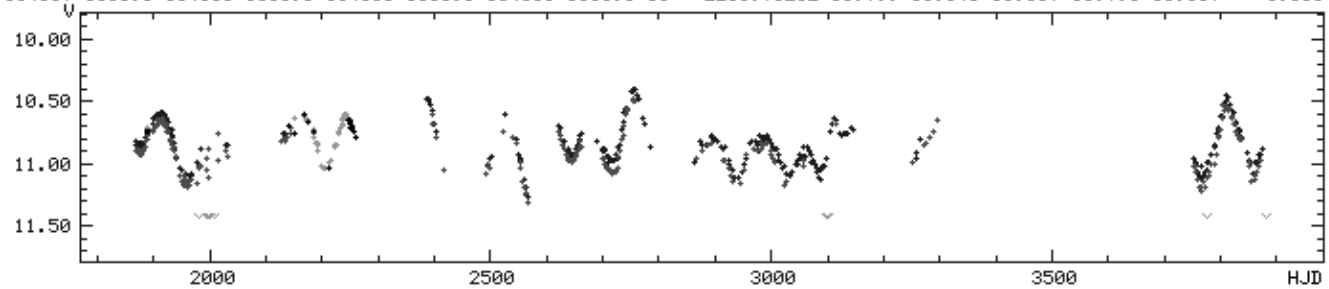
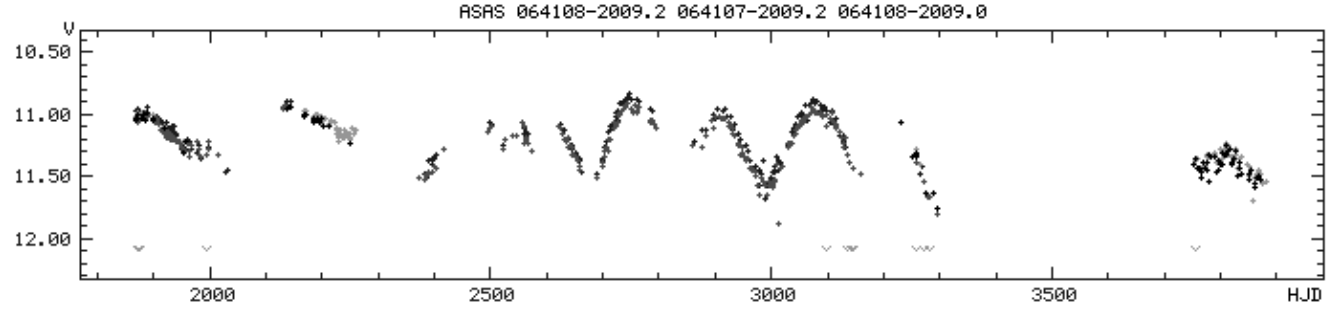
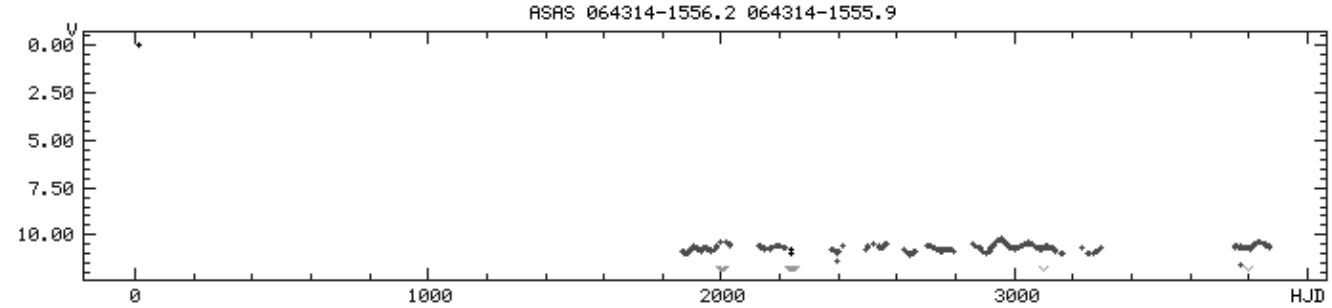


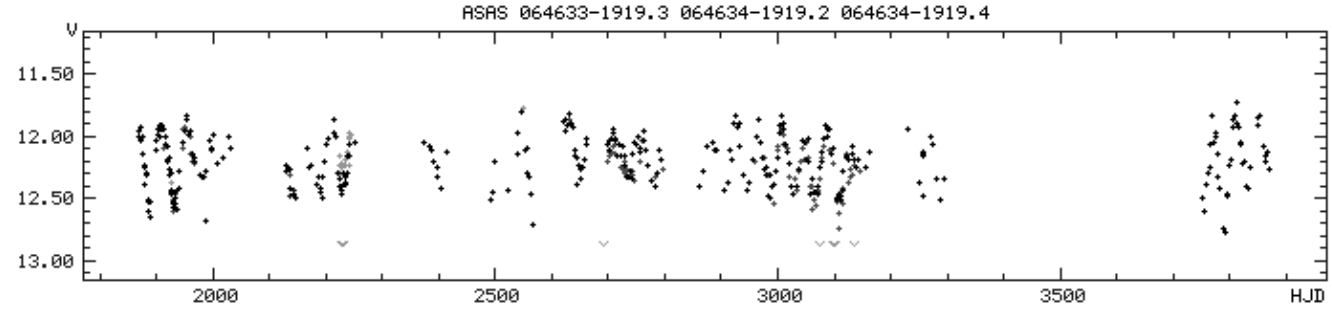

**NSV 3169** J2000 06 41 08.1 -20 09 04



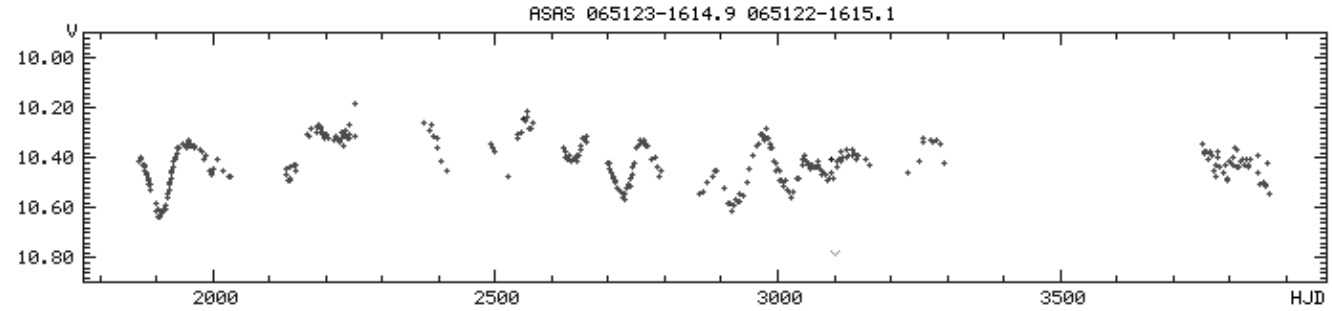
**NSV 3184** J2000 06 43 14.2 -15 56 12




**NSV 3209** J2000 06 46 33.0 -19 19 18




**NSV 3242** J2000 06 51 23.2 -16 14 56




**NSV 3252** J2000 06 51 11.4 -48 21 56

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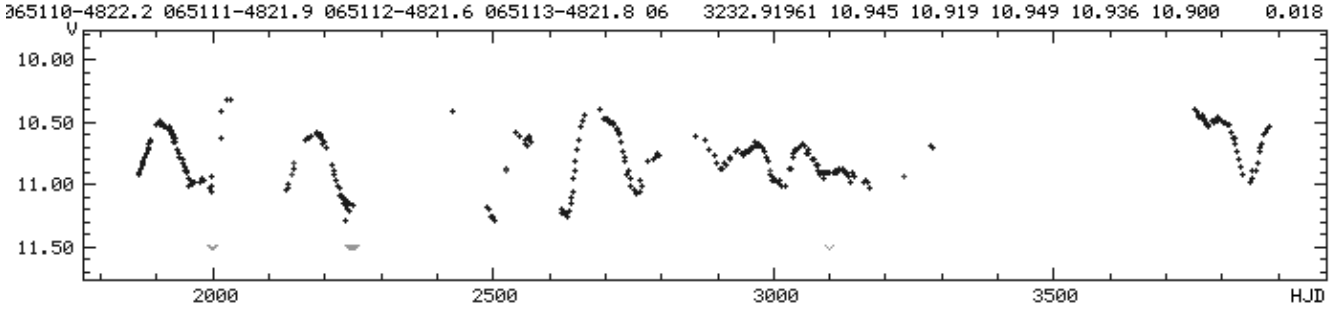
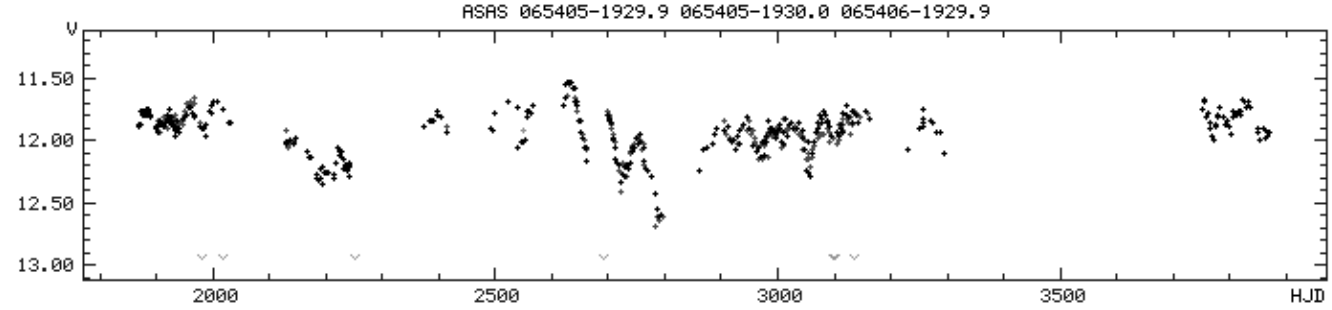
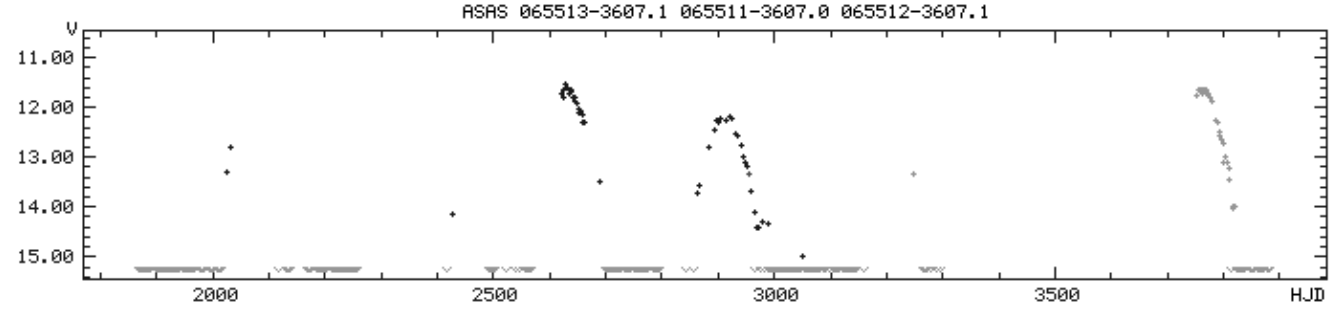


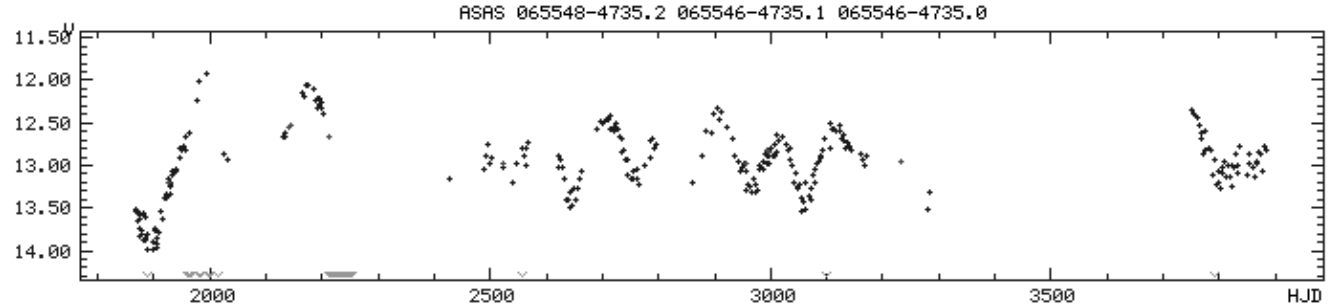

**NSV 3267** J2000 06 54 04.8 -19 29 54



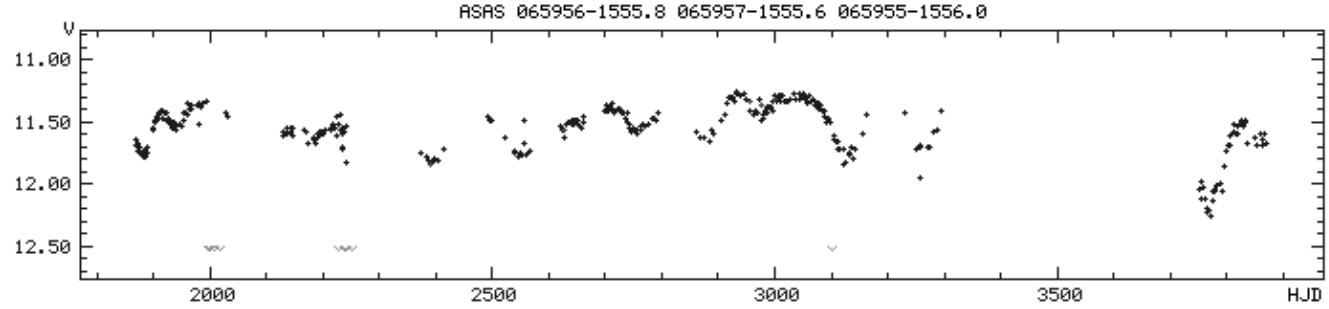

**NSV 3286** J2000 06 55 12.4 -36 07 10



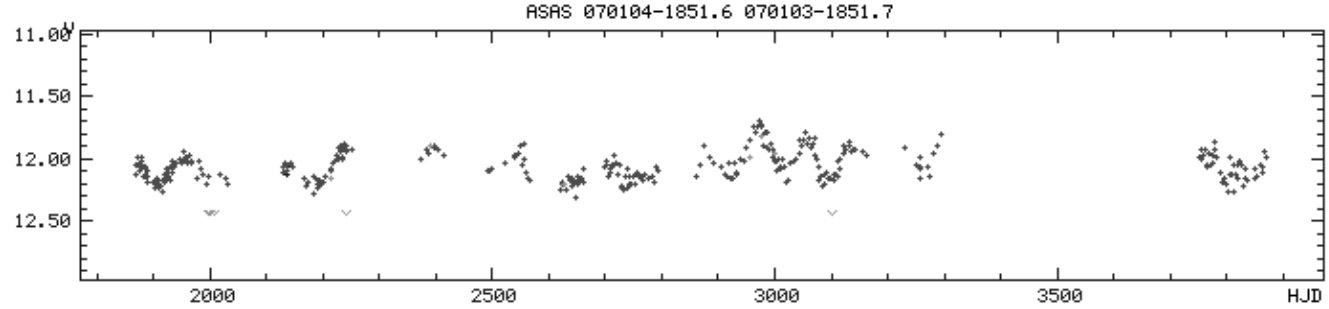
**NSV 3294** J2000 06 55 45.9 -47 35 03



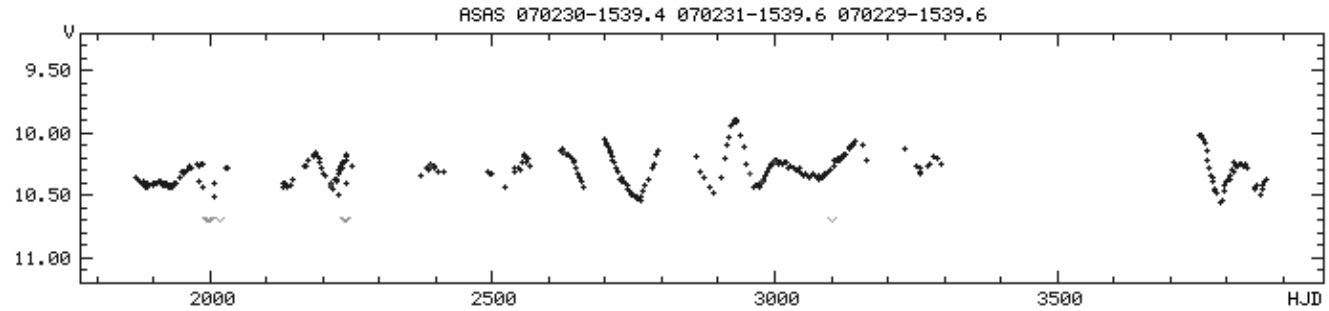

**NSV 3327** J2000 06 59 55.8 -15 55 48



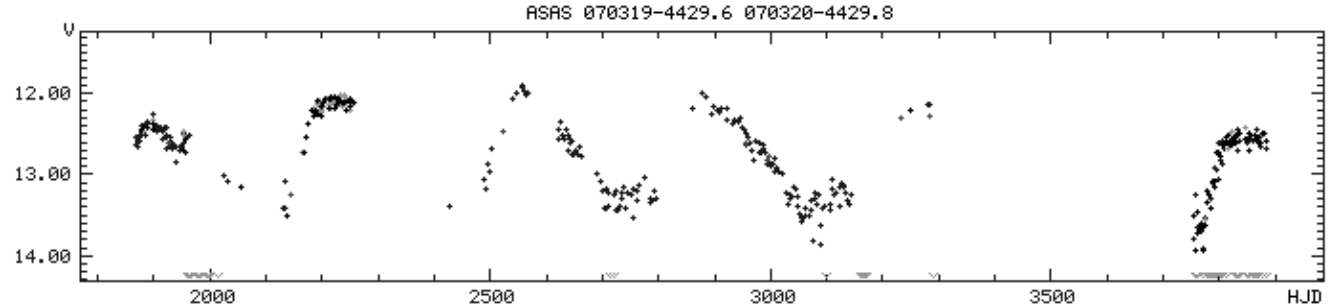

**NSV 3336** J2000 07 01 04.0 -18 51 36



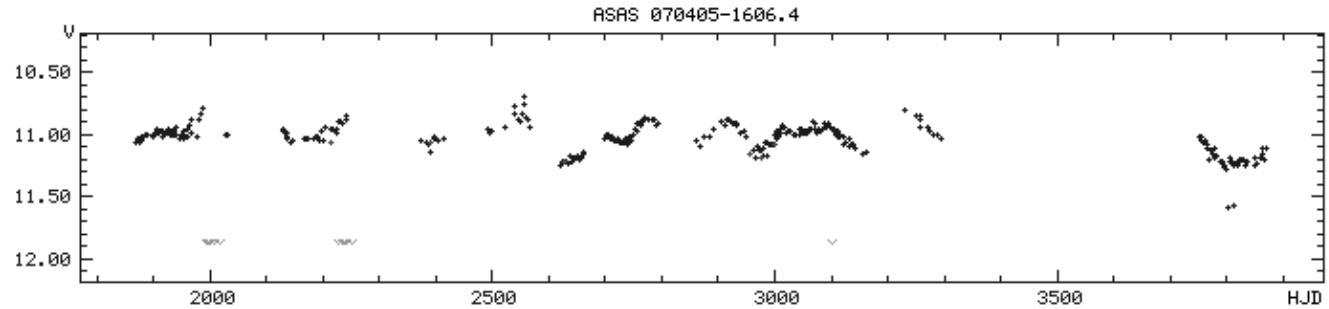

**NSV 3348** J2000 07 02 29.7 -15 39 20



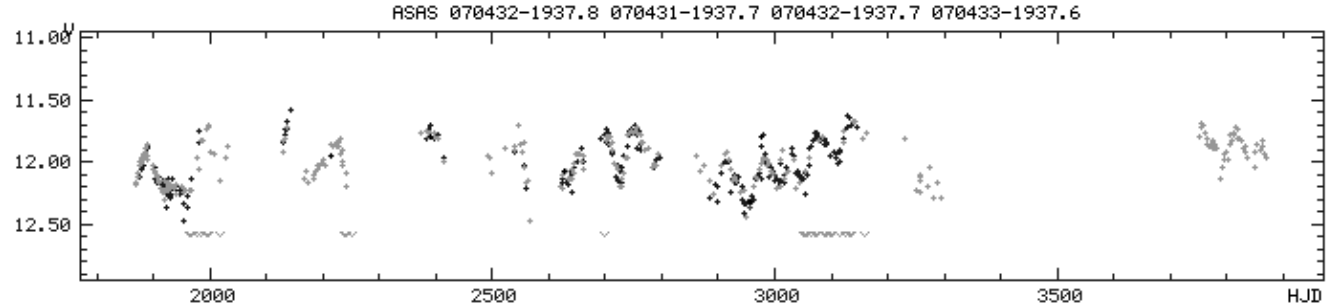

**NSV 3358** J2000 07 03 18.8 -44 29 39



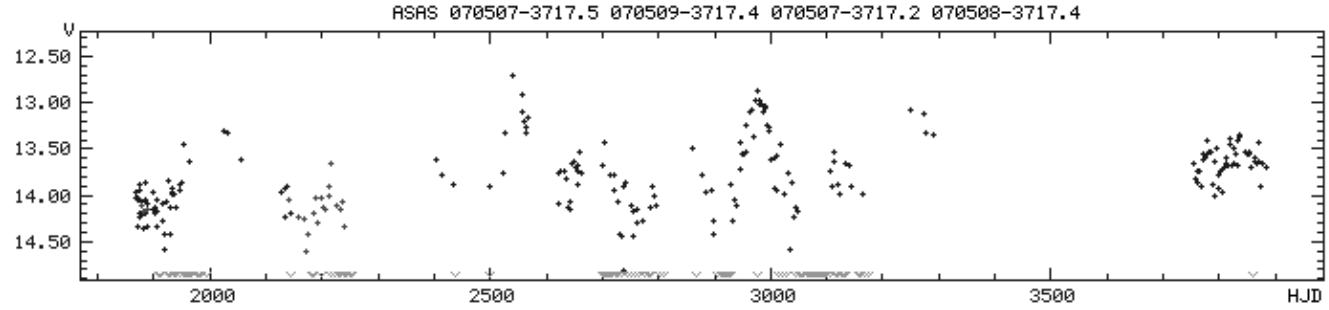

**NSV 3361** J2000 07 04 04.7 -16 06 23



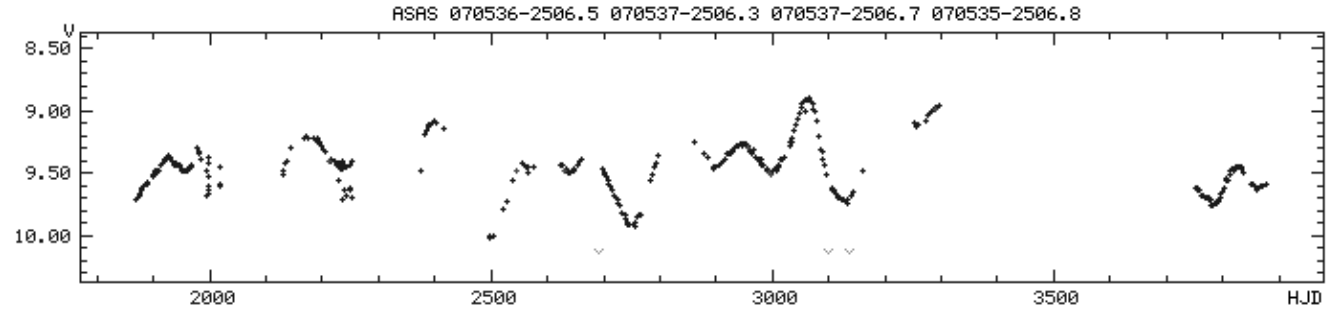
**NSV 3366** J2000 07 04 32.3 -19 37 46



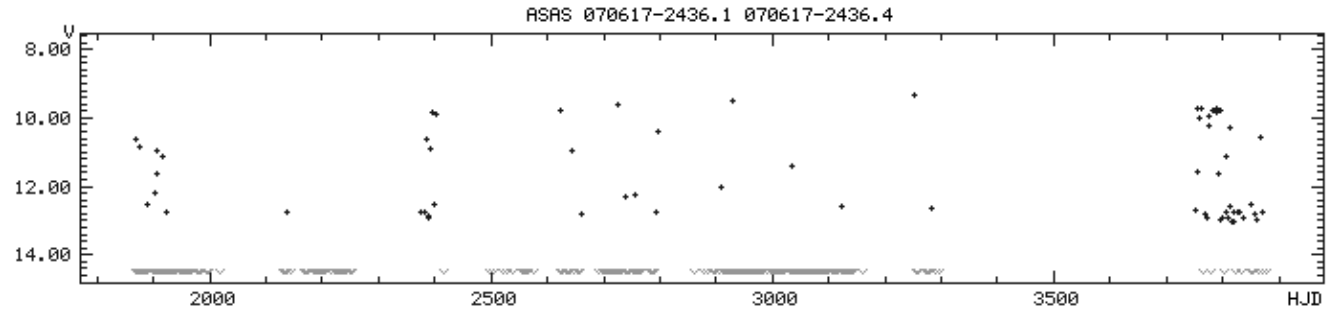

**NSV 3380** J2000 07 05 07.5 -37 17 30



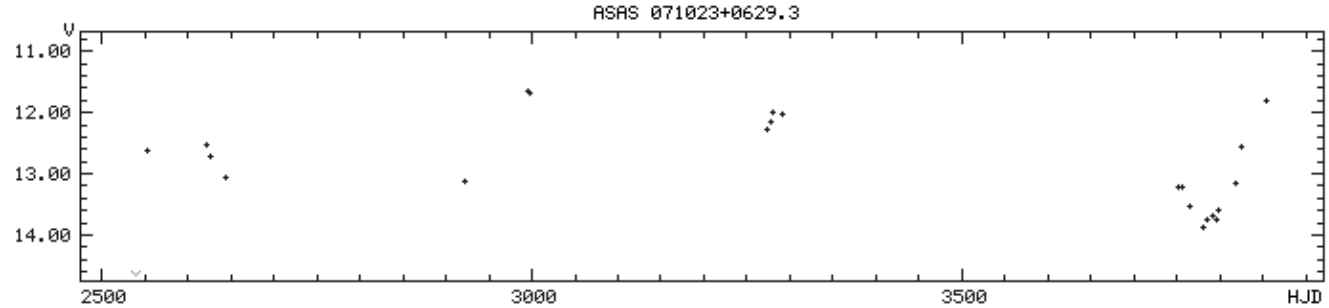

**NSV 3384** J2000 07 05 36.1 -25 06 33



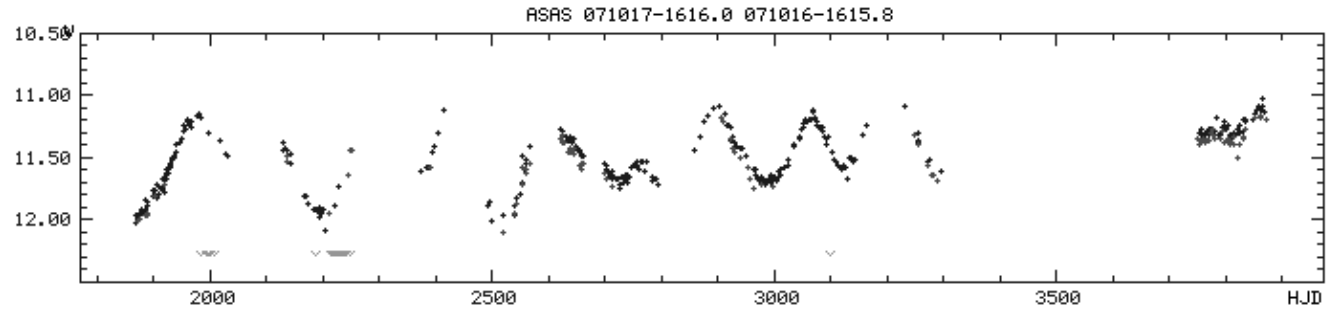

**NSV 3391** J2000 07 06 17.2 -24 36 58



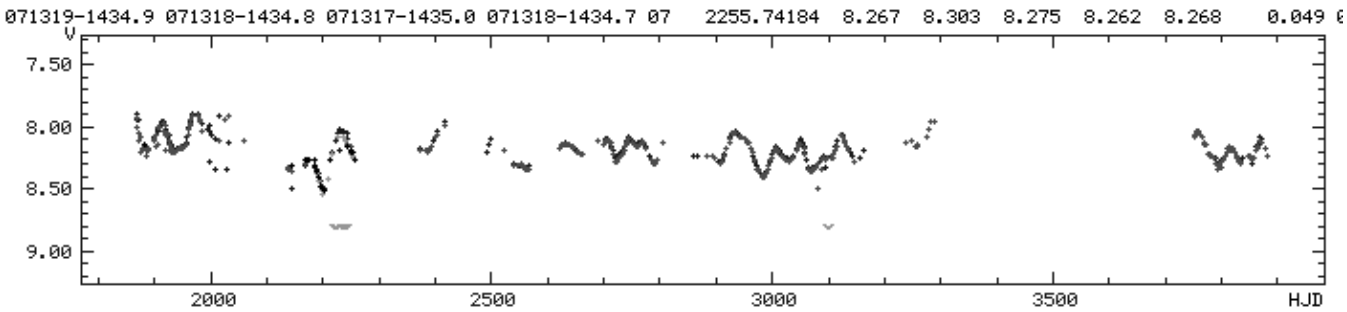

**NSV 3434** J2000 07 10 23.2 +06 29 11



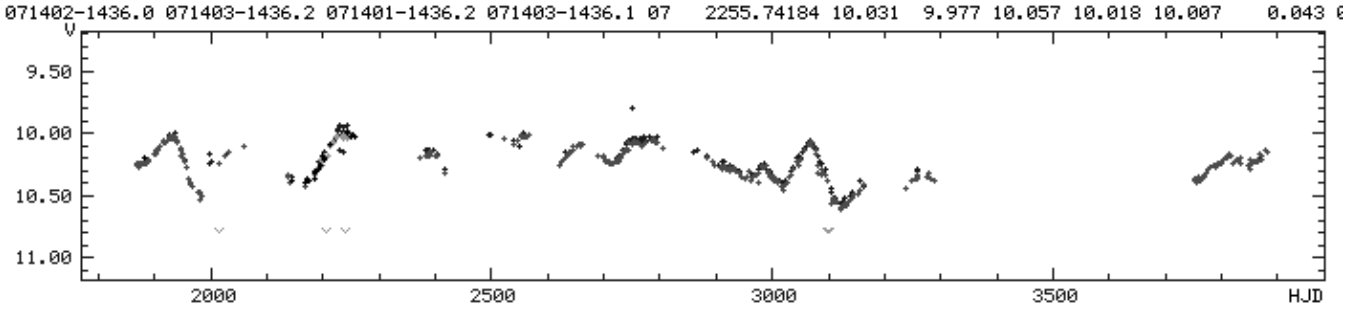

**NSV 3439** J2000 07 10 16.4 -16 15 49



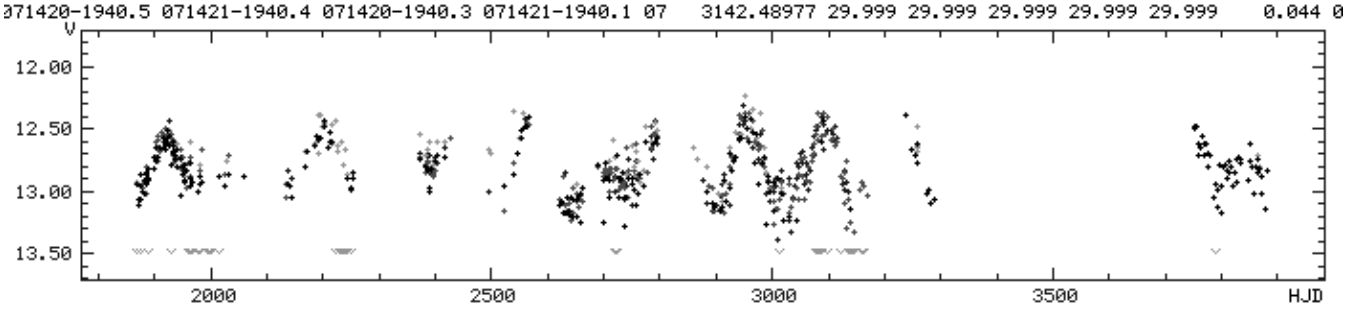
**NSV 3466** J2000 07 13 18.2 -14 34 47



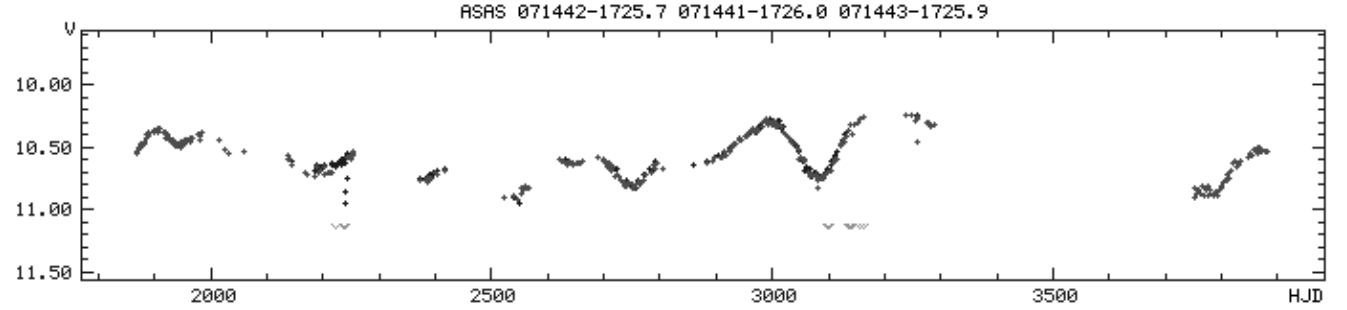

**NSV 3471** J2000 07 14 01.7 -14 36 00



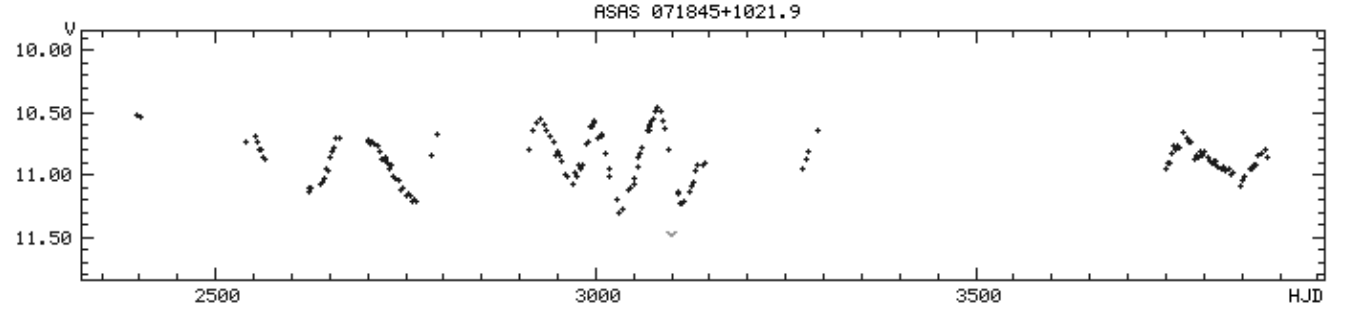

**NSV 3475** J2000 07 14 20.3 -19 40 23



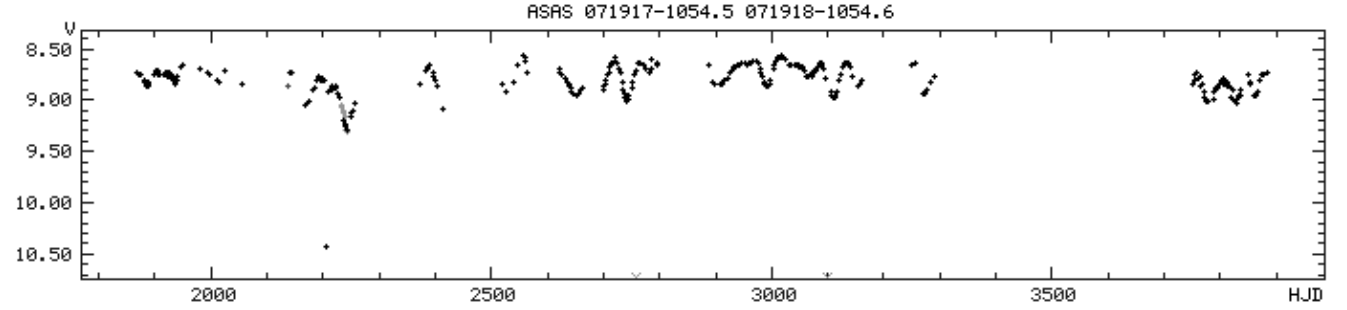

**NSV 3482** J2000 07 14 42.1 -17 25 41



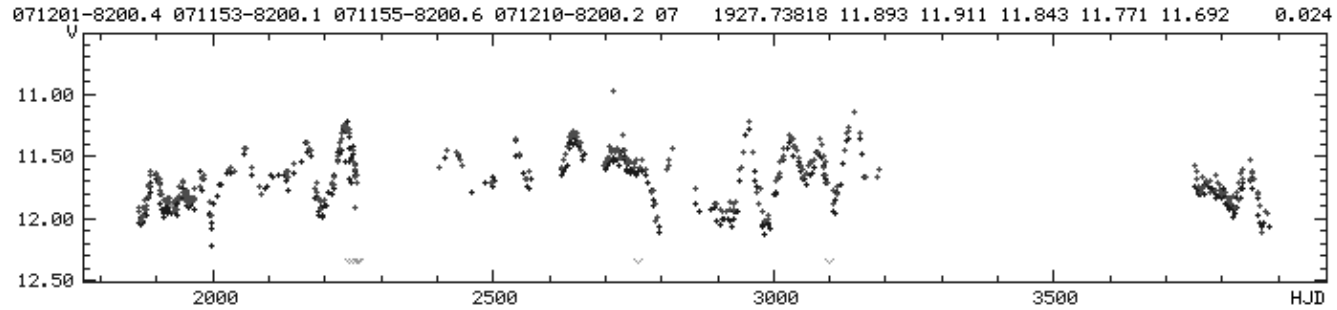

**NSV 3522** J2000 07 18 44.7 +10 21 53



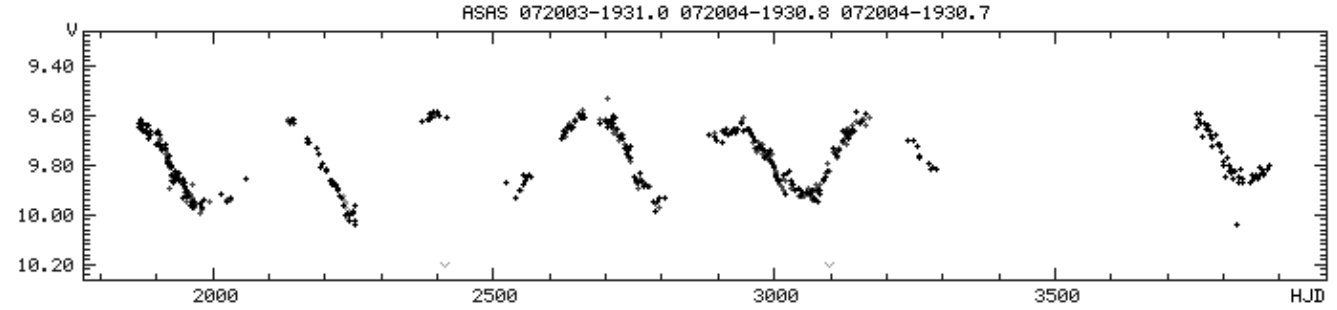

**NSV 3532** J2000 07 19 17.2 -10 54 32



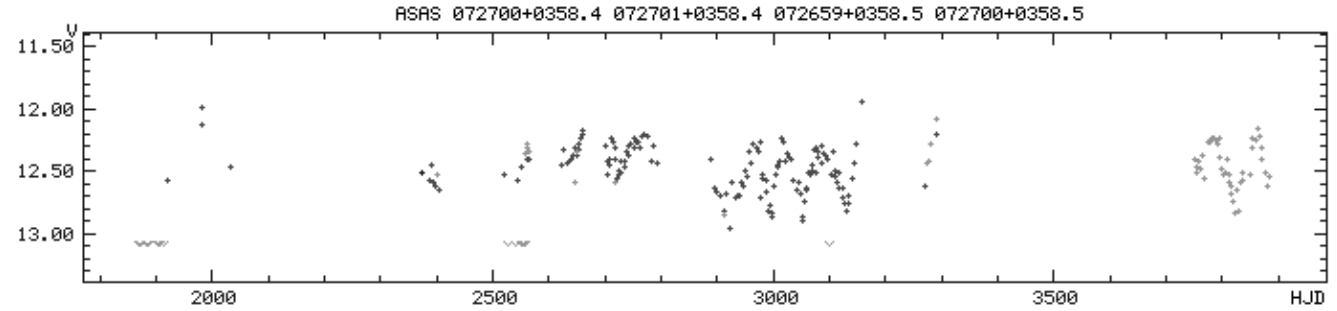
**NSV 3534** J2000 07 12 01.6 -82 00 24



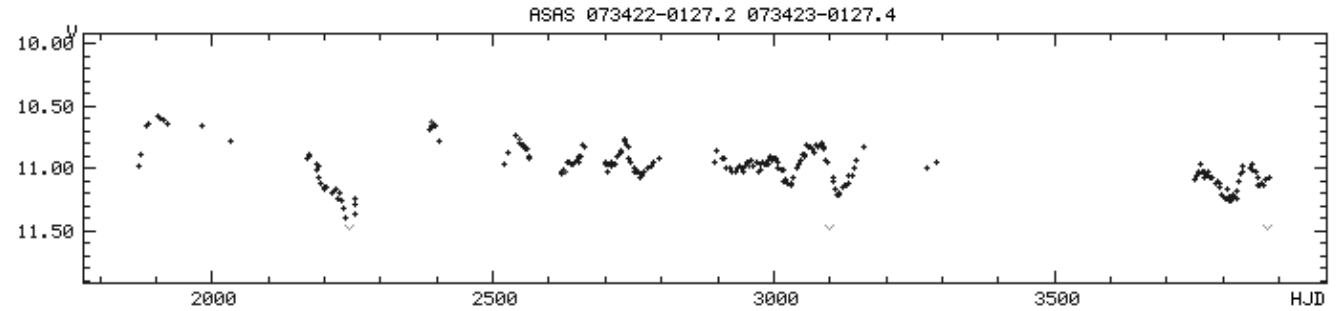

**NSV 3539** J2000 07 20 04.1 -19 30 46



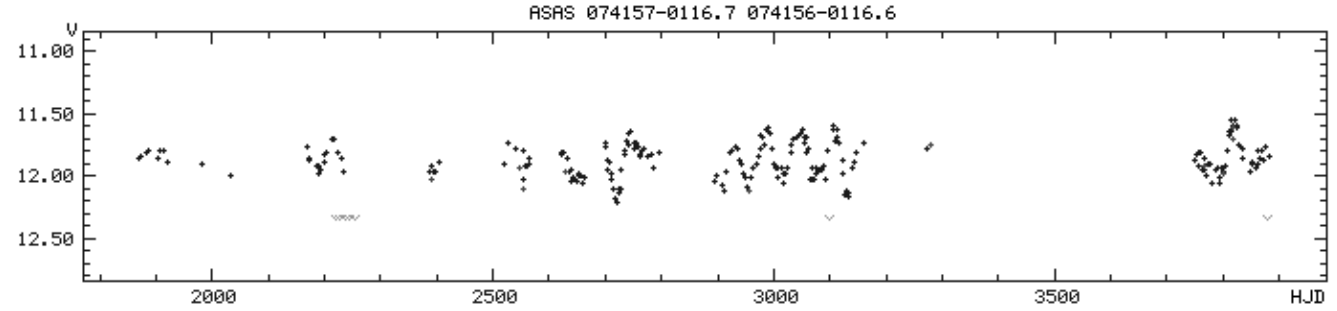

**NSV 3594** J2000 07 27 00.3 +03 58 27



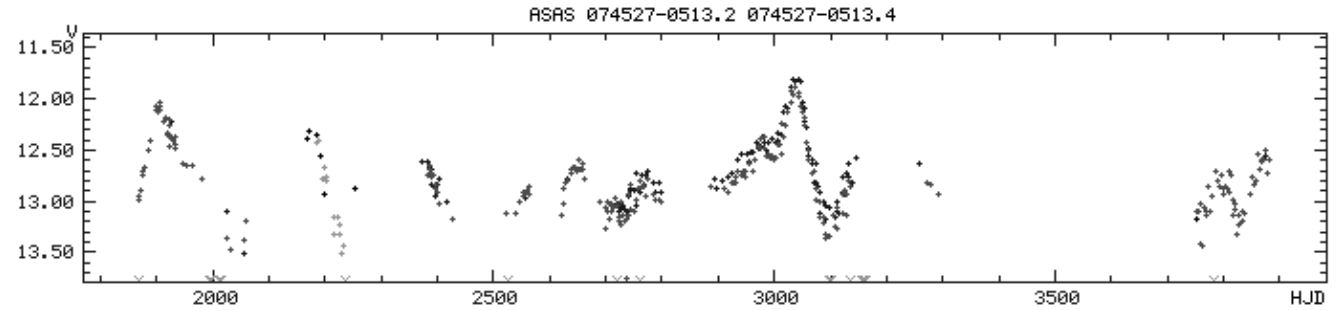

**NSV 3647** J2000 07 34 23.0 -01 27 23



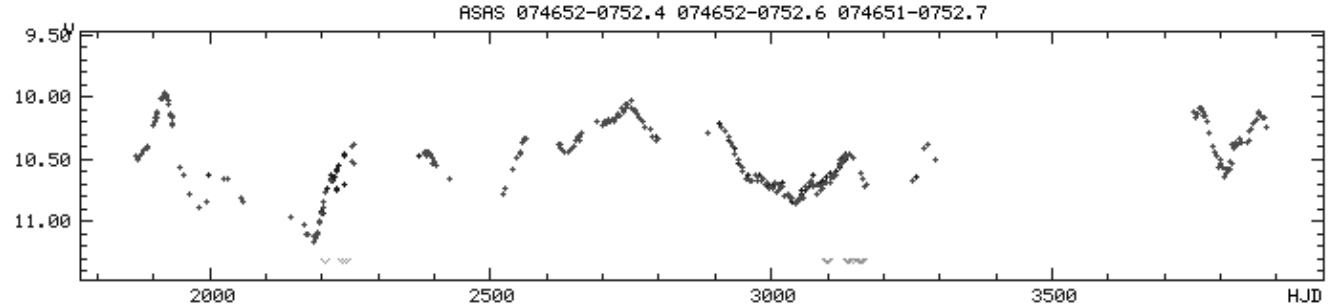

**NSV 3692** J2000 07 41 55.7 -01 16 36



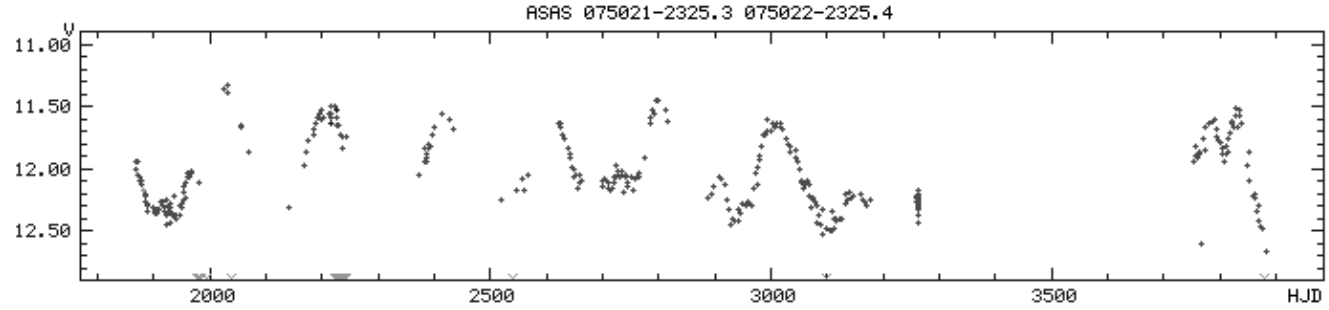

**NSV 3719** J2000 07 45 27.2 -05 13 11



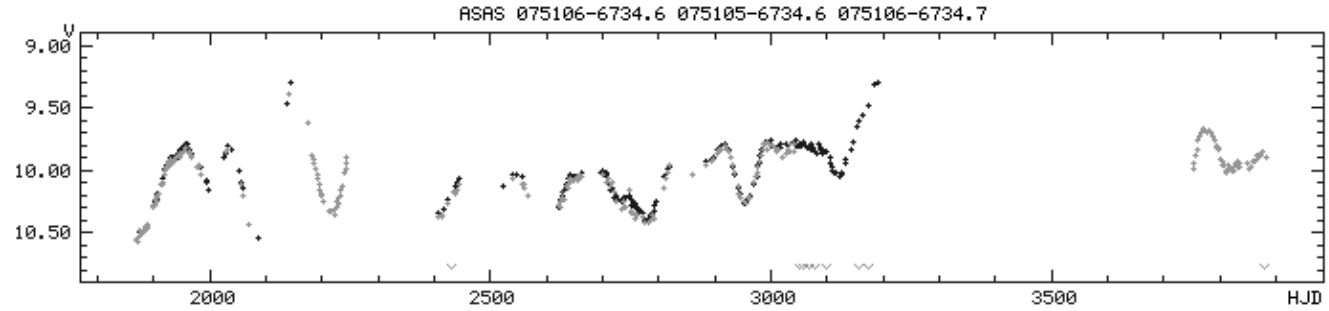
**NSV 3730** J2000 07 46 51.5 -07 52 26



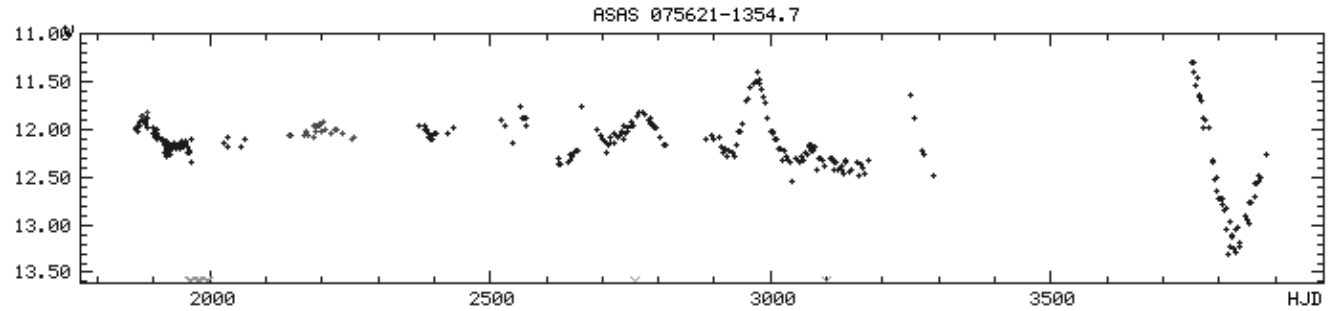

**NSV 3759** J2000 07 50 21.4 -23 25 21



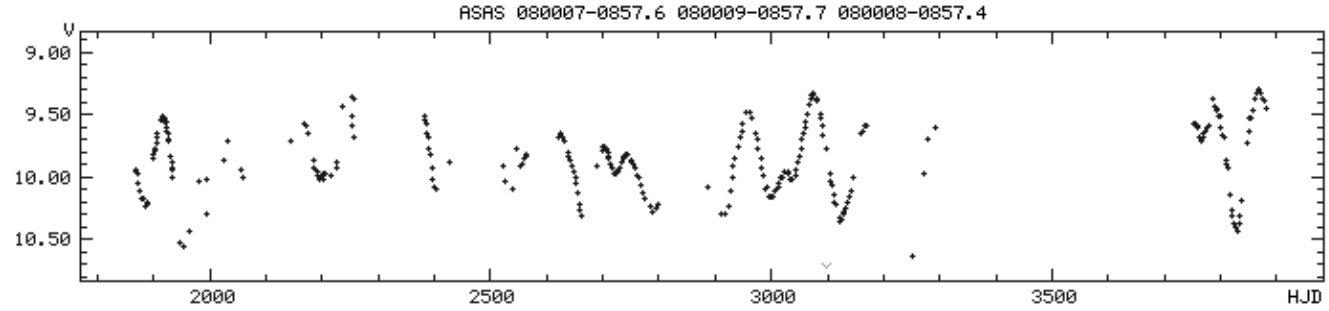

**NSV 3790** J2000 07 51 05.5 -67 34 38



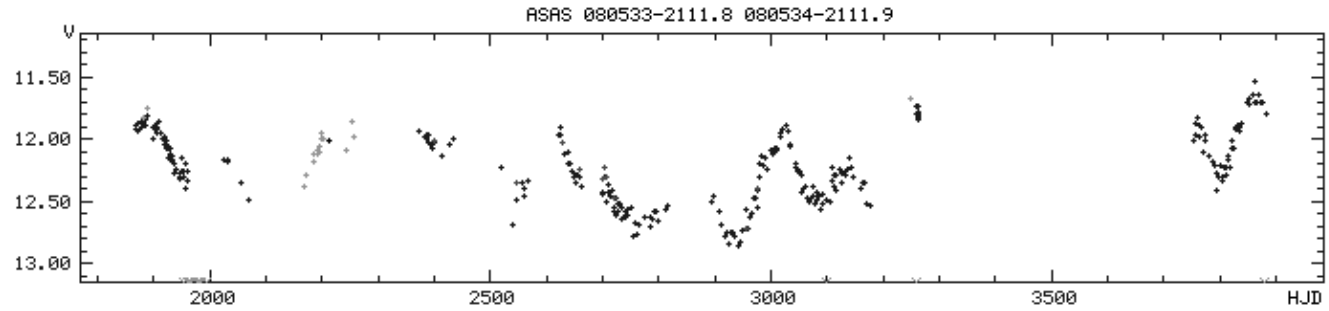

**NSV 3820** J2000 07 56 21.1 -13 54 39



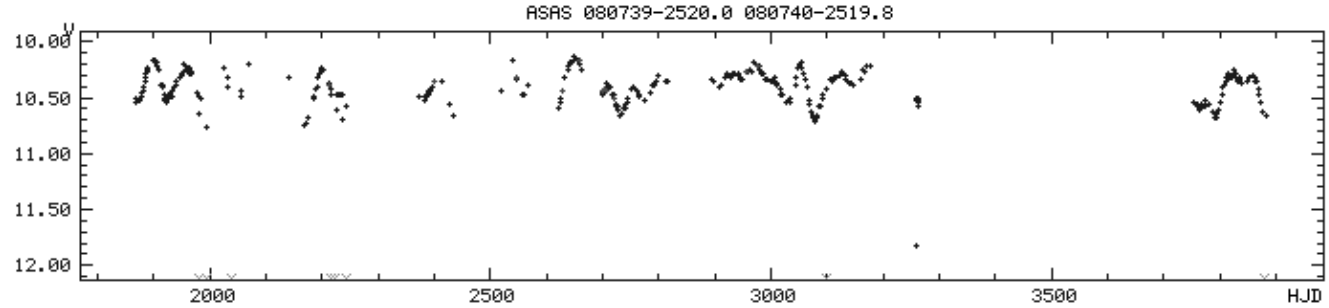

**NSV 3850** J2000 08 00 07.8 -08 57 26




**NSV 3898** J2000 08 05 32.8 -21 11 47

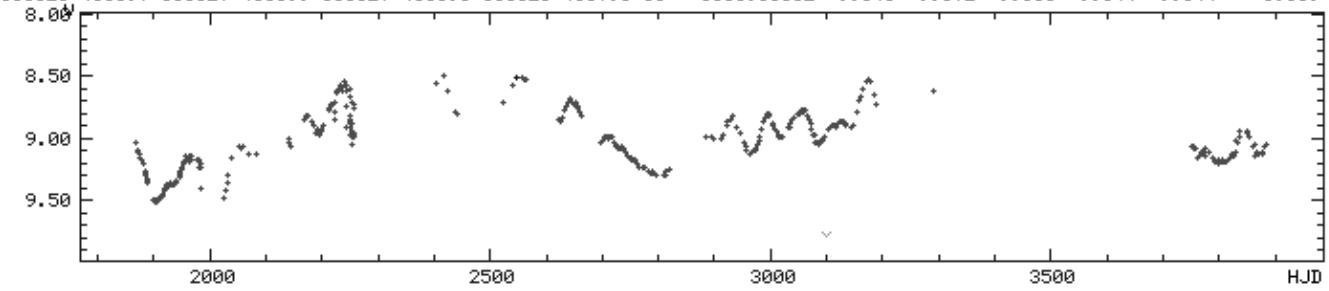


**NSV 3913** J2000 08 07 40.3 -25 19 51

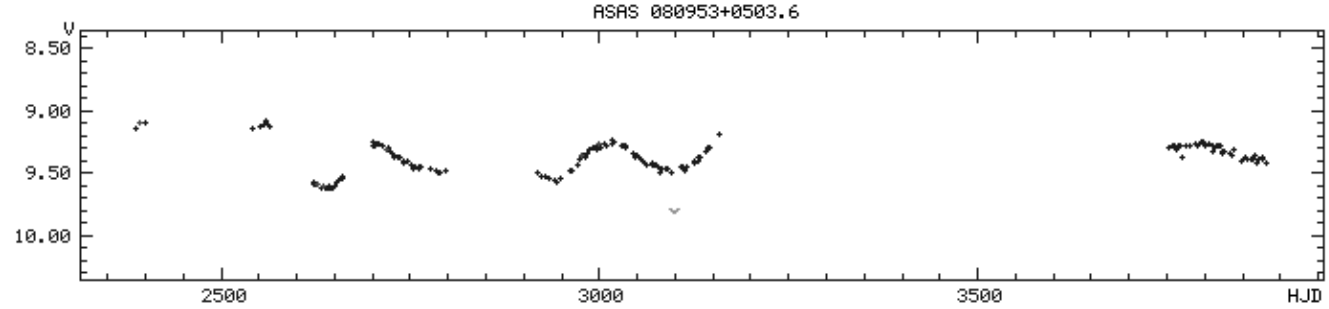



**NSV 3926** J2000 08 08 25.1 -48 36 45

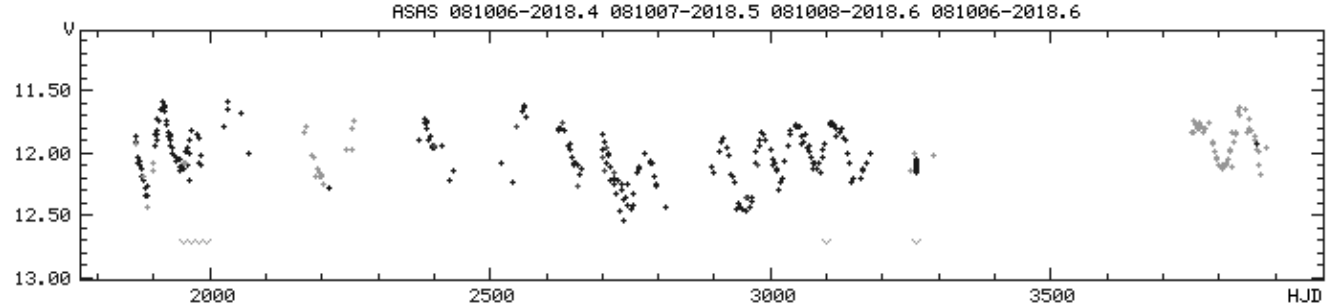
080825-4836.7 080827-4836.9 080827-4836.6 080823-4837.1 08 3883.53862 9.046 9.072 9.051 9.044 9.044 0.019 0




**NSV 3927** J2000 08 09 52.9 +05 03 36




**NSV 3929** J2000 08 10 07.0 -20 18 29




**NSV 3994** J2000 08 18 00.8 -19 22 14

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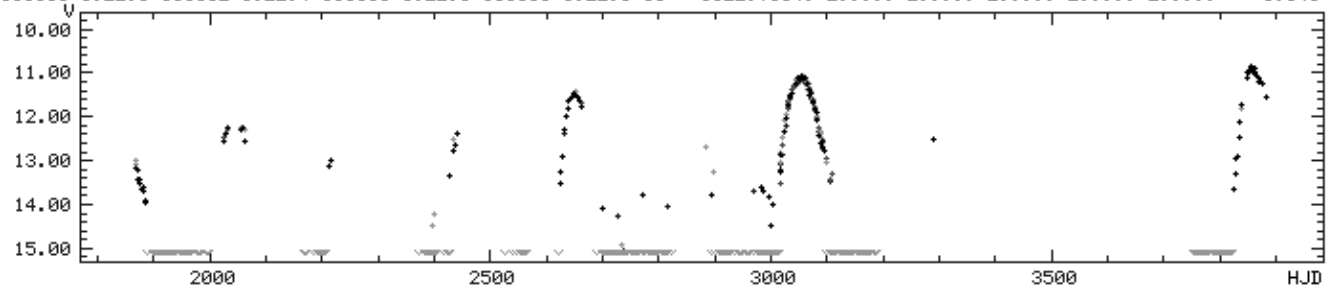
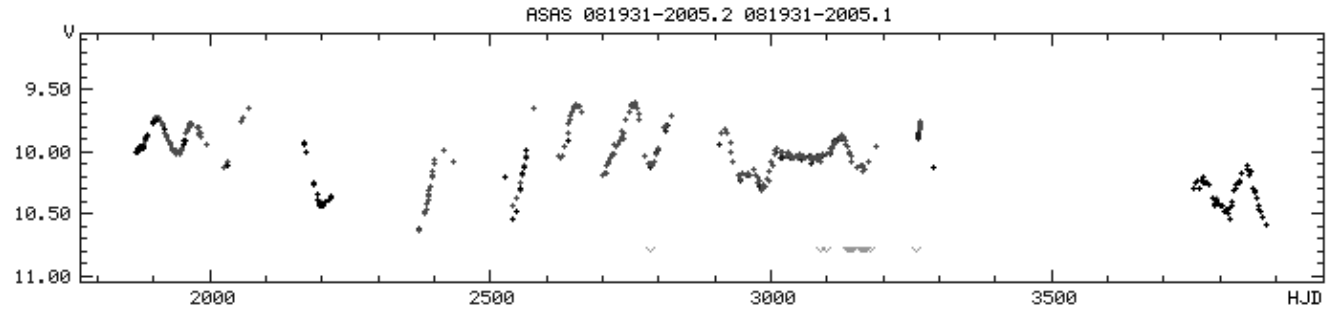
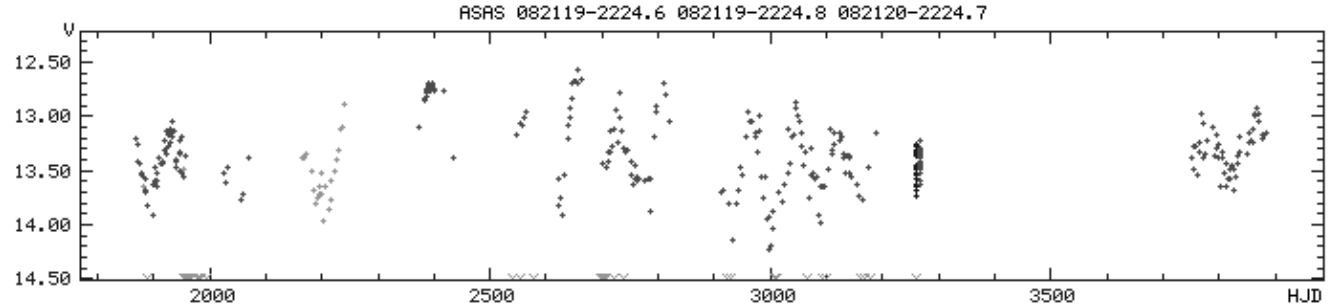


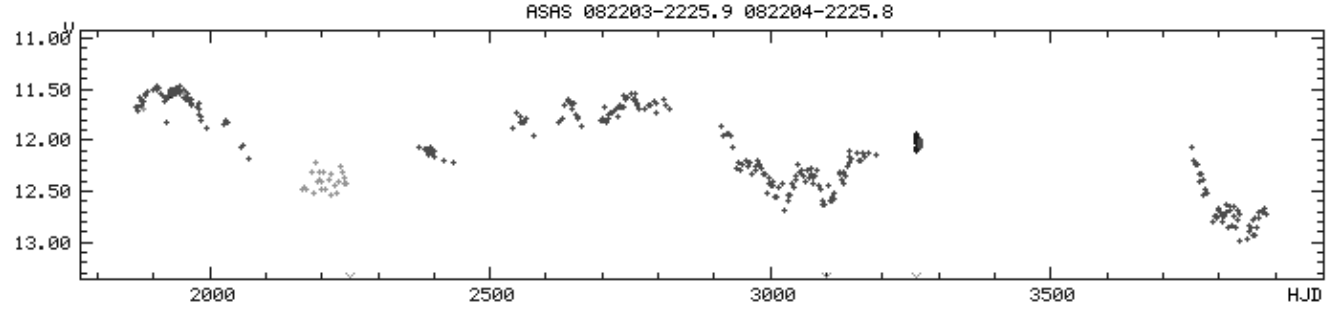

**NSV 4005** J2000 08 19 30.6 -20 05 09



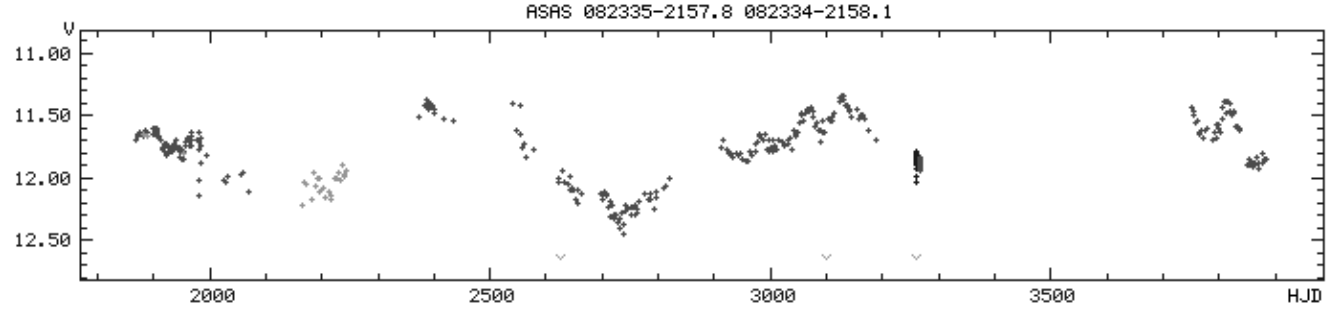
**NSV 4028** J2000 08 21 19.5 -22 24 37



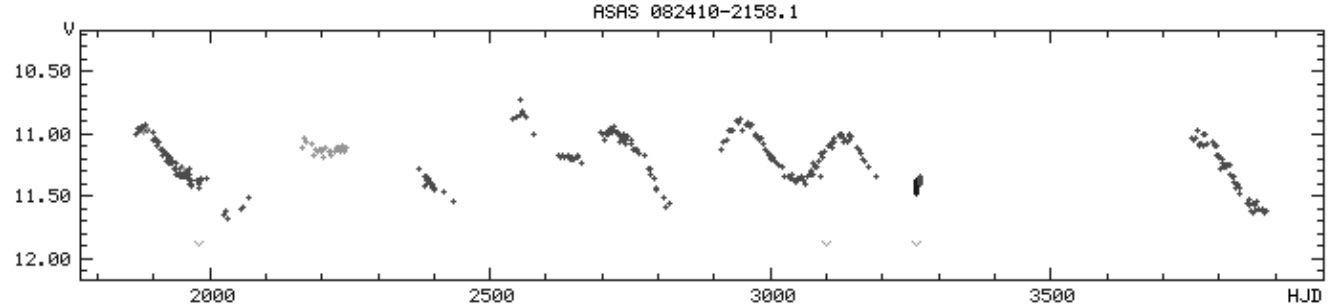

**NSV 4036** J2000 08 22 02.8 -22 25 56



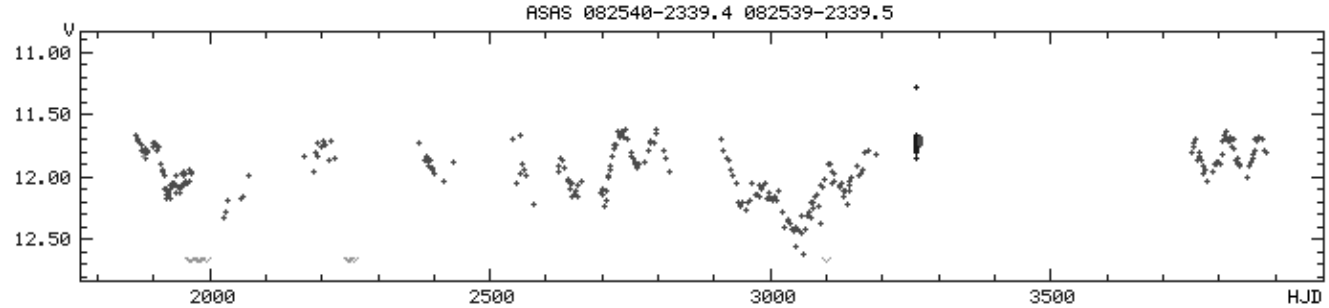

**NSV 4054** J2000 08 23 34.9 -21 57 49



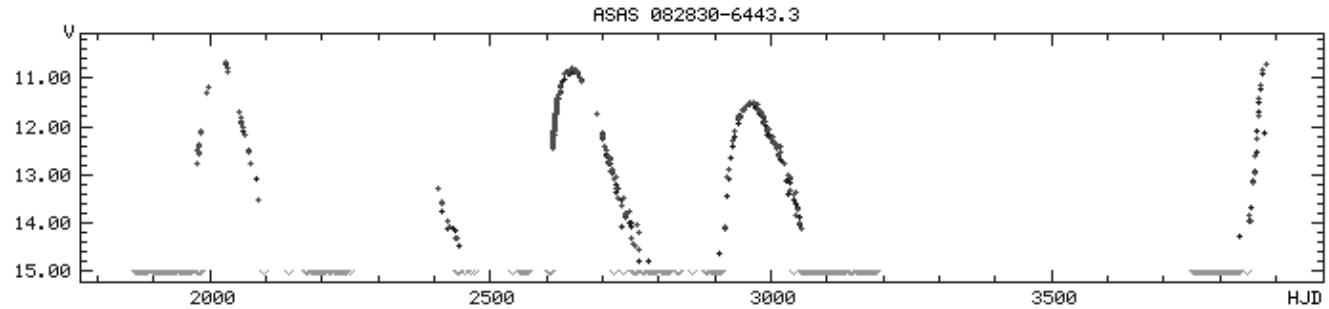

**NSV 4059** J2000 08 24 09.7 -21 58 06



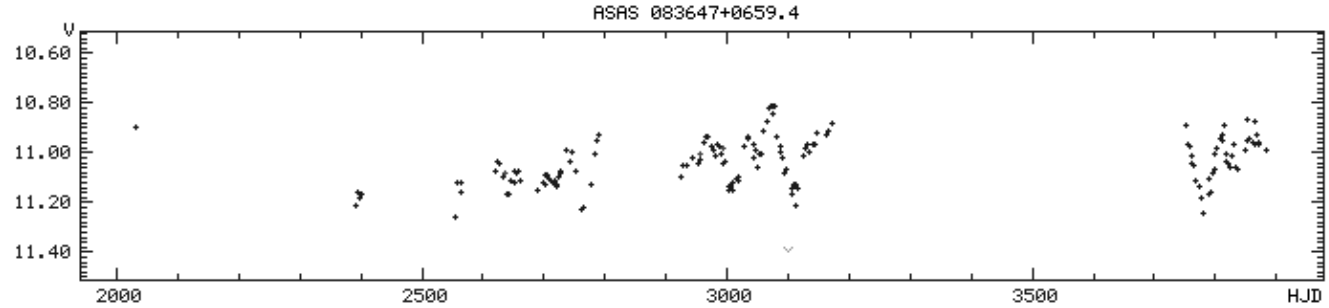

**NSV 4072** J2000 08 25 40.0 -23 39 24




**NSV 4109** J2000 08 28 30.1 -64 43 20



**NSV 4150** J2000 08 36 47.4 +06 59 22




**NSV 4249** J2000 08 44 40.0 -71 07 41

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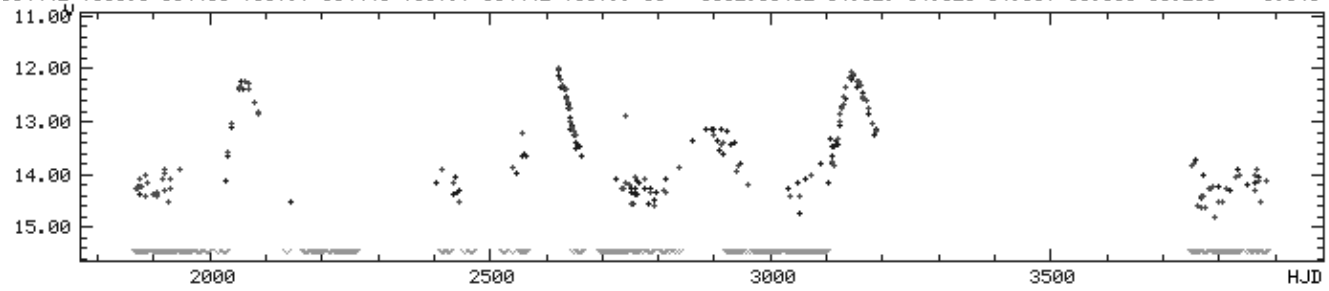
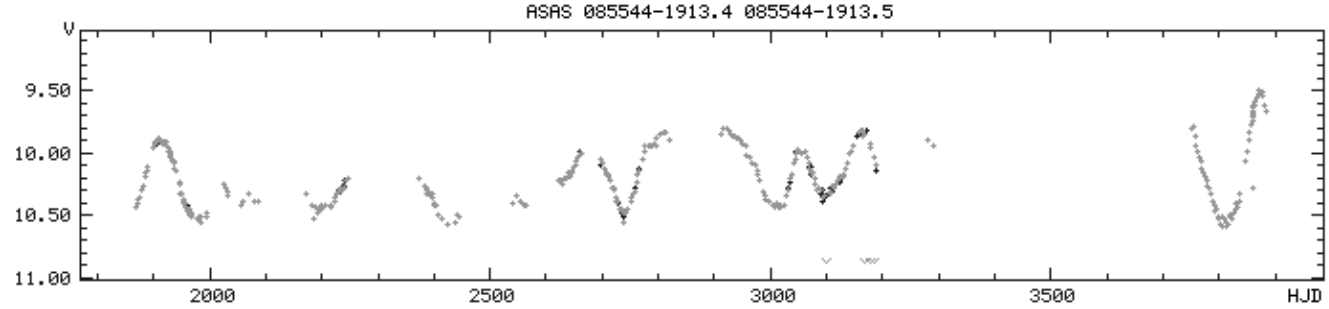
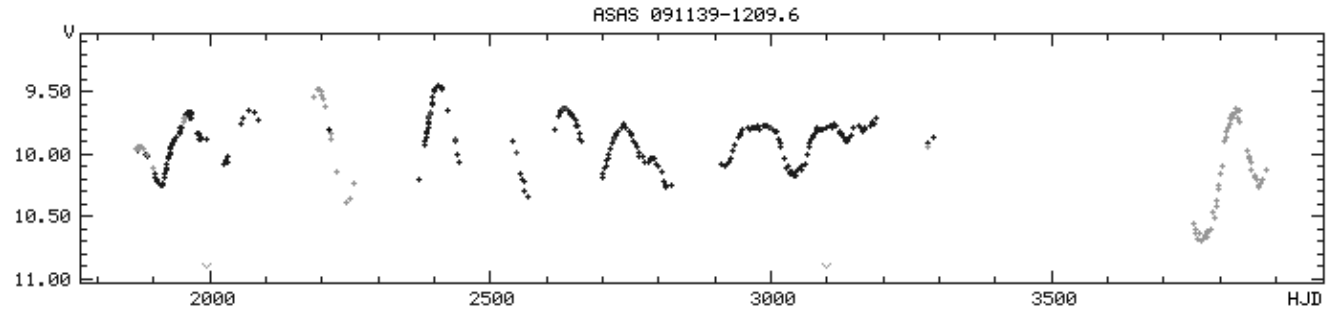


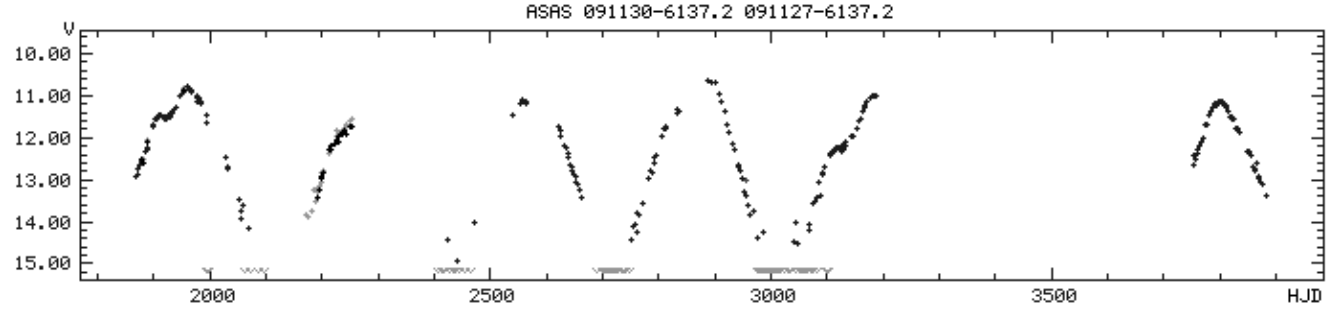

**NSV 4312** J2000 08 55 43.8 -19 13 28



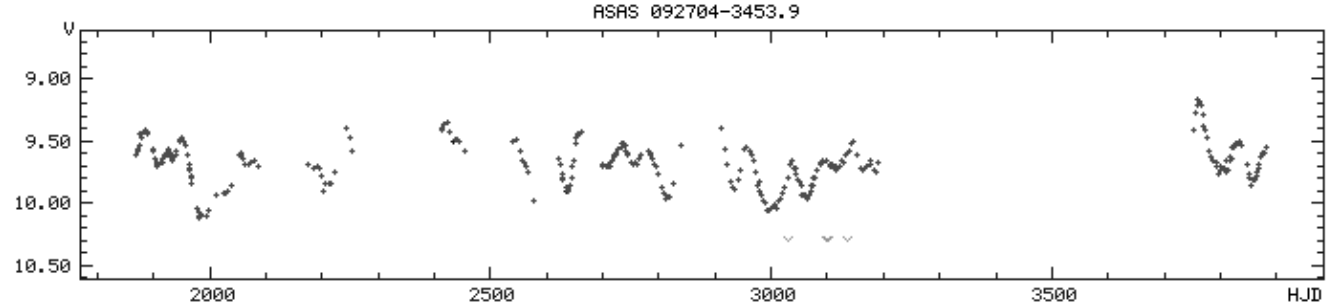

**NSV 4412** J2000 09 11 39.4 -12 09 35



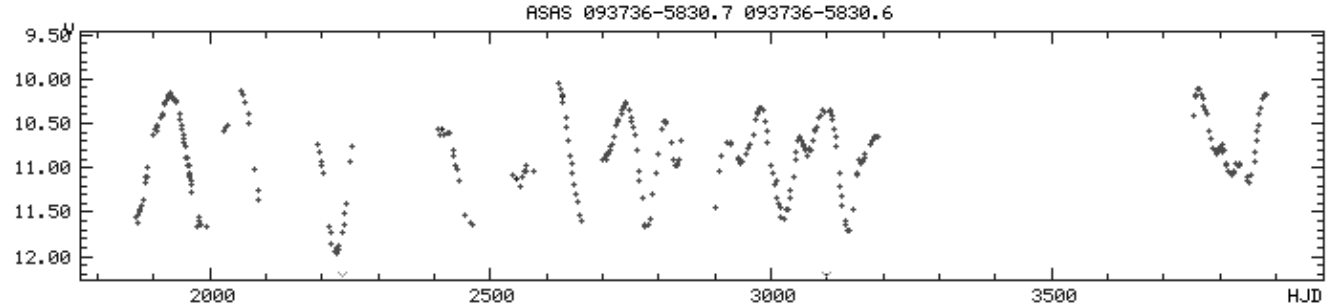

**NSV 4416** J2000 09 11 30.0 -61 37 13



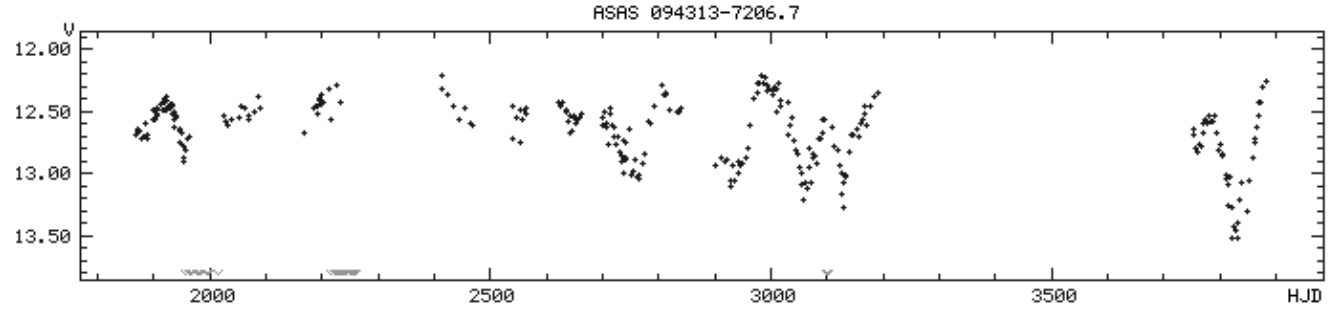

**NSV 4495** J2000 09 27 04.0 -34 53 50



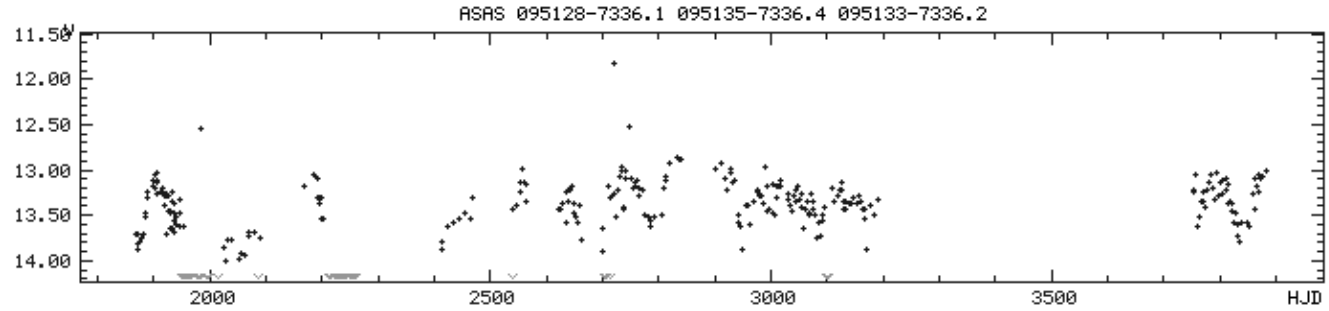
**NSV 4560** J2000 09 37 35.8 -58 30 38



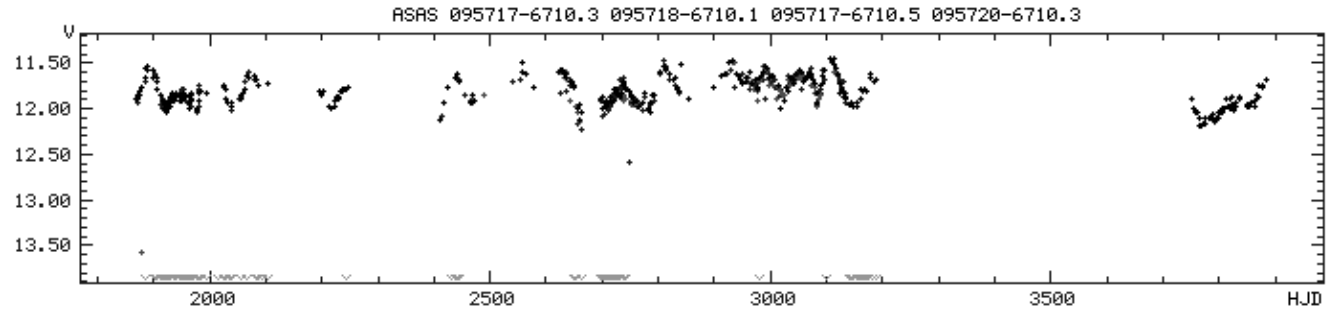

**NSV 4610** J2000 09 43 13.1 -72 06 38



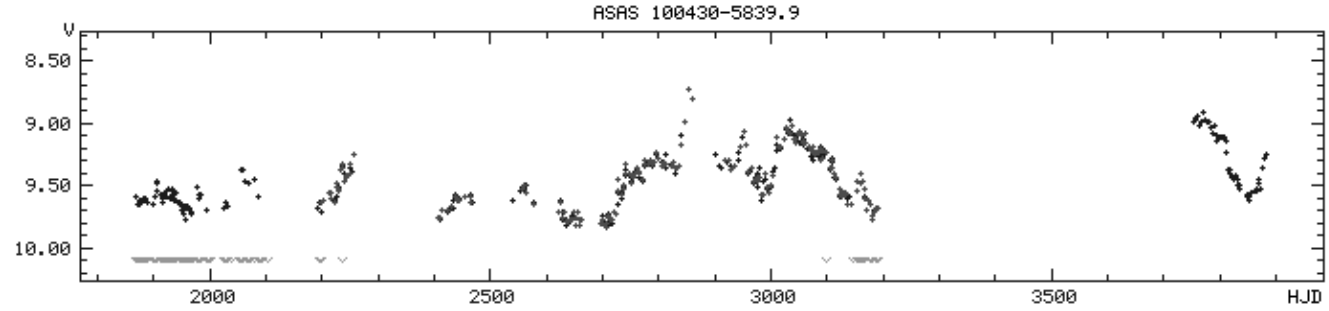

**NSV 4666** J2000 09 51 33.3 -73 36 11



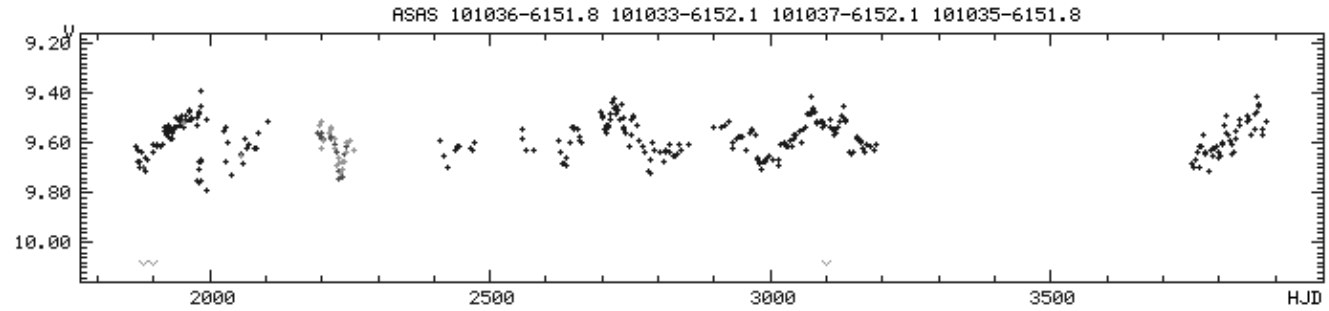

**NSV 4687** J2000 09 57 18.3 -67 10 10



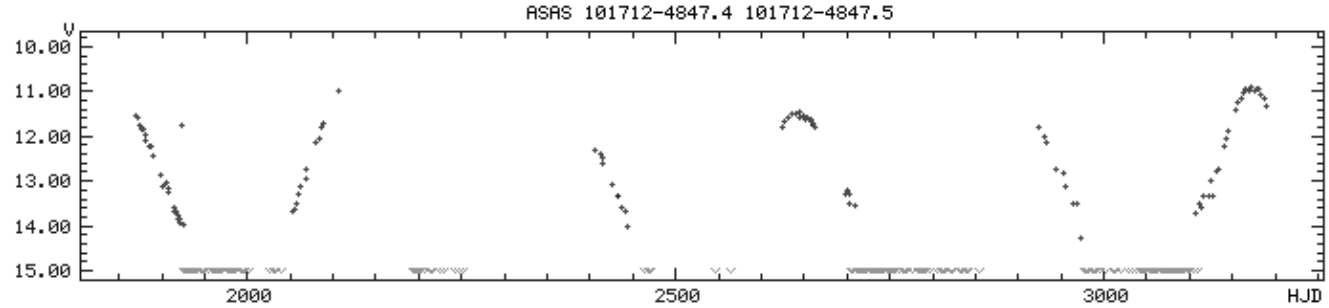

**NSV 4727** J2000 10 04 30.4 -58 39 52



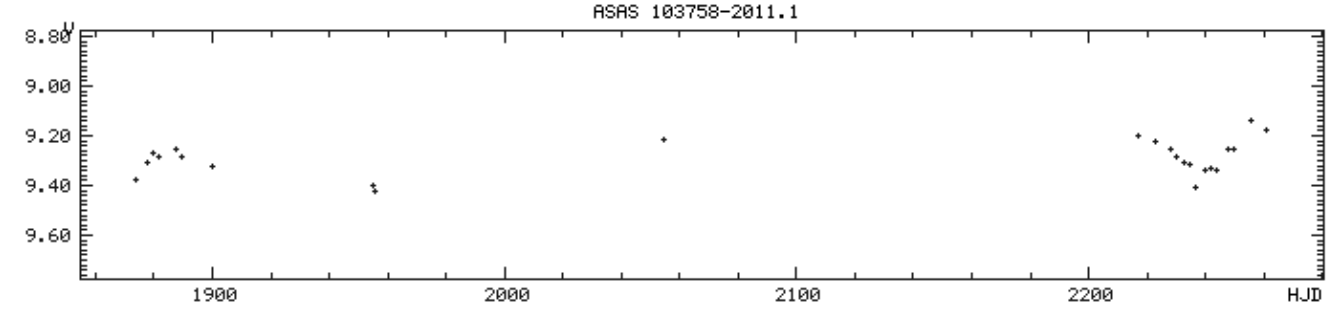

**NSV 4769** J2000 10 10 35.5 -61 51 48



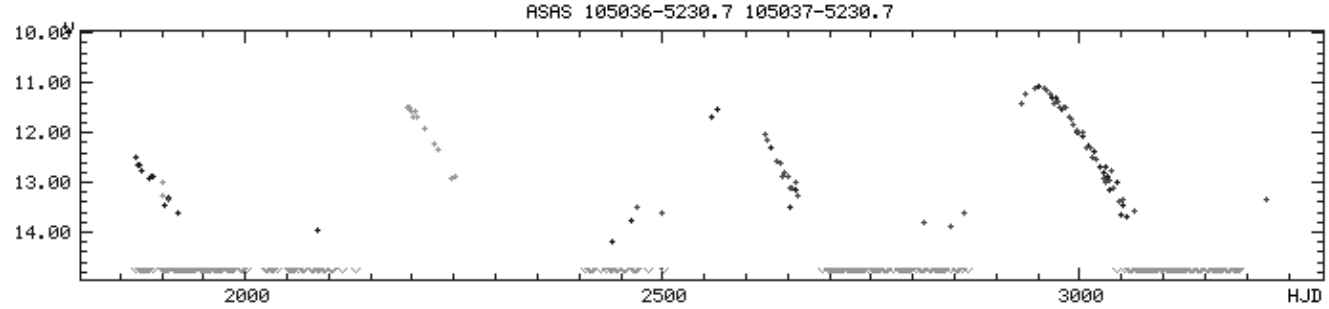
**NSV 4814** J2000 10 17 11.9 -48 47 27



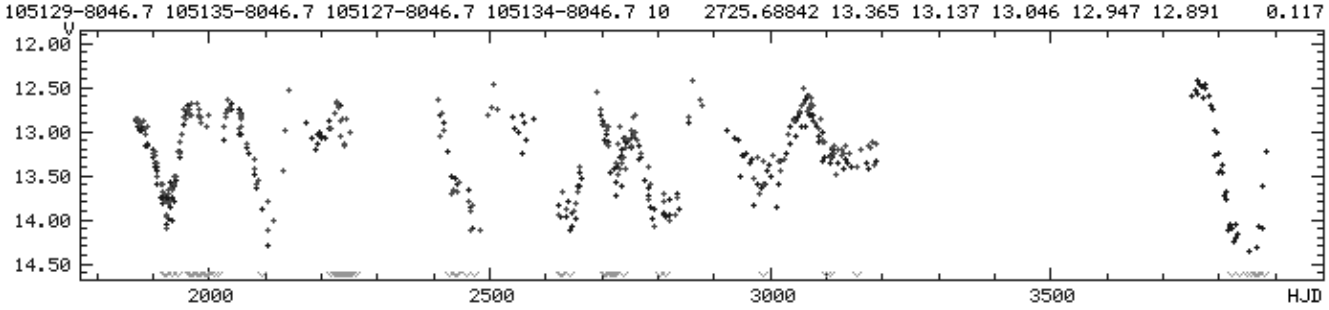

**NSV 4915** J2000 10 37 58.3 -20 11 09



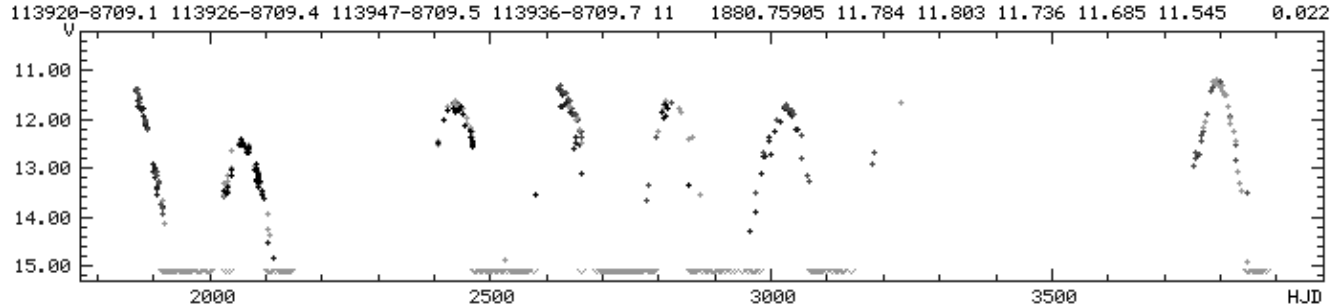

**NSV 4989** J2000 10 50 36.3 -52 30 40



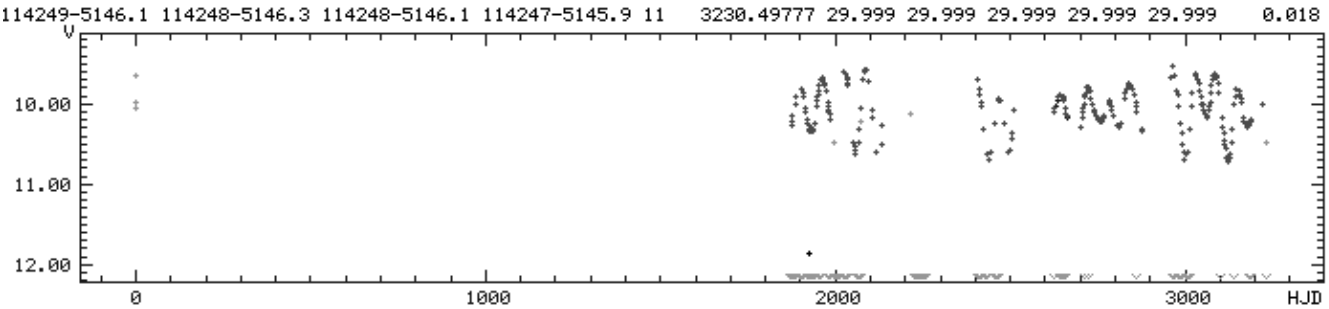

**NSV 5004** J2000 10 51 28.7 -80 46 41



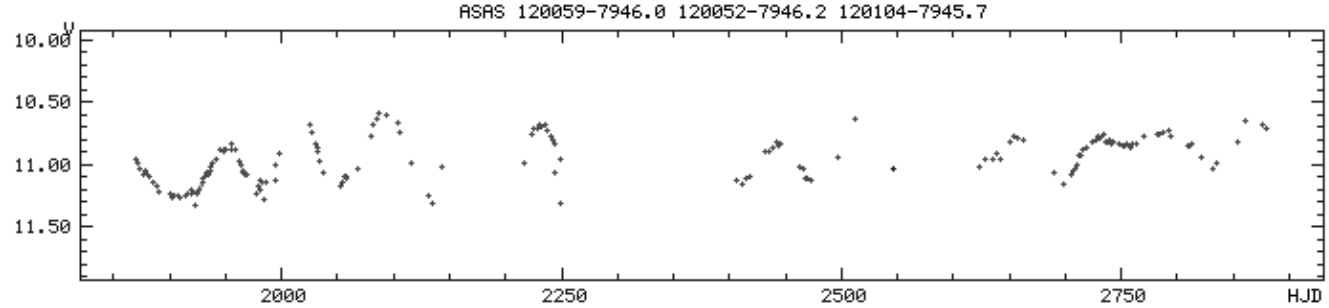

**NSV 5292** J2000 11 39 25.9 -87 09 26



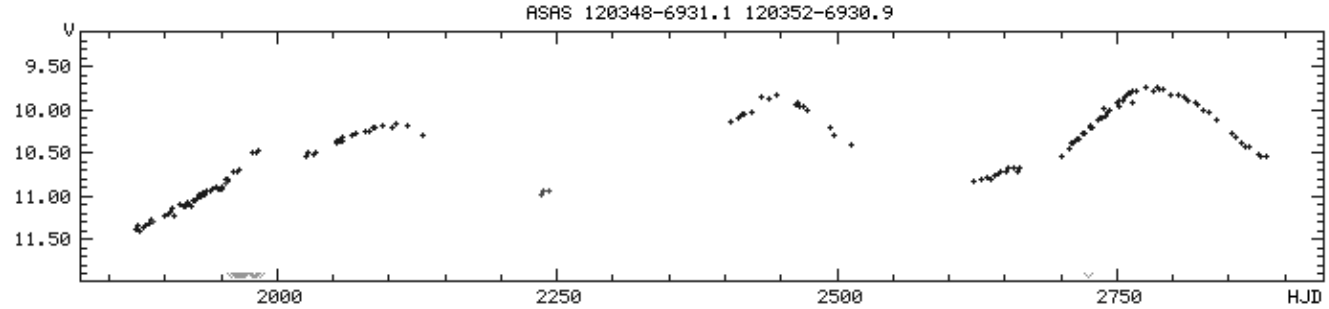

**NSV 5302** J2000 11 42 48.4 -51 46 08



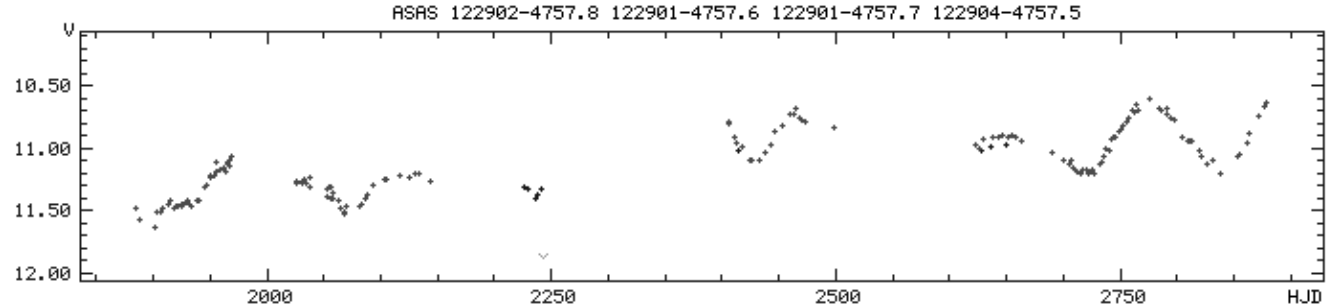
**NSV 5423** J2000 12 00 59.4 -79 46 00



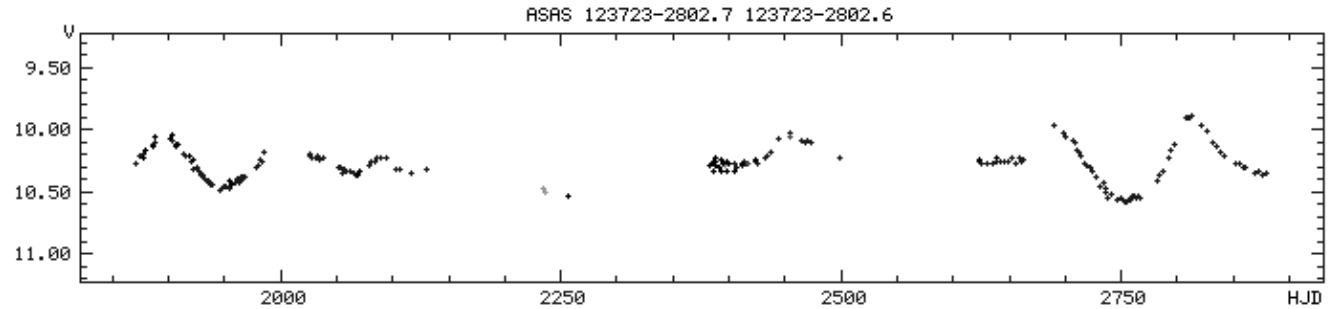

**NSV 5443** J2000 12 03 52.0 -69 30 55



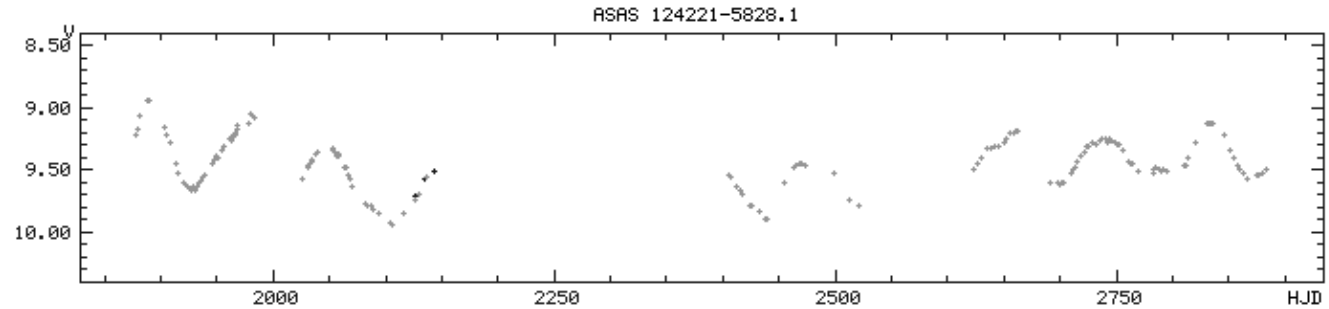

**NSV 5642** J2000 12 29 01.2 -47 57 39



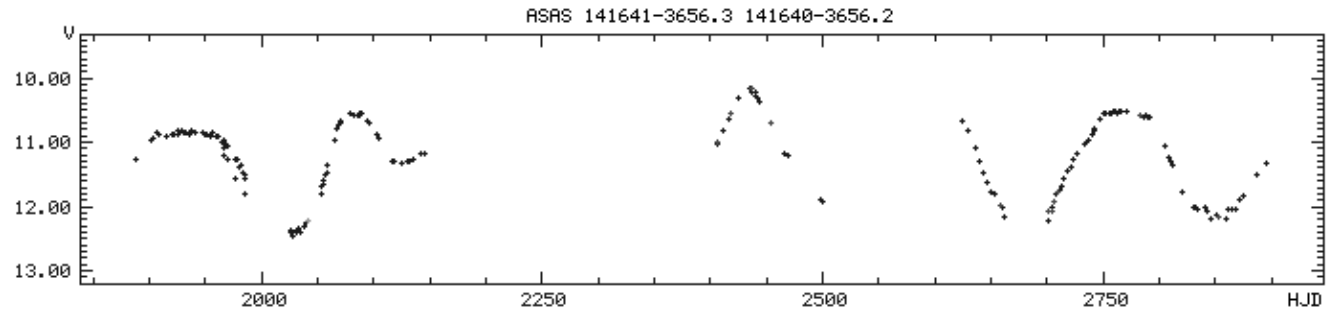

**NSV 5789** J2000 12 37 22.7 -28 02 40



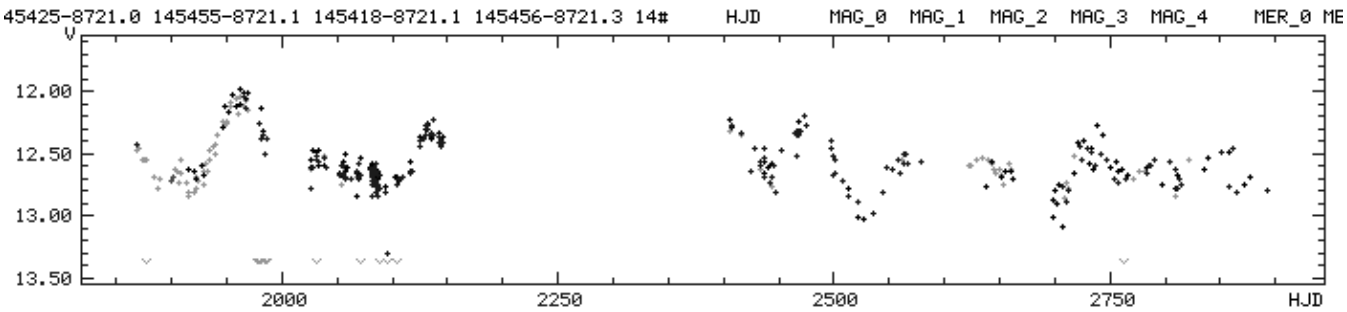

**NSV 5870** J2000 12 42 21.3 -58 28 06



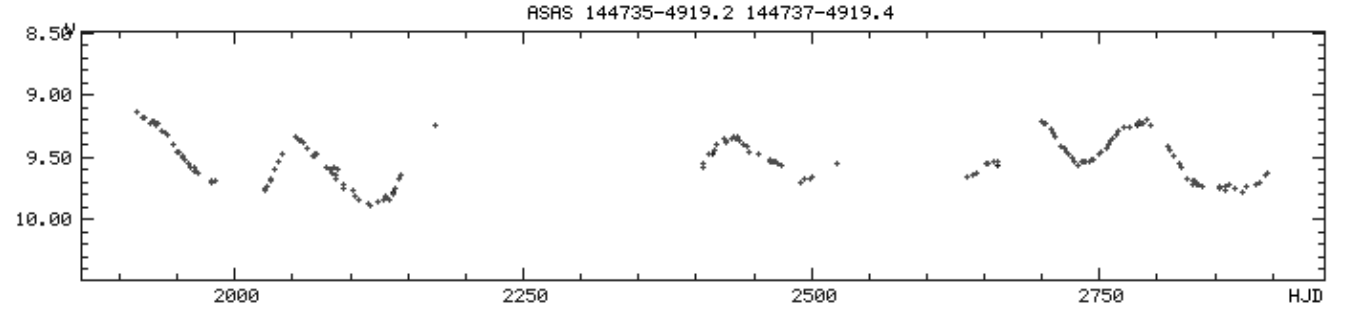

**NSV 6605** J2000 14 16 40.8 -36 56 18



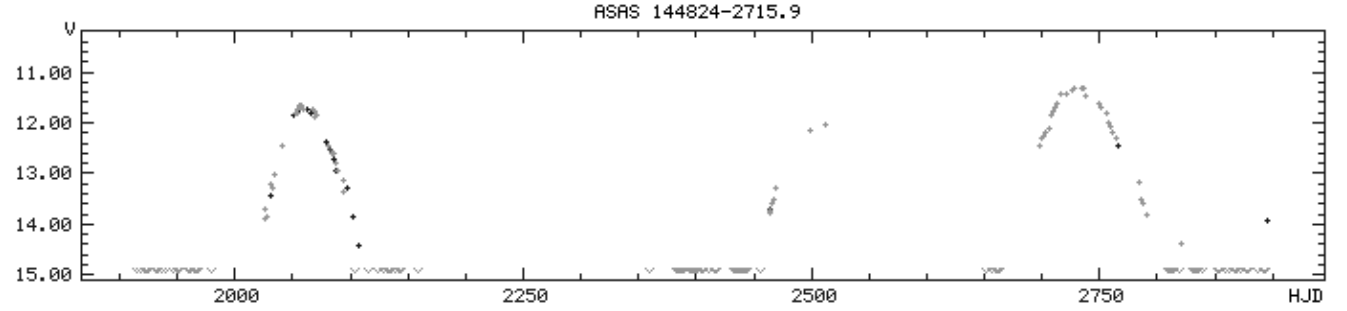
**NSV 6749** J2000 14 54 22.0 -87 21 05



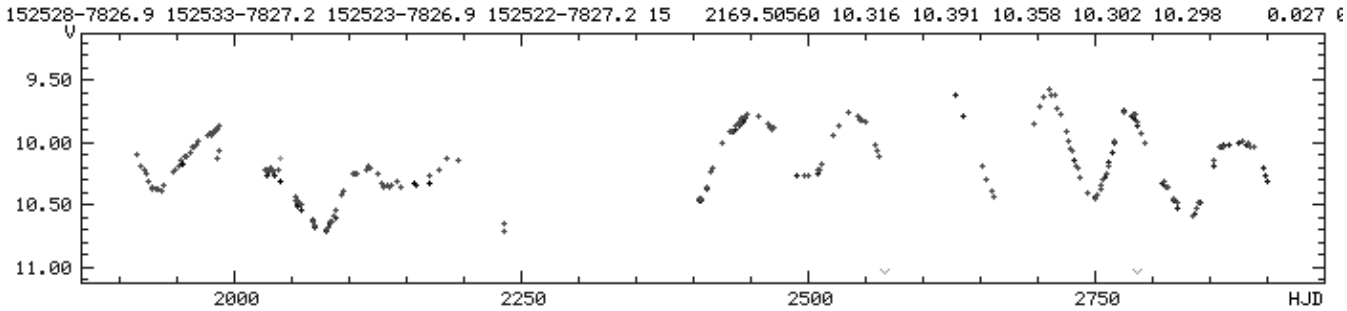

**NSV 6799** J2000 14 47 34.9 -49 19 13



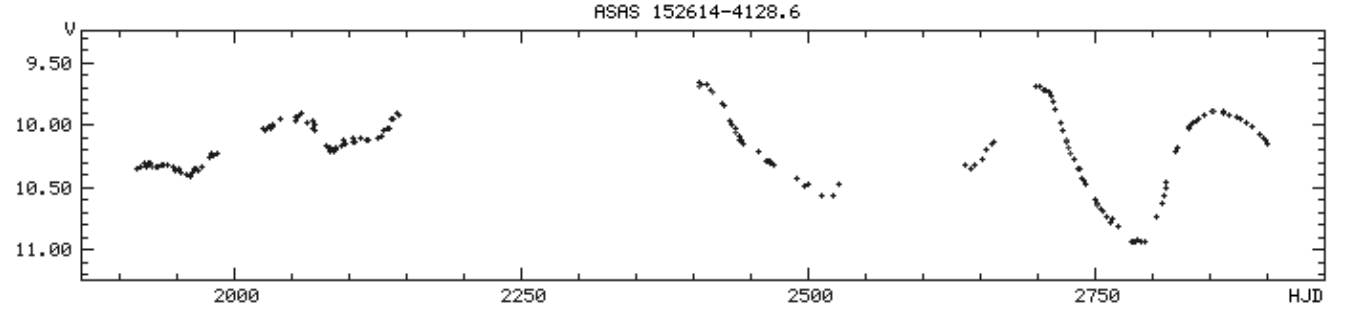

**NSV 6806** J2000 14 48 24.0 -27 15 54



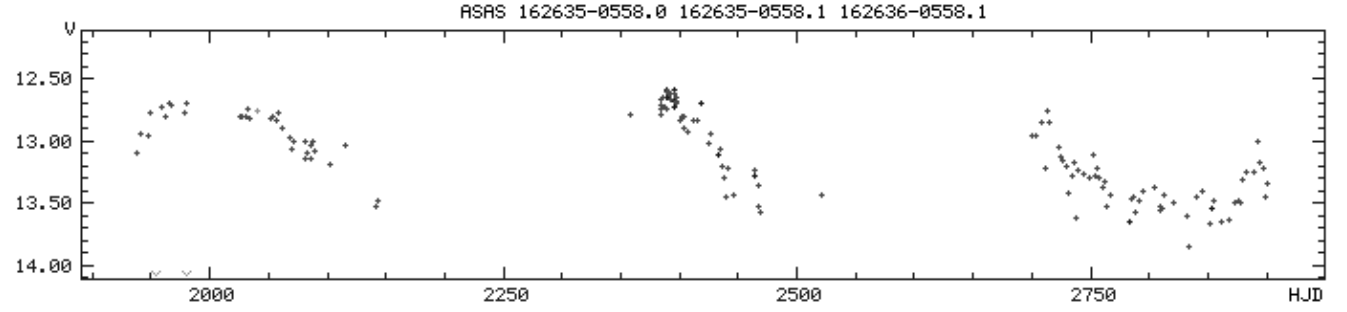

**NSV 7039** J2000 15 25 28.6 -78 26 55



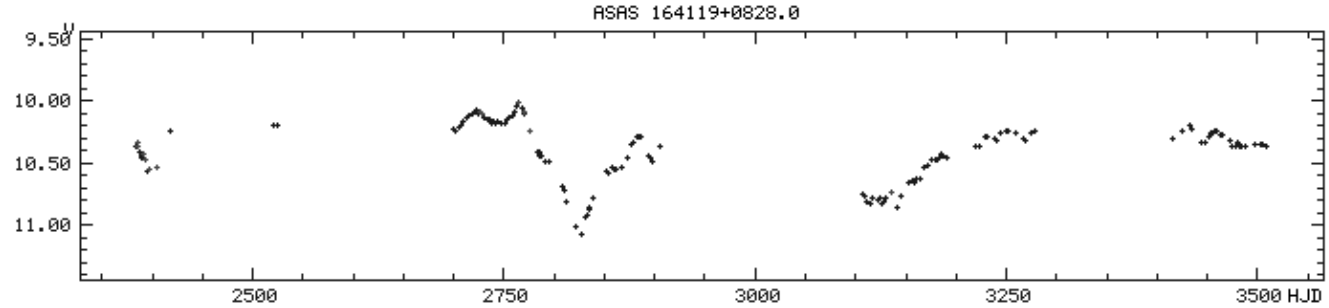

**NSV 7070** J2000 15 26 14.3 -41 28 35



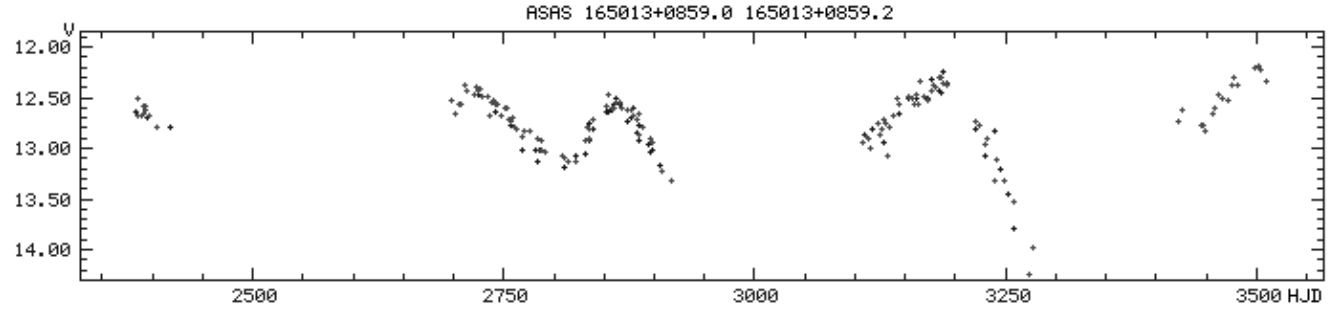

**NSV 7722** J2000 16 26 35.1 -05 58 03



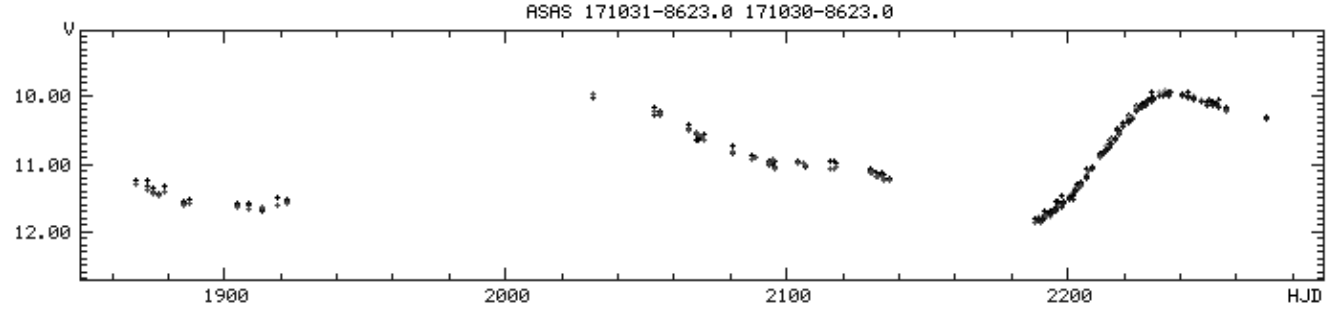
**NSV 7913** J2000 16 41 19.4 +08 28 02



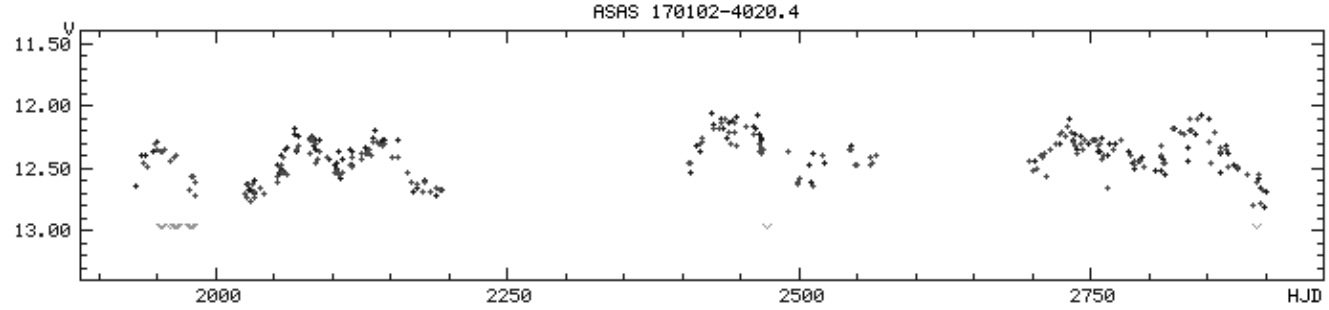

**NSV 7989** J2000 16 50 13.1 +08 59 11




**NSV 8042** J2000 17 10 29.6 -86 23 00




**NSV 8099** J2000 17 01 02.3 -40 20 24




**NSV 8251** J2000 17 13 40.2 -73 53 43

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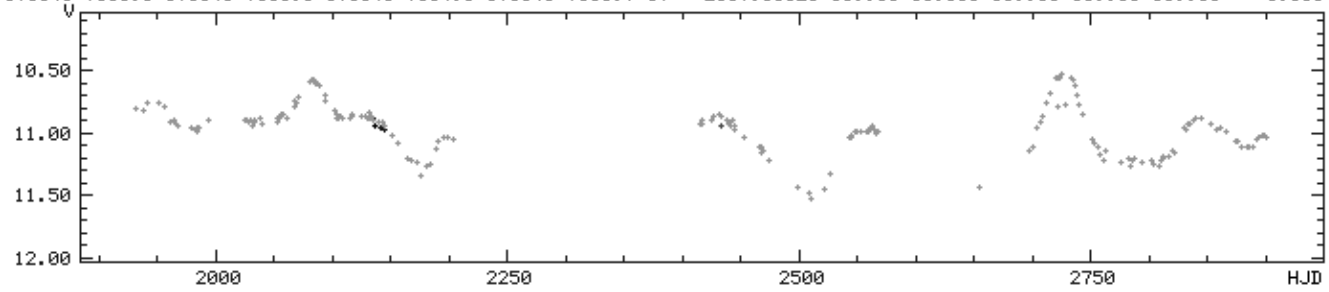
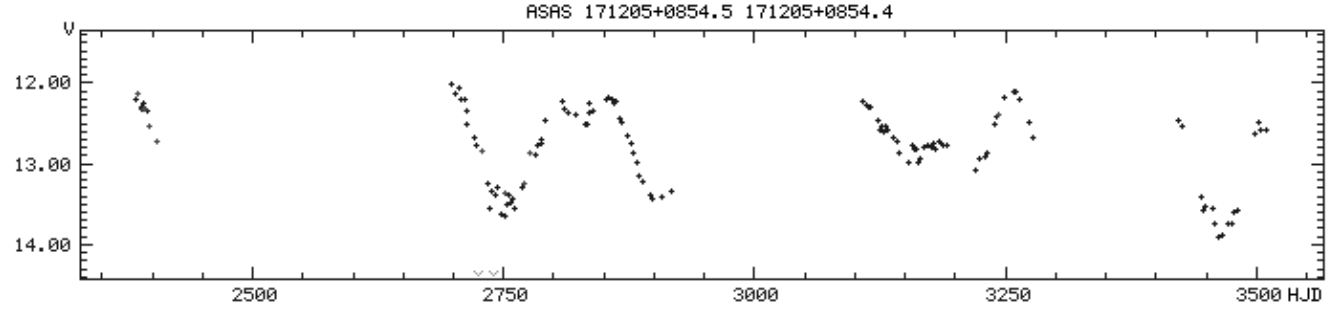
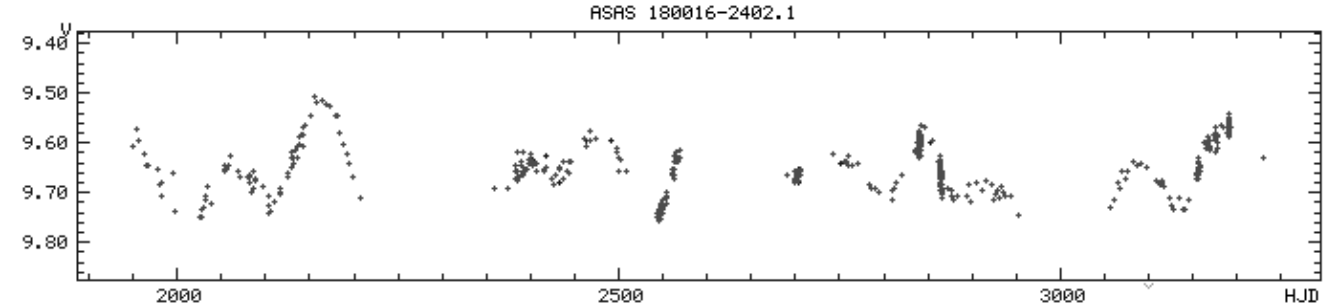


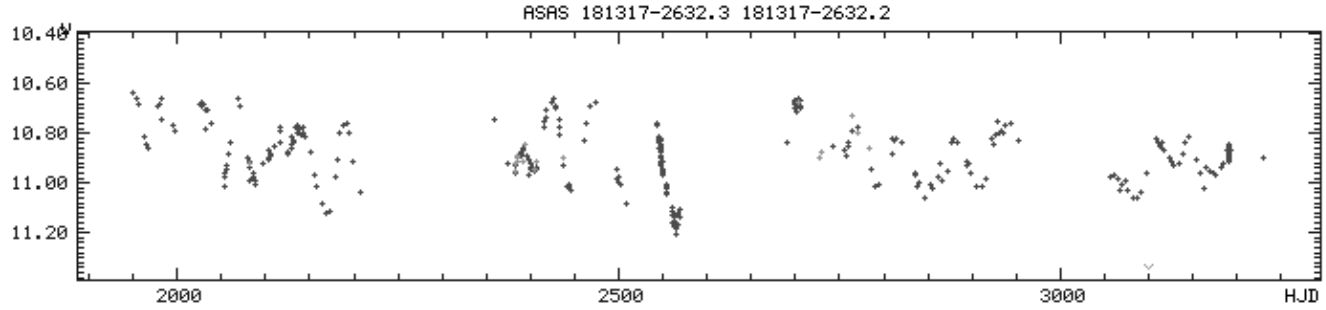

**NSV 8293** J2000 17 12 04.6 +08 54 28



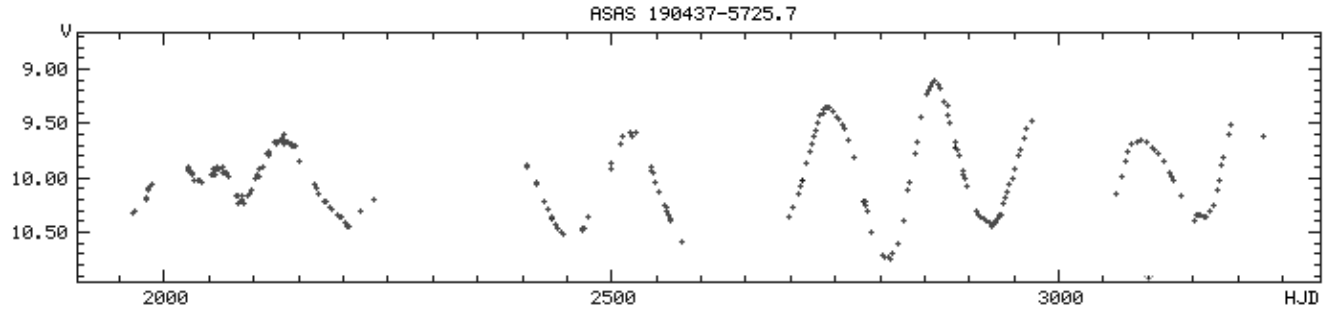
**NSV 9957** J2000 18 00 16.1 -24 02 06



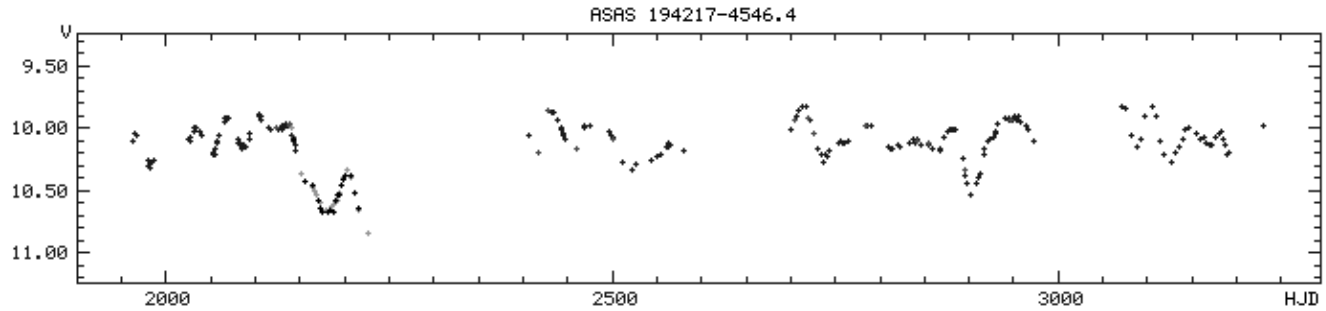

**NSV 10368** J2000 18 13 17.3 -26 32 14



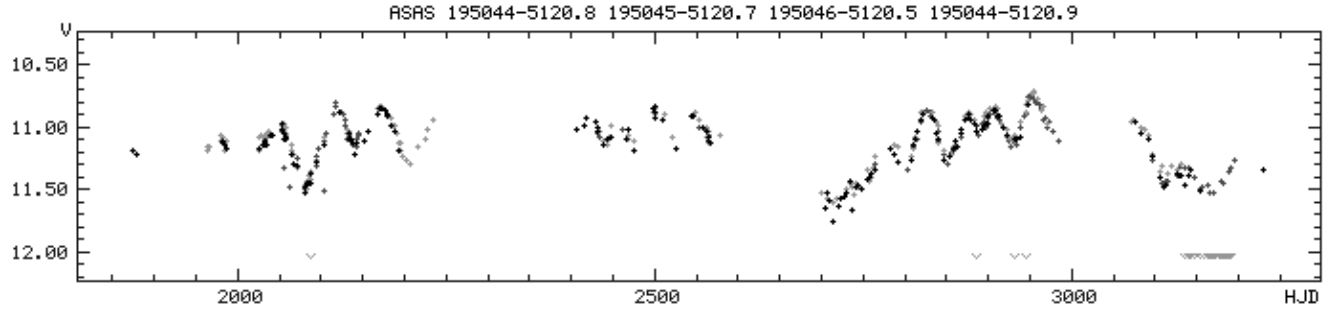

**NSV 11686** J2000 19 04 36.6 -57 25 42



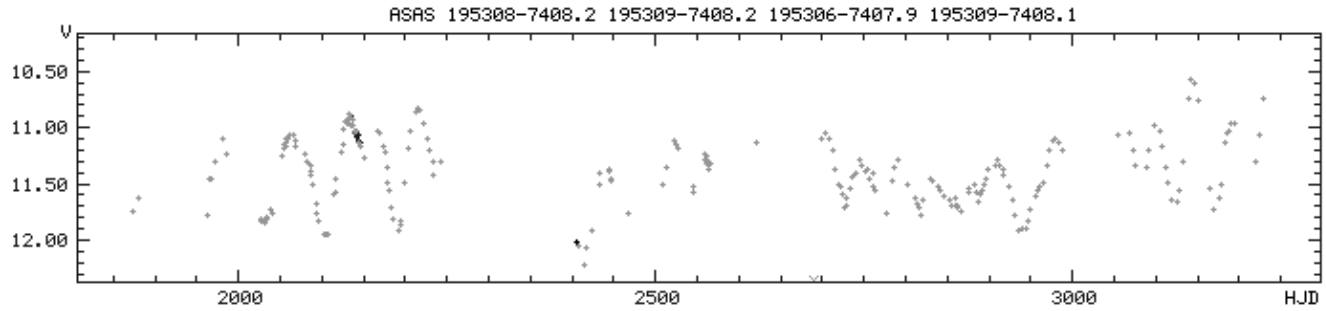

**NSV 12283** J2000 19 42 17.1 -45 46 22



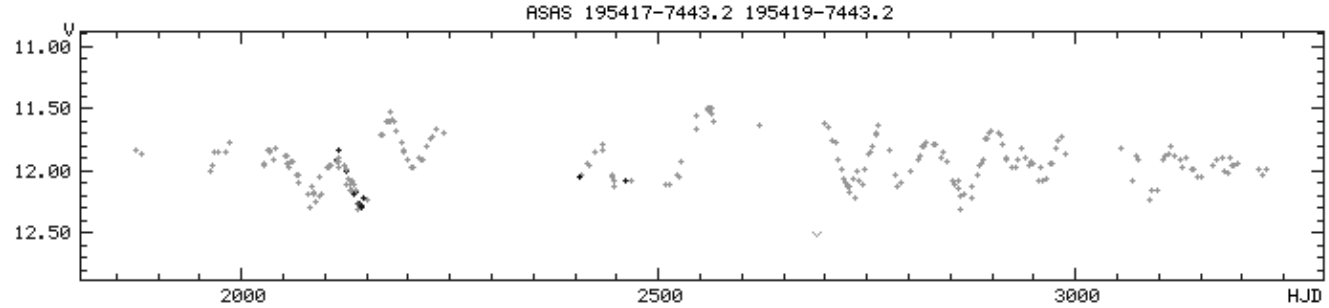

**NSV 12438** J2000 19 50 45.0 -51 20 43



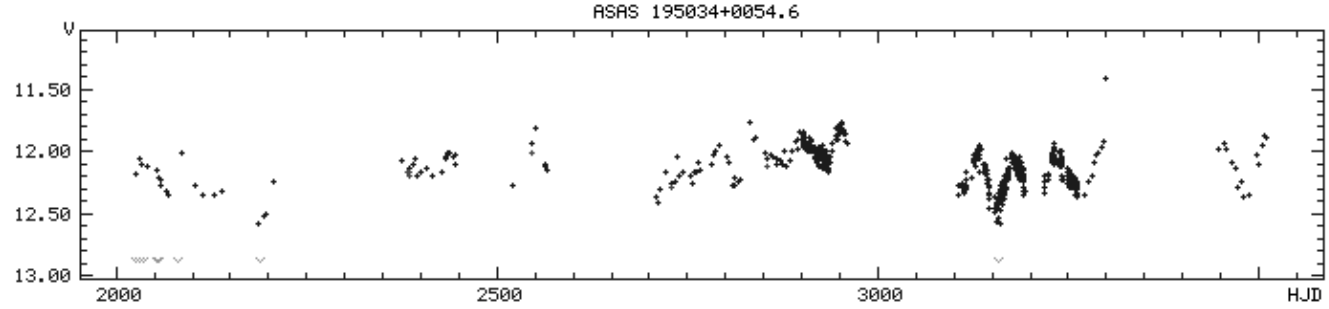

**NSV 12440** J2000 19 53 08.9 -74 08 08



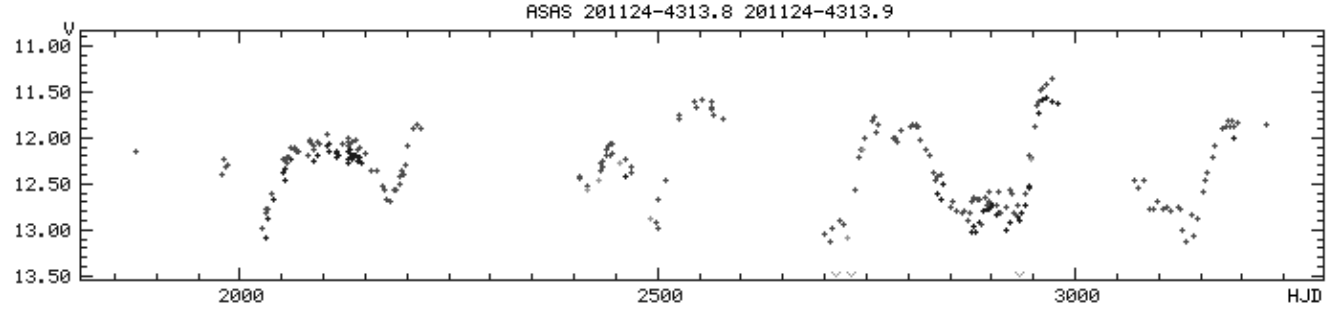
**NSV 12460** J2000 19 54 17.4 -74 43 10



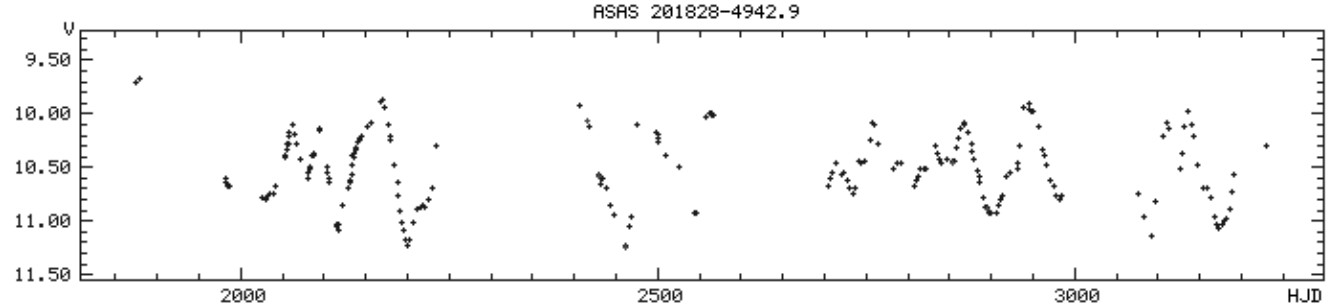

**NSV 12461** J2000 19 50 34.0 +00 54 38



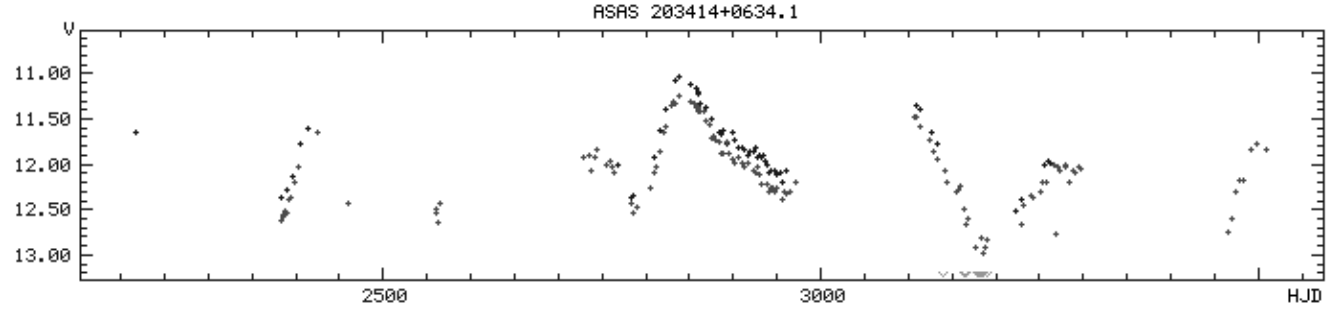

**NSV 12854** J2000 20 11 23.5 -43 13 48



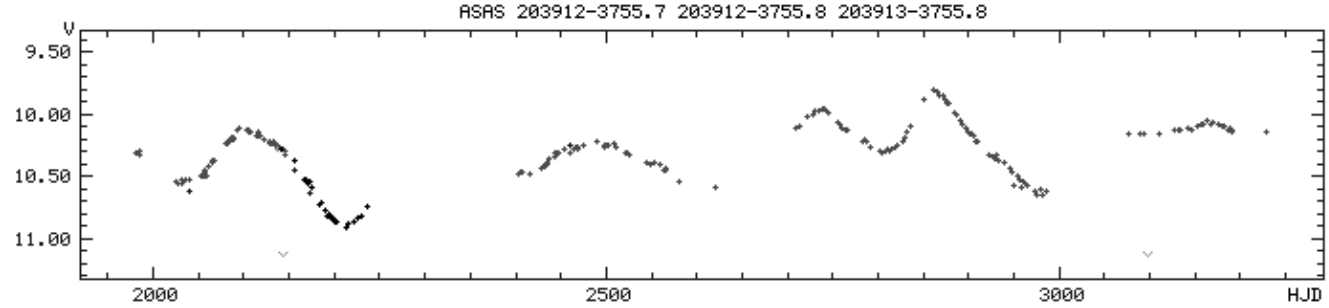

**NSV 12974** J2000 20 18 28.1 -49 42 56



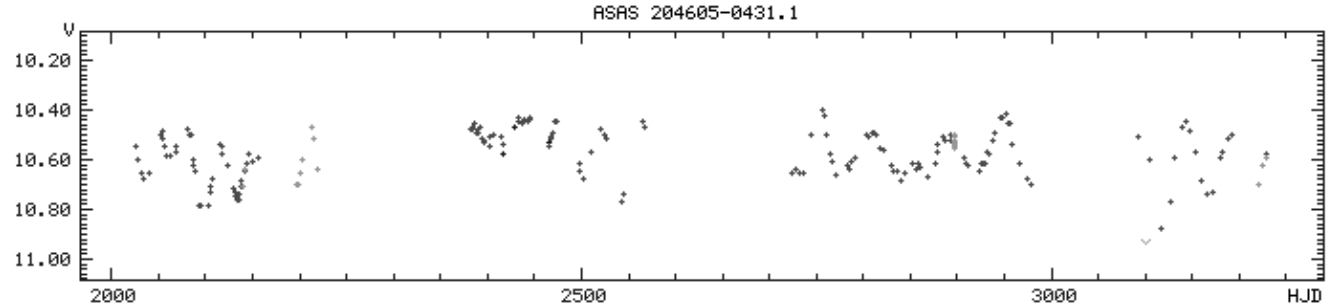

**NSV 13149** J2000 20 34 14.3 +06 34 05



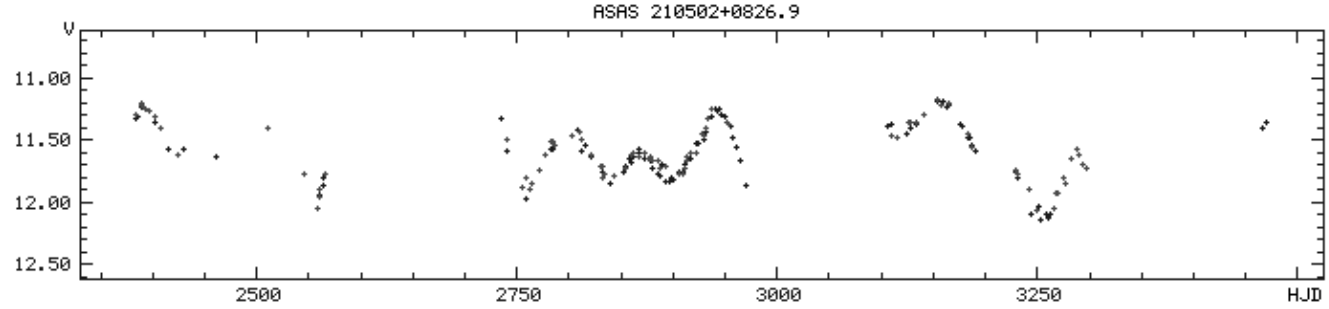

**NSV 13190** J2000 20 39 11.6 -37 55 48



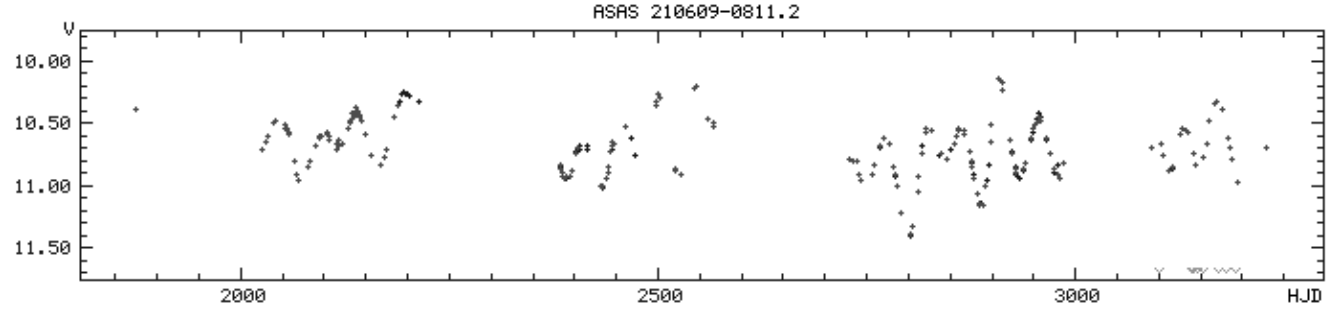
**NSV 13281** J2000 20 46 05.1 -04 31 07



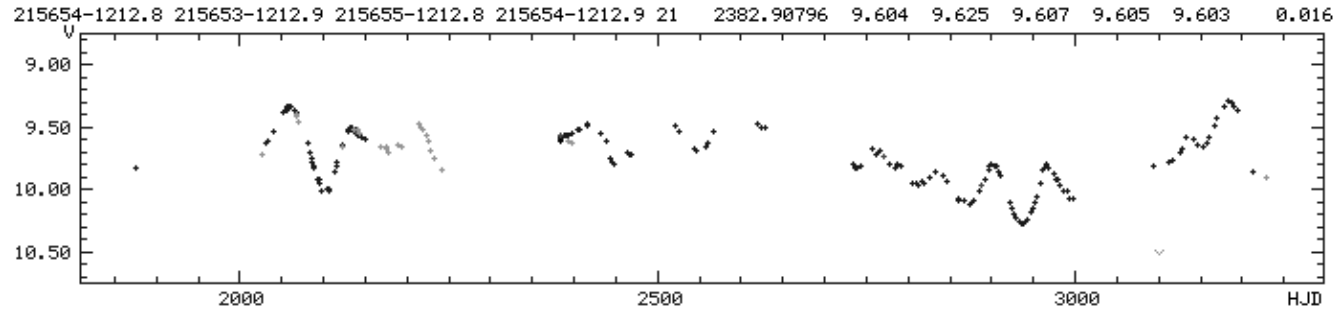

**NSV 13510** J2000 21 05 02.4 +08 26 51



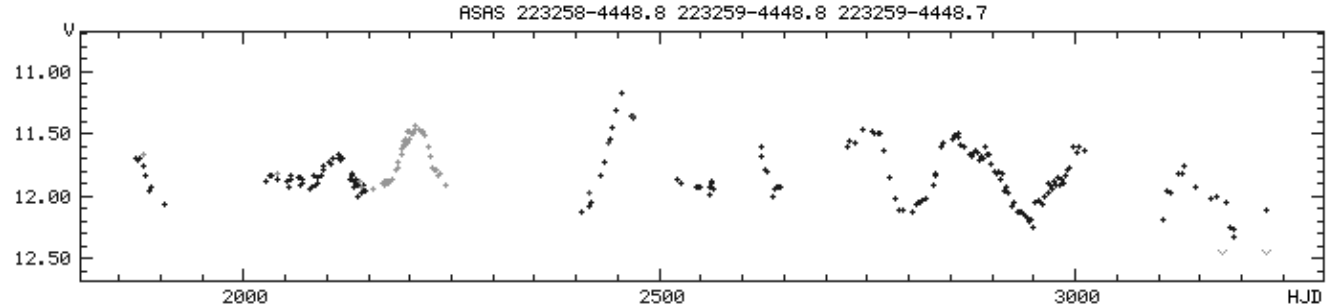

**NSV 13526** J2000 21 06 09.1 -08 11 12



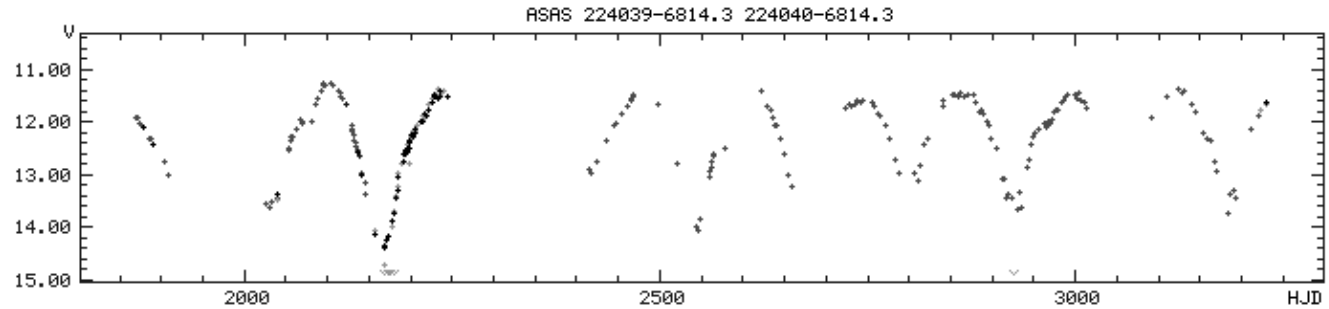

**NSV 13967** J2000 21 56 54.3 -12 12 50



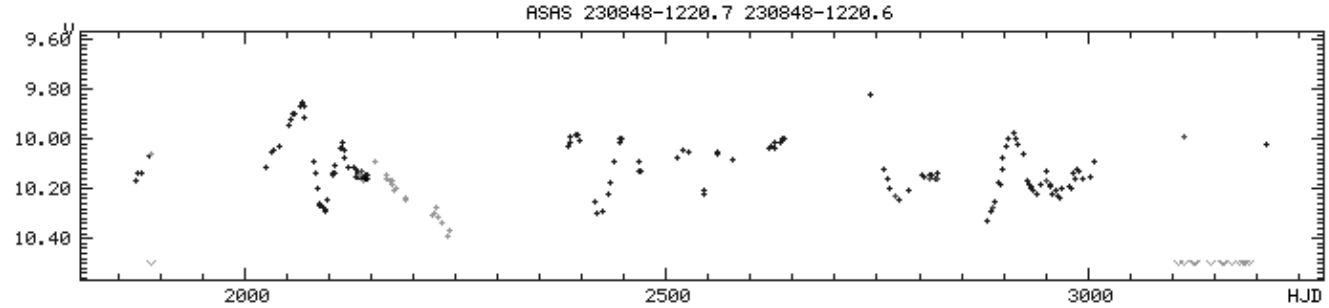

**NSV 14195** J2000 22 32 59.3 -44 48 45



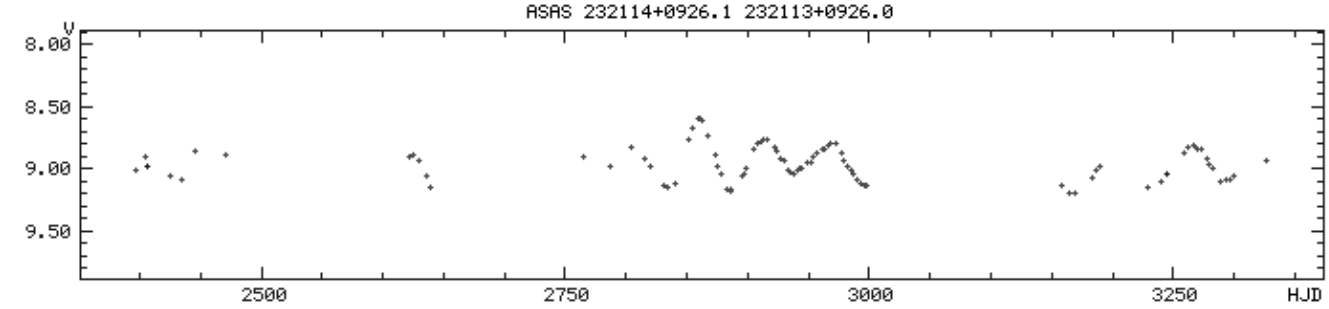

**NSV 14263** J2000 22 40 39.7 -68 14 17



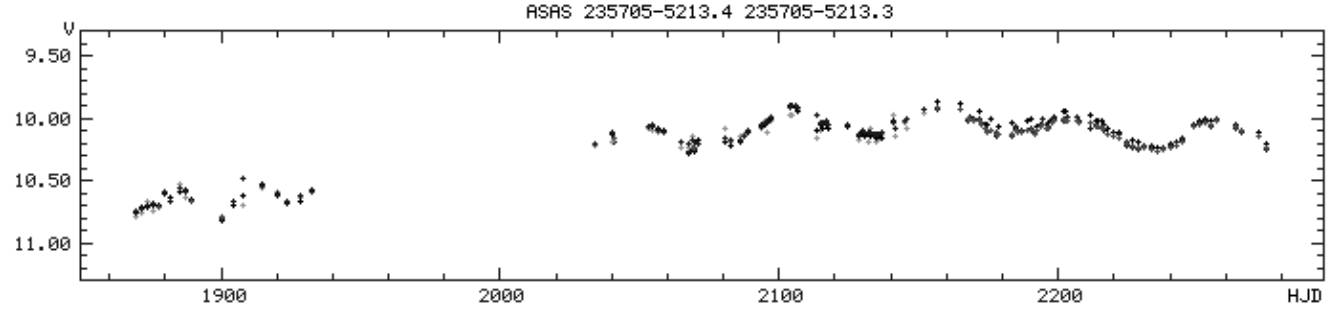
**NSV 14437** J2000 23 08 48.0 -12 20 40



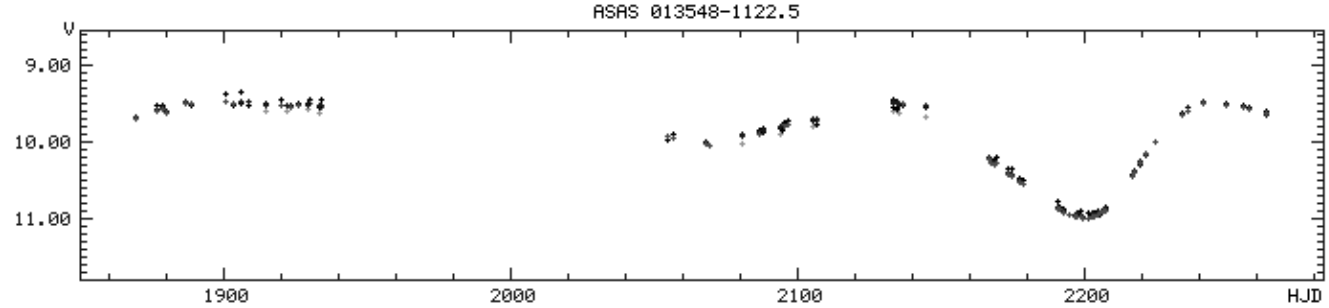

**NSV 14520** J2000 23 21 14.1 +09 26 07



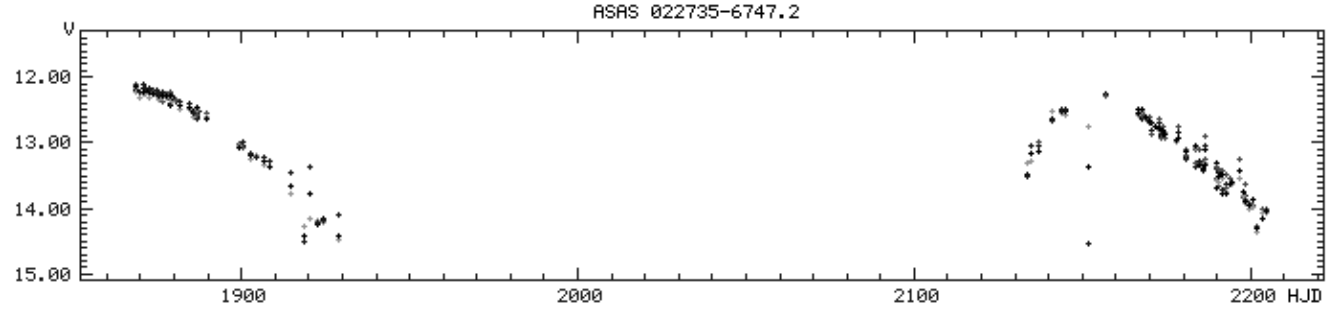

**NSV 14769** J2000 23 57 04.6 -52 13 18



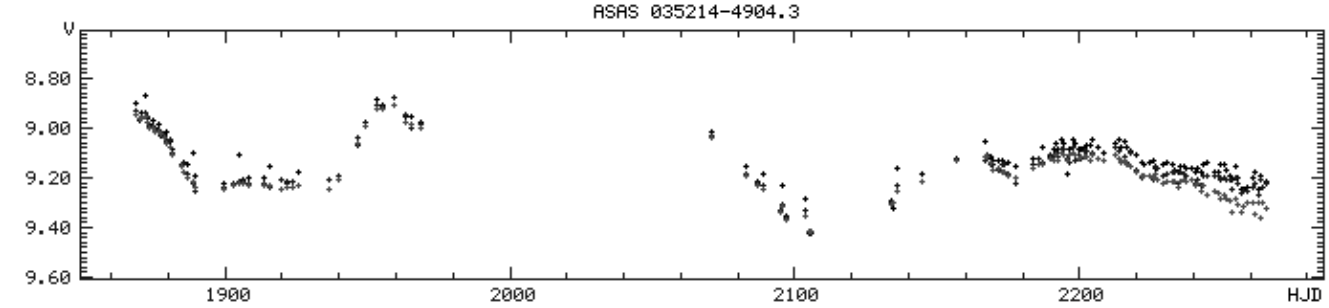

**NSV 15337** J2000 01 35 47.9 -11 22 30



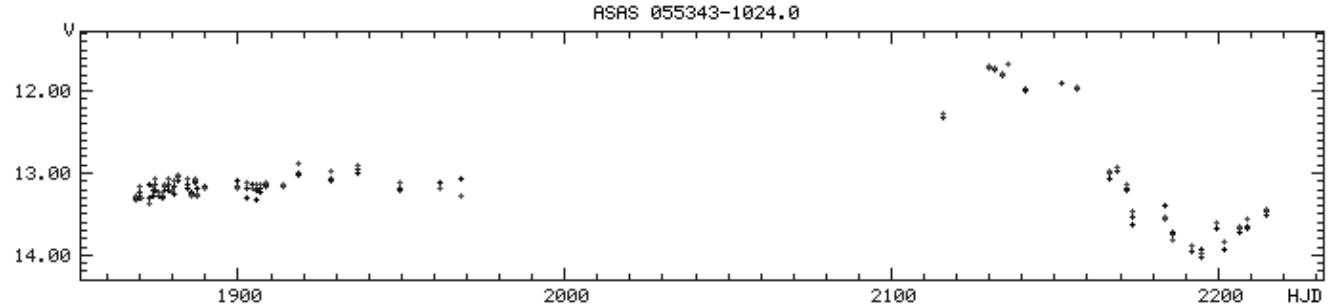

**NSV 15526** J2000 02 27 34.9 -67 47 12



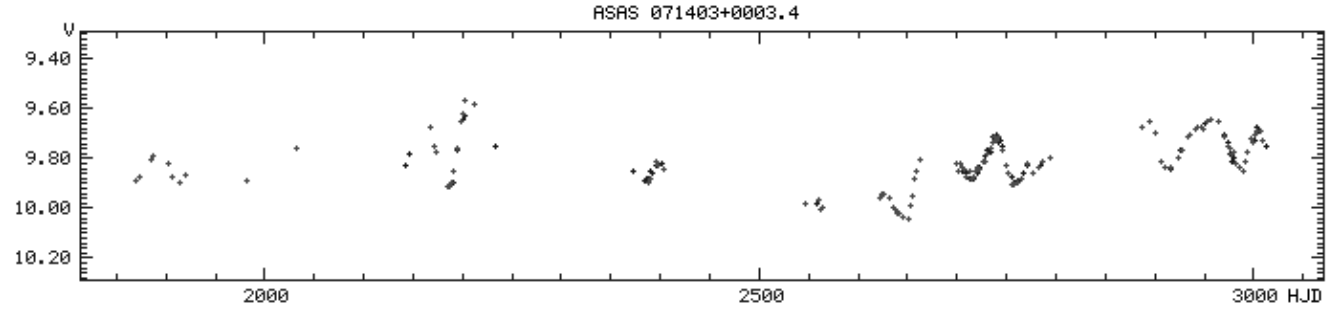

**NSV 15830** J2000 03 52 14.4 -49 04 18



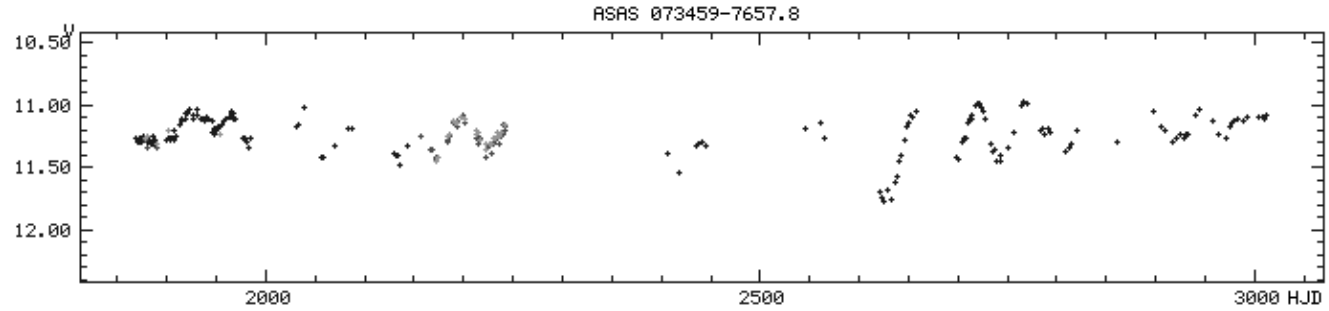
**NSV 16725** J2000 05 53 42.5 -10 24 01



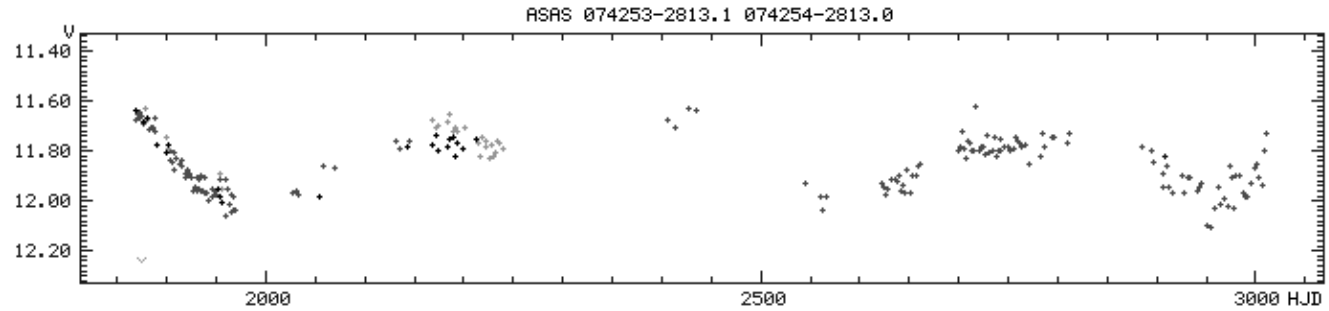

**NSV 17388** J2000 07 14 02.9 +00 03 24



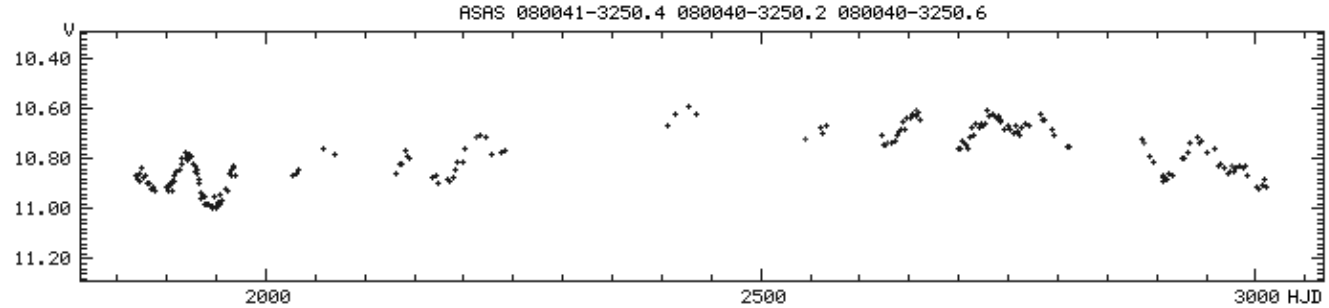

**NSV 17537** J2000 07 34 58.5 -76 57 48



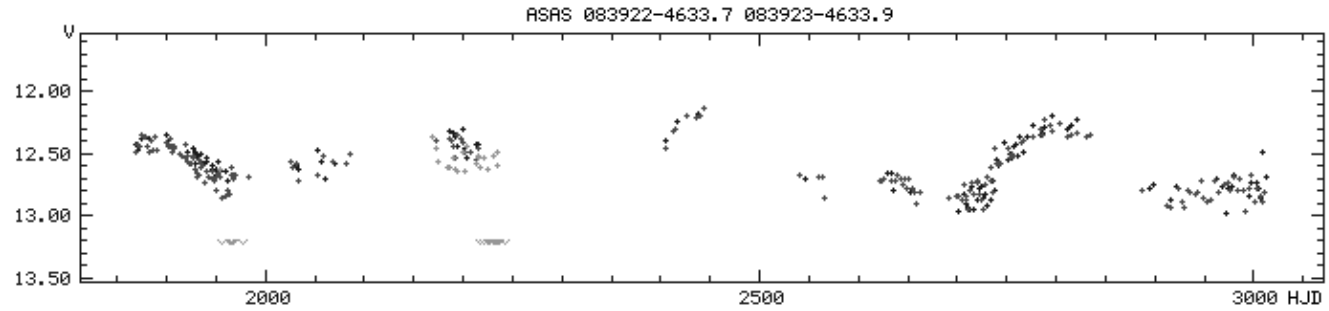

**NSV 17570** J2000 07 42 53.2 -28 13 05



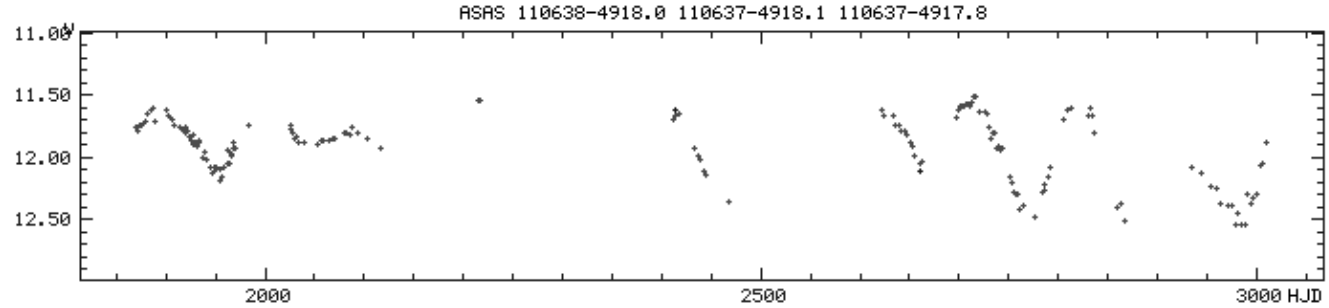

**NSV 17705** J2000 08 00 41.4 -32 50 25



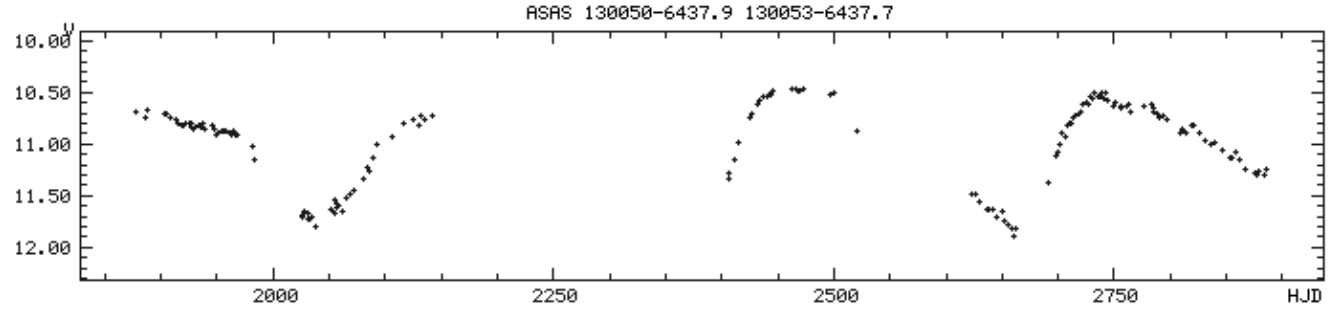

**NSV 17954** J2000 08 39 21.7 -46 33 43



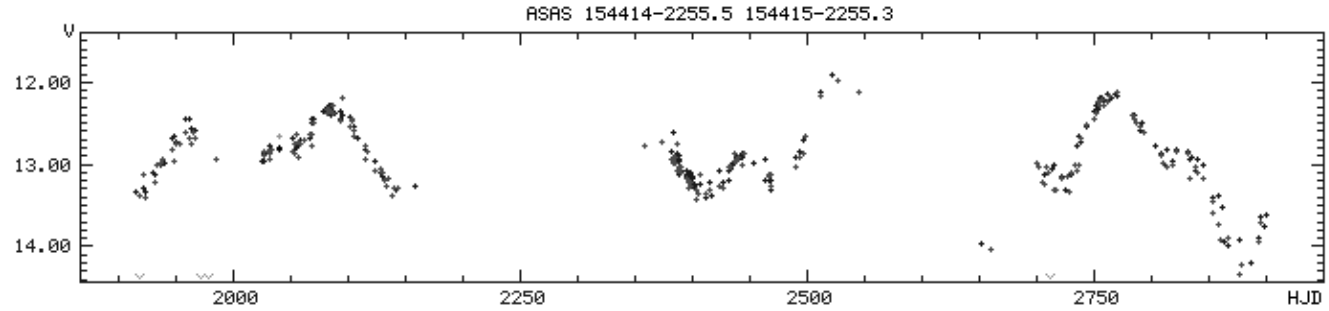
**NSV 18645** J2000 11 06 38.2 -49 18 01




**NSV 19569** J2000 13 00 50.3 -64 37 51

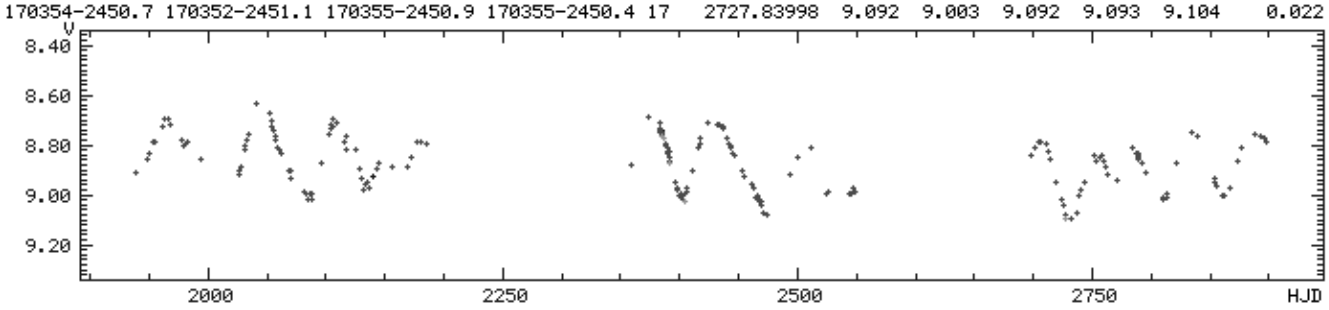



**NSV 20387** J2000 15 44 14.3 -22 55 32

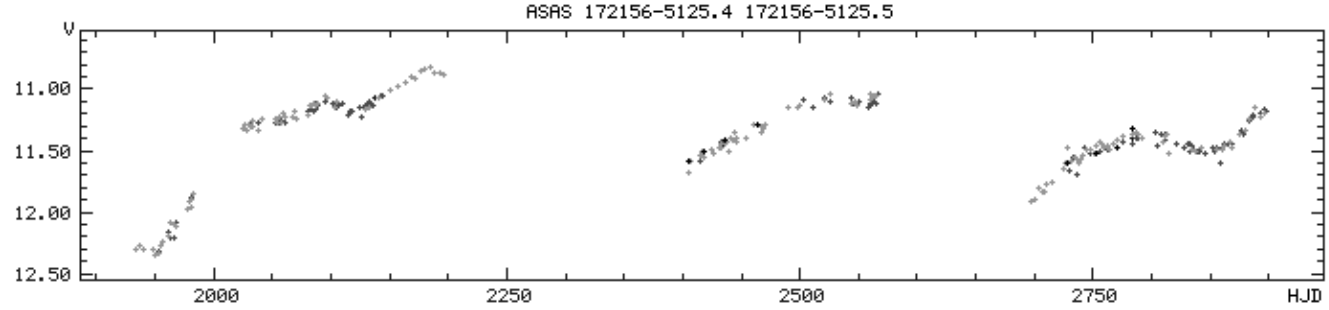



**NSV 20892** J2000 17 03 53.7 -24 50 43

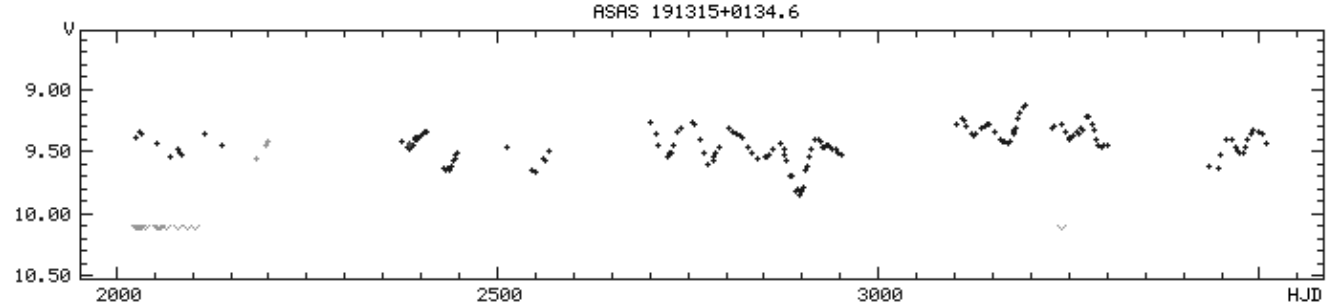
170354-2450.7 170352-2451.1 170355-2450.9 170355-2450.4 17 2727.83998 9.092 9.003 9.092 9.093 9.104 0.022 0



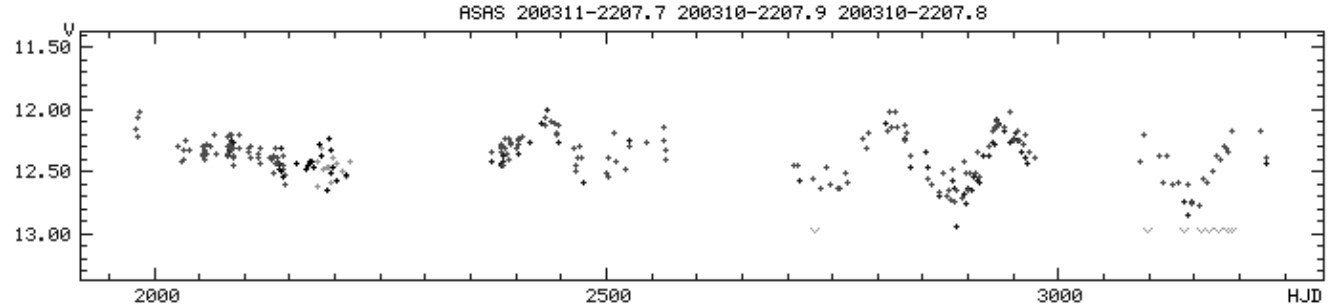

**NSV 21540** J2000 17 21 56.1 -51 25 26



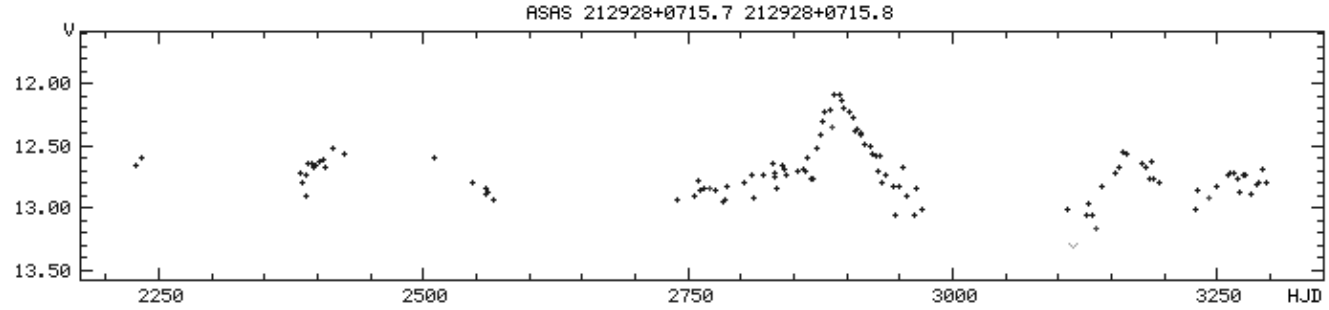

**NSV 24712** J2000 19 13 15.1 +01 34 38



**NSV 24979** J2000 20 03 11.1 -22 07 39




**NSV 25617** J2000 21 29 28.2 +07 15 44




**NSV 25913** J2000 22 29 13.3 -09 02 54