Our Love for Variable Star Observing

by Kazuo Nagai and Chris Stephan

I am an amateur observer of variable stars in Japan. I was invited to co-author this article by Chris Stephan, Associate Editor. Chris and I have been friends for eleven years. We both have a passion for observing eclipsing binary stars.

Let me first share about the organization of variable star observation in Japan. In Japan, there are many amateur organizations for observing variable stars. There are three major organizations. Each of these is active in its own way.

1.Japan Astronomical Study Association
2.Oriental Astronomical Association (OAA)
3.Japan Variable Stars Study Association

This makes it difficult to understand Japan's activities from a foreign perspective.
Therefore, Variable Star Observers League in Japan (VSOLJ) was established in the late 1980s. VSOLJ is a loose aggregation of these three. It is sometimes mistaken for VSNET.
VSOLJ and VSNET are two different things. VSNET is a mailing list of the Department of Astronomy, Kyoto University, Japan.

There are three activities of VSOLJ: the mailing list, the release of the database, and the publication of Bulletins. Chris and I, along with many others have our observations published in the Variable Star Bulletin of the VSOLJ. Chris is the only observer from outside of Japan.

The mailing list is used for information exchange and observation reports. Submitted observation reports are mechanically checked and stored in a database. The photometric data stored in the database is publicly available. Data is available from 1906. Two databases are available. The first is a data-checked database from 1906 to 2004.
http://vsolj.cetus-net.org/database.html The second is that only mechanical checks have been done on the data since 2004. http://www.cetus-net.org/cgi-bin/obs_search.cgi

VSOLJ Light Curve Generator allows you to see the light curve.
http://kws.cetus-net.org/~maehara/LCG.html The last step is to issue the Bulletin.
VSOLJ members can contribute to the VSOLJ Variable Star Bulletin for free. http://vsolj.cetus-net.org/bulletin.html In this way, Japanese amateur variable star observers are connected by VSOLJ.

Kazuo Nagai was born in January 1957. I have been observing variable stars since 1972.
At first, I made visual observations, as Chris continues to do. Then I did photographic observations using Tri-X.

To study eclipsing binary stars, I built a photoelectric photometer using a photomultiplier tube (R647-04). After that, cooled CCD cameras became available at a reasonable price. Now I am using a cooled CCD camera and DSLR for photometry and spectroscopy of eclipsing binary stars.

The observations are made on the balcony of my apartment. Therefore, the view is limited. The balcony faces south, and I cannot see Polaris. There is another building to the east and west, so I can only see the sky from the
southeast to the south. There is an upper floor and you can only see up to 60 degrees altitude. There are a lot of exterior lights, and the sky is only bright enough to see second magnitude stars occasionally. Still, it is fun to observe variable stars.

I have been using photometric data of eclipsing binary stars observed by VSOLJ members to determine the minimum time. I am submitting this to the VSOLJ Bulletin.

I received the ASJ Award from The Astronomical Society of Japan in March 2016.
The ASJ Award for the Outstanding Achievement by Amateur. The award is for "long-term observation of variable stars, publication of self-made software, and training and guidance of variable star observers.

My latest observation is a flare monitor of a close binary star. I started this project in January 2021. The only stellar flares I can observe are super flares. Even the largest Carrington flare on the Sun only brightens the entire Sun by a factor of 10,000. Even if we were doing photometry of the sun from distant space, we would not be able to detect flares. A super flare can detect flares in the stars.
However, super flares occur very infrequently. Also, there are certain conditions for stars to produce super flares.

In the case of main-sequence stars, the following conditions apply.
1. young
2. low temperature
3. fast rotation

The Sun also used to conform to these conditions to some extent around the Zero Age Main Sequence (ZAMS), but super flares are not expected now.

My latest observation is a flare monitor of a close binary star.

The eclipsing binary that is likely to have a super flare is a subclass type-W of EW-type contact binary with a short period. Type-W is closer to ZAMS than type-A, and its stellar classification is late type, so it is cooler.

When selecting a star to observe, pay attention to its spectral type and orbital period.
The spectral type is information about temperature. The orbital period of a contact binary star is the period of its rotation, since its rotation and revolution are synchronized.
So, you can select a binary star with low temperature and fast rotation.

The observations are photometric and spectroscopic. First, about photometry. There are two types of flare: white light flare and H-alpha flare. When a white light flare occurs, the temperature of the photosphere rises. This increases the flux of short wavelengths.
This is why I use short wavelength photometry such as the U band. In the case of H-alpha flares, the H-alpha flux increases, so it is best to use H-alpha filters for photometry.

Spectroscopy is done by low dispersion spectroscopy. I use the SA-100.
https://www.rspec-astro.com/star-analyser/ All of the visible light band can be captured.
The image also shows other stellar spectra. This is used for wavelength calibration and sensitivity correction. After sensitivity correction, I can measure the effective surface temperature of the star, and if there is a white light flare, I can detect the temperature rise. Even if there is a reddening effect, the relative temperature change can be measured correctly. In the case of Hα flare, Hα is captured as emission lines. Equivalent Width (EW) can also be measured by standardization. By measuring the EW, I can determine the energy change of the Hα flare.

For observations, start shooting from the western star in the cataloged star list.
After introduction, correction, and continuous shooting, when shooting is not possible due to diurnal motion, the next star in the western side of the star list is introduced.
This is done automatically from dusk to dawn.
The software is Stella Shot, but it is only available in Japanese.

http://www.astroarts.co.jp/products/stlshot/