# Nova Delphini 2013:
# a naked-eye visible flare in northern skies

*On August 14, 2013 a new bright star (6.3m) was detected in the constellation of Delphinus on the frames taken by Koichi Itagaki (Yamagata, Japan). Later it was assigned a status of Nova Delphini 2013 and became the brightest nova visible to a naked eye since Nova Scorpii 2007 (which reached magnitude 3.9 on February 17, 2007).*

The star was discovered by Koichi Itagaki, Yamagata, Japan, in the northwest corner of Delphinus, near the border with Sagitta and Vulpecula using 0.18-m reflector on unfiltered CCD images. Nothing was visible at this location on Koichi's past frames (limiting mag. 13.0) taken on 2013 August 13.565 UT., a day before the discovery.


***Nova Deplhini 2013***
*RA: 20 23 30.68; DEC: +20 46 03.8*
*Image Credit: Koichi Itagaki*

Initially, the Nova received temporary designation PNV J20233073+2046041 when it was posted on the CBAT TOCP webpage, and soon the name was changed to Nova Delphini 2013. Soon it has received a permanent designation V0339 Del, according to IAUC 9258.

Nova is identical to the blue star USNO-B1.0 1107-0509795 and ultraviolet source GALEX J202330.7+204603.

For now it is brightest nova since 2007. Despite the name, the star is not truly new but an explosion on a star otherwise too faint for anyone to have noticed. A nova occurs in a close binary star system, where a small but extremely dense and massive (for its size) white dwarf grabs hydrogen gas from its closely orbiting companion.

After swirling about in a disk around the dwarf, it's funneled down to the star's 150,000 degree F surface where gravity compacts and heats the gas until it detonates like an enormous number of thermonuclear bombs. Suddenly, a faint star that wasn't on anyone's radar vaults a dozen magnitudes to become a standout "new star".

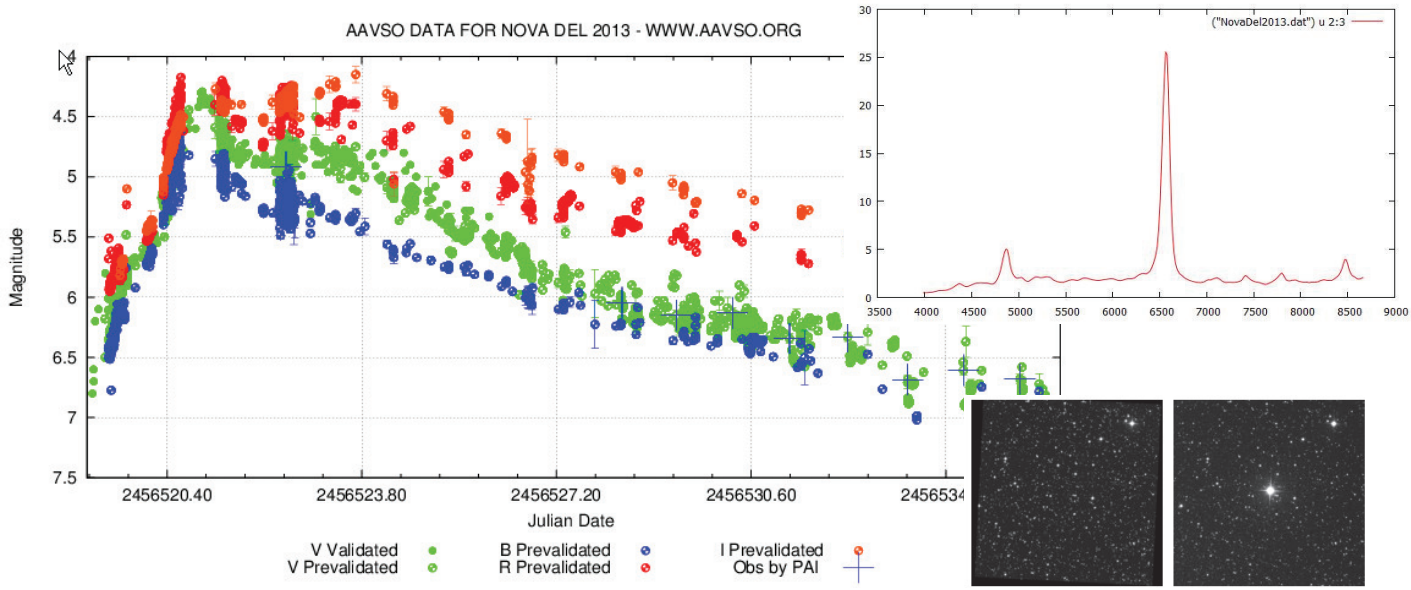
Novae are distant cousins to Type Ia supernovae. In novae, the surface of the white dwarf produces a powerful explosion, but the white dwarf itself survives.

In a Type Ia supernovae, the white dwarf accumulates just enough mass from its binary partner to be pushed above the Chandrasekhar limit of about 1.4 solar masses. This triggers a massive thermonuclear explosion that blows the entire white dwarf to smithereens.

In the last 112 years, 47 novas have brightened into naked-eye view and novas as bright as Nova Delphini 2013 occur about every 10 years, skywatching experts say.

According to the light-curve from AAVSO Nova has reached magnitude 4.3 visual on August 16.45. It immediately entered the decline phase. For a few next days the nova stopped fading at mag. ~5 and then continue its declining. So far, it appears as Nova Del 2013 is a type NA in the VSX. As a final preliminary estimate, the distance of the nova is about 4 kpc (or a bit less).

It worth to mention the opportunity for amateurs to make a contribution to the research of this kind of bright stars - and variable stars as a whole - without the use of any special hardware equipment. Below there is a photometric data for Nova Del 2013 is presented with the measurements done with DSLR camera (blue crosses). All the measurements have a good match with those obtained by other methods.




*Nova Delphini 2013 photometric observations. Measurements marked with blue crosses are done by Andrey Prokopovich (VS-COMPAS) using DSLR. Spectra (top right) shows strong H-alpha (credit: E. Ricciardiello, A. Porcelli, D.Castellano, A.Marino, C. Perrella). The chart is generated by the AAVSO web service.*

DSLR photometry is not really as complicated as it looks like. If you have a DSLR camera with standard lens all you need is to study some details of shooting parameters, camera settings and image processing. DSLR photometry can produce high quality data in a fairly short period of time at modest cost.

The main workflow is:

1. Getting images in a RAW data format.
2. Calibration of images.
3. Processing images in photometric software (obtaining instrumental magnitudes).
4. Analyzing data in spreadsheet.

Successful photometry can be done from a backyard with a typical suburban light pollution. Use focal length that allows you to see the variable star and at least one comparison star in the FOV. Longer focal length will make images less affected by vigneting, but also less "sensitive" to faint stars. Keep in mind that longer exposures require star tracking. Slightly defocus images to spread stars on a bigger area of the sensor surface. Remember to never oversaturate images, since camera's sensors have non-linear response. In addition to a series of sequential star field images, you also need dark frames and flat frames.

Once we done with the frames, we need to extract the green portion of the RGB Bayer array of the RAW images because it most closely corresponds to the photometric V-filter.

The final step is the most important - the instrumental magnitudes should be entered into a spreadsheet to calculate calibrated Visual or V-magnitudes. Spreadsheet calculates Transformation Coefficient to make this conversion possible. Air Mass must be taken into account to calibrate your data correctly if calibrator-to-variable distances less than 34 degrees at zenith angles.

**Online resources for further reading:**

More detailed information and a nice explanation on DSLR photometry are available at:

http://www.citizensky.org/content/dslr-documentation-and-reduction
http://www.britastro.org/vss/JBAA%20120-3%20%20Loughney.pdf
http://www.variablestarssouth.org/techniques/dslr-photometry-guide

Details on Nova Delphini 2013:

http://www.cbat.eps.harvard.edu/unconf/followups/J20233073+2046041.html
http://www.aavso.org/aavso-alert-notice-489
http://ooruri.kusastro.kyoto-u.ac.jp/mailarchive/vsnet-alert/16337
http://www.aavso.org/nova-del-2013-makes-top-30
http://www.aavso.org/vsx/index.php?view=detail.top&oid=322784

*Andrey Prokopovich*