



Simeis 147 – another supernova remnant in Taurus

Asked to name supernova remnants in Taurus, a lot of amateurs would probably be stuck after the Crab Nebula. In fact not far away from the Crab is the huge but very faint remnant Simeis 147. Discovered in 1952 by G. A. Shain & V. E. Hase at the Crimean Astrophysical Observatory at Simeis in the former USSR using a 25-inch (635mm) Schmidt camera, it was numbered 147 in their list. The nebula was also catalogued by Stewart Sharpless, an astronomer at the United States Naval Observatory in Flagstaff, Arizona who examined the Palomar Observatory Sky Survey plates (POSS) for HII regions. His second and final catalogue of 313 objects was published in 1959 and Simeis 147 appears in his list as Sh2-240, which is the preferred designation in most charting software. The remnant can be found at RA 05h 39m and Dec +28° (2000.0) and is thought to lie at a distance of around 3,000 light years with a diameter of 150 light years. At the heart of

this intricate mass of twisted strands of nebulosity lies a pulsar, catalogued as PSR J0538+281 – all that remains of the star that exploded some 60,000 years ago.

Until recently Simeis 147 was an extremely challenging target for both imagers and visual observers and while still a very difficult visual object, modern filters and CCDs have made it an achievable, but still somewhat challenging object for the photographer. And, with a diameter of 200



Bob Winter

arcmin (over 6 times the diameter of the full Moon), wide field instruments will be needed if the nebula is to be captured without stitching individual frames together. The photograph shown here, the only one received so far by the Section, was taken by Bob Winter from rural Wales during 2010 January. It was made using a Takahashi FS60C refractor with 0.72 focal reducer and QSI 583 CCD camera. Exposure time was 90min through an H-alpha filter.

Visual observers should not expect to see the remnant in its entirety and the most that can be expected is to glimpse some of the brighter areas. These lie to the south of the nebula although some observers also see a brighter, and the word is very relative here, spot on the northern edge. It goes without saying that extremely transparent skies will be needed and probably a telescope in the 50cm-plus class with an OIII filter. The centre of Simeis 147 lies about 3.5° ESE of β Tauri (Al Nath), the star forming the top of the bull's upper horn. Probably the best approach for the visual observer is to hop to this region and then slowly scan methodically around the area. If you suspect an area of nebulosity sketch its position against the star field so you can compare it to a star chart.

US amateur Rich Jakiel has posted his sketch of the nebulous areas, along with a comparison chart and photograph, on the Adventures in Deep Space web site, see <http://astronomy-mall.com/Adventures.In.Deep.Space/s147>.

Simeis 147 is one of the most challenging deep sky targets. If you fail to see or image it you can always console yourself by observing the Crab Nebula a few degrees away.

Observations of NGC 40

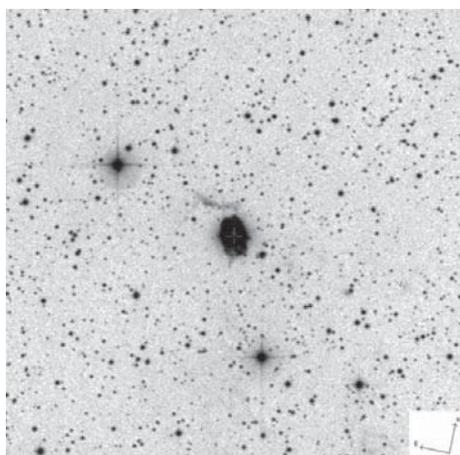
In the 2010 August Journal 'Observers' Forum' (120(4), 245) the planetary nebula NGC 40 was discussed. Following on from this Owen Brazell has commented:

NGC 40 is one of the more interesting of the brighter planetary nebulae in the sky. Unlike most other such nebulae this object does not respond well to the use of an OIII filter because there is very little OIII emission. Normally the OIII emission comes from collisionally excited lines of oxygen and the reasons for no OIII emission in this case could be either a low temperature central star that is not emitting enough high energy photons to excite the nebula, or a high density nebula where the energy levels that produce the OIII lines are getting collisionally de-excited before they have a chance to emit the

photons, a process called damping. In the case of NGC 40 the central star is a high temperature object with a spectral type of WC 8, so it is likely that this is a high density object.

My main interest here though is not in the planetary nebula itself but in the strange loop of gas seen in the image just above it. Whilst observing with my 20-inch (50cm) F5 Dobsonian and DGM NPB filter (similar to a UHC filter) and a 10mm Tele Vue Ethos eyepiece, which gives a magnification of $\times 250$, I saw this structure with averted vision. It was sufficiently obvious that I have little doubt about the observation, especially as it was a blind observation – that is I did not know it was there when I was looking at the nebula, and its position in relation to the two brighter stars was correct. I have not seen any other observations of this halo and despite checking with two other respected observers I can get no other confirmation of the visibility of this nebula. I would be interested to hear if any other observers have seen it. Unfortunately the observation was made this summer at the Salisbury Star Party (SSP) and was too late for the Observers' Forum article in the August Journal.

The attached image is the blue plate from the DSS as the nebula hardly shows up on the red plates at all. I used the *Aladin* server from CDS to create the image.



Owen Brazell, Assistant Director, Deep Sky Section

Stewart L. Moore, Director, Deep Sky Section



Gyulbudaghian's nebula – the story continues

If you look at the Andromeda galaxy tonight, the view you get will not differ significantly from that seen by an observer 10, 50 or even 200 years ago. Some deep sky objects, such as planetary nebulae, increase minutely in size as they disperse into space, and some galaxies have been shown by Tom Boles *et al.* to play host to supernovae, but beyond these, readily observable changes are rare. Consequently, the deep sky is sometimes perceived as a source of attractive, but unchanging, observing opportunities. This is not in fact the

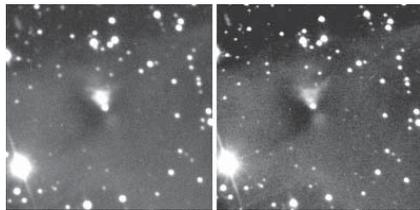


Figure 1. Images of the nebula taken a week apart during 2007 October. The scaling is linear and is similar. North is up. G. Privett.

case, as there are several nebulae which appear to change substantially. Five examples are well known, with a few others visible in the infrared. All but one, Hubble's variable nebula, are generally poorly studied.

For the last 18 months the BAA DSS has undertaken a project to observe one of these objects on a regular basis, and thereby gain an appreciation of the extent of variations currently taking place. The object chosen for investigation is the circumpolar Gyulbudaghian's nebula (sometimes spelt Gyulbudagyan). A small group of observers (Boyd, Brazell, Clayton-Jones, Garner, Goldsmith, Harlow, Holt, Luck, Privett, Self,



Figure 2. Image of the near-quietescent nebula on 2010 April 09 after PV Cep had started to brighten. Canon 350D DSLR camera and 505mm f3 Newtonian. Dan Self.

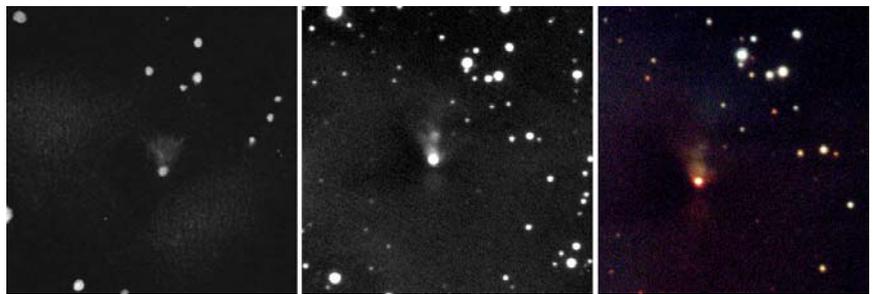


Figure 3. Left: Drawing made by Dale Holt using a 505mm Newtonian and a Watec 120 camera, 2010 May 13.

Centre: Image by Owen Brazell using the Sierra Stars 610mm Cassegrain, on 2010 May 04. Right: LRGB image by Simon Clayton-Jones using the 2m Faulkes Telescope North, La Palma, 2010 Apr 22.

Tasselli), some observing visually or using DSLRs, CCDs and remote observing, have been monitoring the object on a semi-regular basis since early 2009.

Gyulbudaghian's nebula, also known as GM29, is illuminated by light emitted from the young energetic protostar PV Cephei. This has a mass of probably less than 7 solar masses, is of apparent type A5 and has been recorded as varying in brightness in a manner that has been described as eruptive – the best observed instance occurring in 1977/78.¹ Like many protostars, it still retains an accretion disc and sometimes generates a substantial flow of fast-moving material in a polar stream, which is impacting on the local medium. At the points of impact the bow shock generates Herbig-Haro (HH) objects as pairs on either side of the star. In the case of PV Cep three major pairs are clearly seen, with other knots of material present. There is circumstantial evidence that PV Cep is moving quickly through the interstellar medium.²

An image by Garner taken during 2004 suggests that PV Cep experienced a bright episode during that year, and a very sparse light curve³ shows a bright period in late 2005 declining through early 2006, and a low in 2006 September. However, it was observed by Privett as bright during 2007 October and was at that point seen to vary substantially in appearance over the course of a week (Figure 1). Starting in 2008 April there was a well documented fall to 2008 June,⁴ after which the star appears to have remained faint for some time. Spectroscopic measurements at that time suggest that the change in brightness might be attributable to extinction caused by increasing intervening dust. When our efforts began in earnest during the summer of 2009, PV Cep was found to be quite dim at 18th magnitude and the nebula was a pale ghost of the form observed in 2007 (Figure 2).

It took a little time to work out the most useful exposure length for the monitoring. Unsurprisingly, initial results were a bit dis-

appointing with no visual observations reported at all. For a few months this remained the case, until 2009 September when PV Cep started to brighten, and over the next few months it rose further to attain magnitude 15.5 during 2010 July. Since then it has faded slightly to 15.9. At the same time, the appearance of the nebula has changed enormously (Figure 3). Observations using a hydrogen-alpha filter suggest that during 2010 October the unfiltered image was very similar in feature to that taken using a filter (Figure 4).

A plot of the brightness of PV Cep as a function of time has recently been supplied to us by David Boyd (Figure 5). He has made measurements of both the star and the surface brightness of the nebula close by in the region of HH-215 – the most recently generated HH object associated with PV Cep. His photometry results, obtained using a 350mm Schmidt-Cassegrain telescope and an R band filter, show a light curve similar in many respects to other observations and indicate that the brightness of part of the nebula varies in a similar fashion. For the portion of the nebula he measured, the brightness appears to vary in a manner that is akin to PV Cep itself, but lagging in time by approximately 30 days. Making some simple assumptions about the

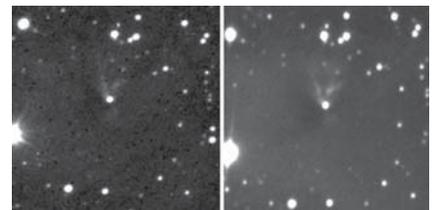


Figure 4. Two images of the nebula taken during 2010 October by Andrew Luck using the GRAS001 300mm remotely-operated telescope in New Mexico (left) and Grant Privett (right) using a 250mm Newtonian. A dark 'butterfly wing' shaped nebula is clearly visible to the left of the star.

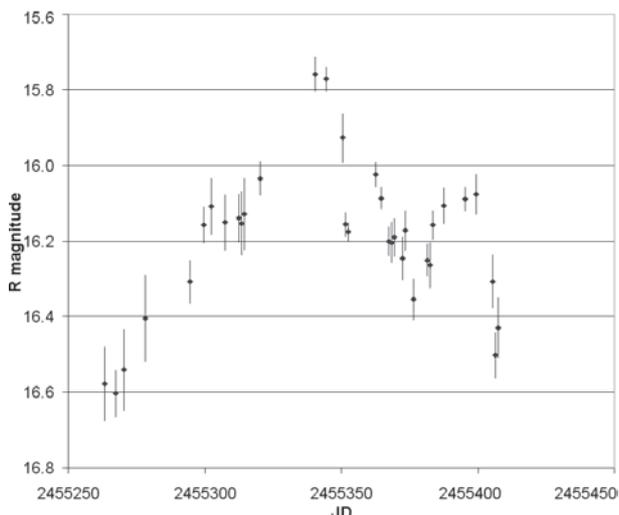


Figure 5. Plot of the R band magnitude of PV Cep between 2010 Feb 22 and 2010 Sept 10. 350mm Schmidt-Cassegrain + CCD, David Boyd.

nebula, he estimates that the cloud of gas and dust reflecting the starlight is approximately 0.026 parsecs from PV Cep – which is not an unreasonable figure.

sequence? What causes them? Happily, today's amateur astronomers are in a position to help out, and we appear to be making useful progress. If you can occasionally

Other members are also submitting their work, including Andrea Tasselli who is taking multi-colour images of the nebula using the Sierra Stars observatory 0.61m Cassegrain remotely operated telescope in California. These he is forming into colour renditions of the nebula as its brightness changes.

Clearly, Gyulbudaghian's nebula is, as yet, far from fully understood and there are questions to be answered. How much does the brightness vary? Is the variation periodic? Do the changes follow a fixed

set aside a half-hour of observing time, or take some images – we can handle the photometry for you – then your observations would be very welcome. Even old format images from 2008 or earlier would be helpful as they would allow us to see how the form of the object can appear at different stages of the variation. Please send them to the co-ordinator Grant Privett at g.privett@virgin.net. The first results will be reported fully in a formal BAA *Journal* paper to be submitted during early 2011.

Grant Privett, Variable Nebula Coordinator, Deep Sky Section

The author would like to gratefully acknowledge the generous support given by the BAA to help finance the Gyulbudaghian images collected using the Sierra Stars telescope.

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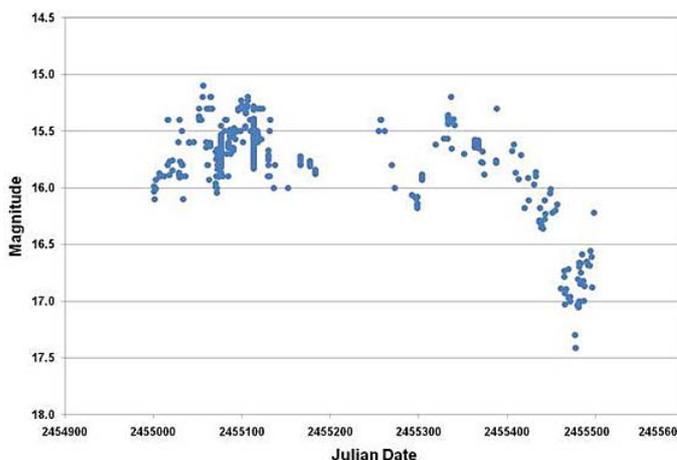
A deep fade of HR Lyrae

The variable star HR Lyr was discovered as Nova Lyr on 1919 Dec 6 at magnitude 6.5.^{1,2} It faded rapidly over the following six weeks and has remained below mag 15 ever since. However, in the middle of 2010 September HR began an unusually deep fade to an unprecedentedly faint level, on occasions to below 17.0. The accompanying lightcurve shows the behaviour of HR Lyr between 2009 June 29 and 2010 Oct 29.

Novae are interacting binary stars where a cool secondary star loses mass to a white

dwarf primary. Material from the secondary flows from the secondary towards the primary, but because it has substantial angular momentum it forms an accretion disc around the primary. In the case of HR Lyr, much of the light at quiescence probably comes from this accretion disc, so the recent 'low state' suggests a cooling of the accretion disc. We encourage observers, especially those equipped with CCDs, to monitor HR Lyr closely over the next few months to determine how long the fade lasts and how faint it becomes. One observation per night is sufficient to cover the general profile of the event; a comparison star sequence can be found on the AAVSO web site.³ Observations should be submitted to the BAA Variable Star Section.

Time series photometry is also encouraged. Time resolved photometry by Ian



HR Lyr between 2009 June 29 and 2010 Oct 28. Data from the BAA VSS and the AAVSO International Database.

Miller, David Boyd and Tom Krajci has revealed various modulations in the light curve, which may be related to the white dwarf spin period, but so far none of the signals appears to be persistent.

Jeremy Shears & Gary Poyner

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BAA's Ridley Grant helps variable star observer

Finally after a one year and two week wait, my new 50cm f4 Dobsonian reflector arrived from Orion Optics and was installed in the observatory in early October. The telescope, which was funded in part with a BAA Ridley Grant, has replaced a Meade 14" (35.5cm) SCT GPS which had been used since September 2003 for the study of variable stars, in particular cataclysmic variables.

After observing variables with Newtonians on various mounts for nearly 35 years, the change to a computer controlled telescope had been, for me, a major one. The Meade was of exceptional quality with excellent GOTO, but I found it extremely difficult to use in the broken cloudy skies which make up most of our clear sky quota. Chasing holes in cloud is not what a GOTO telescope is designed for. After a while I also realised that I could locate VS fields quicker by eye than with the GOTO, and that if I was to be truthful with myself, I wasn't enjoying observing with a high tech

telescope as much as a standard Dobsonian. I therefore decided in 2009 to go back to a Dobsonian, and the BAA's Ridley Grant made it possible for me to go for a 20-inch.

Early results with the new telescope are encouraging. Of excellent optical quality, the telescope took me to magnitude 16 on the first night's observing under average skies, and perhaps with a rare polar air stream and Moonless night, I might come close to 17th magnitude visually. This will enable me to extend my visual programme to include fainter magnetic CVs on the BAA Polar Programme, which I currently monitor in the V-band with the AAVSO Sonoita Research Observatory, as well as complement my existing CV programme of around 400 stars.

All I need now is a house and observatory in the country. I wonder if the BAA can help me with that too....

For details of how a Ridley Grant could help you with your astronomical project, see www.britastro.org/ridleygrant/.

Gary Poyner



Jupiter and Europa with a small telescope

Here is a picture that may interest readers of the *Journal*. It shows what can be achieved doing video astronomy with a small telescope. I had my vintage Celestron 5 out for lunar work and decided to image Jupiter, and the result was surprisingly good.

Jupiter and Europa, 2010 Sept 24, 02:39 UT. Taken with a Celestron 5 (125mm f/10), x3 Barlow, and DFK colour video camera. 1342 frames of video, stacked and enhanced with *RegiStax* and further processed with *Photoshop*. On the same night, observers in the area with



larger telescopes were reporting poor seeing, and the small telescope apparently had the advantage. *Michael A. Covington*.

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