

## ONE MAN'S NOVA PATROL

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Abstract

A method for visual nova patrol with binoculars is described and compared to photographic techniques. Future prospects are outlined.

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I wish to describe a system of nova patrol, conducted visually with binoculars, that I have been following since November of 1977. I think of this paper as a sequel to the delightful one read by Edward Oravec at the Smith College meeting in 1976 on his very active binocular variable program, and would suggest that we here offer yet another pleasant binocular activity for our members. I would stress that critical sweeping of the Milky Way with glasses is a most enjoyable pastime!

It seems to me that the record of astronomers in detecting novae is abysmal. In her Henry Norris Russell lecture on novae, Professor Payne-Gaposchkin (1977) quoted Solon Bailey in estimating that some 50 galactic novae of the 7th visual apparent magnitude or brighter appear each year throughout the sky, while only a handful are discovered. Of the novae that are found, few are well observed before maximum. Of 71 novae discovered between 1900 and 1952 brighter than the 9th magnitude at maximum, we have pre-maximum spectra of only 14, according to Payne-Gaposchkin (1964).

Since 1952, things seem little better. Two cases in point are Nova Scuti 1975, which was 6th magnitude on prediscovery plates taken about 35 days before its photographic discovery by P. Wild at 8th magnitude, and Nova Sagittae 1977, which was thought to be as bright as 5th magnitude a month before its visual discovery by J. Hosty at 7th.

One answer to this dilemma has been a proposal for extensive photographic patrol by amateurs, championed by Ben Mayer (1978). This, if done diligently, would do a good service in finding some novae. The trouble is that we cannot expect prompt notification by amateurs using this method, because in virtually all cases the film would not be examined until at least the morning after it was exposed. Novae could not be verified, even by the same observer, until the following night. Given the unreliability of weather, and the possible tendency of observers to wait for an entire roll of film to be exposed before development, the delay could be even longer. Also, moonlit nights would be neglected by many.

Visual patrol does not suffer from these problems, although it must concede to the photographic methods the greater accuracy of the latter.

Given that we are ambitious and wish to work visually, it might be supposed that it is sufficient to go out with atlas and flashlight in hand, and compare sky and atlas field by field. This to my taste is dull and laborious, and it is rather slow. I found it took about 3 hours to cover 20 degrees of the Milky Way to magnitude 7.5 by these means, but by the technique of memorization to be described, I can now do that same region in 30-45 minutes. Also, charts now available do not have good consistent visual limiting magnitudes, and to my knowledge no photovisual atlases are available, so there is difficulty in making the atlas-sky comparison.

Beginning in the 1950's, George Alcock in Britain memorized the Milky Way down to about 8th magnitude as seen in 4-cm and 8-cm binoculars. It has been said that he has completed this process. If so, this stands as one of the great observational feats of the 20th century, and he holds the record of 4 novae discovered by visual means, in some 10 years. But I do think that his achievement, or a portion thereof, is within the reach of many.

My approach to the problem has been to divide the binocular fields into small constellations of my own devising, with my own names. Each night, one or two of these constellations would be learned, and all those previously known would be examined for any alteration. An attempt is made to reach a limiting magnitude between 7.5 and 8.0. Any star seemingly out of place is checked in the Atlas Coeli when the region is finished, and if not there, is checked in the Smithsonian Atlas, or the Atlas Borealis. I keep sheets copied from the Smithsonian Atlas in my Atlas Coeli, of the regions I am covering. Usually I will find up to half a dozen suspects needing checking on a night, although they are rarely novae, to be sure. Normally, they are results of failures of memory, or artifacts of an inconsistent limiting magnitude, but if the suspect is not on the Smithsonian chart, the matter is serious. This has only happened twice in my experience--once being a true nova--and the procedure I follow in this case is described below.

I generally use the smallest binoculars that will reach the 8th magnitude comfortably under the prevailing conditions of illumination and atmosphere. This has in practice meant a choice between 7x50 and 11x80 binoculars. (I understand that George Alcock has used 12x40, 10x80 and 15x80 glasses in his sweeps.) The use of different binoculars, under different conditions, has not caused much difficulty for me, although it may prove confusing for the novice.

Nova patrol can be conducted in different locations, and is even possibly helped by city lights. My own haunts have generally been the Burnham Lookout of the Steward Observatory in Tucson, Arizona, the roof of the Observatory building downtown, and the 2500 meter level of Mt. Hopkins, south of Tucson. At the great altitude of the mountain, the slightest optical aid is sufficient for the purpose. I usually use 7x50's and see somewhat more stars than I really want. In all cases, I hold the glasses without a tripod, my hand being steady enough.

There are some piquant delights to this work. One is that one sees variable stars at their play. My favorite is U Sagittae, an eclipsing binary near Brocchi's Cluster. When in eclipse, the constellation (of my own devising) of which it is a part is quite transformed. The eclipse in binoculars is even more dramatic than Algol is to the naked eye observer. I have also followed Chi Cygni with interest. I have not felt inclined to make estimates of variable stars while on nova patrol, but it would be a far from unreasonable thing to do. A great pleasure of the patrols is the easy familiarity one gains of the starry heavens, and the splendor of the objects visible.

Now we come to the matter of the suspected novae, when the observer is at the threshold of a discovery. It must be remembered that novae are not common, and the moment we are describing may well be a long time in coming. I was fortunate to co-discover Nova Cygni 1978 on 10 September, rather less than a year after I had begun this program, after about 130 nights of patrol. It may have been a fluke, and the next could take longer, perhaps much longer. It took Alcock on the order of 12 years to find his first, Nova Delphini 1967, although he had not the benefit of the near-desert climate that is my current lot. The nova hunter must cultivate the patience of a stone Buddah, maintaining his enthusiasm through the reaches of time and starry space.

In any event, a serious suspect must first be checked against a photographic atlas, lest it be an omission of the Smithsonian chart, of which there are many. The Vehrenberg Atlas Stellarum is good, although expensive. It would not be hard to construct one's own atlas with a good camera of just the regions currently being covered. Since the photographic atlas has a blue sensitivity not the same as the eye, care is necessary. One must be attentive to position more than relative brightness. It helps to use more magnification here than can be provided by the binoculars--a 10-cm refractor at 100 x is quite reasonable. If the object is indeed not on the photographic atlas, we need a reasonably good position. This can be obtained with the plastic grid usually provided with the photographic atlas, but I prefer to use stars on the Smithsonian atlas, whose precise positions can be found in the printed Catalog. We now wish to see if the star is a cataloged variable star, or a minor planet. First, use the General Catalog of Variable Stars and its supplements, available at reasonable cost from AAVSO Headquarters. Deciding on the accuracy of your position, presumably 1 arc-minute or better, consider all variables listed within, say, twice that distance of the object. If there is a match, you can pretty well forget the matter unless the listed variable is very faint. Minor planets are not much of a worry. If you are working to a limiting magnitude of 7-8, you need only consider the "Big 4" and maybe one or two others. Common handbooks will carry ephemerides of these objects. Don't forget Uranus and Neptune. The latter is presently in the Milky Way.

These checks might take two hours, and if you are still convinced, you must notify the astronomical world. The Central Bureau for Astronomical Telegrams should be cabled, and a telephone call to the AAVSO is appropriate. Other observers and professional observatories should be notified, to verify the discovery and obtain early spectroscopic and other observations. In the case of Nova Cygni, I erred on the side of over-caution and failed to notify several nearby observatories that could have seen the star.

For the future, I will be working very hard to learn the entire Milky Way as well as I now know my small regions. I reckon that it might take three years to initially learn everything visible in the Milky Way from my site, and maybe another two years to consolidate my knowledge. I hope that more observers will take up this work, so that the galactic novae will get the coverage they deserve. The day may come when novae routinely have several discoverers, as do most bright comets nowadays, and only then can we start to be satisfied that we are keeping a sharp lookout for novae.

In closing, I would like to express my gratitude to Janet Akyüz Mattei of the AAVSO for her judicious advice; Mr. Dennis Milon of Sky and Telescope who provided encouragement and some key information on George Alcock; Dr. Brian Marsden of the Central Bureau for Astronomical Telegrams who has been my mentor on things observational for some years; Mr. Jack Bennett and Mr. Steve O'Meara, both nova hunters themselves, for their interest and encouragement; and finally the staff of the Multiple Mirror Telescope Observatory, who cheerfully put up with my nocturnal jaunts for novae during this last summer on Mt. Hopkins.

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