PROBLEMS OF OBSERVING NEARBY GALAXIES VISUALLY

Rev. Robert Evans
57 Talbot Road
Hazelbrook, N.S.W. 2779
Australia

ABSTRACT. A review of progress made by amateurs in visual searching for supernovae in other galaxies reveals twelve discoveries made so far. A comparison between photographic and visual search methods reveals that each type of method has certain advantages and disadvantages. There are three minor problems and three major problems confronting visual searching. The main problem is the poor availability of good Survey photographs of many galaxies to amateurs and the restricted range of galaxies covered by available charts.

1. INTRODUCTION

It has now been established that visual observers can make serious contributions to the search for supernovae. It is possible for amateur astronomers, using quite modest equipment, to discover visually at least some of the brighter supernovae occurring in nearby galaxies. Twelve supernovae (Table I) have now been discovered visually in this way.

Jack Bennett (1968) of South Africa found the first of these using a 13 cm comet-seeking refractor. Gus Johnson (1979) of the USA picked out the second with a 20 cm reflector. The others were all discovered with a 25 cm portable Newtonian, f/1 4.3, of dubious and elementary construction. Five (marked *** in the Table) were found before they reached maximum brightness.

This list is noteworthy in that both of the recently discovered peculiar Type I supernovae are included. Spectrophotometric studies of these two SNe have confirmed the existence of a spectrally distinct class of Type I SNe (Leverault & Wheeler 1984; Margon & Downes 1984), three specimens reported earlier (Rosino & di Tullio 1974; Chevalier 1980) not having had sufficient data clearly to establish the distinctness of the class.

2. COMPARING PHOTOGRAPHIC SEARCHES WITH VISUAL

Photographic searches for supernovae have had nearly all the success over the years. But the limitations of this method have become increasingly

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TABLE I

VISUALLY DISCOVERED SUPERNOVAE

NAME	GALAXY	APPARENT MAGNITUDE GALAXY	SN	TYPE/NOTES
1968 l	NGC 5236	8.0	11.9	II
1979 c	NGC 4321	10.6	12.1	II ***
1981 a	NGC 1532	11.5	13.5	II
1981 d	NGC 1316	10.1	12.5	I ***
1983 g	NGC 4753	10.5	12.8	I *
1983 n	NGC 5236	8.0	11.5	I pec. ***
1983 s	NGC 1448	11.8	14.5	II
1983 v	NGC 1365	11.2	13.5	II ***
1984 e	NGC 3169	11.5	14.5	II **
1984 j	NGC 1559	11.1	13.2	II ***
1984 l	NGC 991	12.7	13.8	I pec.
1984 n	NGC 7184	12.0	14.0	I

* Unconfirmed photographic discovery two days earlier by K. Okazaki (1983) of Japan

** Photographic discoveries three days earlier by K. Okazaki and N. Metlova (USSR) reported to IAU Central Telegram Bureau after issuance of telegram announcing visual discovery (Waagen et al. 1984)

*** Discovered before maximum light

obvious (Kare et al. 1982). Advantages of photographic searches over visual ones lie in the permanent nature of the record and in the fainter limiting magnitude that can usually be reached. This second advantage may tend to be reduced a little as visual observers bring larger instruments into use.

Visual searching shares one problem with photographic methods; the resolving power of the telescope can cause some events to be lost against the main body of the galaxy. This applies especially to SNe within a magnitude of the telescope limit. But even an SNI at maximum would be very hard to see against the core of a galaxy like NGC 1316. Amateur visual searching, however, does have three major advantages:

a. Because of the low cost of operation and unrestricted use of telescope time, galaxies can be observed with great regularity, perhaps every few days. The brightest galaxies can even be observed during full moon. This regularity greatly increases the possibility of finding bright supernovae well before maximum. Already SN 1983n has been found and reported nearly a week before visual maximum and about two weeks before ultraviolet maximum (Evans & Thompson 1983; Wamsteker et al. 1983).

b. By the visual method, a supernova can be found, confirmed, and reported to the Central Bureau all within a few hours. This happened with about half the discoveries in Table I. Several times, on the night of discovery, contact has been made immediately with an observer using a spectrograph at a large telescope, who has made immediate use of the new

discovery. This is an achievement very hard to emulate photographically.

c. Amateurs can pay better attention to the more isolated galaxies, which include many close ones that can produce important bright supernovae. There is a good case for believing that at least a few of the supernovae listed in Table I that occurred in galaxies that are isolated or do not normally have much attention paid to them would have been missed completely without the success of the visual search.

3. MINOR AND MAJOR PROBLEMS

3.1. Minor Problems

a. It is very easy to mistake spiral arms, HII regions, and compact galactic nuclei for stars. Certain atmospheric conditions accentuate this problem.

b. It is also easy to gain a fleeting glimpse of stars or features just below the magnitude limit on a given night, and easier still to imagine that a star is present when it is not.

c. The possible presence of asteroids or galactic variable stars always poses a problem, particularly for asteroids near the retrograde part of their orbit, which move very slowly.

The remedy for these problems is for each observer to have good photos or charts of all the galaxies he observes, showing foreground stars and other necessary details, and for him to be well experienced in observing these objects. Somebody in the team should have access to an asteroid ephemeris and a variable star catalogue.

3.2. Major Problems

a. The most serious problem is that there are no charts or published photographs for hundreds of galaxies which can usefully be searched with a 25 cm or 30 cm telescope. An observer facing this problem will have a great many false alarms, being unable to tell if a newly noticed star is really new or not. This problem destroyed much of the value of my early years in supernova hunting. It should be remembered that home-made visual charts are of very limited value. A soon-to-be-published set of 230 charts of the brightest galaxies has helped me a great deal. But I also owe much in recent years to being given access to the Surveys at the Anglo-Australian Observatory, for which I am very thankful. I can now refer to a very large collection of 35mm photos of galaxies made from these Surveys. Amateurs need a great deal of help at this point.

The ESO Quick B Survey is the only one that can generally be relied upon to show all the foreground stars in the field of a galaxy. The other Surveys suffer from over-exposed images for this purpose.

b. In amateur searches, the most attention is usually paid to the brightest galaxies, though these are not necessarily where the brightest supernovae will appear. One wants the closest galaxies, which are often overlooked because amateurs do not know where many of them are located. What is needed is a list of all galaxies with redshifts less than 1000 km/s and another list stopping at 2000 km/s.

c. The final major difficulty is that, up to the present time, amateur astronomers can never be sure that professionals will make the best use of the supernova discoveries they have worked so hard to find.

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Especially is this so in the Southern Hemisphere.

The problem exists because of the way observing time is allocated at major facilities and because of the difficulty in changing equipment quickly. Very few observatory directors have issued orders requiring or encouraging new SNe to be observed. The problem is increased when observers using these telescopes do not report their observations promptly to the Central Bureau. Some data are lost, unreduced, in observatory tape files.

Far more attention needs to be paid to the immediate low-dispersion spectrophotometry of new supernovae and to the continued observing of them. I would also like to see a few medium-sized profession telescopes, or even small ones, dedicated to supernova work. Even one or two in each hemisphere would make a great deal of difference to the thorough study of this fascinating subject and would help make the best use of each discovery.

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NOTE ADDED: A 13th visually discovered supernova, 1985P, of Type II (plateau) was recently found by the present author at a magnitude of 13.5 in NGC 1433 (m = 11.4).