

A Photometric Study of the Bright Cloud B in Sagittarius: First Results

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During the past years, Drs. Agop Terzan and Alain Bernard of the Lyon Observatory, France, have been studying Schmidt plates of fields in the direction of the galactic centre. Most of the plates come from the ESO Schmidt telescope and a thorough intercomparison of plates in different colours and from different epochs have revealed a large number of new variable stars. Some stars have been found to possess large proper motions and some diffuse objects (galaxies, planetaries, nebulae?) were also discovered.

In *Messenger* No. 10 (September 1977) we informed the readers about our study of a region near the centre of the Galaxy. Our investigation was based on photographic plates obtained with the ESO Schmidt telescope and from the Observatoire de Haute-Provence and Mount Palomar.

Photoelectric measurements in the standard UVB system were obtained in June 1978 at La Silla and we here give some new results pertaining to our study of variable stars in the direction of the Milky Way centre.

The Photographic Plates

To start with, we have restricted ourselves to a $5 \times 5^\circ$ field centred on the bright star 45 Oph. We have compared plates taken in 1976 and 1977 with the ESO Schmidt telescope with plates from the 48 inch Mount Palomar Schmidt telescope which were taken in 1968 by A. Terzan.

As a first result we have so far found 268 variable stars with an amplitude of at least $0^m.5$. Most of these stars are long-period red variables, probably of the Mira-Ceti type. We have determined their positions, i.e. (X, Y) and (α , δ) with the ESO S-3000 measuring machine in Geneva. In addition, approximately 150 other stars are suspected of being variable. We have just received some further ESO plates which will be used to look into this question.

We have discovered three diffuse objects, the nature of which is still uncertain (fig. 1).

Objects No. 1 and 2 have a constant density over a circular area (with diameter $6-7''$ and $5-6''$, respectively) and the density falls rapidly off outside this area. The objects are well visible on V (visual) and R (red) plates which were exposed 15 min and they may just be seen on B (blue) plates exposed for more than 40 min. They are not visible on 60 min UV (ultraviolet) plates. During the photometric run in June with the 1 m photometric telescope on La Silla, A. Bernard was able to measure object No. 1 and he found (within a $16''$ circular diaphragm):

$$V_{16''} = 17.1 \pm 0.2, B-V = 1.80 \pm 0.06$$

It is therefore reasonable to believe that these objects are rather heavily reddened, due to the high interstellar absorption in this direction. The total visual absorption is probably larger than 3^m . The objects may also be intrinsically red, and they could be similar to the compact globular clusters

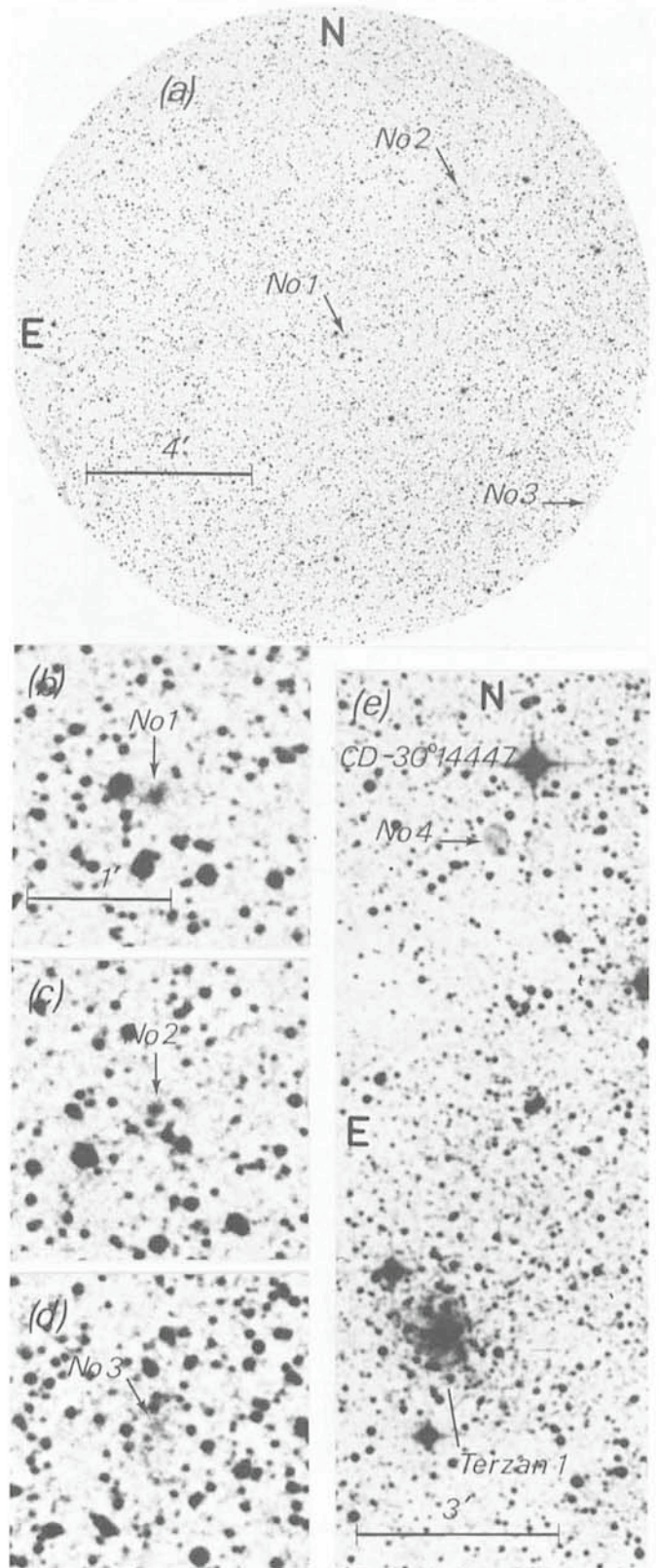


Fig. 1: Finding charts for objects No. 1 to 4. (a): Objects 1, 2 and 3 on plate No. 1745 obtained in the prime focus of the ESO 3.6 m telescope. IIIa-F baked + RG 630; 60 min; observer: C. Bateau. (b), (c), (d) and (e): Enlargements from ESO Schmidt plate No. 2268. 0.98.04 + RG 630; 30 min; observer: H.-E. Schuster.

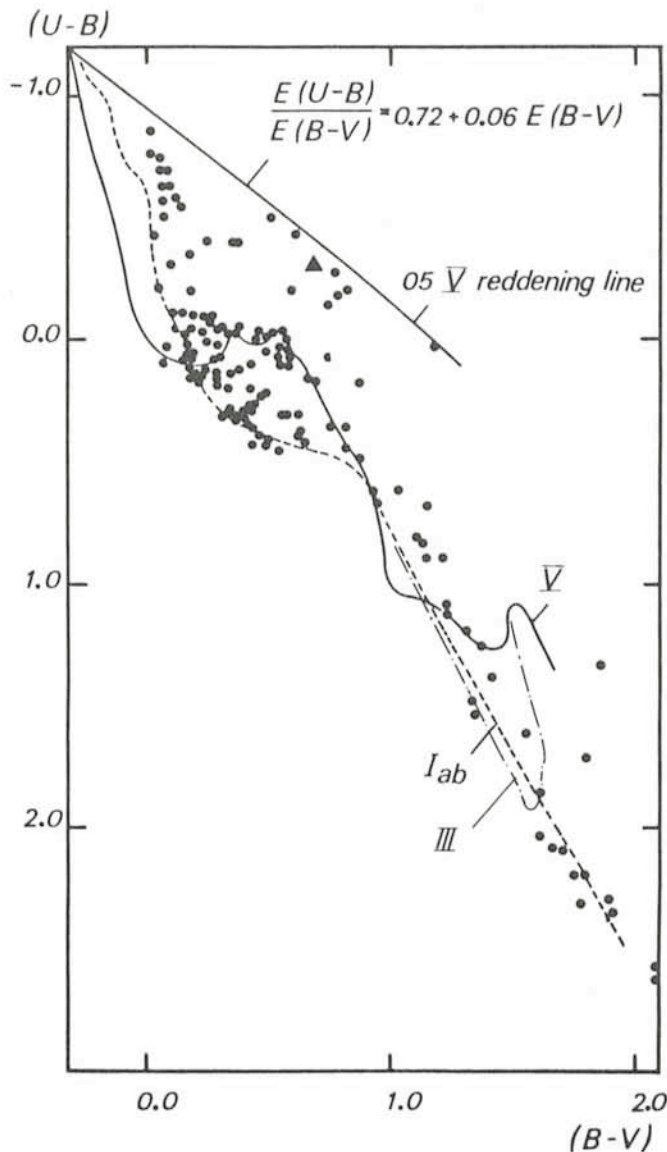


Fig. 2: Two-colour diagram of 153 stars in a field near 45 Oph. (▲) refers to the star CD -29°13809 which was also studied by Hiltner ($V = 9.74$; $B-V = 0.68$; $U-B = -0.34$; $0.9 V$).

Liller 1 and Terzan 2, which is also an X-ray source (XB-1724-31). In that case we only see the core of the clusters.

Another object, No. 3 in figure 1, is rather diffuse and is only visible on the R and V plates. It has a circular form with a diameter of 10" and a soft density distribution.

We have also found a planetary nebula (No. 4) which is situated between the globular cluster Terzan 1 and the star CD -30°14447. It is only seen on the R plate (because of strong emission in $H\alpha$) and has a somewhat elliptical form with the major axis oriented NE-SW. There are a number of condensations on the periphery. The central star cannot be seen, even on a 40-min blue plate that reaches beyond 20".

A by-product of the present investigation has been the discovery of 21 stars with large proper motions. Five of these have already been catalogued by Luyten in 1957 as having an annual proper motion larger than 0".2 and a further one was discovered in 1965 by A. Terzan. We envisage to measure the proper motions in collaboration with Dr. A. Fresneau from the Strasbourg Observatory, who is a specialist in this matter.

Photoelectric Photometry

We used the 61 cm Bochum telescope on La Silla to obtain photoelectric photometry in the UBV system of 153 comparatively bright stars. Most of these were measured twice and we were able to establish a UBV standard sequence near 45 Oph, in the following magnitude intervals:

$$6.71 < V < 12.04; 7.05 < B < 12.75; 6.20 < U < 14.06$$

We hope to extend this sequence to fainter stars in the future.

Figure 2 shows the distribution of the stars in a two-colour diagram. We note that giant M stars were observed which are little reddened. They are therefore nearer than 1 kpc. On the contrary, the reddening of most of the observed early-type stars (O5-B0) is larger than 3" in the visual. They are probably distant stars similar to the group of OB stars observed by Hiltner (Ap.J., 1954, 120, 41) at a distance of 3 kpc and are probably associated with the spiral arm inside the arm at 1.4 kpc. However, for a detailed determination of the interstellar absorption as a function of distance in our field, it is necessary to measure more stars and, if possible, to define the intrinsic value of the $H\beta$ index of the O stars.

Further photoelectric measurements were obtained with the ESO 1 m telescope. About 50 stars, situated within 10' of the open cluster Trumpler 26, were measured in UBV (this cluster is 23' NE of 45 Oph). The aim of this investigation is to learn the structure of the absorption in this direction and to study the cluster itself. Somewhat unexpectedly, the resulting two-colour diagram (fig. 3) does not indicate the ex-

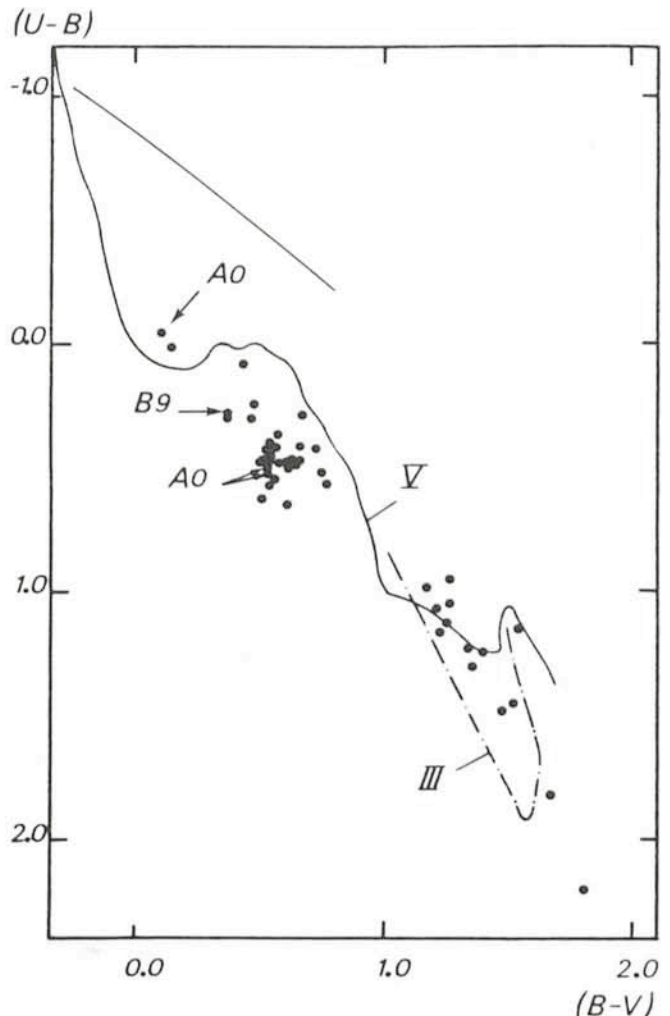


Fig. 3: Two-colour diagram of 46 stars in the field of the open cluster Trumpler 26.

istence of a physical group of stars. We still need additional information about the luminosity classes to resolve this problem. We should also like to add that we have determined m_r and m_{ir} of 274 stars in this field by means of photographic observations at Observatoire de Haute-Provence.

Future Work

There is obviously much work still to be done in order to terminate the present study. First of all, we expect to determine the types of the 268 variable stars by means of further

plates from the ESO Schmidt and to construct the light curves. Secondly, we should like to confirm (or disprove) the variability of the 150 suspected candidates.

We also intend to study spectroscopically the above-mentioned three diffuse objects and to measure the radial velocities and UBVR magnitudes of the 21 stars with large proper motions. We finally expect to continue the photoelectric photometry of many other stars in the direction of the bright cloud B in Sagittarius.

We should like to thank Prof. L. Woltjer and Dr. A.B. Muller for their encouragement and the continued interest they have shown in our work.

The Peculiar Galaxy NGC 4650 A

In the western part of the constellation Centaurus lies a spectacular chain of galaxies. Some of the members are el-

liptical, others are spiral, and one is very peculiar. Its name is NGC 4650 A and the integrated magnitude is about 14^m . The

