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IS NGC 404 A VARIABLE OBJECT?

While searching for the minor planet Appolo on a plate obtained on Nov.20, 1971 with the f/5 - 30 cm Sonnefeld astrographic lens of the Hohe List observatory, I noticed a variable object in the position

$$RA_{1900} = 1^h03^m55^s; \quad D_{1900} = +35^{\circ}11'15''.$$

It appears about 4^m5 magnitudes fainter than on VEHRNBERG's Atlas Stellarum chart No.93, and is close to the plate limit. A second plate, taken on Dec.14, 1971 confirms this. The position of this object coincides with that of the E0/S03 galaxy NGC 404.

On the Palomar Sky Survey print O/406 it clearly appears non-stellar, yet on the relevant E plate it is outshone by the 6' distant bright star Beta And.

Though it is extremely difficult to compare the brightness of non-stellar objects with stellar images on Schmidt-plates, on this print it seems to have comparable magnitude with the not too distant image of BD +33°187 (HD 7254, B8, $m_p \sim 6^m_5$). In Table 1 photographic magnitude estimates of the object on available charts and plates are given. These are based on a rough magnitude sequence of surrounding stars, which was derived from stars of SA 45. They are identified in the Figure and Table 2.

In addition it should be noted that HOFFMEISTER in 1966 thoroughly investigated the field around Beta And for variable stars, but obviously failed to detect variability of NGC 404.

1972, Jan.8.

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References:

- HOFFMEISTER, C.: 1966, Astron. Nachr. 289, 205.
MARSDEN, B.G.: 1972, IAU Circular No.2380.

Table 1: Photographic magnitudes of the variable object

| Source | Date | m_{ph} | Remarks |
|-----------------------------|--------------|-------------------|-------------------------|
| Franklin Adams chart No.141 | 1909.Jan.19 | 11 [±] 0 | non-stellar appearance |
| Carte d.Ciel +35°/No.8 | 1932 Dec.29 | 11.3:: | |
| Palomar SS 0/406 | 1951 Nov.2/3 | 6.3:: | non-stellar appearance |
| Lick Atlas | 1954 Sep.24 | 9.6 | |
| Falkauer Atlas chart No.93 | 1961 Sep.18 | 10.4: | |
| Falkauer Atlas chart No.65 | 1963 Jan.24 | 9.9: | |
| Atlas Stellarum chart No.93 | 1969 Jan.17 | 8.6: | |
| Atlas Stellarum chart No.65 | 1969 Aug.8/9 | 8.9: | |
| Hohe List plate A 2631 | 1971 Nov.20 | 12.9 | |
| Hohe List plate A 2632 | 1971 Dec.14 | 13.2 | non-stellar appearance? |

Addendum:

The brightness-comparison of non-stellar appearing objects on photographic plates obtained with different cameras is only possible if two conditions are fulfilled:

- 1) Identical photographic material has to be used.
- 2) The exposure times have to be adopted according the f-ratios of the cameras, e.g. $t_1/t_2 = (N_1/N_2)^2$; if N_1, N_2 denote the relevant focal ratios.

Since in no case of the above mentioned charts both conditions are matched, a variability of NGC 404 is irrelevant. The effect is in addition exaggerated if very short focus cameras are used, so that the angular resolution is determined by the resolution of the plate.

Table 2: Approximate photographic magnitudes of comparison stars

| Star | Identification | m_{ph} |
|------|--------------------------|----------|
| a | BD +35°218 = HD 7044(F5) | 8,65 |
| b | BD +34°199 = HD 6892(F5) | 8,90 |
| c | BD +35°207 = HD 6679(F8) | 9,30 |
| d | BD +34°182 = HD 6542(K5) | 9,85 |
| e | - | 10,95 |
| f | - | 11,40 |
| g | - | 11,95 |
| h | - | 12,60 |
| i | - | 12,95 |
| j | - | 13,50 |

