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GEOS
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# 7-PASSBAND PHOTOMETRY OF VARIABLE STAR V 449 CYGNI AND ITS COMPARISON STARS



ABSTRACT. 7-PASSBAND PHOTOMETRY OF VARIABLE STAR V 449 CYGNI AND ITS COMPARISON STARS.

5 measures of V 449 Cygni and 9 measures of the stars used for visual comparisons were made in the GENEVA photometric system in August 1982 at the Jungfraujoch Observatory.

RESUME. PHOTOMETRIE EN 7 COULEURS DE LA VARIABLE V 449 CYGNI ET DE SES ETOILES DE COMPARAISON.

Cette circulaire présente les résultats des mesures photoélectriques, effectuées en Août 1982 sur V 449 Cygni et sa séquence de comparaison, dans le système photométrique de GENEVE. Les mesures ont été faites à l'Observatoire du Jungfraujoch et ont été traitées à GENEVE par l'équipe de F. RUFENER.

RIASSUNTO. 7-COLORI FOTOMETRIA DELLA STELLA VARIABILE V 449 CYGNI E DELLE SUE STELLE DI CONFRONTO.

Sono presentati in questa circolare, i risultati delle misure fotoelettriche, fatte nell'Agosto 1982, nel sistema fotometrico di GINEVRA, su V 449 Cygni e la sua sequenza di confronto. Le misure, fatte all'Osservatorio del Jungfraujoch, sono state trattate a GINEVRA dall'équipe di F. RUFENER.

RESUMEN. 7-COLOR FOTOMETRIA DE LA ESTRELLA VARIABLE V 449 CYGNI Y SUS ESTRELLAS DE COMPARACIÓN.

Esta circular expone el resultado de las medidas fotoeléctricas efectuadas sobre V 449 Cygni y sus estrellas de referencia en Agosto de 1982, expresadas en el sistema fotométrico de GINEBRA. Las medidas han sido hechas en el Observatorio de Jungfraujoch y tratadas en GINEBRA por el equipo de F. RUFENER.

## 1. TUTORIAL COURSE ORGANISED BY THE PALAIS DE LA DECOUVERTE AT THE JUNGFRAUJOCH

With permisssion of the Jungfraujoch International Foundation and the Geneva Observatory, the Palais de la Découverte organised an astronomy tutorial course at the Jungfraujoch Observatory (altitude: 3580 m). 16 people took part in the course, lead by Bernard PERNIER and Noël CRAMER ( Geneva Observatory ), Michel DUMONT (Palais de la Découverte), Bernard LEGRAS (CNRS, ENS-Ulm ), Jean-Pierre CLOVIN (Cerfontaine, Belgium) and Thomas WIDEMANN ( undergraduate student, Université de Paris-Sud).

The main theme of the course was the calibration of a new photomultiplier so as to reproduce as accurately as possible the characteristics of the Geneva photometric system.

## 2. THE OBSERVATIONS

All the photoelectric measurements were made in the 7 colour-system $UBVB_1B_2V_1G$ developed by the Geneva Observatory. All the observing nights included the measuring of several standard stars, thus allowing an accurate link-up between different series of observations.The results are given as a magnitude $M_V$ and six standard colour indices, assuming that B = 0; U therefore means $(U - B)$, V means ( V-B ), and so on.

The $(B-V)_G$ Geneva index allows the calculation of the classical $(B-V)_J$ index of JOHNSON and MORGAN, using relation (2) :

$$(B-V)_J = 0,775 + 0,773\ (B-V)_G - 0,045\ (B-V)_G^2 + 0,016\ (B-V)_G^3 + 0,027\ (B-V)_G^4$$

valid for class III stars whose indices satisfy :

$$-1,15 \leqslant (B-V)_G \leqslant 1,20$$

All the observations described in this paper were processed at the Geneva Observatory. The accuracy ot these measures is of the order of 0,008 magnitude. The photoelectric recordings were made under the supervision of Bernard PERNIER jointly with Isabelle BOSC (Ecole de Physique de Marseille), Laurent BOUFFANDEAU ( Lycée d'Abidjan), Bernard LEGRAS and Michel DUMONT.

The photometer was placed at the Cassegrain focus of the 76 cm-telescope. The complete observation of a star would take at least 8 minutes, which is not inconvenient for the stars discussed in this note.

## 3. MEASURES OF V 449 CYGNI = HD 188344

| Date 1982 | U T | J D 2445... | $F_z$ | $M_V$ | U | V | $B_1$ | $B_2$ | $V_1$ | G | $(B-V)_J$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| August 10 | 21h11 | 192,383 | 1,04 | 7,647 | 3,242 | -1,058 | 1,467 | 1,043 | -0,261 | -0,057 | 1,595 |
| - 10 | 21h59 | 192,416 | 1,03 | 7,659 | 3,240 | -1,063 | 1,469 | 1,042 | -0,269 | -0,068 | 1,600 |
| - 11 | 22h26 | 193,435 | 1,03 | 7,648 | 3,265 | -1,097 | 1,451 | 0,997 | -0,301 | -0,100 | 1,629 |
| - 12 | 22h52 | 194,452 | 1,04 | 7,657 | 3,204 | -1,066 | 1,456 | 1,026 | -0,288 | -0,094 | 1,602 |
| - 17 | 21h53 | 199,412 | 1,03 | 7,580 | 3,196 | -1,093 | 1,479 | 1,010 | -0,304 | -0,120 | 1,626 |

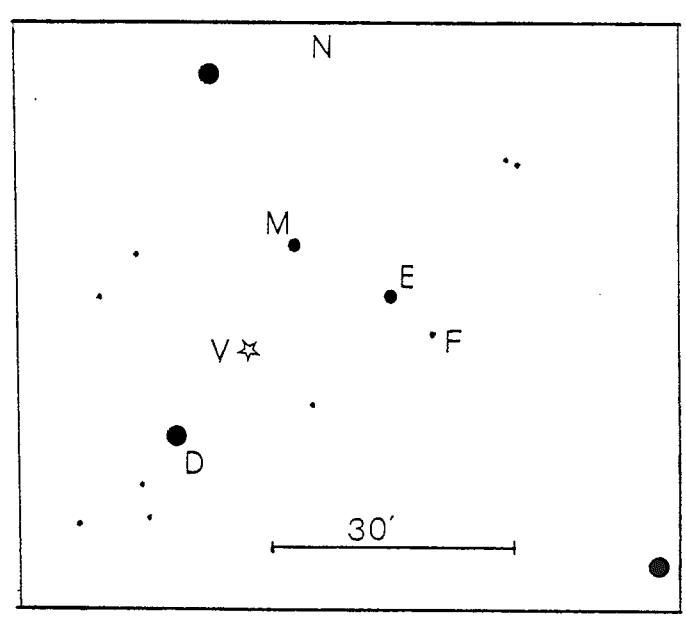
$F_z$ is the air mass. The V column gives (V - B), that is to say - $(B - V)_G$.

## 4. REFERENCE STARS

We also measured the brightness of 4 neighbouring stars often used for visual observations of V 449 Cygni.

Star identification is given by the chart opposite.

D = HD 188484
E = HD 226208
M = HD 188210
F = HD 226159



| star | Date 1982 | U T | Mv | U | V | $B_1$ | $B_2$ | $V_1$ | G | $F_z$ |
|---|---|---|---|---|---|---|---|---|---|---|
| D | 10 Août | 22h 12 | 6,794 | 3,222 | -1,055 | 1,655 | 0,947 | -0,222 | -0,205 | 1,03 |
| E | 10 Août | 22h 51 | 7,457 | 3,073 | -0,952 | 1,625 | 0,963 | -0,114 | -0,094 | 1,03 |
| E | 11 Août | 22h 54 | 7,455 | 3,030 | -0,941 | 1,624 | 0,967 | -0,114 | -0,087 | 1,04 |
| E | 12 Août | 23h 09 | 7,452 | 3,039 | -0,936 | 1,621 | 0,977 | -0,104 | -0,081 | 1,05 |
| E | 17 Août | 22h 19 | 7,451 | 3,081 | -0,945 | 1,620 | 0,971 | -0,127 | -0,103 | 1,03 |
| M | 10 Août | 22h 33 | 7,900 | 0,991 | 1,032 | 0,828 | 1,559 | 1,726 | 2,237 | 1,03 |
| M | 11 Août | 22h 40 | 7,902 | 0,967 | 1,032 | 0,833 | 1,549 | 1,725 | 2,229 | 1,03 |
| M | 17 Août | 22h 08 | 7,893 | 0,978 | 1,028 | 0,821 | 1,549 | 1,725 | 2,230 | 1,03 |
| F | 12 Août | 23h 26 | 8,533 | 1,923 | -0,260 | 1,265 | 1,153 | 0,524 | 0,720 | 1,07 |

It must be noted that the colours of D and E are very close to the colour of V 449 Cygni; on the other hand, M is much hotter and should not be used for comparisons with the variable.

Finally, the following magnitudes were adopted for the comparison sequence:

D = 6,79 E = 7,45 M = 7,90 F = 8,53

## 5. COMPARISON WITH PREVIOUS RESULTS

It is of interest to compare our measures with the comparison sequences usually adopted by amateurs observing V 449 Cygni.

| | GEOS sequence | DMT sequence | Sky Catalogue 2000 | This paper |
|---|---|---|---|---|
| D | 6,85 | 6,9 | 6,8 | 6,79 |
| E | 7,41 | 7,44 | | 7,45 |
| M | | | 7,8 | 7,90 |
| F | 8,13 | 8,6 | | 8,53 |

The GEOS sequence had been established after the CSI ( Catalogue of Stellar Identifications) which gave F a magnitude of 8.1. The GEOS observers had taken an average of every personal sequence which in turn had been adjusted so as to fit best the values published in the extant literature (1).

Magnitudes 6.9 and 8.6 of the DMT sequence had been taken from an old GOEV chart whilst the magnitude of E had been measured by DMT on 1967 July 11 with a Danjon's cat's eye photometer at the S.A.F. observatory. L. BALDINELLI (1) had measured photoelectrically interval ( F - E ) which he had found to be 1.15 magnitude. Our measures give 1.08.

Michel DUMONT

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