V 2113 Oph, FOUR YEAR OF OBSERVATIONS: 1982-85
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Discovered by O.J. EGGEN in 1973, the variations of star HD 156860 = V 2113 Oph have been confirmed photoelectrically at Jungfraujoch Observatory. Four years of visual observations give evidence of alternating intervals of stability and noticeable variations. The star could be an SRb-type variable.

RESUME: V 2113 Oph: QUATRE ANNEES D'OBSERVATIONS 1982-1985


Las variaciones de la estrella HD 156860 = V 2113 Oph, descubiertas por O.J. EGGEN en 1973, han sido confirmadas fotoeléctricamente en el observatorio de Jungfraujoch. Cuatro años de observaciones visuales muestran unos periodos de estabilidad y unos épocas con variaciones sensibles. Podría tratarse de una estrella del tipo SRb.
INTRODUCTION

Regular monitoring of the eclipsing binary U Oph quickly allows observers to notice the variation of neighbouring star HD 156860 (α = 17h 17m 15s, δ = +2° 11' 21''), already discovered by O.J. EGGEN (1).

The sky catalogue 2 000 gives the following data for the star:

\[ V = 6.8 \quad B-V = +1.6 \quad \text{Spectrum M4 III} \]

Figure 1 shows the field of the star and the positions of stars F and K which were used as comparisons for the visual observations:

\[ F = \text{HD 156208} \quad 6.02 \quad \text{AO} \]
\[ K = \text{HD 156458} \quad 6.70 \quad \text{FO} \]

Both these stars are hotter than the variable and the observations were made, as far as was possible, at constant air-mass. All the visual estimates were made with 50 mm binoculars, giving a power of 10 x, well adapted to the observation of the star.

Fig 1 : field of HD 156860

The variables U Oph and Z Oph are close by HD 156860

RESULTS OF THE VISUAL ESTIMATES

Table 1 summarizes the observations of M. DUMONT which appear in figures 2 to 5.
fig. 3

fig. 4

fig. 5
<table>
<thead>
<tr>
<th>Year</th>
<th>Number of estimates</th>
<th>averaged magnitude</th>
<th>Standard deviation</th>
<th>Figure</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>59</td>
<td>6.47</td>
<td>0.092</td>
<td>2</td>
<td>Constancy</td>
</tr>
<tr>
<td>1983</td>
<td>158</td>
<td>6.65</td>
<td>0.207</td>
<td>3</td>
<td>Unconclusive</td>
</tr>
<tr>
<td>1984</td>
<td>103</td>
<td>6.40</td>
<td>0.025</td>
<td>4</td>
<td>Constancy</td>
</tr>
<tr>
<td>1985</td>
<td>123</td>
<td>6.82</td>
<td></td>
<td>5</td>
<td>Regular variations</td>
</tr>
</tbody>
</table>

**TABLE 1**

The standard deviation was calculated assuming that the star was constant throughout the observing season. In 1985, however, the hypothesis is not likely. Also, the strong dispersion of the observations of 1983 is not clearly explained. The star could well have shown rapid and irregular variations but the fact that the observations may have lacked accuracy and thus scattered cannot be ruled out.

An examination of the four light curves reveal an amplitude of the order of 0.7 magnitude. This alternation of constancy (1982, 1984) and relatively rapid variations (1985 and perhaps 1983) suggest that the star could be an SRb-type variable, a hypothesis which would agree with the spectral type M4 III (3).

**PHOTOELECTRIC MEASURES**

Seven photoelectric measures were made in 1984 and 1985. They were made in the three colours U, B and V of the Geneva photometric system. These measures are listed in Table 2.

<table>
<thead>
<tr>
<th>Dates</th>
<th>UT</th>
<th>Mv</th>
<th>(B-V)G</th>
<th>(U-B)G</th>
<th>(B-V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984 July 29</td>
<td>22 h 03</td>
<td>6.53</td>
<td>1.11</td>
<td>2.95</td>
<td>1.64</td>
</tr>
<tr>
<td>1984 August 02</td>
<td>0 h 07</td>
<td>6.49</td>
<td>1.21</td>
<td>3.01</td>
<td>1.73</td>
</tr>
<tr>
<td>1984 August 02</td>
<td>22h 31</td>
<td>6.49</td>
<td>1.17</td>
<td>2.99</td>
<td>1.69</td>
</tr>
<tr>
<td>1985 July 12</td>
<td>22 h 20</td>
<td>6.65</td>
<td>1.08</td>
<td>2.99</td>
<td>1.62</td>
</tr>
<tr>
<td>1985 July 17</td>
<td>22 h 08</td>
<td>6.67</td>
<td>1.07</td>
<td>2.99</td>
<td>1.61</td>
</tr>
<tr>
<td>1985 July 21</td>
<td>22 h 10</td>
<td>6.62</td>
<td>1.08</td>
<td>3.01</td>
<td>1.62</td>
</tr>
<tr>
<td>1985 July 24</td>
<td>21 h 53</td>
<td>6.63</td>
<td>1.13</td>
<td>2.98</td>
<td>1.66</td>
</tr>
</tbody>
</table>

**TABLE 2**
The star was unmistakably brighter in 1984 than in 1985. The (B-V) index was calculated from (B-V)G (4). This seems to reveal a certain trend: the (B-V) index seems to be higher when the star is brighter. Eggen's measures also show the same character (1). These measures and ours are plotted in figure 6 which gives the variation of (B-V) against M_v.

CONCLUSIONS

More visual observations would be necessary to confirm the SRb type and the variation of (B-V) with M_v. This mode of variation suggests that the star is at maximum brightness when its diameter is maximum and that this diameter varies in a ratio sufficiently large (at least 1:4) to compensate for the slight drop in temperature.

Michel DUMONT

REFERENCES


(3) : PETIT M. "Les Etoiles variables". MASSON 1982


(5) : DUMONT M. ; Note Circulaire GEOS NC 474, 1985 "HD 156860 = V 2113 Oph. Quatre années d'observations"