Photographic observation of a minimum of VV Orionis

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Sp / m_v	A_0	A_5	F_0	F_5	G_0	G_5	K_0	K_5	A to
	A_4	A_9	F_4	F_9	G_4	G_9	K_4	K_9	K
3·50 to 3·99			1			4			5
4·00 to 4·49	4								4
4·50 to 4.99		6							6
5·00 to 5·49	3	5	2						10
5·50 to 5·99		5	8			1?			14
6·00 to 6·49			6	2			1?		9
6·50 to 6·99			4	11	1				16
7·00 to 7·49				9	1				10
7·50 to 7·99				3	6		1		10
8·00 to 8·49					5	6	1		12
8·50 to 8·99					1	7	1		9
9·00 to 9·49				2?		5	7		14
9·50 to 9·99							6	1	7
> 10·00							2	4	6

For the A and F stars the distribution in space is fairly well given by the following table (the four giants have not been included).

		number/ps³		same for M 37	
r°	pars.	A_0—A_9	F_0—F_9	A	F
0	0	2·0	2·7	7·0	2·2
·5	·3	1·7	2·2	6·6	2·1
1	·7	·9	1·4	5·5	1·7
2	1·3	·3	·4	2·6	1·0
3	2·0	·08	·25	1·1	·6
4	2·7	·04	·13	·6	·4
5	3·3	·02	·07		
8	5·3	·006	·02		

The square of the p.e. derived from the n residuals of 42 Boss stars given in the table is 1936 ± 430 (unit 10^{-8}″) whereas the square of the p.e. in the *P.G.C.* is 1444 ± 320. The difference 492 ± 536 shows that the internal motion cannot well surpass ± ·004″/*y*, and therefore will be much less than the value given in *Gron. Publ.* 35 viz. ± ″·006 (as p.e.).

A search for fainter Hyades in the central region has been recently completed in Groningen. In the Pleiades two stars with Hyades motion have been found, viz. Gaultier 298, m_p = 11·4 (*B A.N.* 95) and α $3^h43^m45^s$, δ + 24° 0′·8 (1900) m_p = 15·6 the latter unpublished.

The p.m. of stars down to 18^m in the surroundings of T Tauri, $4^h13^s·5$ + 19°·2 (1855), were determined by H. D. Curtis. No Hyades were found (*Publ. A.S.P.* 27, 243).

It would be of great interest to extend the search to very faint stars in the central region and some selected areas at e.g. 2°, 5° and 10° from the centre.

Among the Hyades there are many spectroscopic binaries (see rad. vel.) and the following visual binaries:

B.D.	Bu.G.C.	m	ρ″	dyn. par.
14° 657	2040	6·0 8.8	3·64	″·008
16 579	2134	7·0 8·9	·8	22
14 690	2154	7·0 9·0	1·0	38
17 712	2183	4·7 9·2	64	
18 636	2187	7·8 8·4	·16	19
15 633		6·5 7·5		18
15 636	2230	6·5 9·0	1·74	27
21 694	2340	9·1 10·5	5·2	
10 654	2381	7·9 7·9	·35	22
13 728	2383	7·0 10·0	·8	22
6 865	2574		123	
23 902	2661	7·9 8·1	9·2	
9 1064	3111	triple.		

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Of this variable=B.D. —1° 943, 5^h $28^m·4$, −1° 13′·6 (1900) two well determined epochs of the minimum were known as yet, given by the observations of Hertzsprung (Potsdam 1913–14) and Stearns (Yale 1922–23). To see if the period had changed the photographic observation of one new minimum would suffice.

On account of the low declination of the star there are but few minima per year which can be wholly followed here in Leiden. The cloudy weather reduced this number to a single one in the winter of 1933–34, viz. the minimum of 1934 Jan. 5, which could be photographed with the Zeiss double camera with moving plate holders.

89 Exposures on small fields of the size 1 cm × 3 cm were taken on Eastman 40 9 × 12 plates. The exposure time was 200^s.

The images are squares with sides of ·18 mm.

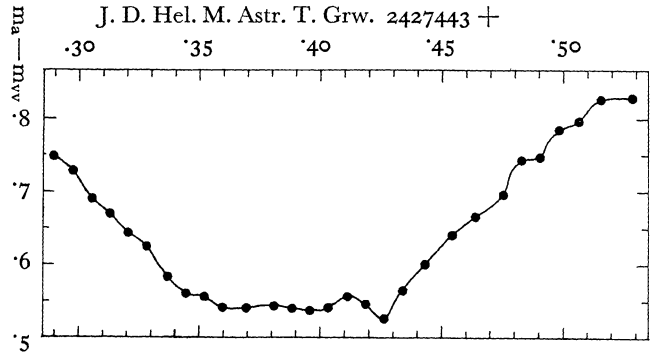
A grating l = d, Δm = $^m·97$ was used.

As comparison star was used *a* = B.D. —1° 94[illegible] about 10′ (1·5 mm on the plate) from VV Ori. The differences m_a—m_{vv} were directly computed from the readings in a Schilt photometer, assuming a grating constant of $1^m·00$.

The single observations (means of the two camera's) are given in table 1. The differential extinction amounting to $^m·006$ was taken into account.

Assuming a mean lightcurve consisting of thr[illegible]

linear parts the m.e. of a single observation between 2^h and 7^h sid. time (J.D. ·287—·493) turns out to be $\pm$ m·018.



The epoch of the minimum was calculated with the aid of the curve drawn through means of 3 observations and given in the diagram. From this curve the magnitudes at J.D. ·290, ·295, ·300 etc. were taken. The sums of the squares of the differences in magnitudes at 2 × 19 points aequidistant from J.D. ·3825, etc. were made up, they are:

JD d	$\Sigma (\Delta m)^2$
·3825	·021639
·3875	·002426
·3925	·008665

Assuming a quadratic relation between $\Sigma (\Delta m)^2$ and J.D. the minimum of $\Sigma (\Delta m)^2$ = ·001650 is found at ^{d}·3887.

The m.e. of this epoch was calculated from the m.e. of the observations on the descending and rising branch to be $\pm$ ^{d}·0008.

The epochs from photographic lightcurves now available are:

	J.D.	phase
Potsdam [1])	242 0095·2198 ± ·0014	6796·3941 ± ·0010
Yale [2])	3401·680 ± ·004	9022·3988 ± ·0030
Leiden	7443·3887 ± ·0008	11743·3941 ± ·0005

The first and last epoch give the period:

$$1^d\cdot 4853788 \pm \cdot 0000003$$

[1]) *Potsdam Publ.* 23. Band, 5. Stück.
[2]) *Yale Transactions* III. 2.

The phases of the 3 epochs were calculated with this period using the formula:

$$\text{phase} = {}^{d-1}\cdot 67322894\ (\text{J.D. Hel. M. Astr. T. Grw.} - 2410000).$$

From these we may conclude that the period has not sensibly changed. The deviation of the Yale minimum is about one and a half time its mean error only.

The observations given in *Acta Astronomica* C I 110 (1928 Jan. 11–Apr. 6) are in accordance with the period.

TABLE 1.

J.D. Hel. M. Astr. T. Grw. 2427443 +	$m_a - m_{vv}$ corrected for extinction	J.D.	$m_a - m_{vv}$	J.D.	$m_a - m_{vv}$
d	m	d	m	d	m
·2867	·740	·3648	·560	·4513	·651
93	·754	73	·539	43	·636
·2918	·750	·3759	·523	69	·633
43	·720	84	·538	94	·651
76	·724	·3809	·551	·4619	·635
·3002	·740	35	·543	·4702	·713
26	·698	60	·556	28	·679
52	·693	85	·541	54	·693
78	·679	·3911	·525	78	·713
·3102	·653	36	·537	·4804	·723
28	·681	58	·535	30	·733
54	·672	80	·541	55	·774
80	·651	·4008	·532	80	·733
·3204	·642	33	·543	·4906	·748
30	·636	58	·543	31	·758
55	·627	84	·572	56	·756
81	·654	·4110	·580	82	·796
·3306	·590	34	·512	·5007	·798
32	·593	60	·534	33	·776
69	·565	86	·566	58	·816
93	·591	·4211	·534	·5104	·797
·3419	·553	36	·535	32	·797
45	·539	62	·515	57	·822
69	·591	87	·522	83	·859
95	·553	·4312	·587	·5208	·836
·3521	·561	38	·563	33	·797
46	·550	63	·544	59	·869
71	·515	89	·599	·5319	·824
97	·547	·4414	·564	·5401	·812
·3622	·554	88	·637		

Remarks: Local sidereal time of middle of first exposure $2^h2^m42^s$, of last exposure $8^h8^m32^s$.

Condition of the sky: 7^h5^m light fog.
7 22 passing fog.
7 32 light fog.
from 8^h increasing fog.