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NEW VARIABLE STARS IN CYGNUS

Since 1967 I have observed 32 fields in the Milky Way for variable stars. The following is a presentation of a survey of an area of $20^{\circ} \times 15^{\circ}$ centered at $20^{\text{h}}50^{\text{m}}$, $+45^{\circ}$ in Cygnus. This area has been followed photographically in two colours during the period 1967 to 1981. As a rule one observation per summer was obtained.

Twenty one exposures with 9 x 12 cm photographic plates were taken simultaneously with two cameras connected to the equatorial telescope at my private observatory in Montlaur, South of France. A Perkin-Elmer lens 6.5/30 cm with Schott GG 11 filter and Kodak 103a-D plates was used for photographic photometry close to the Johnson V system. An Aerostigmat 5.5/30 cm with Kodak 103-0 plates without filter was used for photographic photometry close to the Johnson B System. The limiting magnitudes at zenith distance are $V = 15.2$ and $B = 14.7$. The colour correction is small for both the V and B plates. A Maksutov 15/225 cm with a 1 P 21 photomultiplier connected to an inverter change of the frequency of the synchronous motor provided automatic guiding.

The plates were examined with a blink comparator and six stereo comparators standing on a circle with a turnable chair at the center. In this way it was easy to detect variable stars showing a magnitude difference of 0.3 magnitudes and to check their appearance on several plates at the same time.

The magnitudes were estimated by using a step scale in the eye-piece of the blink comparator. The star α Lyr was photographed on fine grain film with exposures in steps of $\sqrt{2}$. The scale is calibrated from the magnitudes obtained for 3 clusters by Hoag et al. (1961). These clusters were photographed with the same techniques as described above on the same plate with the clusters at different positions from the plate center. On the same plate comparison stars were selected and measured.

Table I New variables in Cygnus
Plate centre $20^{\text{h}}50^{\text{m}}45^{\text{s}}$

No	R.A. (1950)	Decl. (1950)	m_V		B-V color	notes	No	R.A. (1950)	Decl. (1950)	m_V		B-V color	notes
			max	min						max	min		
LD 8	19 ^h 49 ^m 17 ^s	50 ^o 36'	12.8-	14.2	1.4		LD 37	21 ^h 02 ^m 25 ^s	37 ^o 38'	12.4-	<14.5	2	
LD 9	19 51 40	46 14	12.6-	14.3	1.4		LD 38	21 04 40	37 20	12.4-	15.0	1.6	1
LD 10	19 52 20	47 04	11.8-	<15.0	1.6	1	LD 39	21 05 35	36 57	12.5-	14.5	1.2	
LD 11	19 56 50	46 58	11.6-	14.8	1.4	1	LD 40	21 05 45	40 28	12.9-	<15.0	1.6	
LD 12	19 57 44	48 36	11.6-	<15.0	1.5		LD 41	21 06 15	37 15	13.5-	<15.0	>1	
LD 13	19 58 20	40 53	13.6-	14.0	0.3	1	LD 42	21 07 50	37 38	11.8-	13.0	1.7	
LD 14	20 02 05	47 35	13.6-	<15.0	1.4		LD 43	21 12 55	44 05	12.4-	14.0	2.0	1
LD 15	20 07 56	47 48	11.9-	<15.0	2.4		LD 44	21 13 15	44 28	12.6-	13.5	1.7	
LD 16	20 08 27	38 03	14.0-	14.7	>0.5		LD 45	21 15 35	50 32	13.1-	14.3	1.3	
LD 17	20 09 04	40 49	13.8-	14.8	0		LD 46	21 17 00	39 41	13.6-	<14.8	>0.8	
LD 18	20 09 32	36 52	13.8-	14.5	>0.7	1	LD 47	21 17 55	50 28	13.1-	<15.0	>1.2	
LD 19	20 10 15	39 28	12.2-	15.0	>2.5	2	LD 48	21 18 00	49 30	12.0-	13.2	1.7	
LD 20	20 15 30	45 26	14.0-	14.6	0		LD 49	21 19 00	38 01	12.4-	<14.8	2.1	
LD 21	20 16 20	43 36	13.3-	<15.0	>1.2	2	LD 50	21 21 55	47 59	13.7-	14.2	>1	
LD 22	20 18 58	49 33	12.2-	<15.0	>2		LD 51	21 25 30	39 04	12.0-	14.8	2	
LD 23	20 19 27	50 18	12.6-	15.0	0	3	LD 52	21 26 45	37 47	13.5-	<14.5	1	1
LD 24	20 32 32	49 13	13.6-	15.0	>1.9		LD 53	21 28 50	43 19	13.4-	14.5	0.5	
LD 25	20 34 05	42 49	13.6-	15.0	0.7		LD 54	21 29 00	43 17	13.8-	14.5	-0.2	
LD 26	20 35 00	37 42	13.4-	<15.0	>1		LD 55	21 29 15	38 32	11.5-	<14.7	1.0	
LD 27	20 38 30	49 47	13.0-	15.0	1.5		LD 56	21 29 30	40 44	11.8-	<14.8	2.0	
LD 28	20 40 40	42 07	13.2-	14.6	1.3	1	LD 57	21 30 30	38 44	11.8-	14.5	-0.4	
LD 29	20 46 08	45 31	12.8-	<14.5	1.7		LD 58	21 30 50	39 04	11.6-	<14.5	2.2	
LD 30	20 46 32	46 22	14.0-	15.0	0.2		LD 59	21 31 15	37 49	10.4-	<14.0	0.5	1
LD 31	20 48 14	37 19	12.4-	<14.8	2.2		LD 60	21 34 20	38 10	11.8-	14.3	2.0	
LD 32	20 50 45	46 14	12.0-	14.7	2.3		LD 61	21 36 40	45 29	11.6-	14.2	>2.2	
LD 33	20 53 12	38 25	14.5-	15.0	>0		LD 62	21 37 45	43 05	13.8-	<14.5	0.7	
LD 34	20 56 00	42 35	12.6-	15.0	>2		LD 63	21 40 45	44 42	11.4-	12.4	>2.4	
LD 35	20 58 45	38 25	12.8-	13.6	1.0	1	LD 64	21 41 30	50 25	12.0-	<14.5	>2	
LD 36	21 01 10	37 35	10.8-	13.2	0.9	1	LD 65	21 41 45	48 55	13.0-	14.5	>1.2	

This procedure provides magnitudes with an accuracy of ± 0.2 magnitudes.

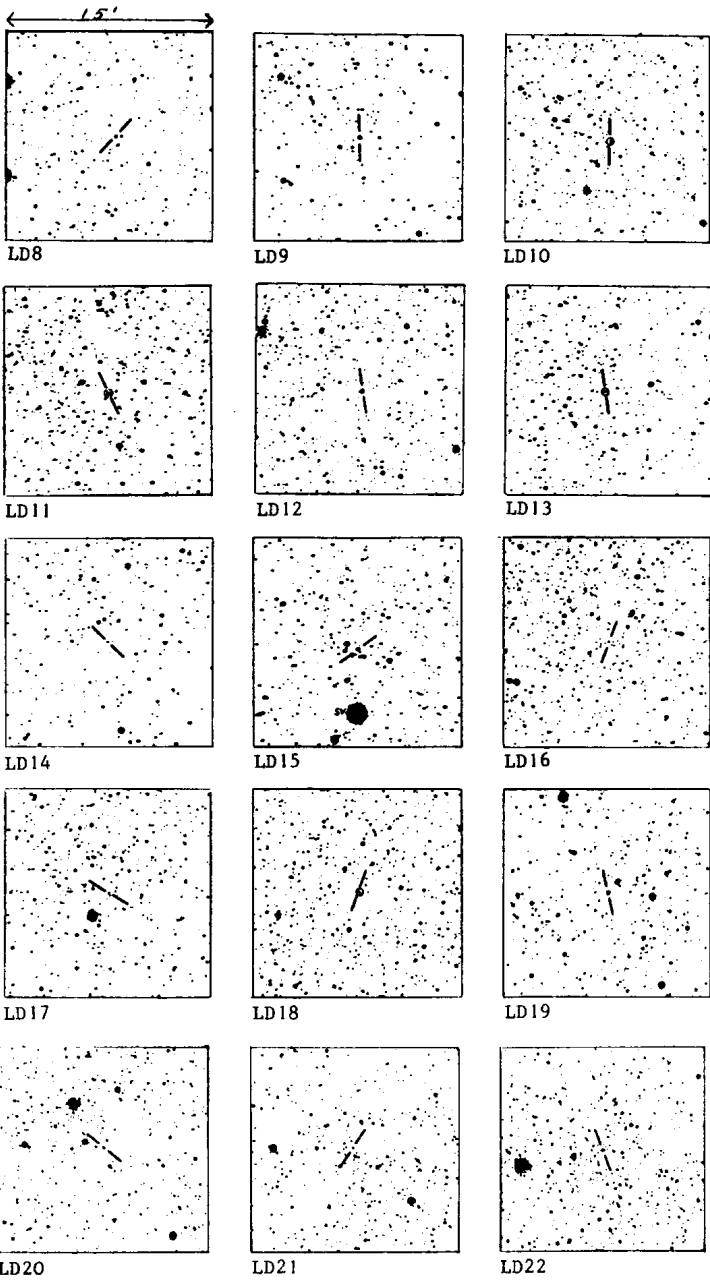
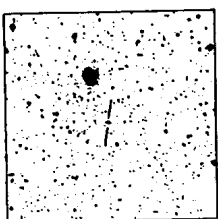
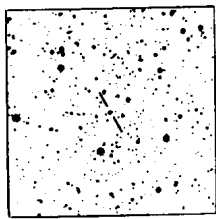


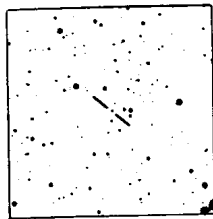
Figure 1



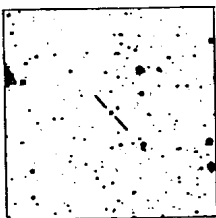
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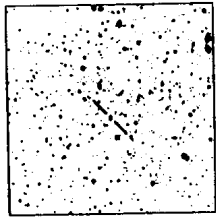
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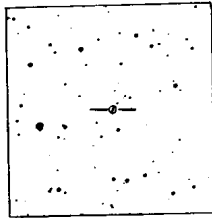
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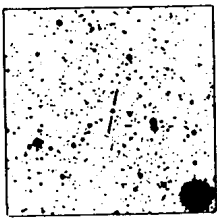
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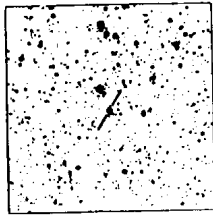
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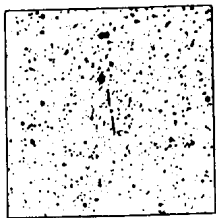
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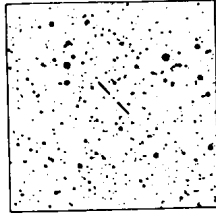
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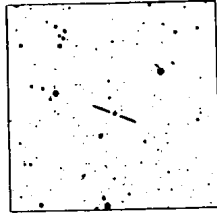
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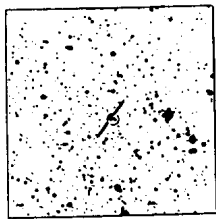
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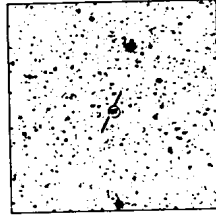
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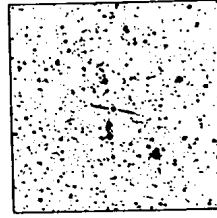
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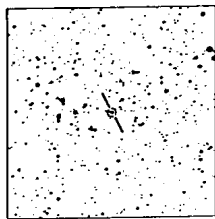


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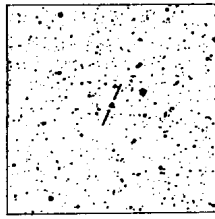


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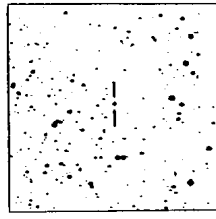
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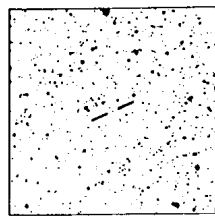
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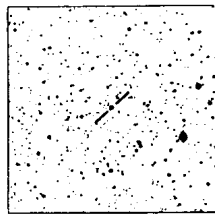
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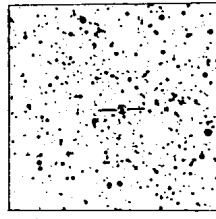
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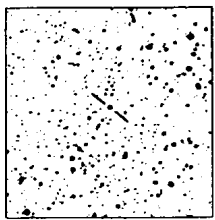
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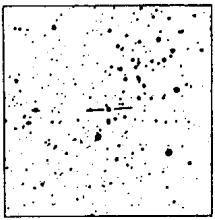
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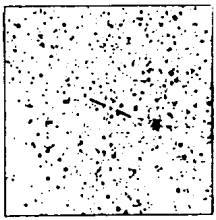
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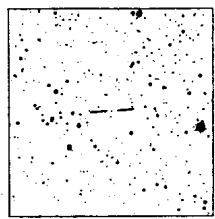
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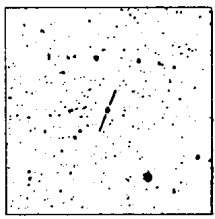
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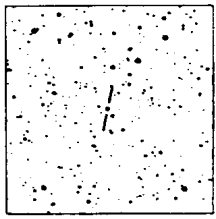
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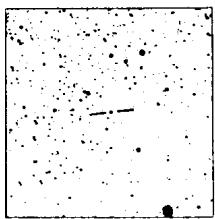
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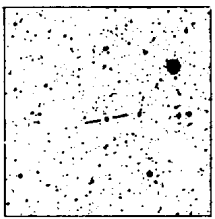
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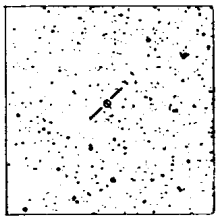
LD49



LD50



LD51



LD52

Figure 1 (cont.)

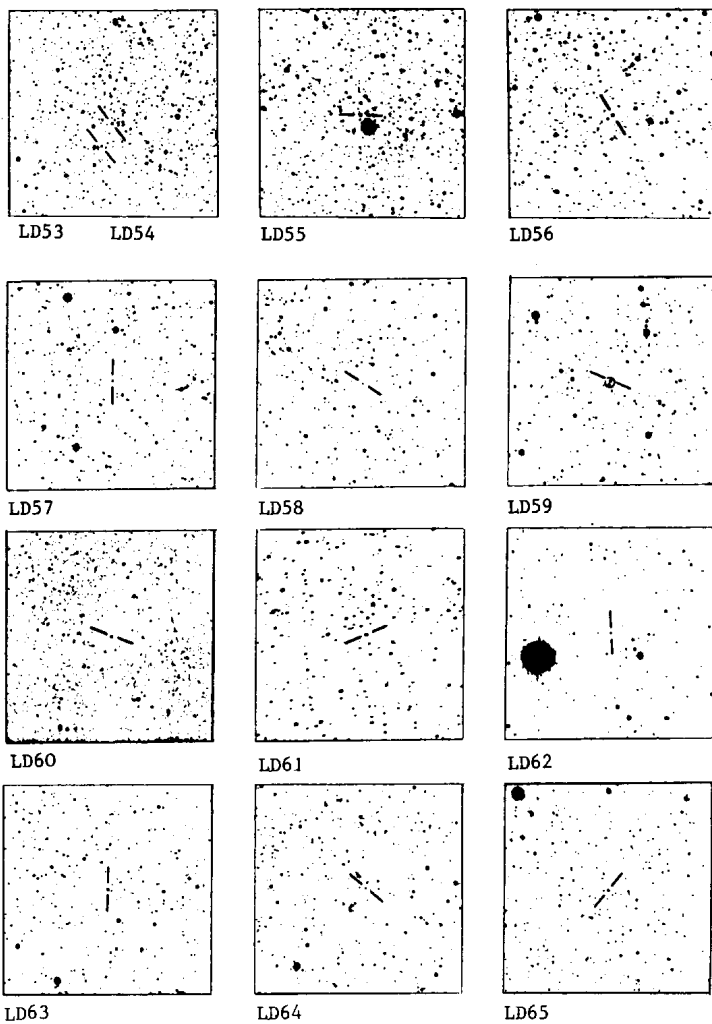


Figure 1 (cont.)

Co-ordinates were determined through a grid of epoche 1950.0 co-ordinates based on the SAO catalogue. The accuracy of the co-ordinates is of the order of 1 minute of arc. With help of this grid 450 known variables in the field could be localized. Co-ordinates for new variables were determined from this grid.

In this survey 58 new variable stars were found. In most stars 20 individual magnitude estimates exist for this period. All stars are fainter than $V = 11.0$ at maximum brightness. 30 stars are fainter than $V = 13.0$. 17 stars could not be traced on the B plates. Most stars are red.

The new variables are listed in Table I, where the first column gives the provisional designation of the star, columns 2 and 3 the position and column 4 the range in visual magnitude. Column 5 gives the approximate colour. The notes in the last column refers to: 1. Two close stars, the magnitude refers to both stars; 2. Flare star? Only one maximum; 3. Eclipsing binary, the period is 27.001 days or fraction of this at epoch 2439710.439. Minimum lasts for more than 60 minutes; 4. Very slow dwarf nova?

The finding charts were obtained with a Newton 21/166 cm reflector and an intensifier camera of type Electrophysics Corporation, model 350, including an image intensifier type Varo S-20. Individual magnitude estimates and large-field finding charts can be delivered upon request.

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Reference:

Hog, A.A., Johnson, H.L., Iriarte, B., Mitchell, R.I., Hallam, K.L.
and Sharpless, S., 1961, Publ. U.S. Naval Obs. 17, 1.