

# A CATALOGUE OF FLARE STARS IN THE CYGNUS REGION

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**ABSTRACT.** A catalogue of known flare stars in the region of the emission nebulae NGC 7000 – IC 5068-70 and IC 1318 a,b,c in Cygnus is presented. The UBV magnitudes and spectral types, as far as available, for 96 flare stars and their 144 flares were collected. Patrol observations from the Asiago, Byurakan, Konkoly, Rozhen and Tonantzintla observatories, covering a total of 1500 hours effective observing time were used.

## 1. Introduction

Flare star observations, which started systematically in the early nineteen-sixties, showed the importance of flare stars as a separate class of variables for our understanding of processes of star formation and evolution (Ambartsumian and Mirzoyan 1977). Today, a large number of data from flare star observations in different stellar aggregates is available. For the reduction of existing observations and the preparation of future patrol observations, as well as for statistical investigations of flare stars, a compilation of the available data is needed. Up to now two catalogues exist – for the Pleiades region (Haro et al. 1982) and for the aggregate in Orion (Natsvlshvili 1988). In the present paper a new catalogue is described, containing 96 flare stars in Cygnus and their 144 observed flare events. The complete version of the catalogue will be published later because of the limited space available here.

A machine-readable version of the catalogue is available upon request.

## 2. The Catalogue

The catalogue lists the results of flare star observations in Cygnus (photographic and photoelectric) amounting to about 1500 hours effective observing time. Systematic observations of the region around the emission nebulae NGC 7000 – IC 5068-70 (Cyg T1 association) were conducted mainly at Byurakan Observatory, these of IC 1318 a,b,c (Cyg T2 association) mainly at Rozhen Observatory. A few additional flare stars in the vicinity of those fields are also included. The list of the 96 flare stars in Cygnus, given in the catalogue, is presented in Table 1.

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TABLE 1. List of flare stars in the catalogue of the Cygnus region.

Cyg No	Fl Des	GCVS	RA (1950)	Dec (1950)	Cyg No	Fl Des	GCVS	RA (1950)	Dec (1950)
1	Ct	V 1581	19 <sup>h</sup> 52. <sup>m</sup> 3	44°17'	49	B 22	V 1599	20 <sup>h</sup> 50. <sup>m</sup> 6	42°48'
2	Cr	V 1513	20 03. 9	54 18	50	T 6	V 1494	20 50. 6	43 24
3	R# 6	V 1772	20 15. 5	42 28	51	B 25	V 1600	20 50. 7	44 25
4	A	V 1381	20 19. 1	41 10	52	B 31	V 1601	20 51. 0	43 05
5	R#12	V 1777	20 23. 0	42 23	53	B 33	V 1602	20 51. 1	41 45
6	R# 7	V 1778	20 23. 6	41 55	54	B 26	V 1603	20 51. 3	42 26
7	R# 8	V 1779	20 24. 6	40 18	55	K 4	V 1709	20 51. 6	44 53
8	R# 9	V 1780	20 25. 4	41 32	56	B 43	V 1710	20 51. 7	41 33
9	R#10	V 1781	20 25. 6	41 09	57	A 2	V 1924	20 52. 0	44 09
10	B# 2	V 1750	20 26. 2	40 06	58	Bj	V 1926	20 52. 9	42 48
11	R# 1	V 1752	20 27. 3	40 16	59	B 55	V 1795	20 53. 0	40 17
12	R# 2	V 1753	20 30. 1	43 01	60	T 7	V 1495	20 53. 4	44 38
13	B# 3	V 1754	20 30. 4	43 06	61	B 18	V 1604	20 53. 7	43 23
14	B 28	V 1586	20 32. 0	44 13	62	B 30	V 1605	20 53. 9	40 45
15	B# 1	V 1695	20 32. 5	43 30	63	B 3	V 1536	20 53. 9	44 09
16	R# 3	V 1755	20 33. 3	42 21	64	B 5	V 1537	20 54. 0	43 31
17	R#11	V 1785	20 33. 8	41 01	65	B 37	V 1606	20 54. 5	42 49
18	R# 4	V 1756	20 34. 3	39 51	66	B 49	V 1713	20 54. 5	43 03
19	R# 5	V 1757	20 34. 5	40 37	67	B 48	V 1712	20 54. 5	43 05
20	B 32	V 1587	20 39. 6	41 38	68	B 47	V 1927	20 55. 0	43 53
21	B 16	V 1522	20 40. 1	40 03	69	A 4	V 1928	20 55. 3	41 50
22	B 40	V 1588	20 40. 3	44 08	70	B 24	V 1607	20 55. 5	40 53
23	B 19	V 1589	20 41. 0	41 11	71	B 44	V 1714	20 55. 5	42 58
24	B 35	V 1590	20 41. 4	40 07	72	B 8	V 1538	20 55. 6	43 39
25	B 38	V 1591	20 41. 4	44 08	73	B 17	V 1608	20 55. 6	44 32
26	B 27	V 1592	20 41. 7	43 08	74	A 5	V 1929	20 55. 8	43 46
27	B 34	V 1593	20 42. 3	42 13	75	B 12	V 1539	20 56. 2	43 41
28	K 1	V 1698	20 43. 1	44 33	76	B 29	V 1609	20 57. 1	42 41
29	B 53	V 1789	20 43. 3	42 26	77	T 2	V 1496	20 57. 3	42 26
30	B 6	V 1526	20 43. 9	42 41	78	B 50	V 1717	20 57. 5	41 44
31	B 41	V 1699	20 44. 1	43 38	79	Cr	V 1396	20 58. 1	39 53
32	B 46	V 1700	20 46. 2	42 49	80	T 5	V 1497	20 58. 2	43 20
33	B 7	V 1528	20 47. 1	41 02	81	B 45		20 58. 6	43 04
34	B 39	V 1594	20 47. 2	42 10	82	Bj	V 1930	20 58. 6	44 19
35	R 1	V 1790	20 48. 3	43 14	83	B 15	V 1544	20 58. 8	42 10
36	B 10	V 1595	20 48. 5	41 33	84	B 56	V 1796	20 59. 0	43 58
37	B 11	V 1529	20 48. 7	41 46	85	B 51	V 1797	20 59. 5	41 45
38	B 36	V 1596	20 48. 7	43 15	86	B 57	V 1798	20 59. 6	40 29
39	B 1	V 1530	20 48. 8	40 43	87	B 58	V 1799	20 59. 9	42 31
40	B 54	V 1791	20 48. 8	40 50	88	B 2	V 1545	21 00. 0	42 26
41	K 2		20 48. 8	44 25	89	T 3	V 1498	21 00. 5	44 54
42	B 59		20 49. 0	43 46	90	T 1	V 1424	21 00. 7	42 08
43	K 3		20 49. 0	44 08	91	B 20	V 1611	21 01. 3	44 22
44	B 9	V 1597	20 49. 2	44 04	92	B 21	V 1612	21 01. 6	40 59
45	B 14	V 1598	20 49. 3	44 00	93	T 4	V 1499	21 01. 7	42 03
46	B 42		20 49. 5	40 43	94	B 23	V 1613	21 02. 3	43 24
47	B 52	V 1793	20 49. 9	43 26	95	B 13	V 1550	21 04. 5	44 25
48	B 4	V 1534	20 50. 5	41 26	96	B	V 1758	21 11. 1	48 44

The columns in the table are: catalogue number of the flare star; original designation of first registered flare event; designation according to the General Catalogue of Variable Stars (Kholopov 1985) and subsequent Name Lists of Variable Stars; equatorial coordinates. In addition to the information given in Table 1, the original catalogue contains the following data: catalogue number of flare event; dates of observed flare events, and apertures of the telescopes used; minimum and maximum magnitudes of the flare stars in U- or pg-light; values of V, B-V, U-B in quiescence from photographic photometry and corresponding spectral type. Flare stars not satisfying the criterion  $\Delta m \geq 5\sigma$  (Oskanian and Terebizh 1971) are marked.

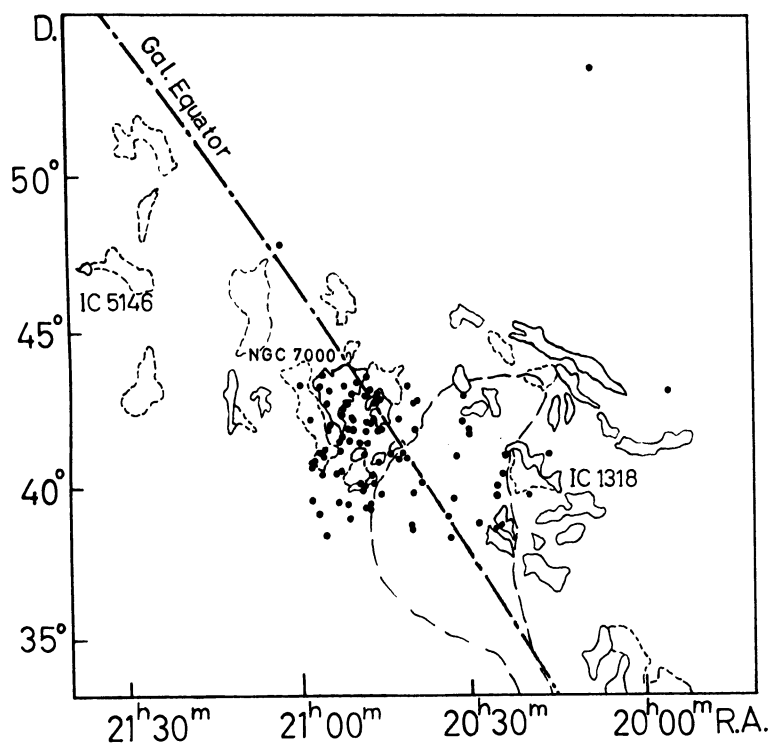


Figure 1. Distribution of known flare stars in Cygnus

In Fig. 1 the distribution of all known flare stars in Cygnus is shown. They were mostly found in the two patrol fields, around the emission nebulae NGC 7000 – IC 5068-70 with more than 1000 hours effective observing time, and around IC 1318 a, b, c with 300 hours.

In Table 2 the frequency distribution of flare events during the time of observations is given.

TABLE 2. Numbers of Cygnus flare stars and incidence of flare events

Number of flare events	1	2	3	5	7	10	Total fl. stars	Total fl. events
Number of flare stars	78	12	1	1	2	2	96	144

It should be noted that the plate sizes and centers around Cyg T1 vary slightly. There is no clear void between the two systematically observed fields. The different densities of objects may be attributed to the different time coverage and to the greater richness of the Cyg T1 association in H $\alpha$  emission and flare stars. The comparison of the two fields in Cygnus is interesting because the regions are connected across the Great Rift of the Milky Way and are at approximately the same distance (about 500 pc – Tsvetkov 1977; Tsvetkova 1986). Future photometric and spectroscopic investigations of this region will help to clarify questions concerning the membership in the aggregates and the differences displayed by H $\alpha$  emission and flare stars.

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