Die wiederkehrende Nova
T Coronae Borealis
(T CrB)

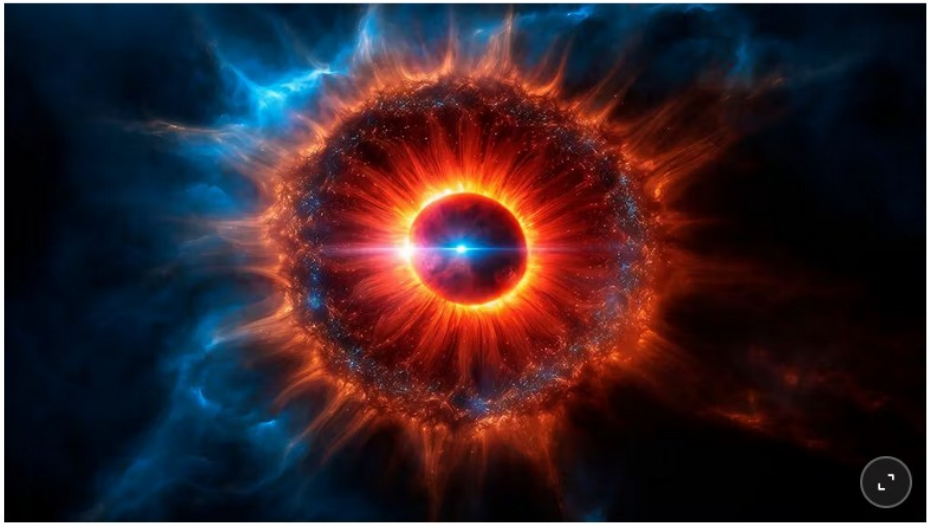
Österreichischer Astronomischer Verein, 25.Apr.2025, Wolfgang Vollmann

T. Coronae Borealis

Ist bald gigantische Nova-Explosion am Himmel zu sehen?

Es passiert nur alle 80 Jahre: Im Sternensystem T. Coronae Borealis wird eine Nova-Explosion erwartet, die mit bloßem Auge beobachtet werden kann.

Von **Heute Life**
27.03.2025, 14:33



„T CORONAE BOREALIS“

Sehen wir jetzt eine Nova aus dem 13. Jahrhundert?

Vorarlberg | 06.04.2024 06:12

Ein weißer Zwerg wie dieser macht derzeit Schlagzeilen. (Bild: Bartlomiej - stock.adobe.com)

Noch heuer soll im Sternbild Nördliche Krone eine Nova aufleuchten, wörtlich ein „neuer Stern“. Dabei gibt‘s den Stern schon lange, man sieht ihn nur mit freiem Auge selten. Autor und Naturwissenschafter Christian Mähr hat einen Mönch gefunden, der die Nova aber schon beobachtet hat – im 13. Jahrhundert.

Wiederkehrende Nova T CrB

- 12.Mai 1866: 2. Größe
  Entdecker John Birmingham
  William Huggins: Spektroskopie
- 9.Feb.1946: 2. Größe
  mehrere unabhängige Entdecker
- In beiden Erscheinungen innerhalb einer Woche unter die Grenzgröße für das freie Auge
- Normalhelligkeit ~10. Größe

Eruptionen von T CrB

Aus diesen Beobachtungen ergibt sich eine mittlere Periode von 80,7 Jahren, die zu den folgenden Zeitangaben für die Nova-Ausbrüche führt:

Datum	Jahr	Abstand	Beobachtung
	1217	–	Burchard von Ursberg[7]
	≈1299	≈81,4 Jahre 1217…1787 = 570 Jahre zwischen 8 Ereignissen	
	≈1380		
	≈1462		
	≈1543		
	≈1625		
	≈1706		
≈20. Dez. 1787	1788,0		Francis Wollaston
12. Mai 1866	1866,4	78,4 Jahre	John Birmingham
9. Feb. 1946	1946,1	79,8 Jahre	mehrere
	≈2025	*79-80 Jahre*	*Prognose, Stand 1/2025*[8]

Figure 1. Light curve for T CrB. All B- and V-band observations are shown by the blue and green circles, respectively. ...

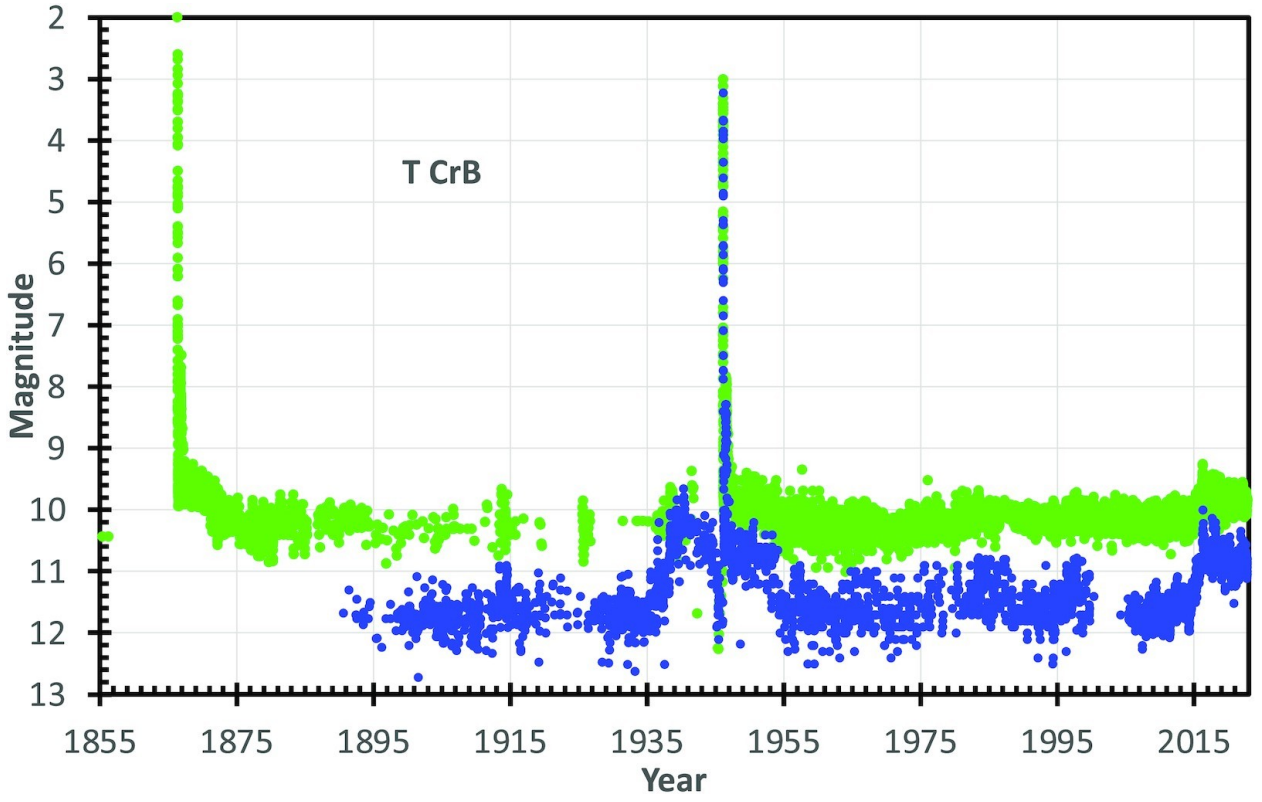


Figure 2. B and V eruption light curve for T CrB in 1866 and 1946.
Some binning of closely spaced magnitudes measures ...

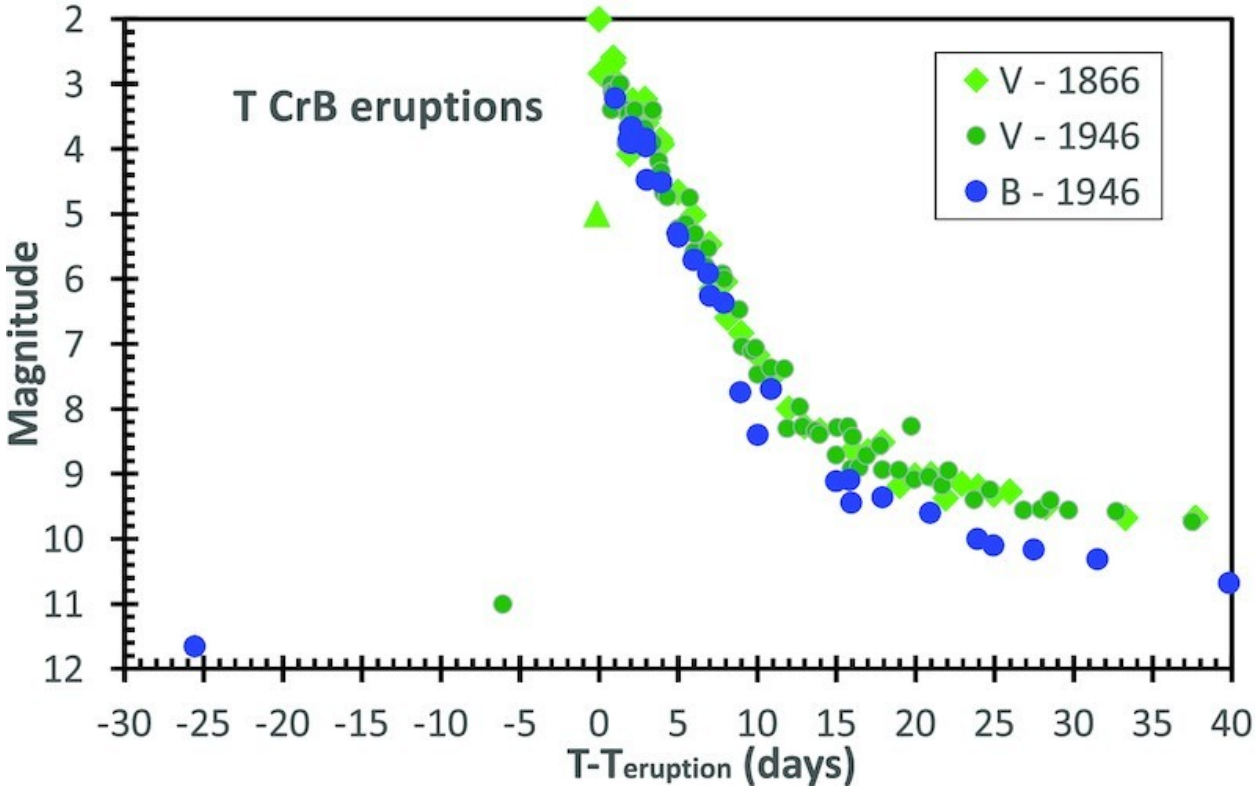


Figure 3. Secondary eruption light curve for T CrB in 1866 and 1946. We see that the timing and structure of the ...

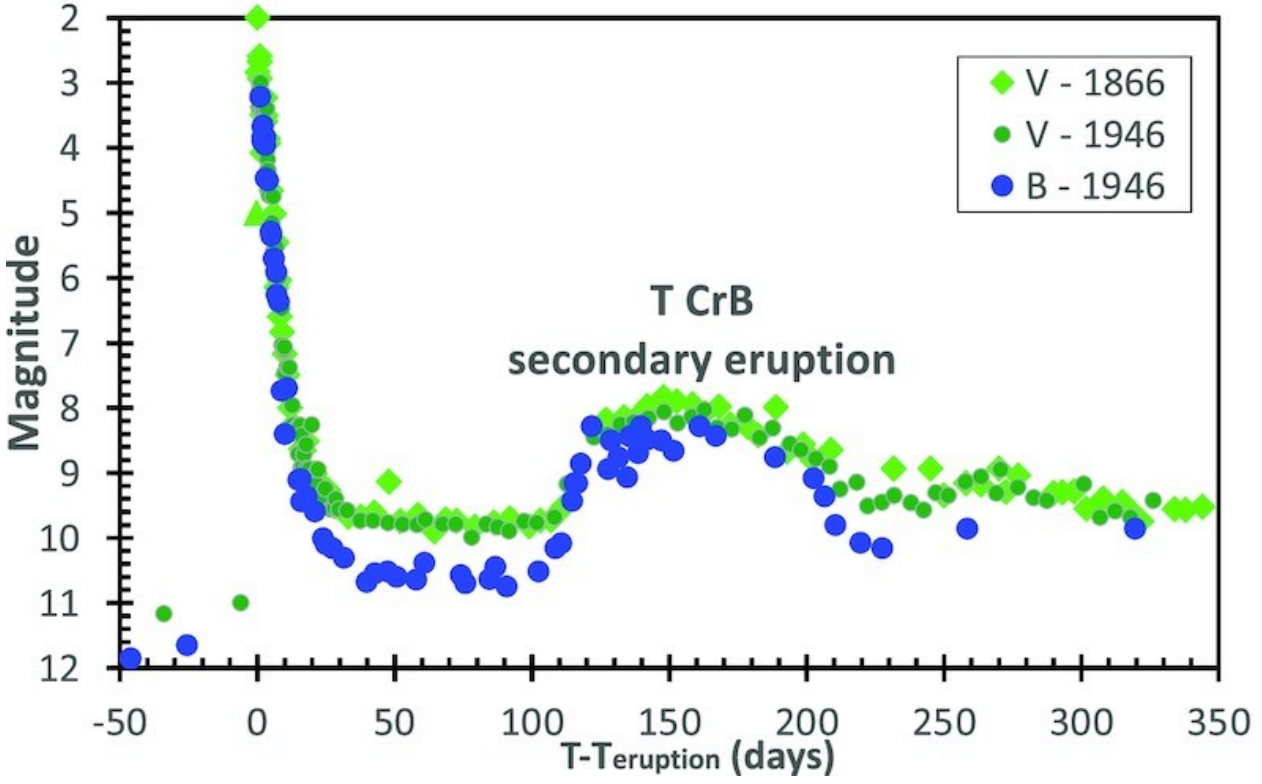


Figure 4. Pre-eruption dip in the year before the 1946 eruption. This light curve shows all of the un-binned B ...

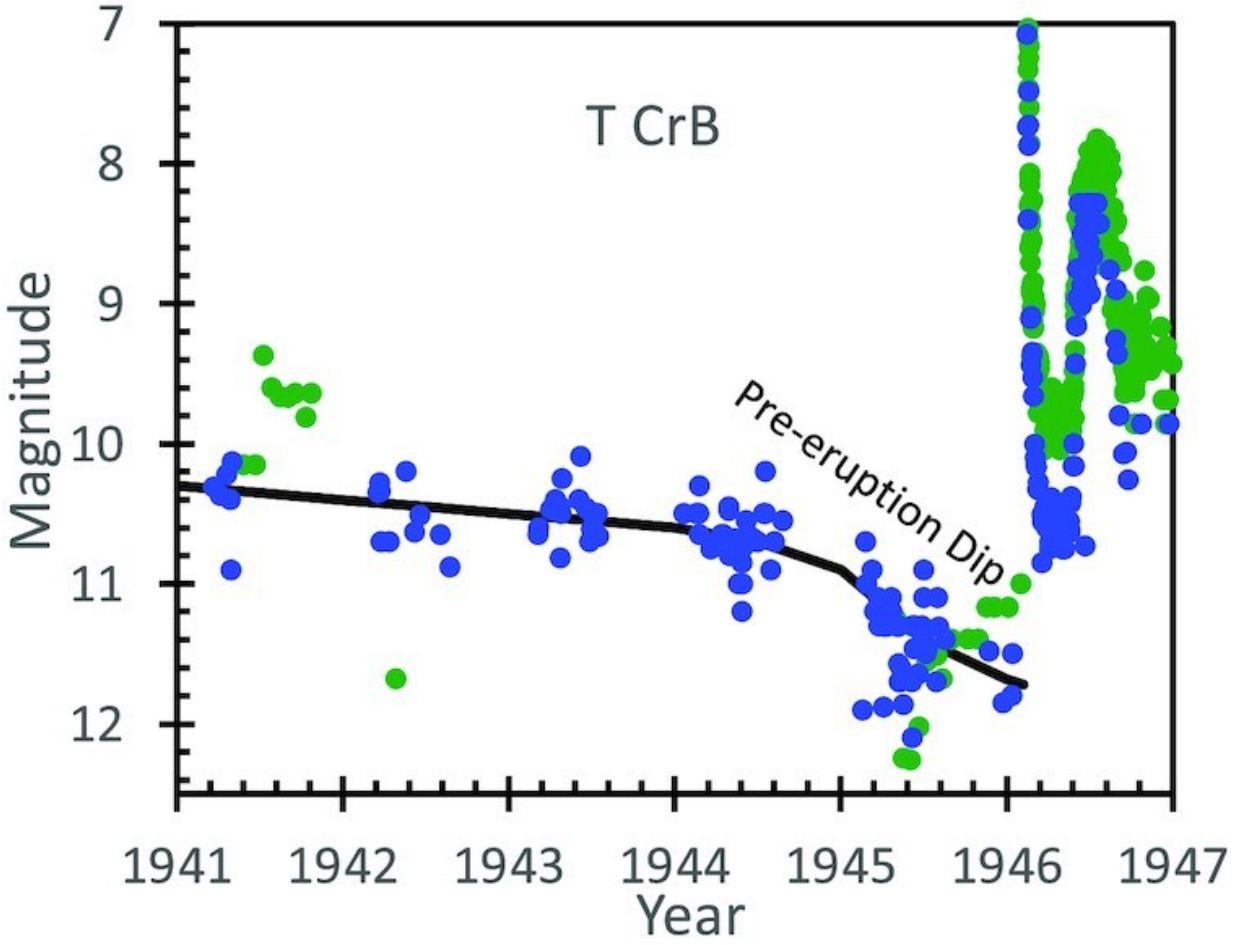
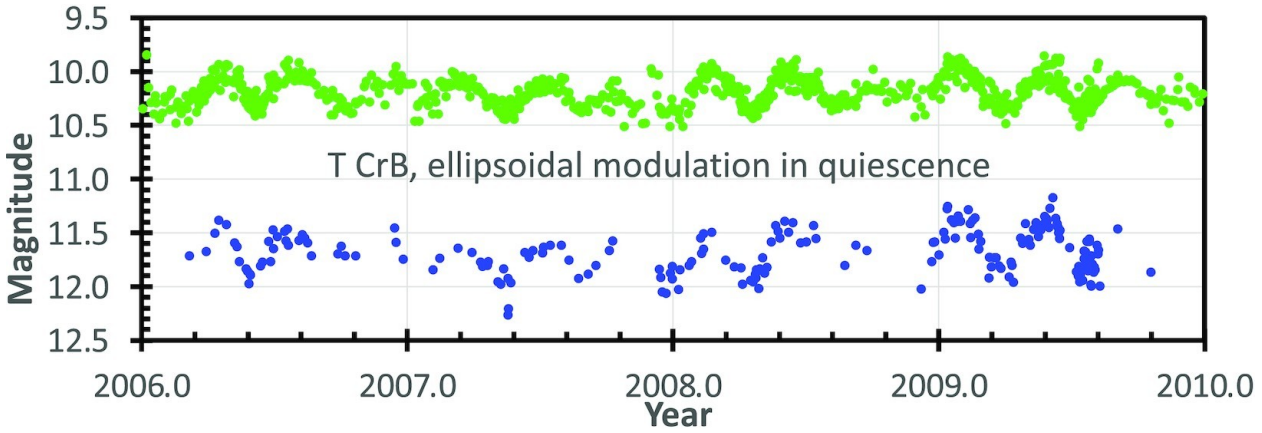


Figure 5. T CrB in normal quiescence, 2006–2010, with ellipsoidal modulation. The red giant star is necessarily ...



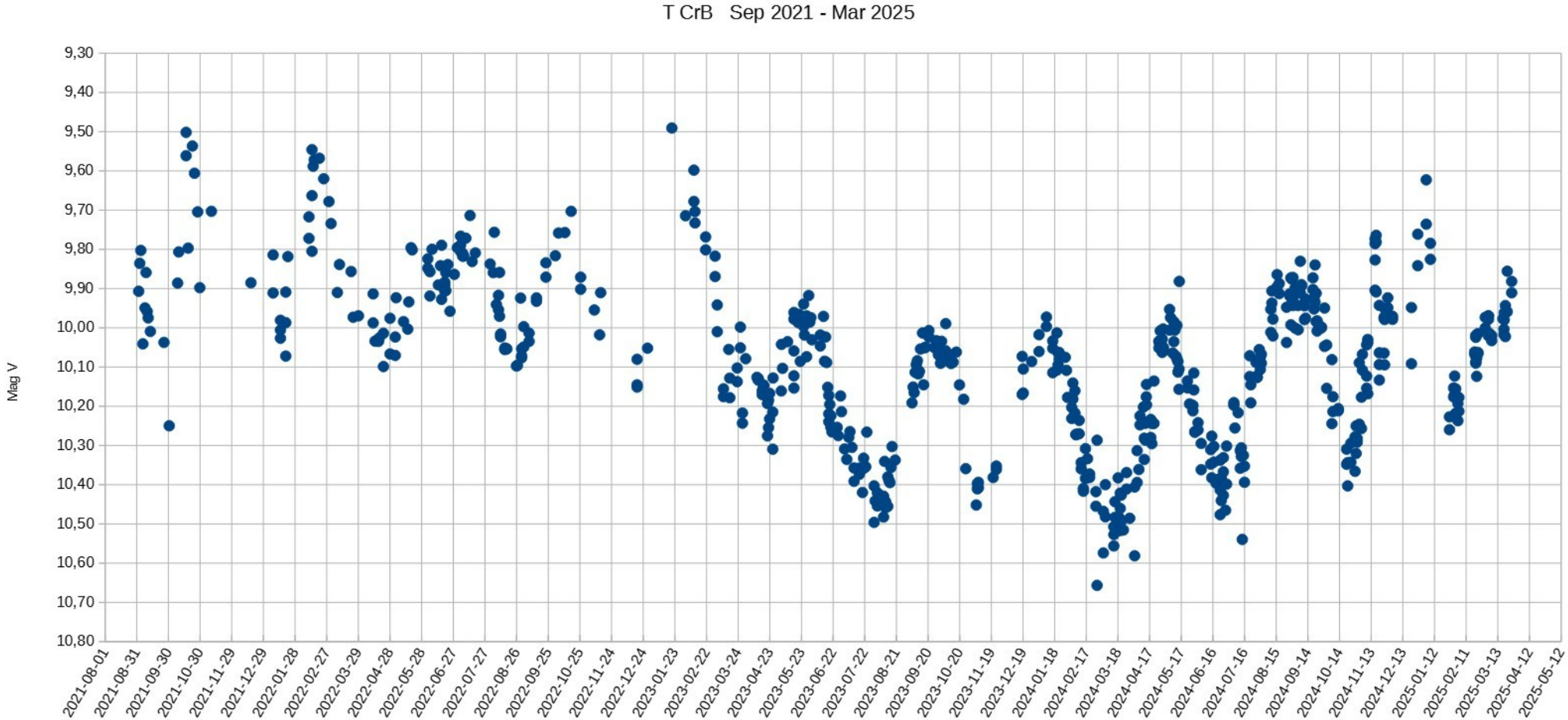
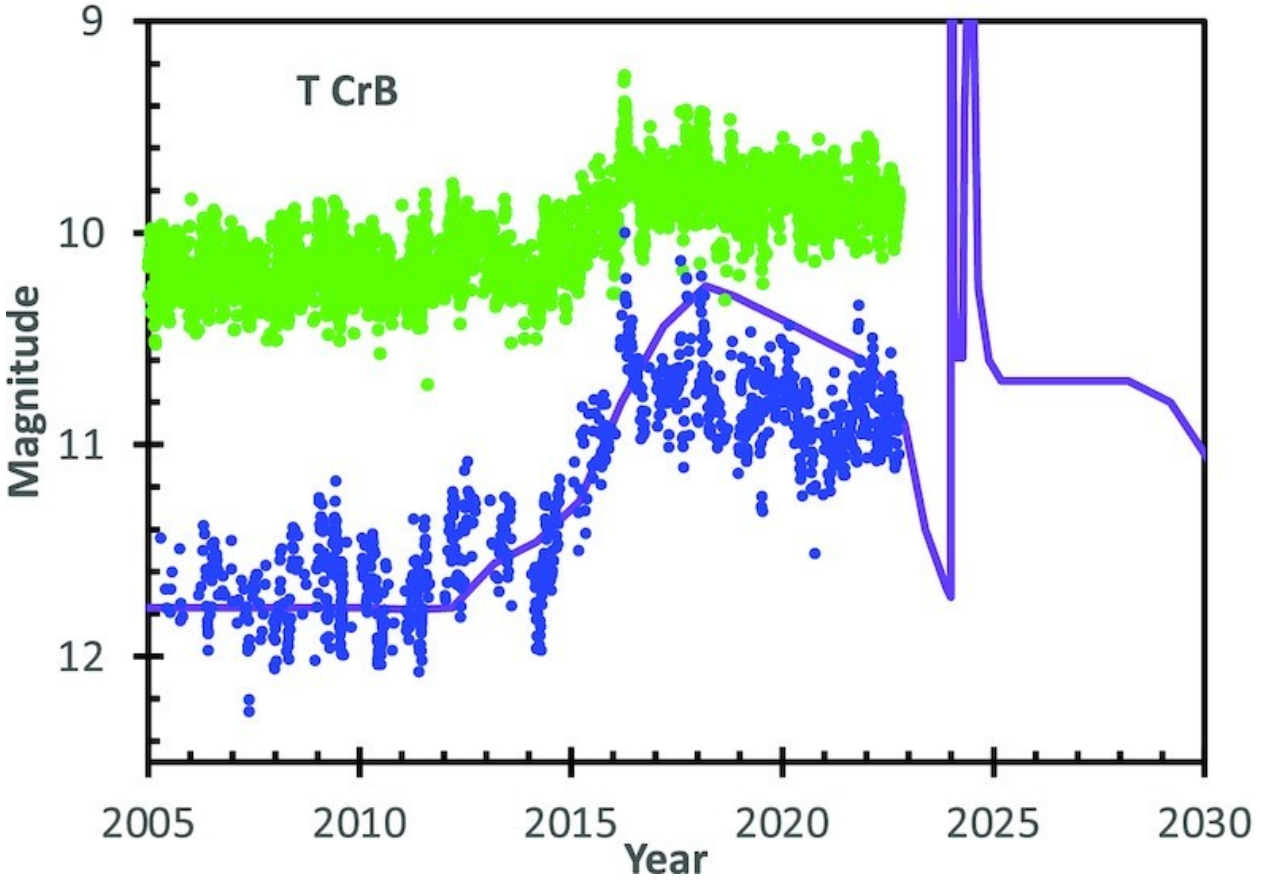

T CrB Sep 2021 - Mar 2025
Mag V
9,30
9,40
9,50
9,60
9,70
9,80
9,90
10,00
10,10
10,20
10,30
10,40
10,50
10,60
10,70
10,80
2021-08-01
2021-08-31
2021-09-30
2021-10-30
2021-11-29
2021-12-29
2022-01-28
2022-02-27
2022-03-29
2022-04-28
2022-05-28
2022-06-27
2022-07-27
2022-08-26
2022-09-25
2022-10-25
2022-11-24
2022-12-24
2023-01-23
2023-02-22
2023-03-24
2023-04-23
2023-05-23
2023-06-22
2023-07-22
2023-08-21
2023-09-20
2023-10-20
2023-11-19
2023-12-19
2024-01-18
2024-02-17
2024-03-18
2024-04-17
2024-05-17
2024-06-16
2024-07-16
2024-08-15
2024-09-14
2024-10-14
2024-11-13
2024-12-13
2025-01-12
2025-02-11
2025-03-13
2025-04-12
2025-05-12

Figure 9. The upcoming eruption of T CrB is predicted for the year 2025.5 ± 1.5. The light curve is a close-up of that ...



T Coronae Borealis

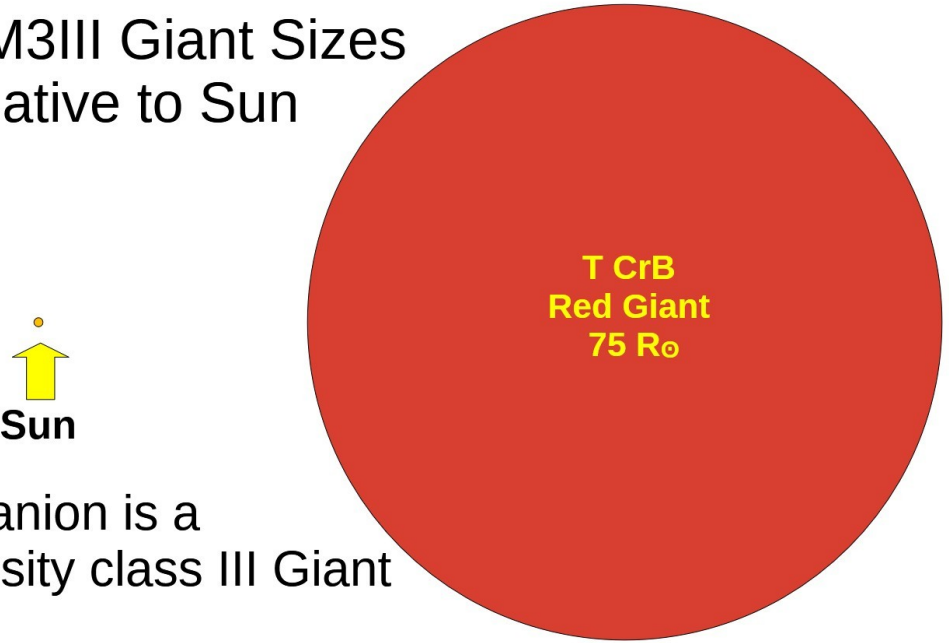
- Doppelsternsystem in ~900 pc ~3000 Lichtjahren Entfernung
- Roter Riese + Weißer Zwerg
-
-
-

	Temperatur	Masse	Durchmesser	Leuchtkraft
Roter Riese	3600 K	0,7x (1,1?) Sonne	70x Sonne	600x Sonne
Weißer Zwerg	100.000 K	1,37x Sonne	~ Erdgröße	100x Sonne

Umlaufzeit 227,5 Tage

- Abstand 0,54 AE ~ 81 Millionen Kilometer

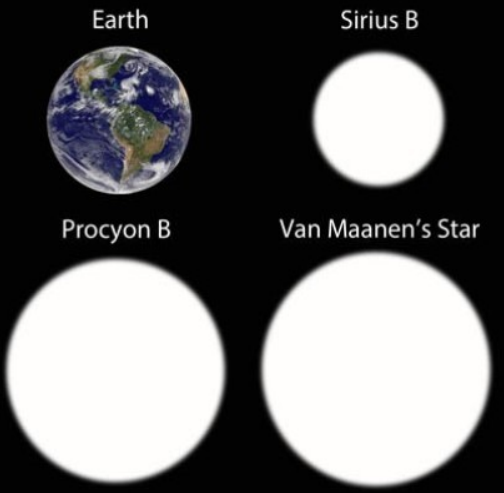
Sun & M3III Giant Sizes Relative to Sun

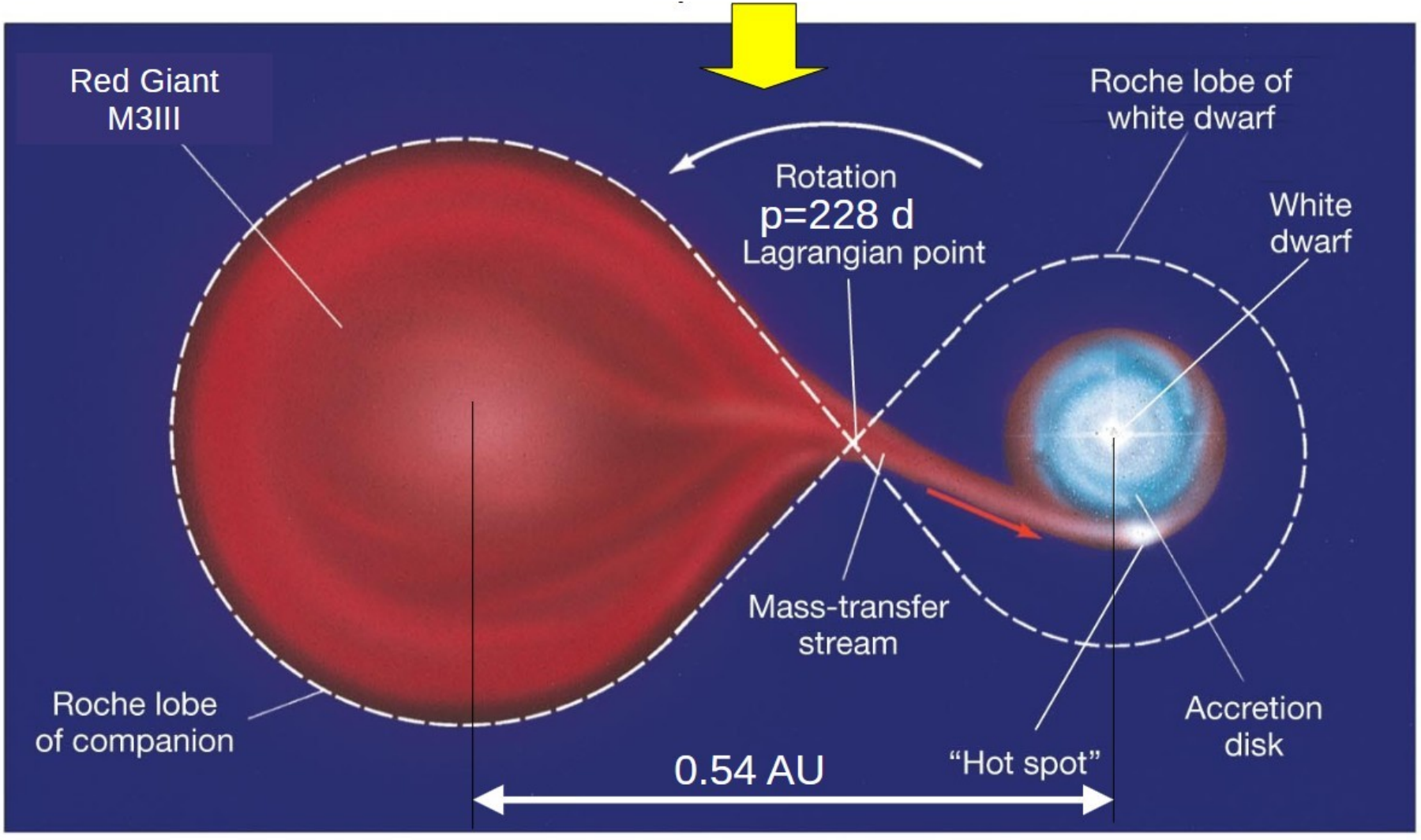


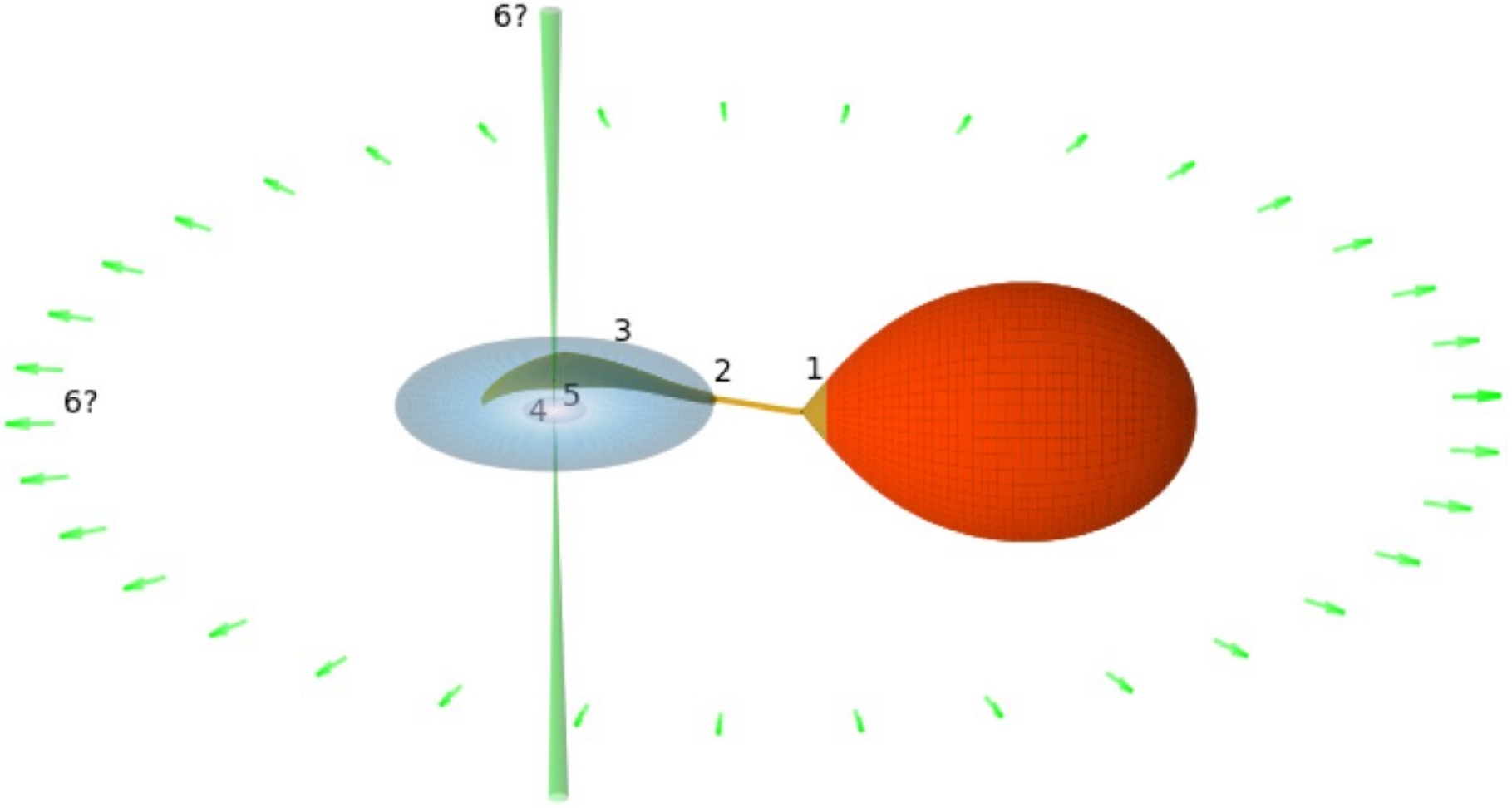
- Companion is a luminosity class III Giant

White Dwarfs

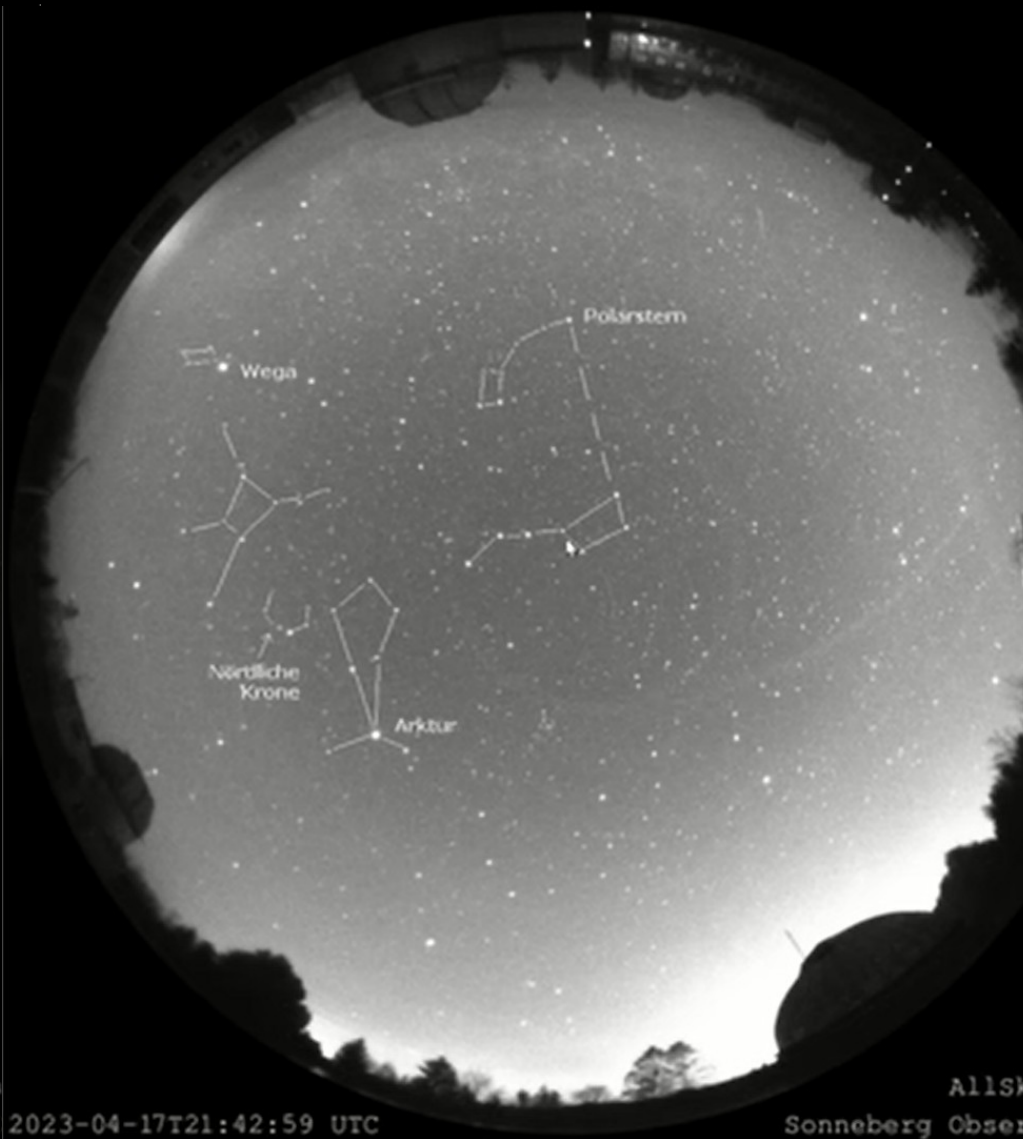
- Small, Earth sized +/-
- Massive ~$M_{\odot}$
- Dense ~10^9 kg/m^3
- Electron degenerate
- No fusion
- Initially hot (white) then cool to Black Dwarf & crystallizes

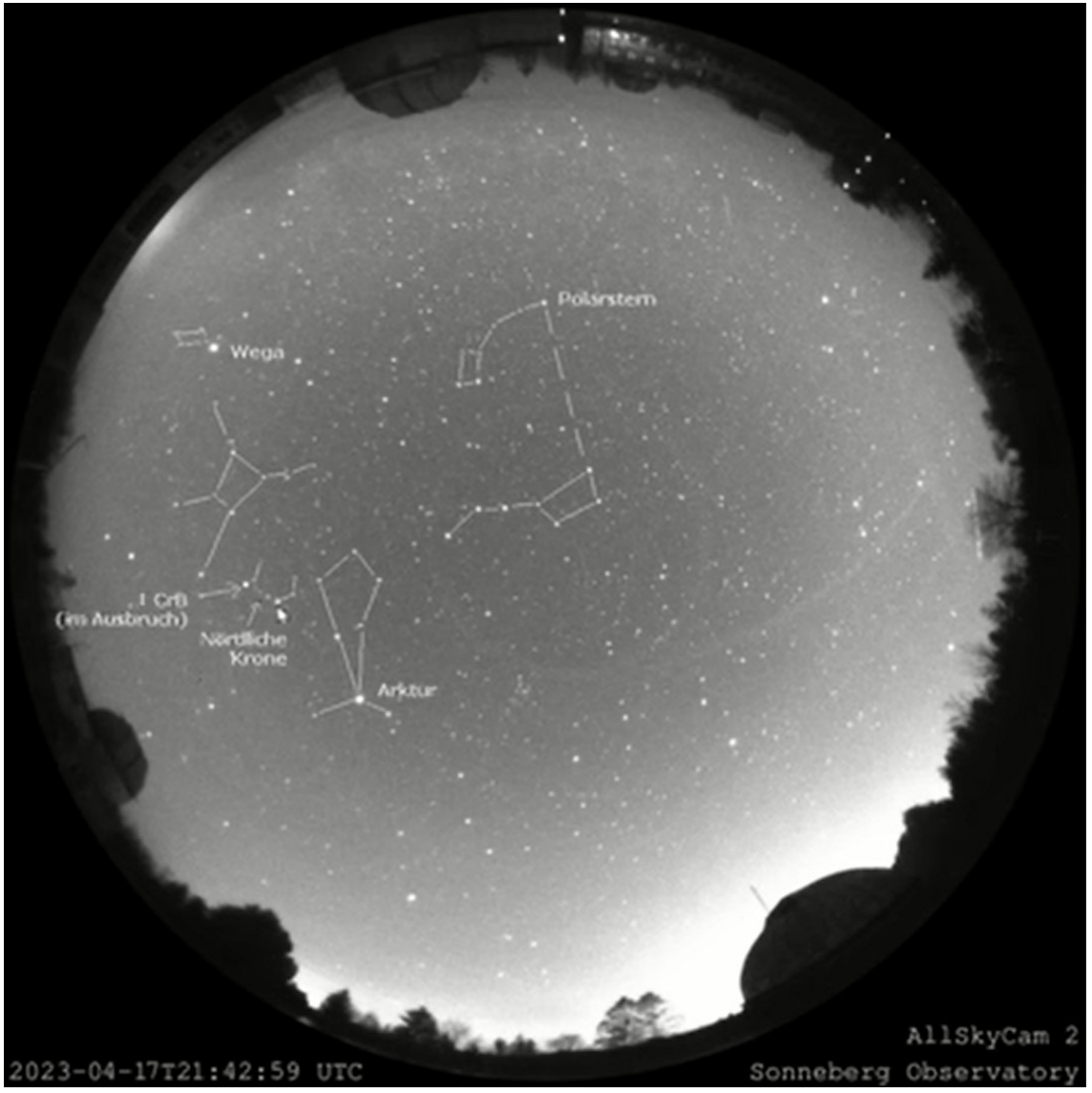



Red Giant
M3III
Roche lobe of
white dwarf
Rotation
p=228 d
Lagrangian point
White
dwarf
Mass-transfer
stream
Roche lobe
of companion
0.54 AU
"Hot spot"
Accretion
disk


6?
6?
1
2
3
4
5


AllSkyCam
2023-04-17T21:42:59 UTC
Sonneberg Observato


Polarstern
Wega
Nördliche Krone
Arktur
2023-04-17T21:42:59 UTC
Sonneberg Obse



T CrB

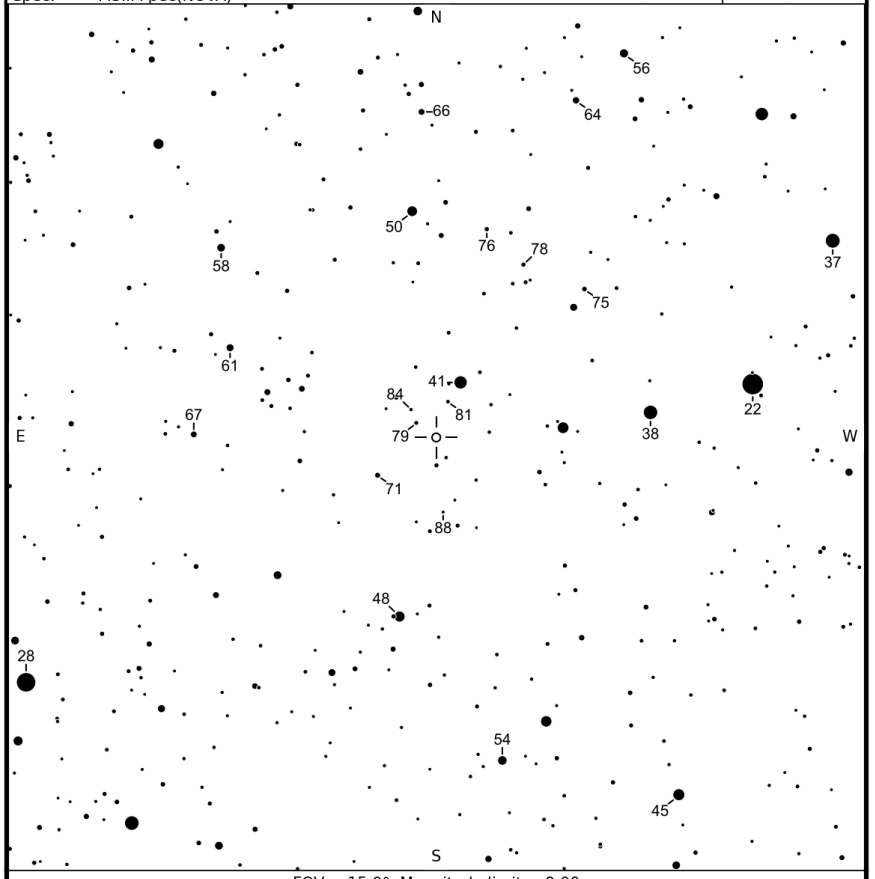
Max mag: 2.0 V
Min mag: 10.8 V
Period: 227.55
Type: NR+ELL
Spec: M3III+pec(NOVA)

T CrB

(J2000) 15:59:30.16 +25:55:12.6
Stars in the chart are drawn at J2015.5

AAVSO
Binocular
Chart

X36941C



FOV = 15.0°, Magnitude limit = 9.00

Please use the photometry table for CCD observations.

https://www.aavso.org/vsp

T CrB

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(J2000) 15:59:30.16 +25:55:12.6
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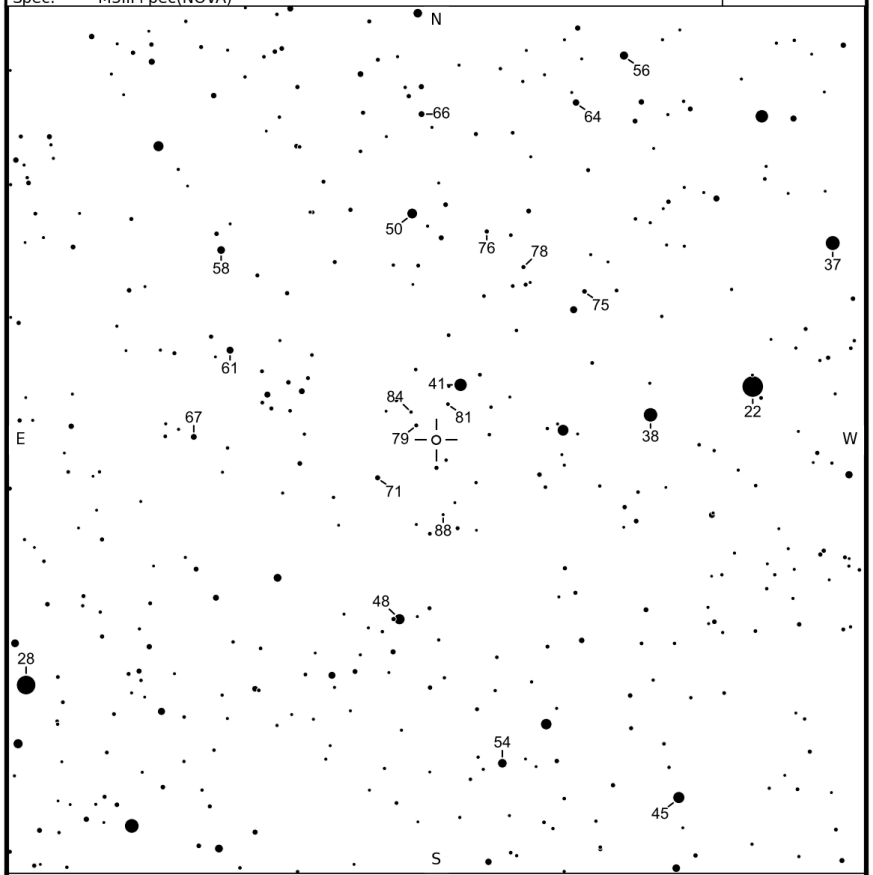

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T CrB

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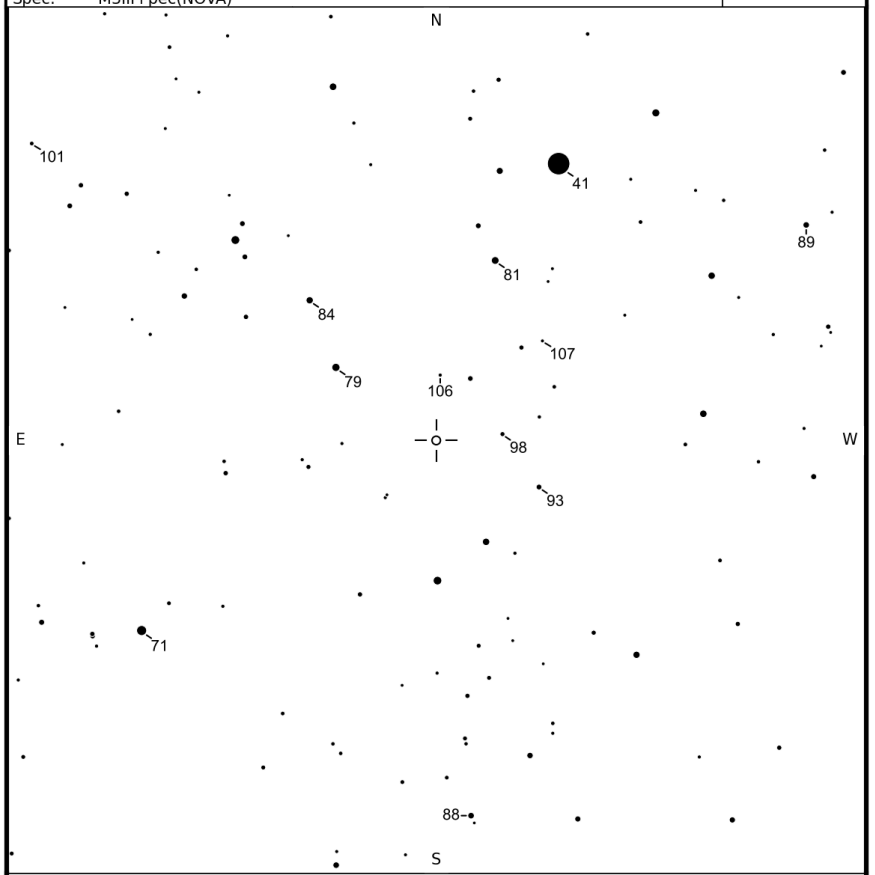
Chart

X36941B



FOV = 3.0°, Magnitude limit = 11.00

Please use the photometry table for CCD observations.

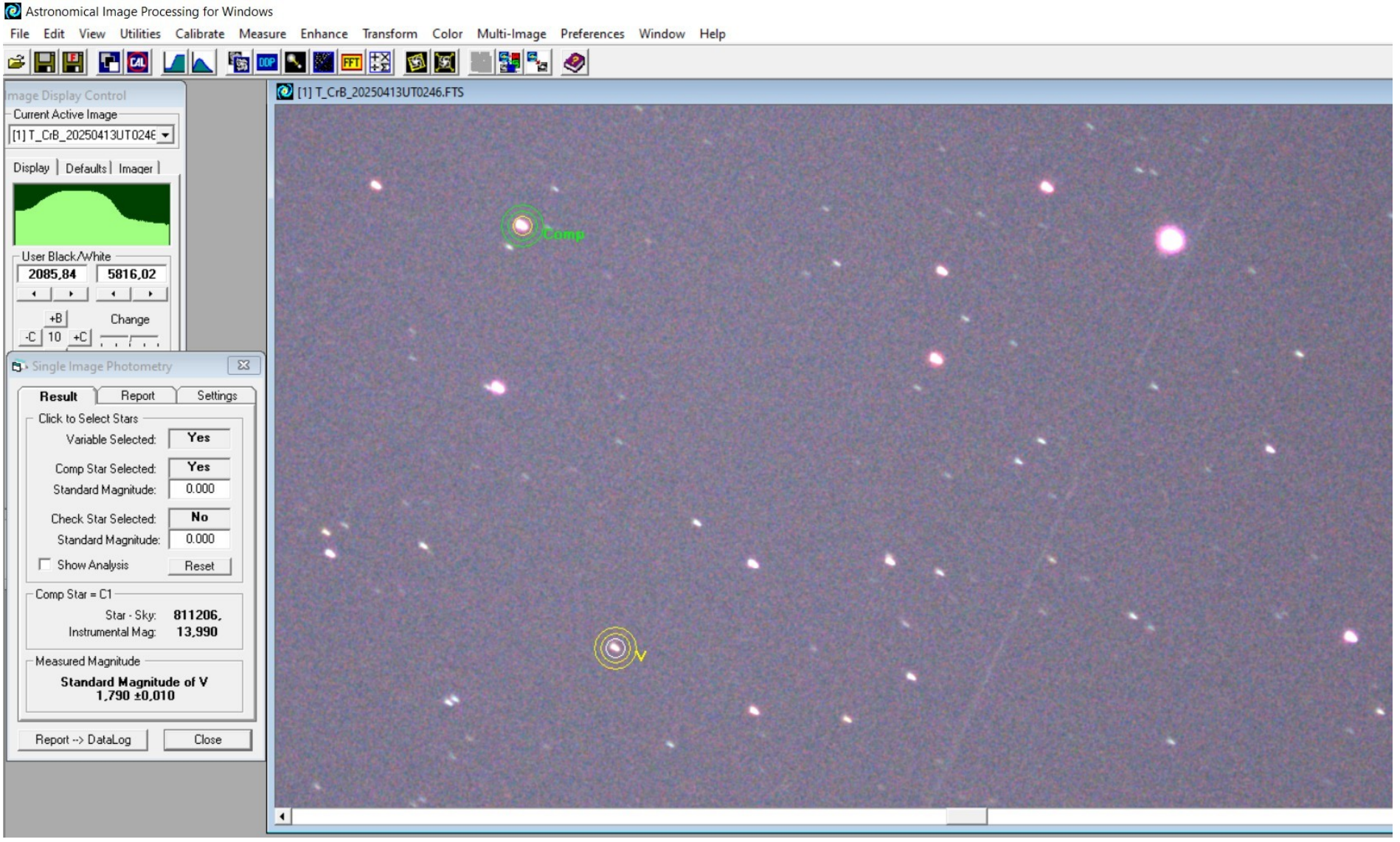

Astronomical Image Processing for Windows
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Image Display Control
Current Active Image
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Display Defaults Imager
User Black/White
2085,84
5816,02
+B
Change
-C 10 +C
Single Image Photometry
Result Report Settings
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Variable Selected: Yes
Comp Star Selected: Yes
Standard Magnitude: 0.000
Check Star Selected: No
Standard Magnitude: 0.000
Show Analysis
Reset
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Star - Sky: 811206,
Instrumental Mag: 13,990
Measured Magnitude
Standard Magnitude of V
1,790 ±0,010
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Close
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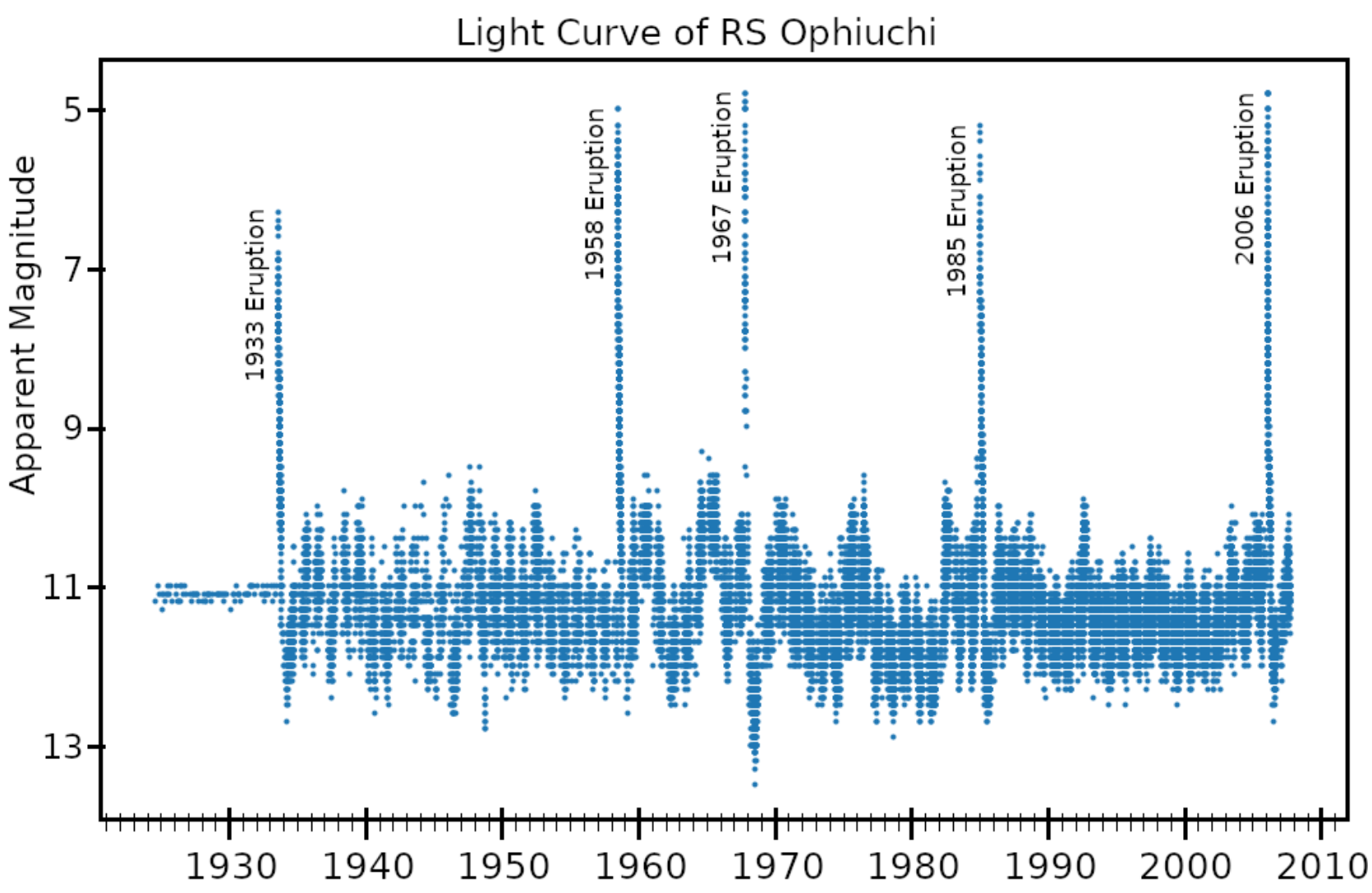
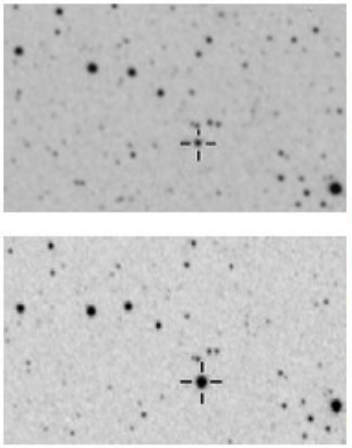
Comp
V



Getting to Know SS Cygni



SS Cygni in its low and high states, as taken with the Stamford Observatory 22-inch Maksutov telescope at f/3.7. Images courtesy of Charles Scovil.

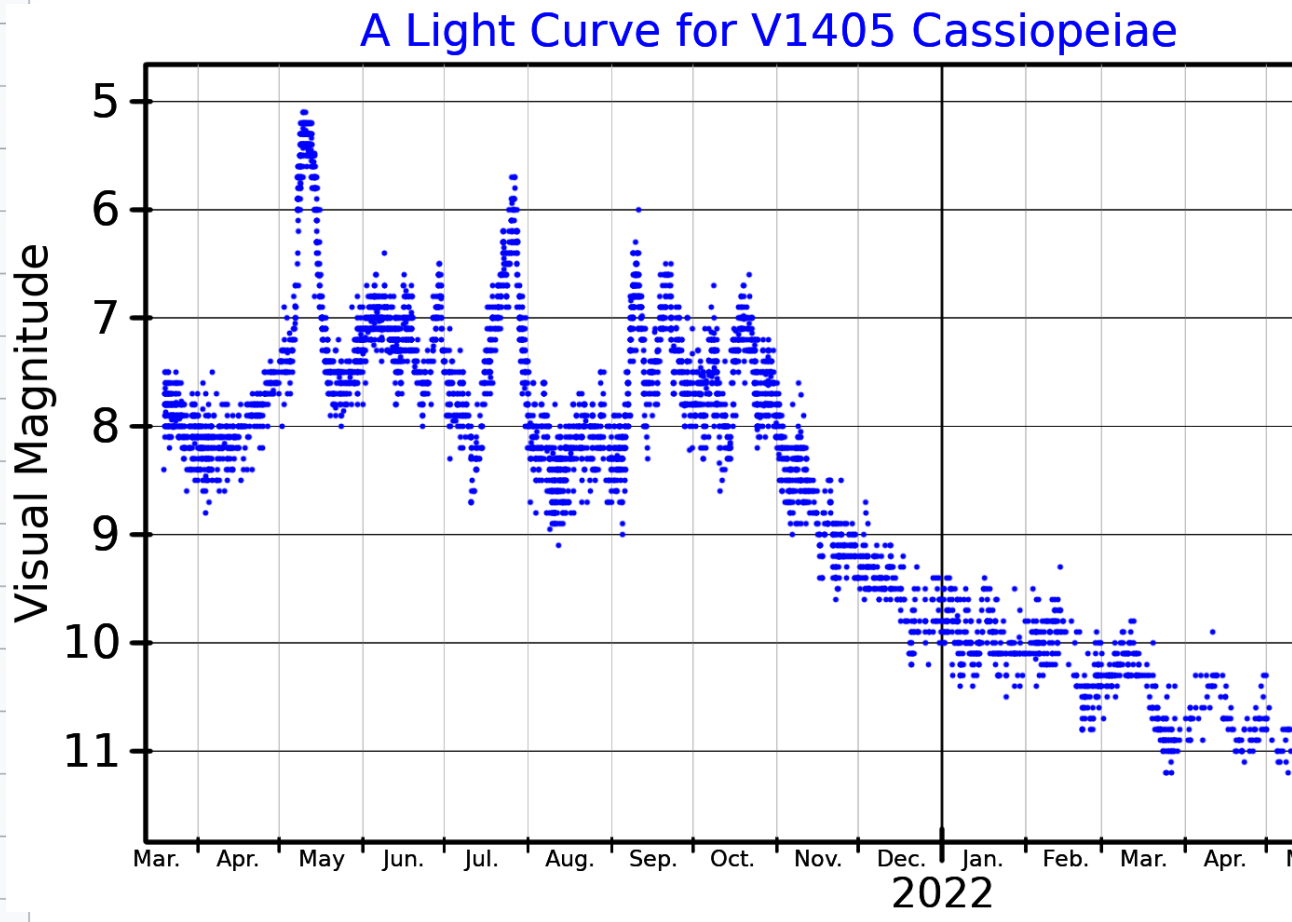
With many dilligent observers watching SS Cyg for well over a century, the tireless behavior of the variable has been well observed in the visual portion of the spectrum. SS Cyg typically remains in quiescence about 75% of the time. From this low state, the star then begins to brighten without warning, and reaches maximum light in just a day or so. The light curve of SS Cyg then shows a distribution of alternating wide and narrow outbursts which bear no specific cyclic pattern. Based on the AAVSO International Database, SS Cyg has a visual range of 12.2 at minimum to 8.3 at maximum. Recurrence can be expected every 4-10 weeks, with a duration of 1-2 weeks.

SS Cyg, like all other cataclymic variables, consists of a close binary system. One of the components is a red dwarf-type star, cooler than our Sun, while the other is a white dwarf. Studies suggest that the stars in the SS Cyg system are separated (from surface to surface) by "only" 100,000 miles or less. In fact, the stars are so close that they complete their orbital revolution in slightly over 6 1/2 hours! Astronomically speaking, SS Cyg is also fairly close by, being a distance of 90 to 100 light years from its Earth-bound admirers (Burnham, 1978). The inclination of the system has been calculated to be about 50 degrees, yielding a respective component mass of M_{wd} = 0.60 solar mass and M_{ms} = 0.40 solar mass (Honey, et al., 1989).

SS Cyg's bright appearance, frequent outbursts, and location in the sky seem to be almost a recipe for a successful variable star!

Full name	Discoverer	Distance (ly)	Magnitude range	Days to drop 3 magnitudes from peak	Known eruption years	Interval (years)	Years since latest eruption
CI Aquilae	K. Reinmuth	8590 ± 830	8.6–16.3	40	1917, 1941, 2000	24–59	24
V394 Coronae Australis	L. E. Erro	17 000 ± 3000[27]	7.2–19.7	6	1949, 1987	38	37
T Coronae Borealis	J. Birmingham	2987 ± 75	2.5–10.8	6	1217, 1787, 1866, 1946	80	79
IM Normae	I. E. Woods	9800 ± 1600[28]	8.5–18.5	70	1920, 2002	≤82	23
RS Ophiuchi	W. Fleming	8740 ± 850	4.8–11	14	1898, 1907, 1933, 1958, 1967, 1985, 2006, 2021	9–26	3
V2487 Ophiuchi	K. Takamizawa (1998)	20 900 ± 5200[29]	9.5–17.5	9	1900, 1998	98	26
T Pyxidis	H. Leavitt	9410 ± 780	6.4–15.5	62	1890, 1902, 1920, 1944, 1967, 2011	12–44	14
V3890 Sagittarii	H. Dinerstein	16 000[30]	8.1–18.4	14	1962, 1990, 2019	28–29	5
U Scorpii	N. R. Pogson	31 300 ± 2000[31]	7.5–17.6	2.6	1863, 1906, 1917, 1936, 1979, 1987, 1999, 2010, 2022,	8–43	2
V745 Scorpii	L. Plaut	25 400 ± 2600[31]	9.4–19.3	7	1937, 1989, 2014	25–52	11

1999	V1494 Aquilae	+4.0
2000	V445 Puppis	+8.6
2002	V4743 Sagittarii	+5.0[5]
2006	RS Ophiuchi	+4.5
2007	V1280 Scorpii	+3.9[6][7]
2009	KT Eridani	+5.5
2013	V339 Delphini	+4.3[8]
2013	V1369 Centauri	+3.3[9]
2015	V5668 Sagittarii	+4.0[10][11]
2016	V407 Lupi	+5.6[12]
2016	V5856 Sagittarii	+5.5[13]
2018	FM Circini	+5.8[14]
2018	V906 Carinae	+5.9[15]
2018	V392 Persei	+6.2[16]
2020	YZ Reticuli	+3.7[17][18]
2021	RS Ophiuchi	+4.6[19]
2021	V1674 Her	+6.0[20]
2021	V1405 Cas	+5.4[21]
2022	V415 Muscae	+8.7[22]




8
29
9
1
5
10
0
5
10
15
Magnitude
Visible limit
for naked eye
Dropped back
below naked
eye visibility
on about
Sept 8
Became visible
to the naked eye
on Aug 29, 1975
Nova Cygni
1975
Deneb