В ОЧАКВАНЕ НА ИЗБУХВАНЕТО НА T CRB

Кирил Стоянов

С подкрепата на проект “Accretion Flows in binary stars”
КП-06-Н98/8
9.12.2025

ИСТОРИЯ НА НАБЛЮДЕНИЯТА НА T CRB ОТ БЪЛГАРСКИ АСТРОНОМИ

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LETTER TO THE EDITOR

Accretion in the recurrent nova T CrB: Linking the superactive state to the predicted outburst★

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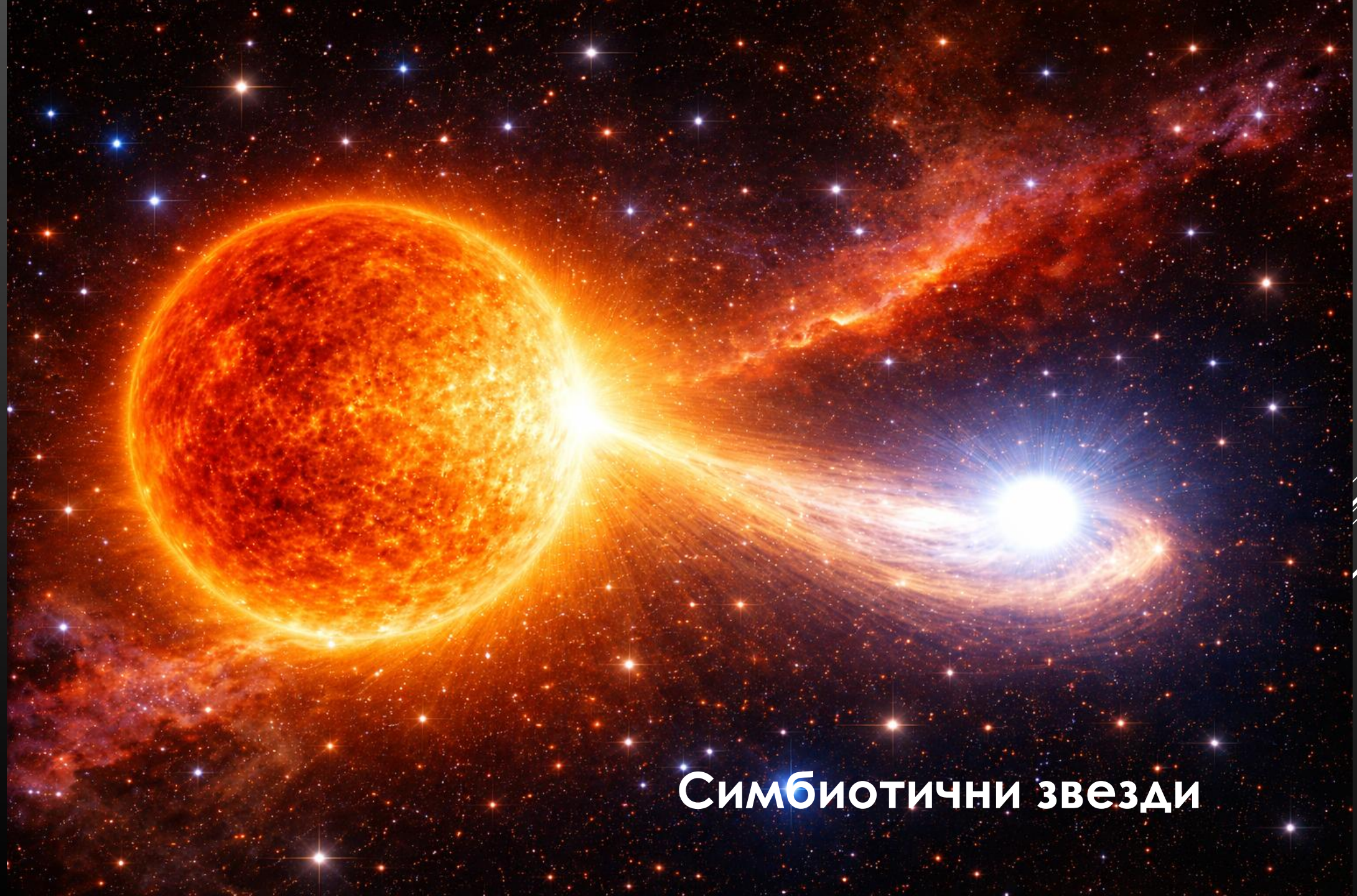
Симбиотичната повторна Нова T CrB

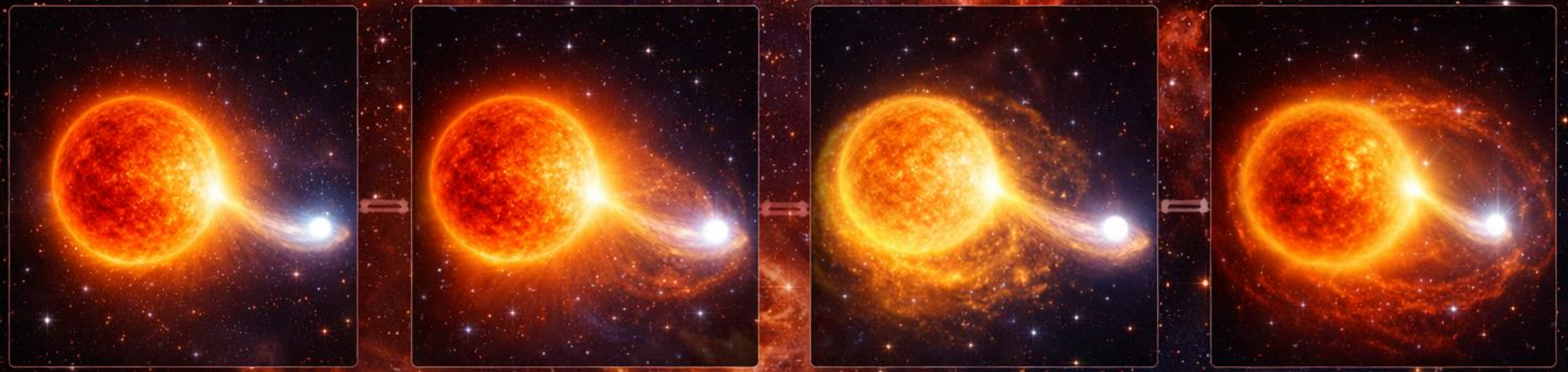
Симбиотичната повторна Нова T CrB



Симбиотични звезди

Symbiotic Star Types

Based on Dust Content

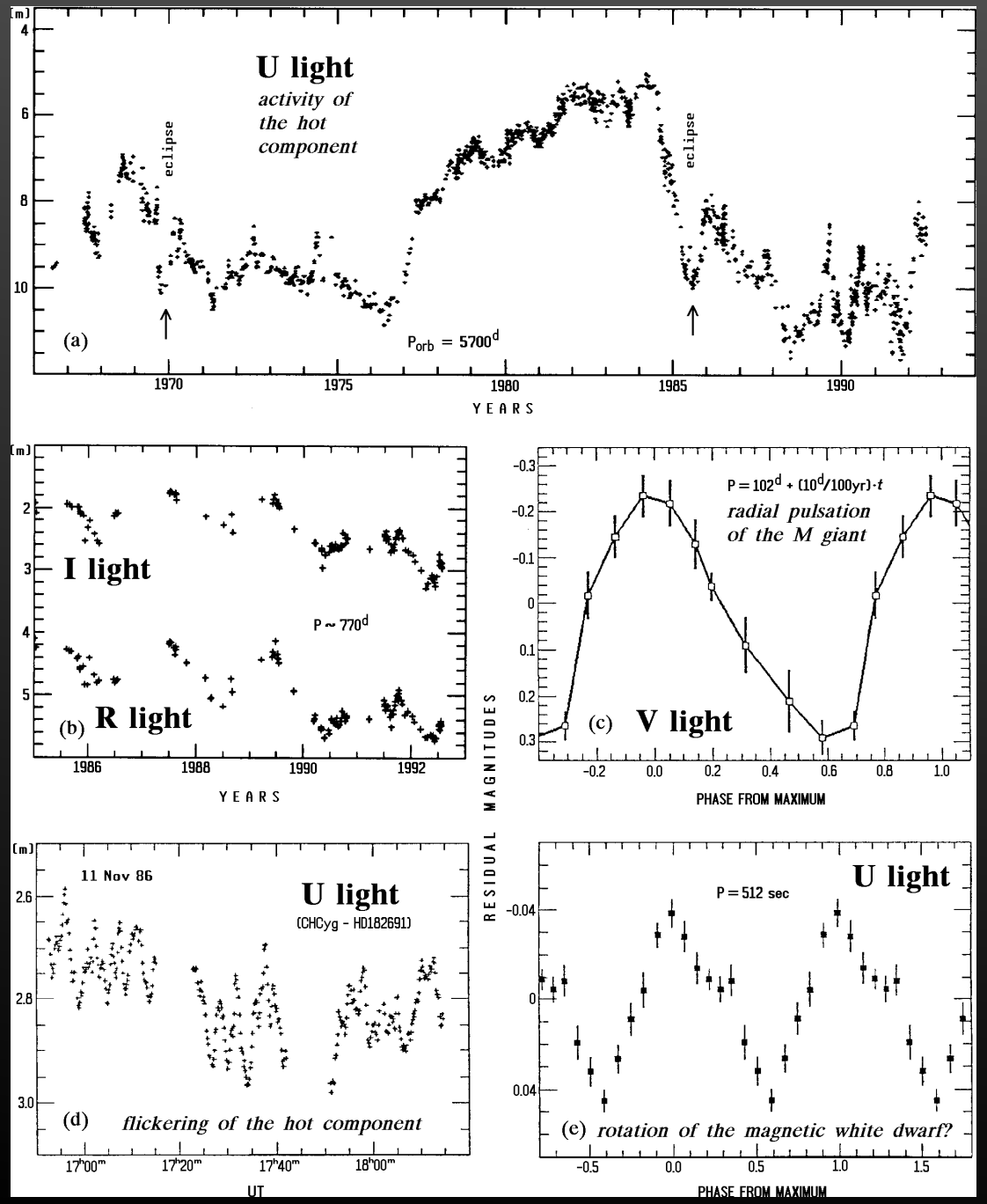


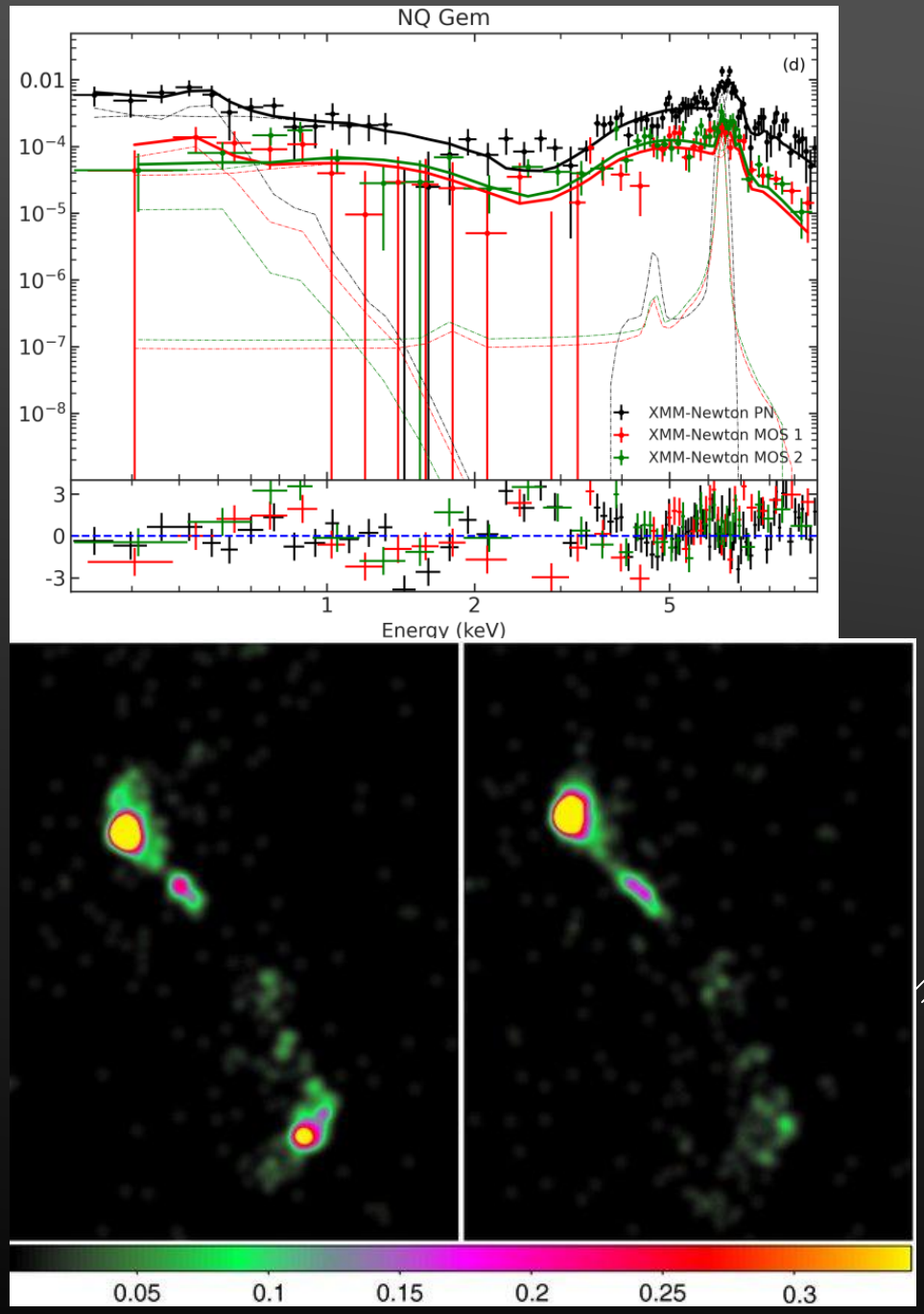
S-type
(stellar)
Little to no dust.

S+IR
Weak IR excess
(some dust)

D′-type
(dusty prime)
Cooler dust.

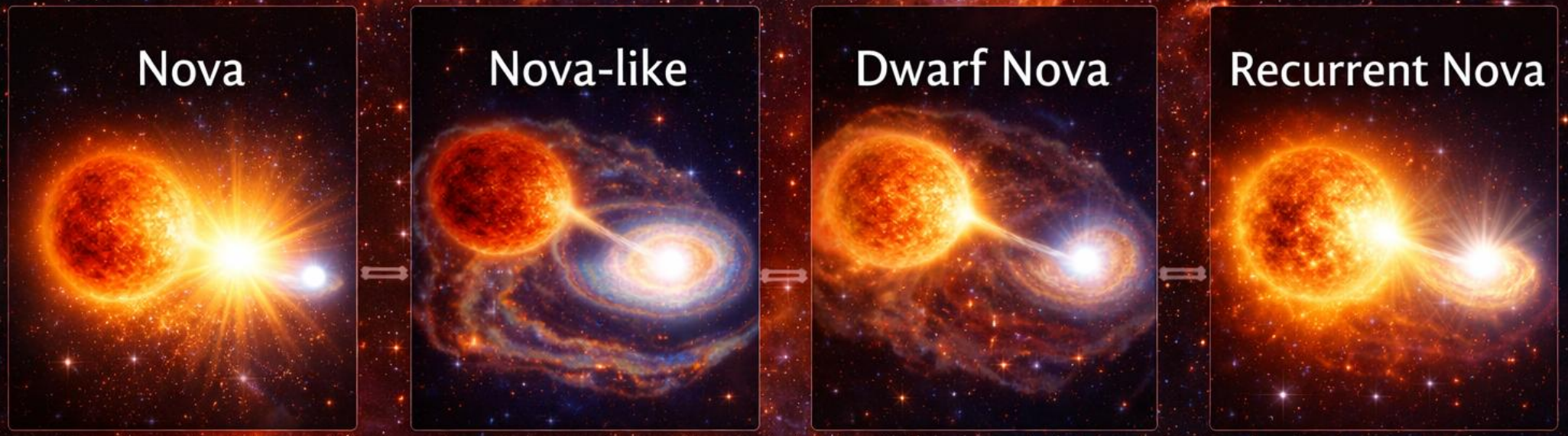
D-type
(dusty)
Warm, dense dust


U light
activity of the hot component
eclipse
eclipse
(a)
P_{orb} = 5700^d
YEARS
I light
P ~ 770^d
(b) R light
YEARS
P = 102^d + (10^d/100yr)·t
radial pulsation of the M giant
(c) V light
PHASE FROM MAXIMUM
RESIDUAL MAGNITUDES
11 Nov 86
U light
(CHCyg - HD182691)
(d) flickering of the hot component
UT
P = 512 sec
U light
(e) rotation of the magnetic white dwarf?
PHASE FROM MAXIMUM


NQ Gem
(d)
XMM-Newton PN
XMM-Newton MOS 1
XMM-Newton MOS 2
Energy (keV)
0.05
0.1
0.15
0.2
0.25
0.3

Симбиотичната повторна Нова T CrB

Cataclysmic Variable Stars



One-time nova eruption

Very bright, steady accretion

Flickers due to disk outbursts

Multiple nova eruptions

Hibernation Theory
in Cataclysmic Variables

Active Phase

- Magnetically braked or dwarf nova-like

Nova Eruption

Bright nova eruption

- White dwarf heats up

Nova Eruption

- White dwarf cools down
- Mass transfer drops off

Weakens

Hibernation

- Mass transfer near zero
- System extremely faint

Orbital evolution

Reactivation

- Low mass transfer resumes

Fades

Симбиотични повторни нови:

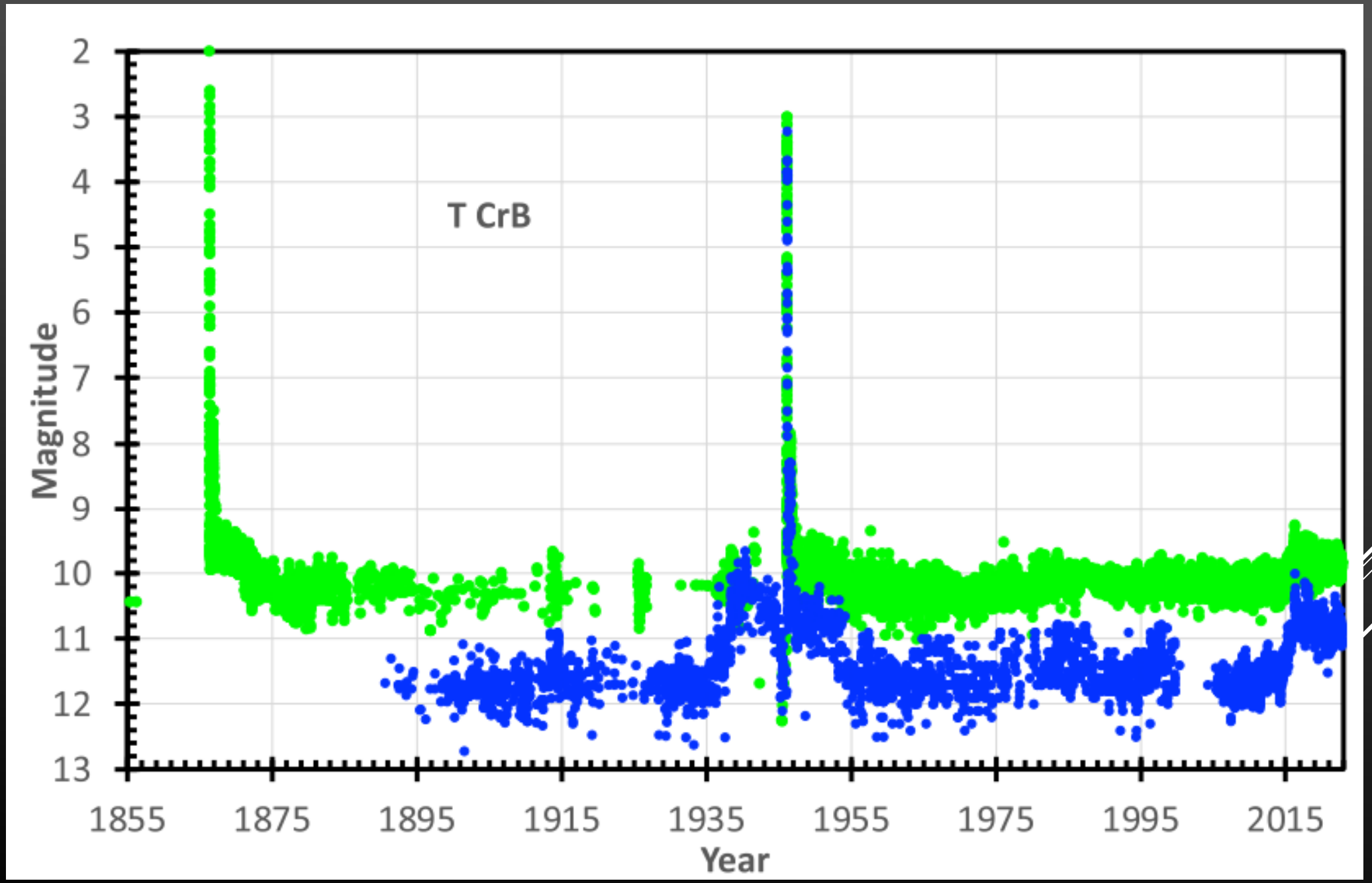
- RS Oph
- T CrB
- V3890 Sgr
- V745 Sco
- V618 Sgr
- LMC S154

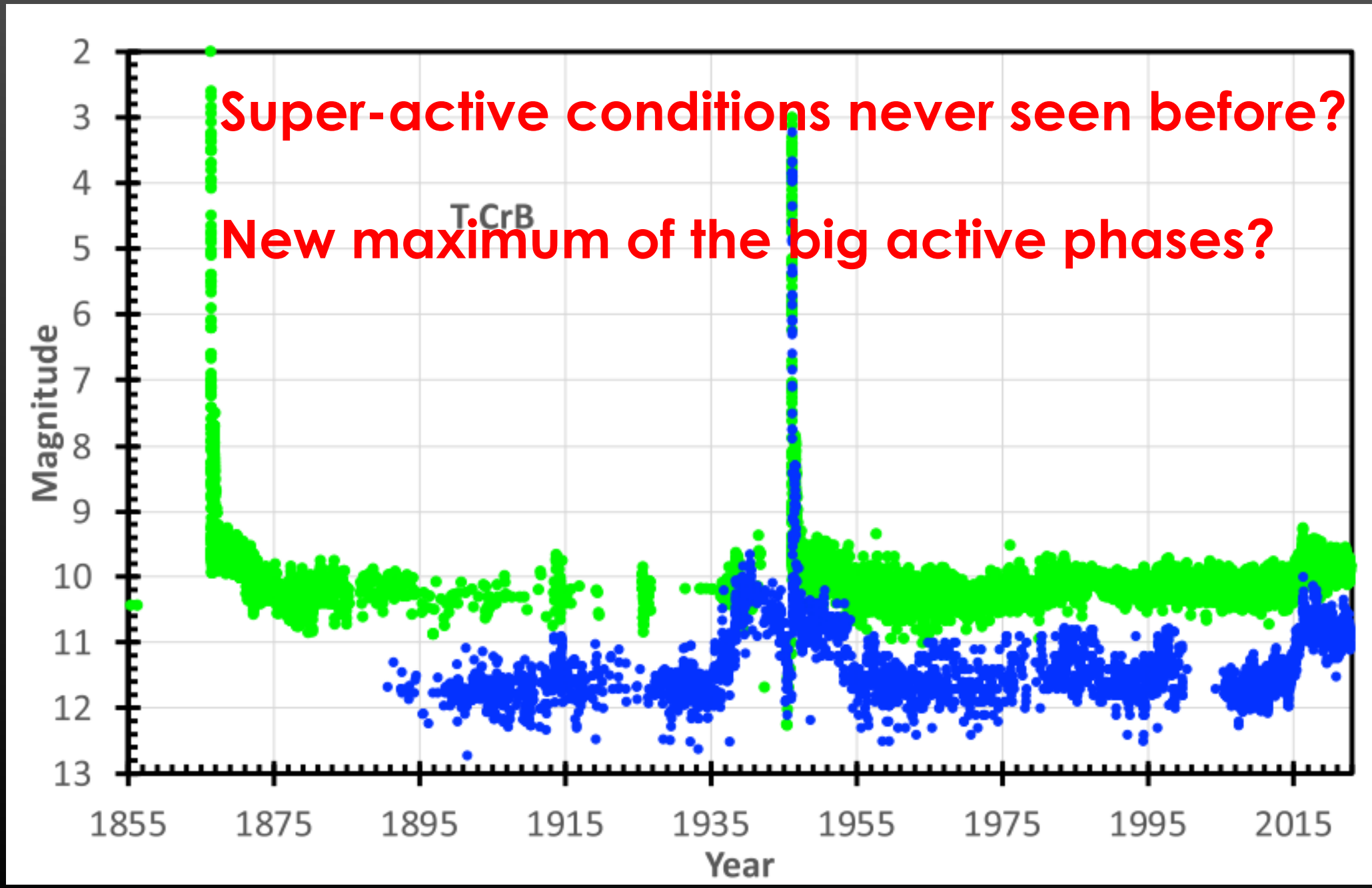
T CRB

M4 гигант (0.7 слънчеви маси) + масивно WD (1.37 слънчеви маси)

P_{orb} = 227.57 дни

Период между избухванията ~ 80 години


T CrB
Magnitude
2
3
4
5
6
7
8
9
10
11
12
13
1855
1875
1895
1915
1935
1955
1975
1995
2015
Year


Super-active conditions never seen before?
New maximum of the big active phases?
T CrB
Magnitude
Year
2
3
4
5
6
7
8
9
10
11
12
13
1855
1875
1895
1915
1935
1955
1975
1995
2015

Symbiotic Star T CrB as an Extreme SU UMa–type Dwarf Nova

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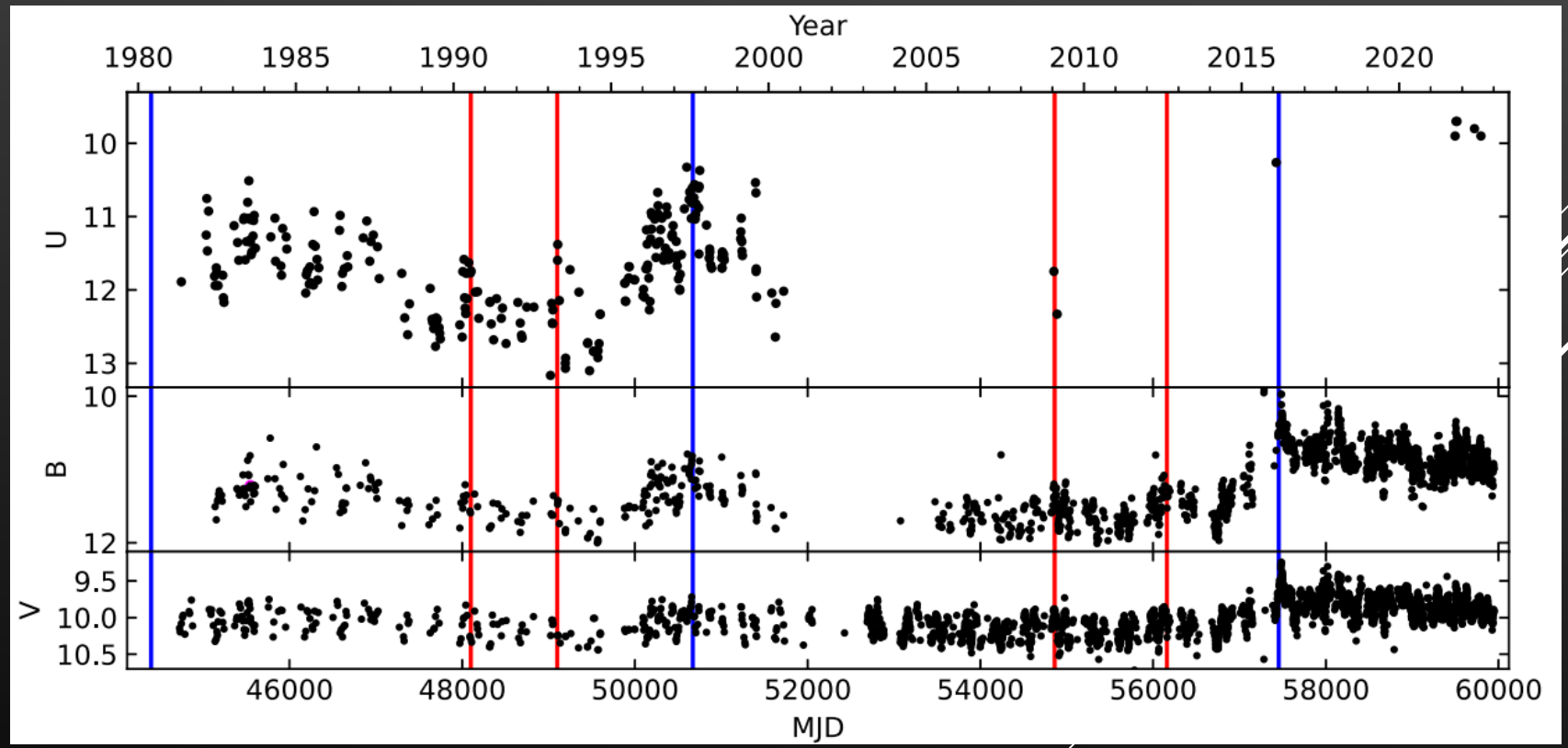
SU UMa – 3:1 приливни резонанси в акреационния диск

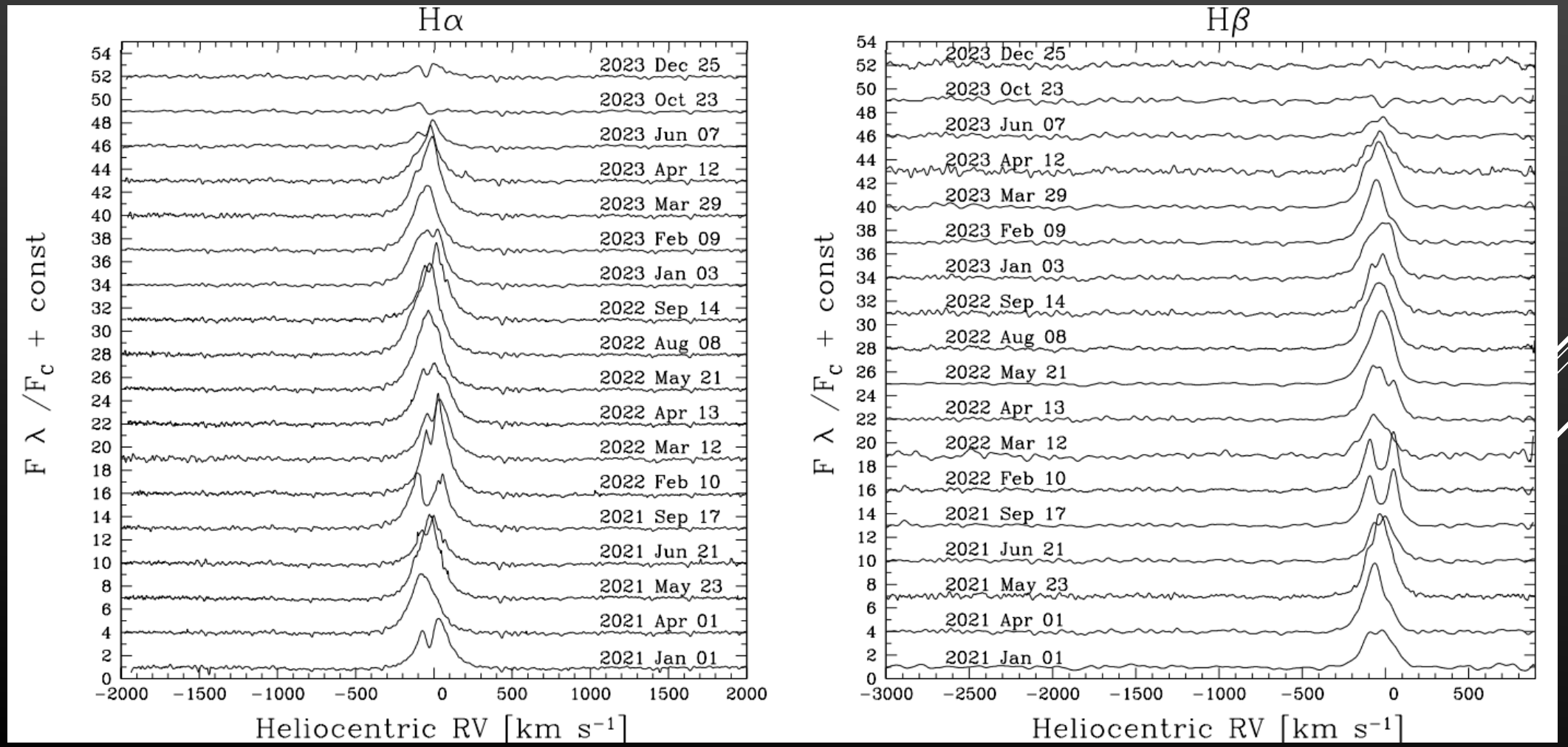
Период между избухванията тип джудже нова – 2.7 години

Bollimpalli et al. (2018) моделира периодичност между 1.5 и 4 години



Evolution of the optical emission lines and the X-ray emission during the super-active stage of T CrB

K. A. Stoyanov[1], G. J. M. Luna[2], R. K. Zamanov[1], K. Iłkiewicz[3],
Y. M. Nikolov[1], M. Moyseev[1], M. Minev[1], A. Kurtenkov[1,4], S. Y. Stefanov[1]



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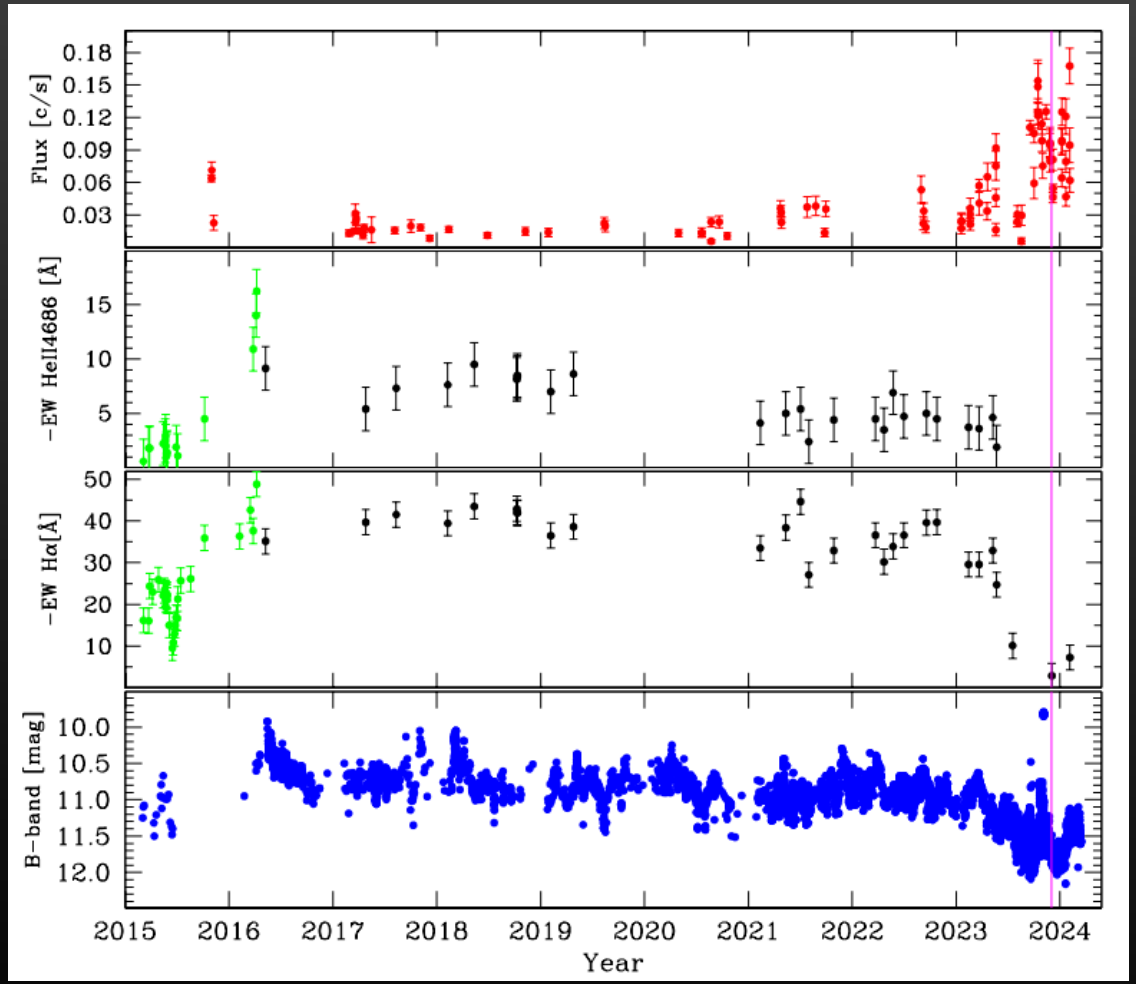
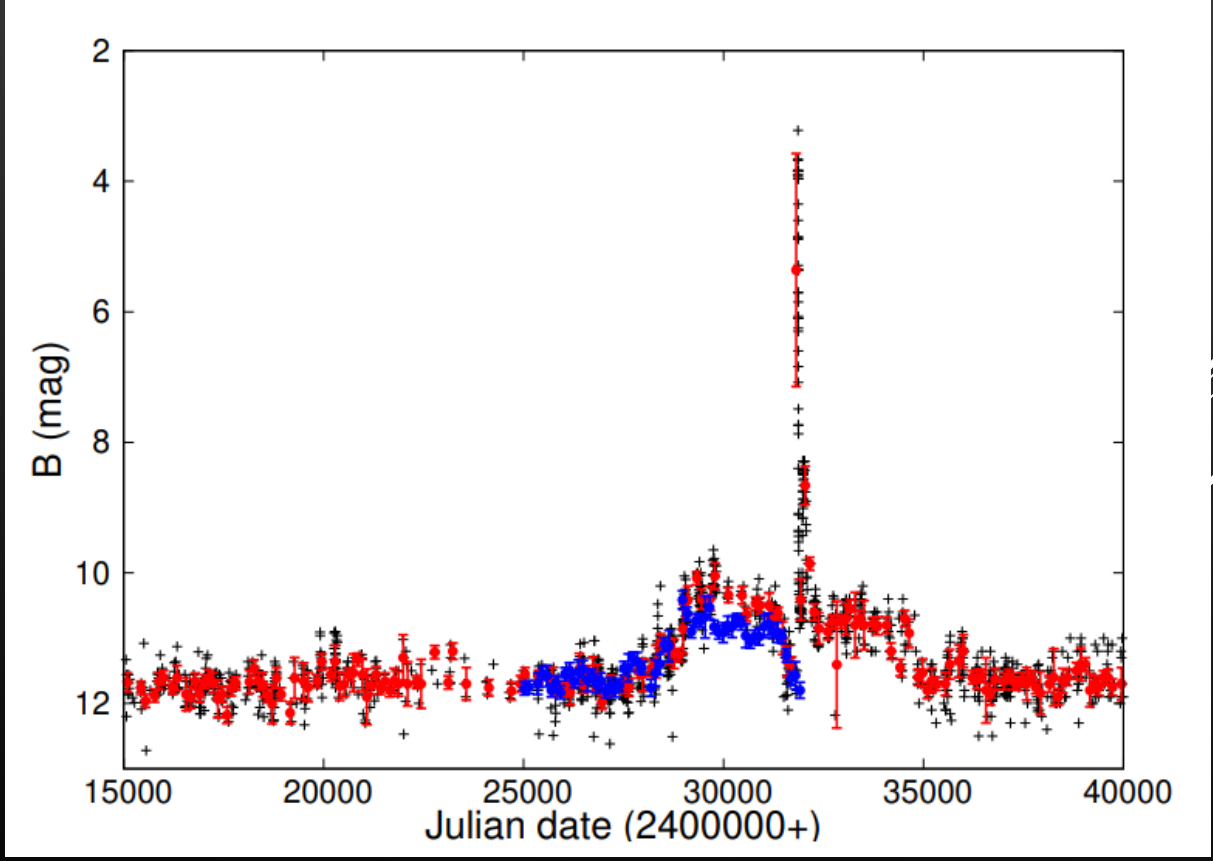


The accretion-driven eruption of the recurrent nova T Corona Borealis

Raymundo Baptista,[a,*] Wagner Schlindwein[b,c] and Gerardo J. M. Luna[d,e]

15-годишния период на активност се обяснява с mass-transfer outburst
Натрупва се 95% от масата, необходима за избухване
Разширение на акреционния диск



Избухванията на T CrB

Избухванията на T CrB

1217 г.

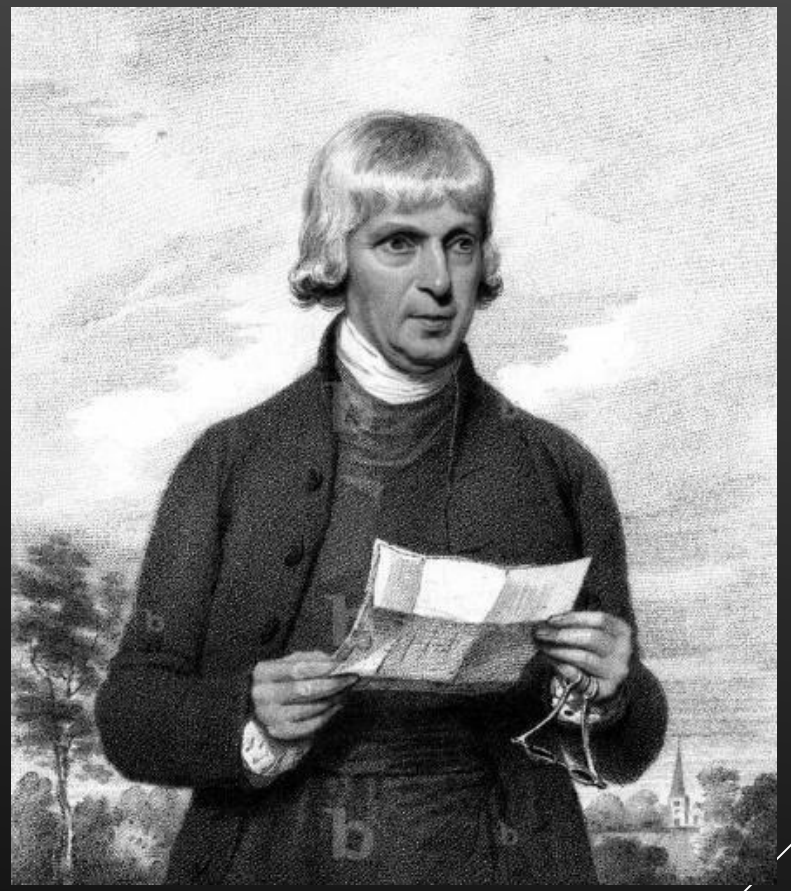
Абат Бурхард в Хроники от Урсберг:
“През есенния сезон на 1217 г., в ранната вечер, имаше чуден знак – звезда на запад. Тази звезда според астролозите се намира в Короната на Ариадна...”

Абатство Урсберг

Избухванията на T CrB

1217 г.
1787 г.

През 1789 г. публикува “Каталог на всички ярки и интересни звезди”



Франсис Уоластън

Избухванията на T CrB

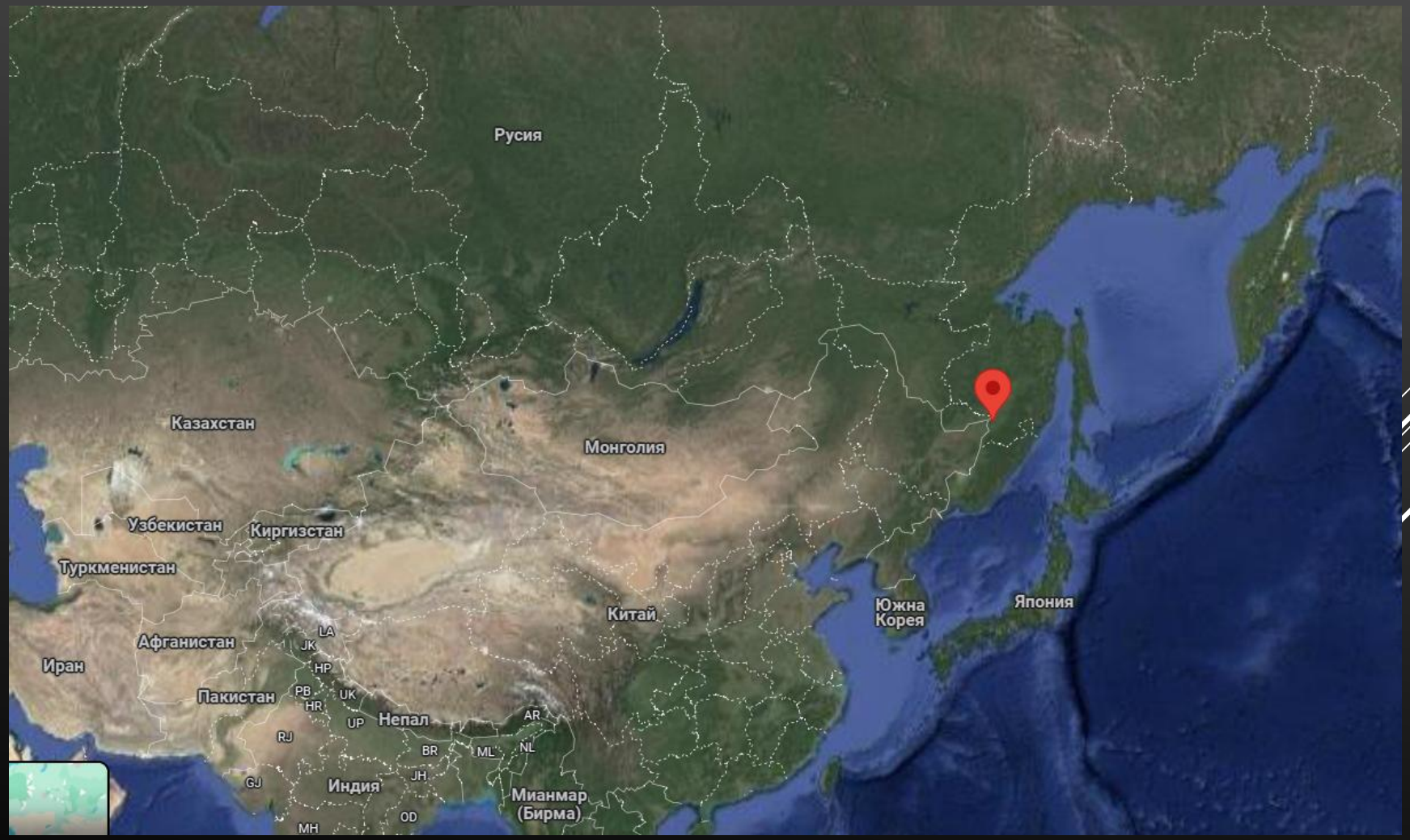
1217 г.
1787 г.
1866 г.

Джон Бирмингам:
“Бях на път когато за първи път видях звездата, така че не може да съм сигурен за времето до минута, но със сигурност е било между 11:30 и 11:45 през нощта на 12-ти май... Размерът й беше поне равен на α Coronae и определено по-ярка..... На цвят звездата изглеждаше почти бяла със синкав оттенък.”

Обсерваторията в Гринуич

Избухванията на T CrB

1217 г.
1787 г.
1866 г.
1946 г.

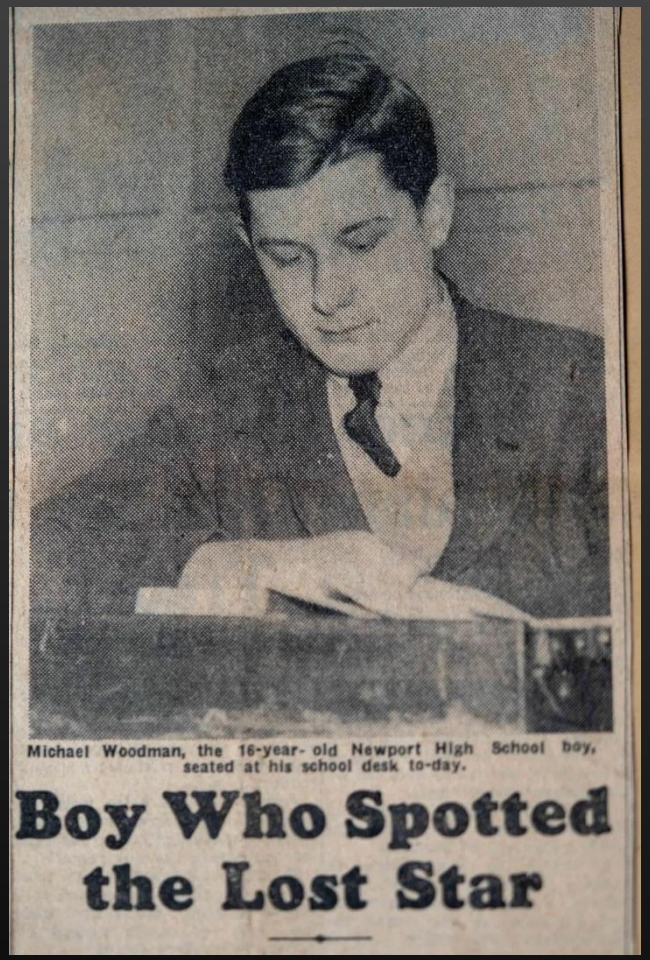


Хабаровск
Каменчук
8 февруари 1946
19.00 UT

Избухванията на T CrB

1217 г.
1787 г.
1866 г.
1946 г.

Нюпорт, Уелс
9 февруари 1946 г.
01:45 UT



Michael Woodman, the 16-year- old Newport High School boy, seated at his school desk to-day.

Boy Who Spotted the Lost Star

Майкъл Уудман

Mon.

Dear Master Woodman,

Thank you for your letter. I should like to congratulate you for noticing that there was something unusual in the constellation of Coronae Borealis and for reporting it to me. You have, in fact, made a very interesting observation.

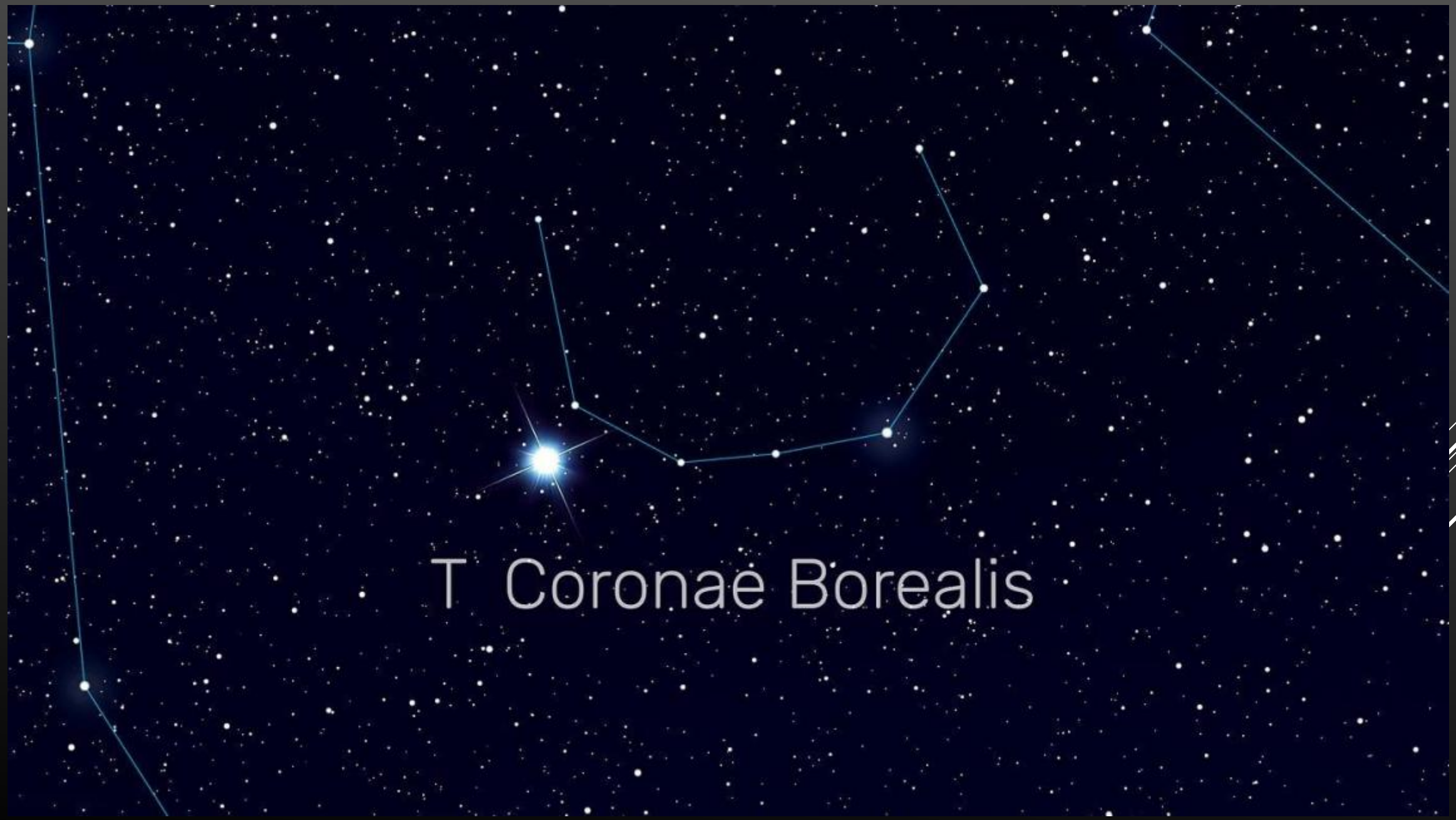
The star you observed is the star known as T Coronae Borealis, which you will find marked in Norton's Star Atlas. It is normally of about the 10th magnitude, but in May 1866 it had a nova-like outburst and brightened rapidly to magnitude 2·1. It then began to fade rapidly and in a few weeks it had reverted almost to its normal brightness. It has been kept under observation since and has remained slightly variable in brightness. Now, after nearly 80 years, it has had a second flare up.

Your observation may prove to be the earliest detection in this country of the brightening of T Coronae. Will you let me know what time on the night of the 11th February you noticed the star? Can you say how its brightness compared with that of α Coronae Borealis (2·3) and β Coronae Borealis (3·7)? You mention that it was of approximately 3rd - 2nd magnitude but if you can give a more precise estimate, it may help to decide whether it was becoming brighter or fainter during the night of Friday.

Избухванията на T CrB

1217 г.
1787 г.
1866 г.
1946 г.

Майкъл Уудман


T Coronae Borealis

Благодаря за вниманието!