

# V838 Mon: is the Sleeping Beauty really waking up?

Image credit: NASA and The Hubble Heritage  
Team (AURA/STScI)

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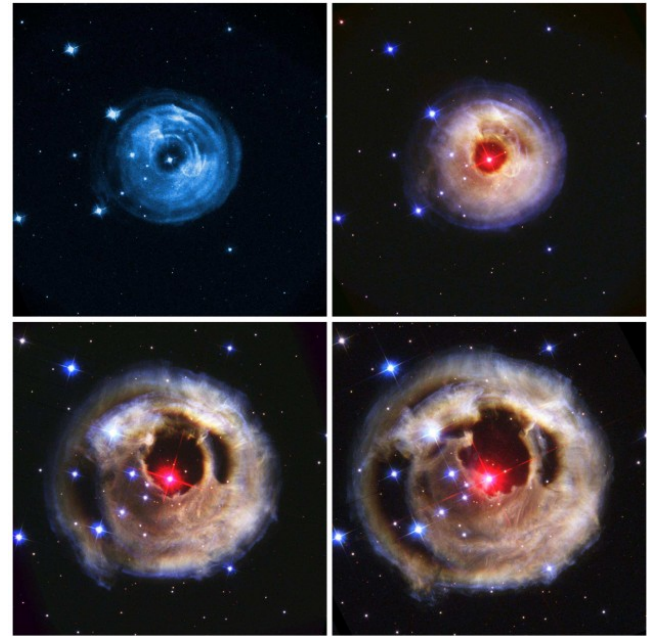
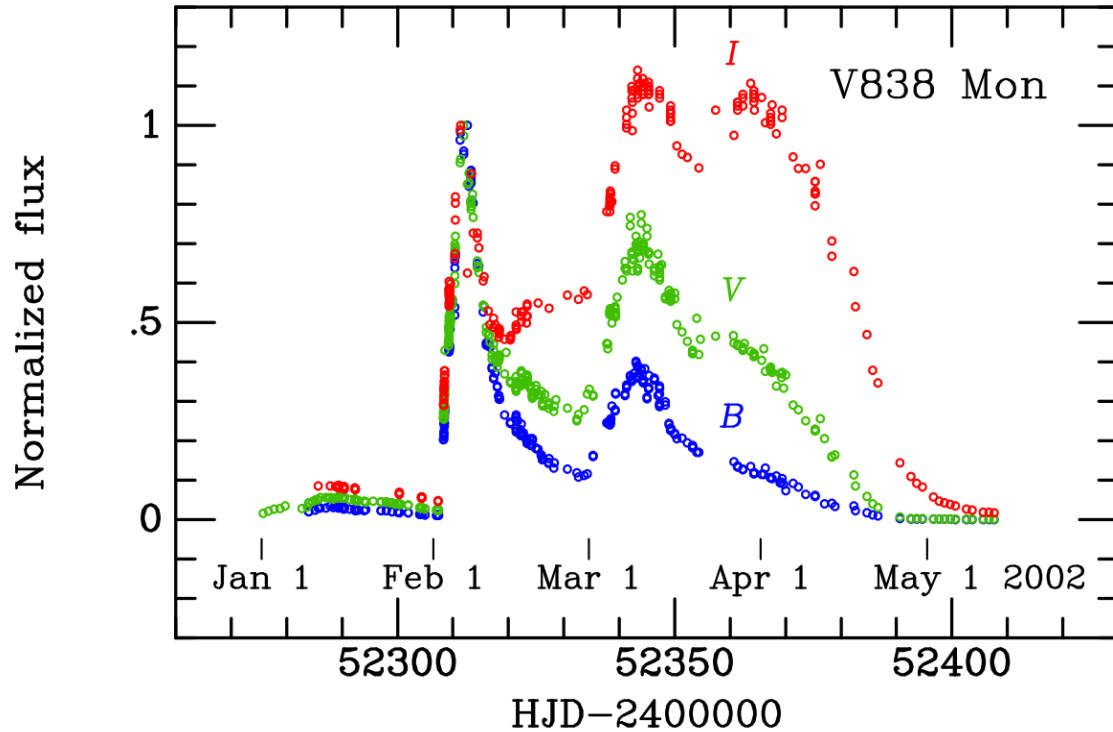
**Boris Deshev** (Astronomical Institute, Czech Academy of Sciences)

**and others.**



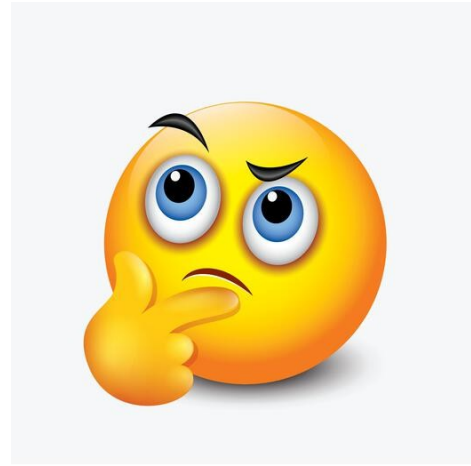
**Astronomical  
Institute**  
of the Czech Academy  
of Sciences

# V838 Mon – Discovery 2002



*Bond et al. 2003, Nature, 422, 405*

# The explosion of V838 Mon?



★ **Stellar merger** (currently most probable option)  
(e.g. *Soker & Tylenda 2003 ApJ, 582, 105*;  
*Tylenda & Soker 2006, A&A, 451, 223*: 8 and 0.3 Msol)

> **luminous red nova** (stellar merger: stars erupting  
into **cool** supergiants)

(e.g. M 31 RV, V4332 Sgr, V838 Mon, M85 OT, V1309  
Scorpii, M101 OT2015-1)

# V838 Mon – Luminous Red Nova

(stellar merger: stars erupting into cool supergiants)

★ Remnant (a very red star):  
cool L-type supergiant + hot B3 V

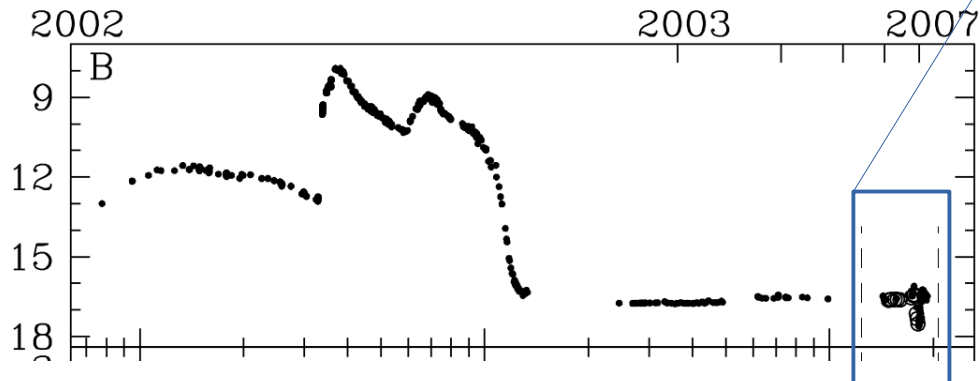
★ Progenitor a triple system (B3 V did not participate in the outburst).

## ★ Supergiant

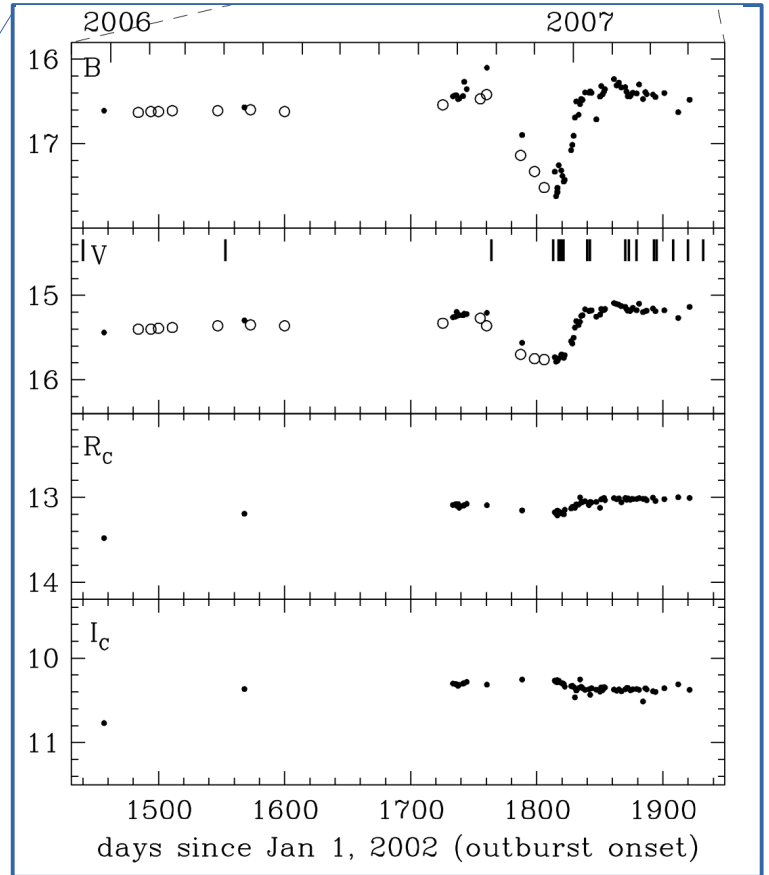
effective temperature ~2000K,  
radius (2004) ~1600 R<sub>sol</sub> (2020 ~450 R<sub>sol</sub>)  
huge mass loss ( $5 \times 10^{-3}$  to 0.6 M<sub>sol</sub>)  
wind velocities up to 600 km/s

# Photometric evolution until early 2007

Both stars in spectrum >  
Hot component interacting with the expelled matter  
(Tylenda+2009)



~70 days  
 $\Delta B = 1.15$  mag

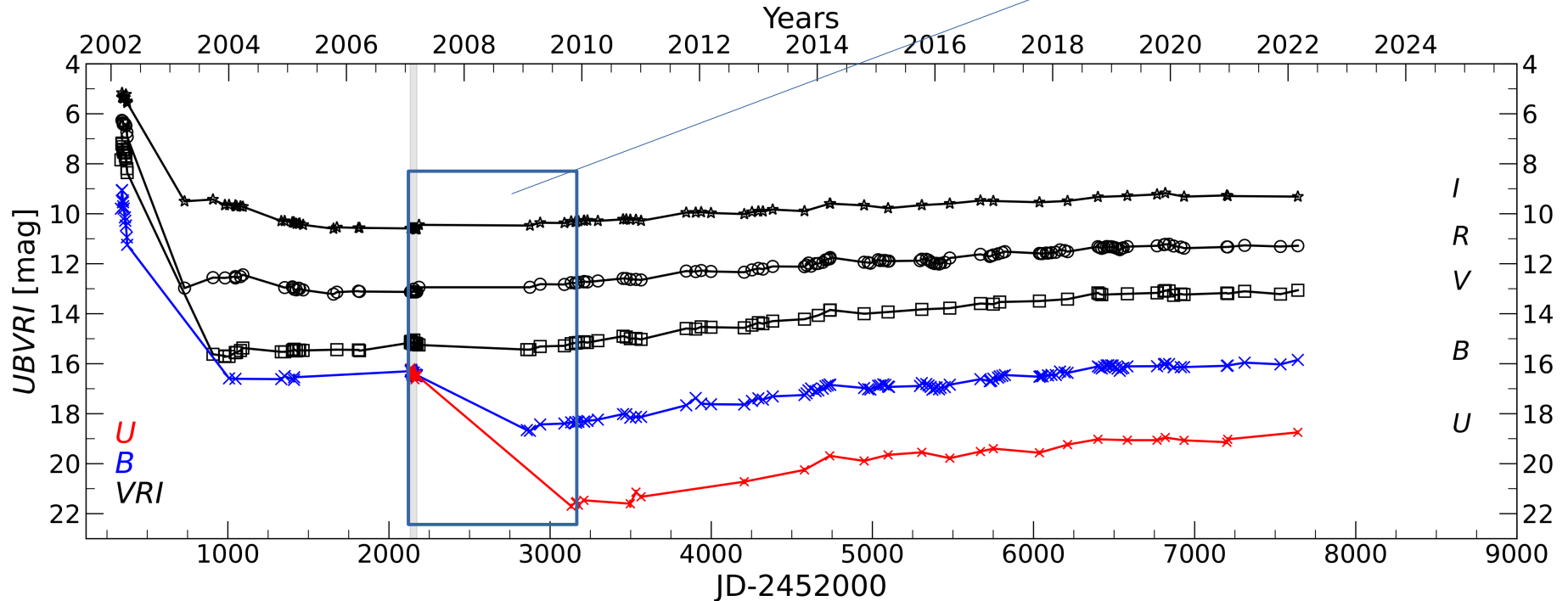


Munari+2007

# Our photometric monitoring

★ Tartu Observatory, South African Astronomical Observatory,  
Since 2009 [Nordic Optical Telescope \(ALFOSC\)](#)

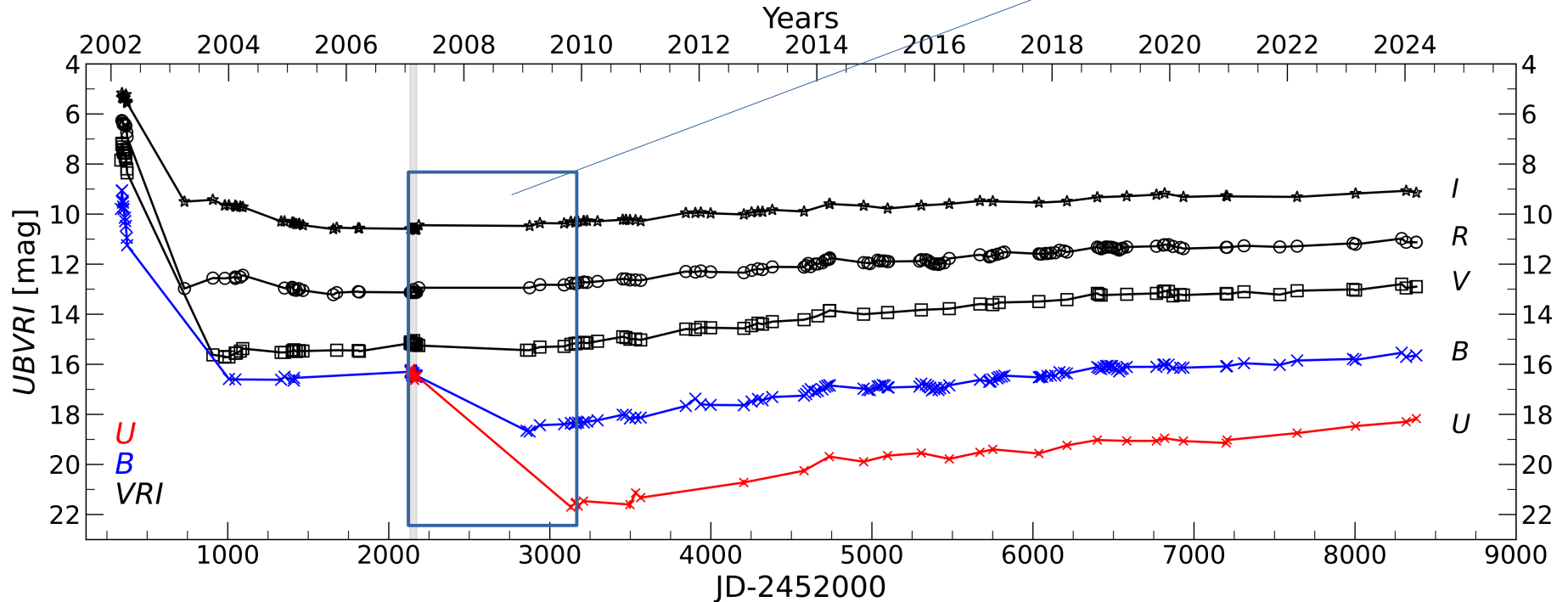
2+ years  
 $\Delta U = 5$  mag  
 $\Delta B = 3$  mag  
 $\Delta V = 0.5$  mag  
**hot star**



# Our photometric monitoring

★ Tartu Observatory, South African Astronomical Observatory,  
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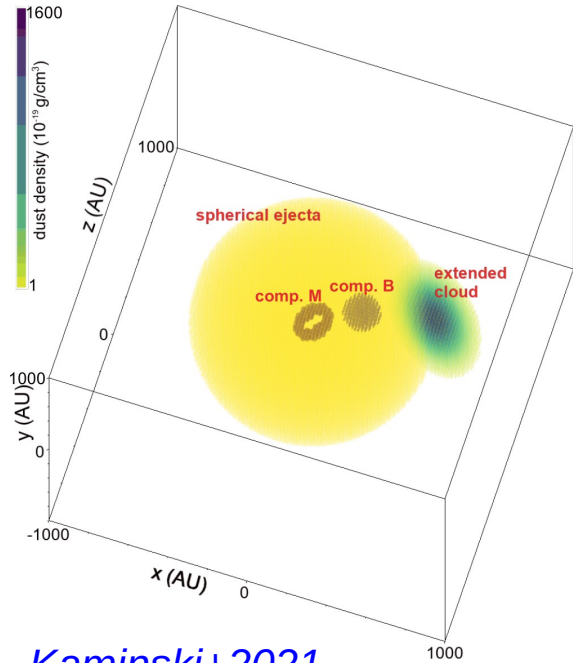
2+ years  
 $\Delta U = 5$  mag  
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 $\Delta V = 0.5$  mag  
**hot star**



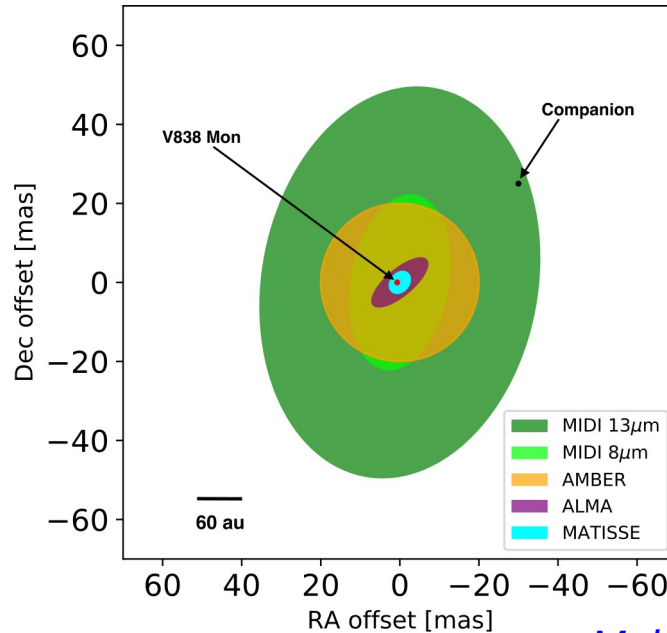
*Liimets+2023 & this work*

Dimming on-going; steady brightening

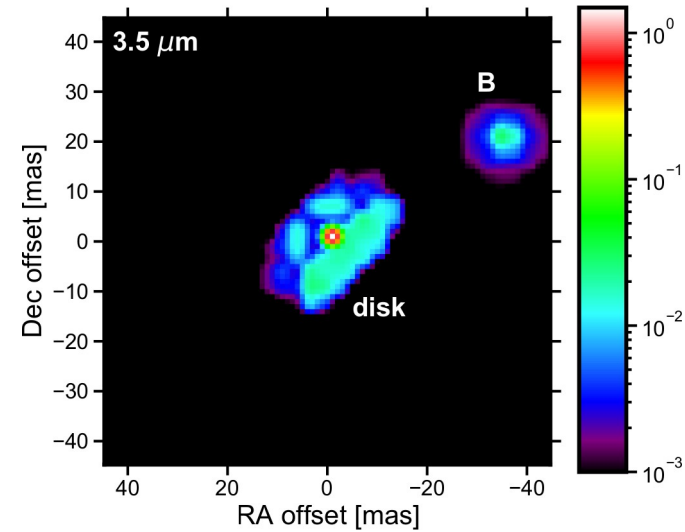
# Mid-infrared to mm view



*Kaminski+2021*



*Mobeen+2021*



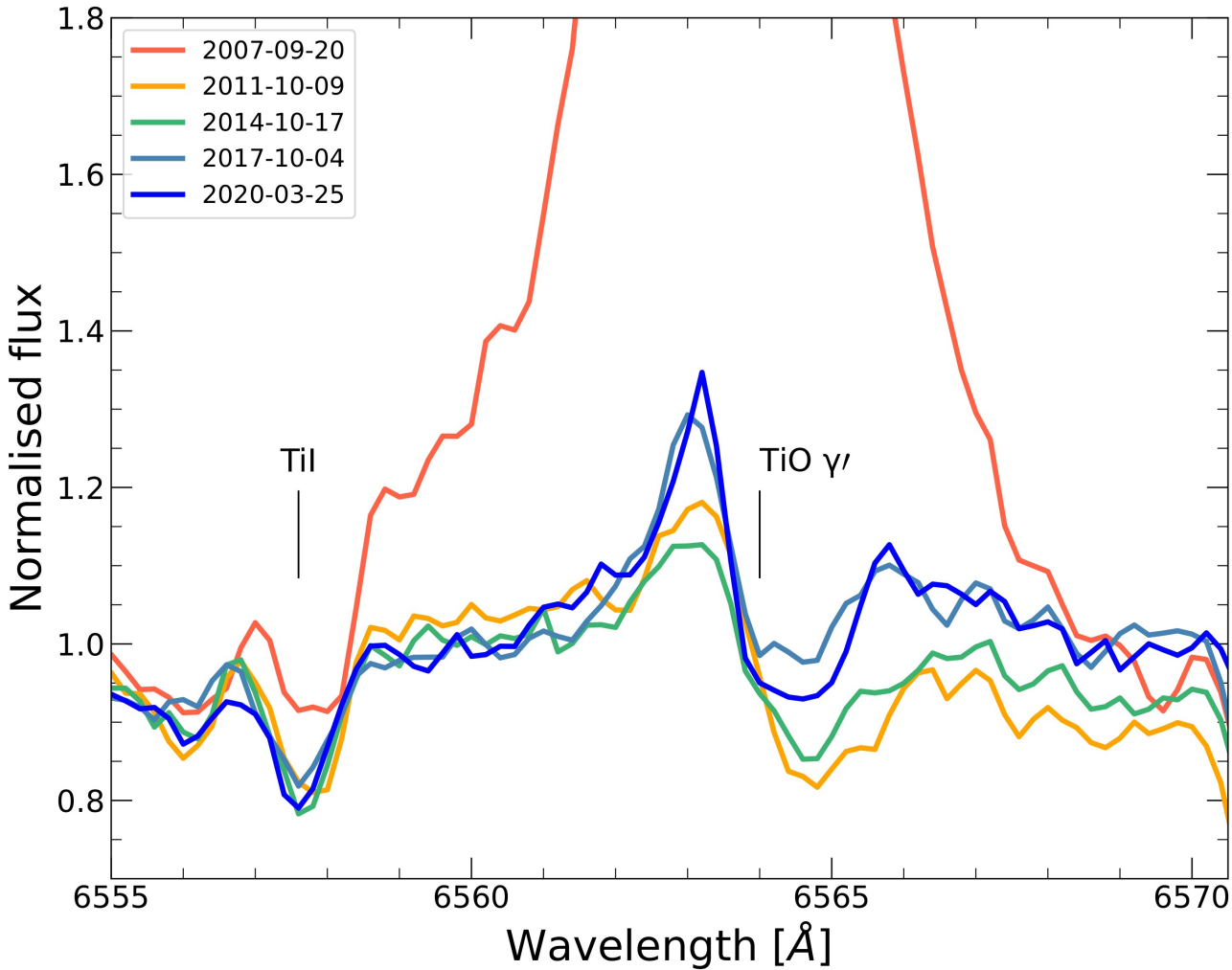
Hot companion is not eclipsed by the supergiant but is engulfed by the dense dusty matter ejected during the 2002 outburst.

*How long must we wait?*



# H $\alpha$ emission line

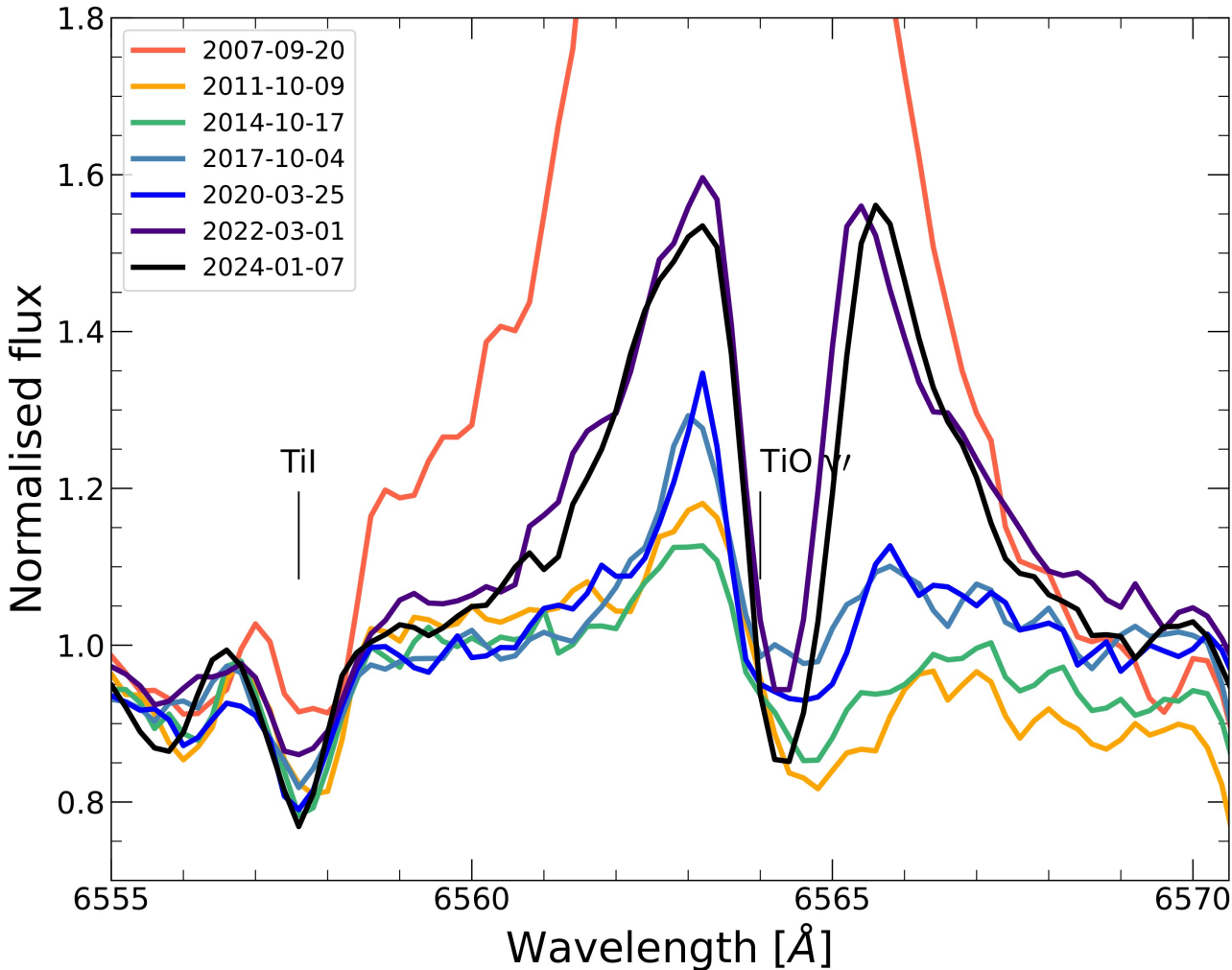
Slow recovery  
since 2015.



# H $\alpha$ emission line

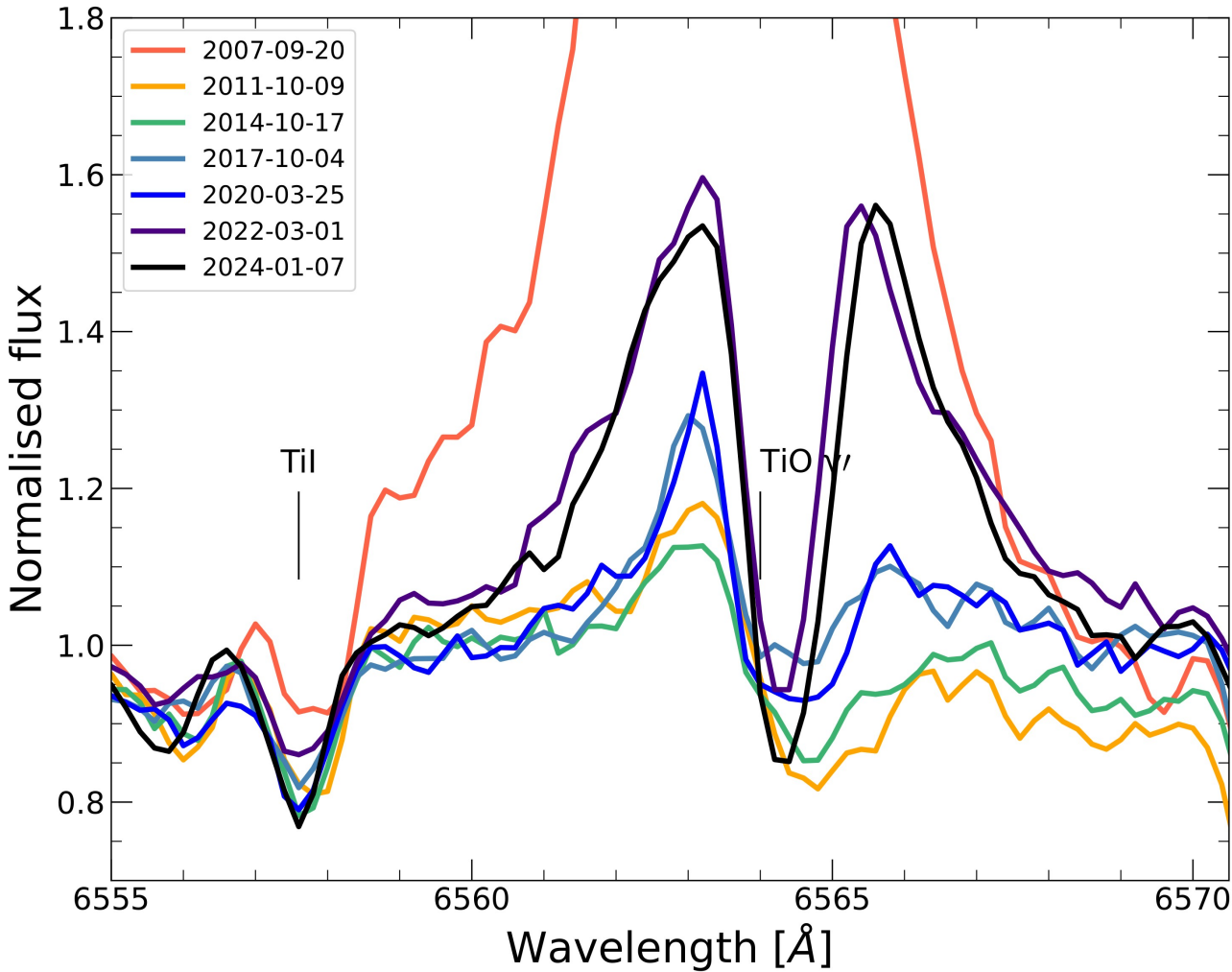
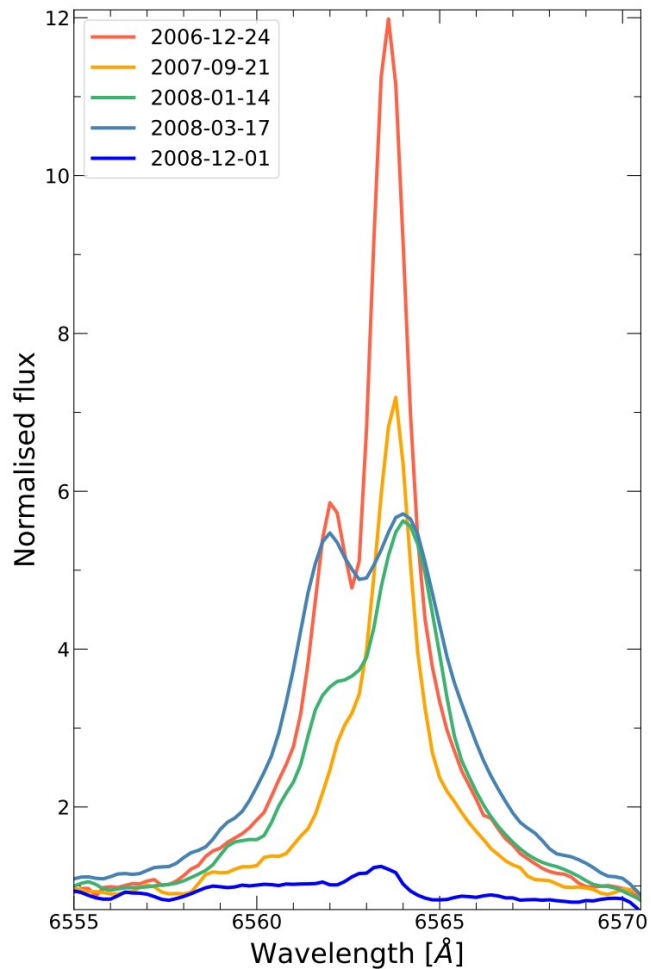
Double peaked H $\alpha$   
> gas disc.

Sleeping Beauty  
is waking up!



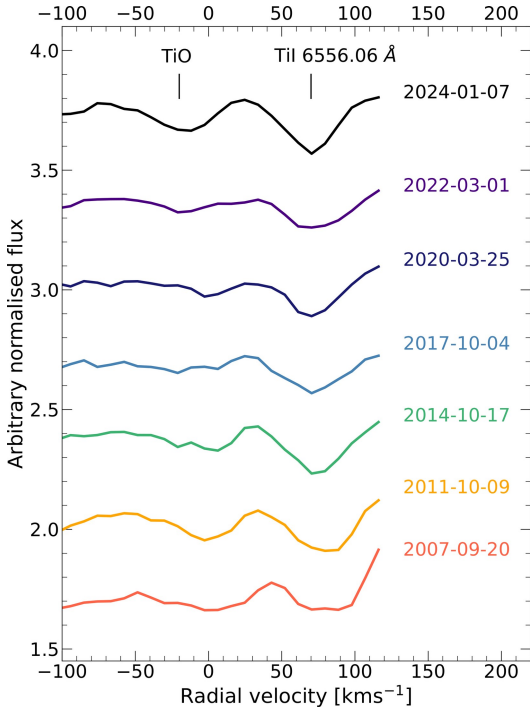
*Liimets+2023 & this work*

# H $\alpha$ – long decline in progress



# Stable Ti I 6556.06 Å (and other lines)!

R = 52 000



## Narrow abs. component

86 – 87 km/s (stellar contraction):

- other atomic lines and high-excitation molecular bands (*Tylenda+ 2009*).
- CO fundamental and first overtone lines (*Geballe+ 2007*);

## Stellar contraction

15 yrs contraction of 86 km/s > 60 000 Rsol

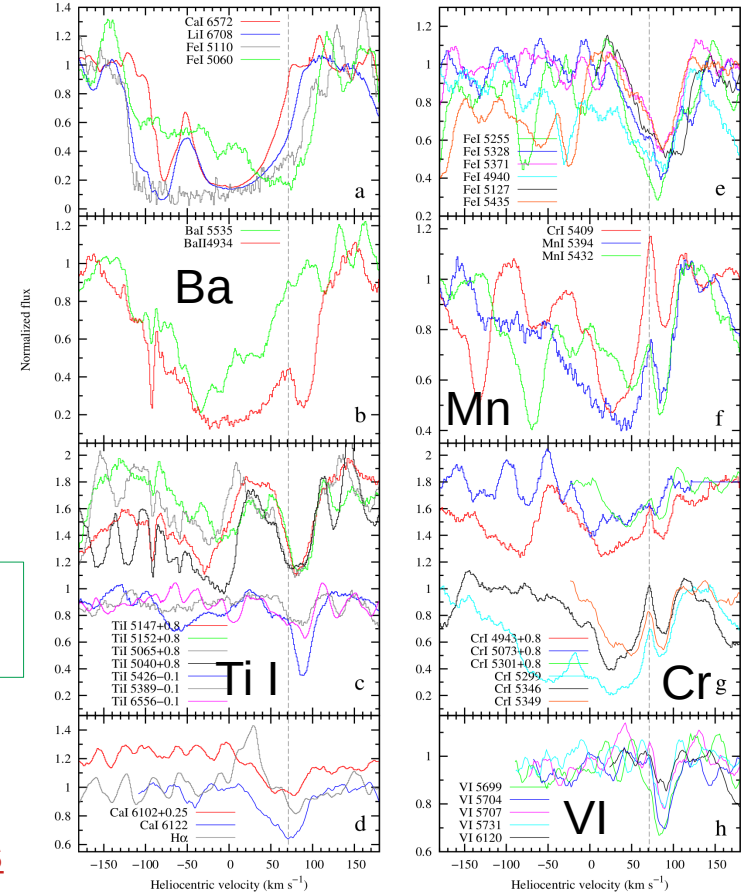
## Chesneau+2014:

10 yrs V838 Mon contraction 1200 > 750 Rsol  
~ 1 km/s

Ti I asymmetric >  
the real RV ~+90 km/s

RV Ti I (2009-2024) =  
+75 +/- 2 km/s

Ti I and VI trace the systemic velocity (RSG) ~ +90 km/s  
(previously proposed +71 km/s)



*Liimets+2023 & this work*

R ~ 10 000

*Tylenda+2011*

