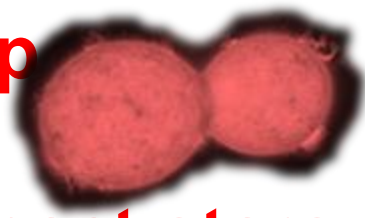


MERGESTARS group

Red novae & mergers of noncompact stars



M. Zain Mobeen (5th year PhD)
Thomas Steinmetz (4th year PhD)

prof R. Tylenda (retired)
prof K. M. Menten

Mirek Schmidt
Tomek Kamiński (SONATA-BIS)

Professor Dr. Karl Martin Menten

03 October 1957 — 30 December 2024

JANUARY 02, 2025

On December 30, 2024, Professor Dr. Karl Martin Menten, Scientific Member of the Max Planck Society and Director at the Max Planck Institute for Radio Astronomy in Bonn, Germany, died at the age of 67.








Karl Martin Menten
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Karl Menten's research spanned a wide range of astrophysical topics, from the birth of stars to their end of evolution, and star formation in the Milky Way to the Early Universe. Early on in his career, he discovered a widespread methanol maser transition, the brightest of its kind, that since then has been used as a signpost for the early stages of massive star formation but also as a tool for high precision astrometry.

Karl Menten studied Physics and Astronomy at the Rheinische Friedrich-Wilhelms-Universität in Bonn and earned his doctoral degree in 1987, with a dissertation on "Interstellar Methanol towards Galactic HII Regions". He worked as a postdoctoral research fellow at the Harvard College Observatory at the Harvard-Smithsonian Center for Astrophysics (CfA), Cambridge, MA, USA, later-on as radio astronomer and senior radio astronomer at the Smithsonian Astrophysical Observatory before he was appointed scientific member of the Max Planck Society and Director for Millimeter and Submillimeter Astronomy at the Max Planck Institute for Radio Astronomy in Bonn in 1996.

Menten's groundbreaking career began with two transformative projects during his postdoctoral years. He led the discovery of seven sub-millimeter water vapor maser transitions, including isotopic lines, documented in five landmark papers. These discoveries opened the field of sub-millimeter maser astronomy and advanced the theoretical understanding of

Reconstructing the near- to mid-infrared environment in the stellar merger remnant V838 Monocerotis

Muhammad Zain Mobeen¹, Tomasz Kamiński¹ , Alexis Matter², Markus Wittkowski³ , John D. Monnier⁵ , Stefan Kraus⁶, Jean-Baptiste Le Bouquin⁷, Narsireddy Anugu⁸, Theo Ten Brummelaar⁸, Claire L. Davies⁶, Jacob Ennis⁵, Tyler Gardner⁶, Aaron Labdon⁴, Cyprien Lanthermann⁸ , Gail H. Schaefer⁸, Benjamin R. Setterholm⁵, Nour Ibrahim⁵ , and Steve B. Howell⁹

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⁹ NASA Ames Research Center, Moffett Field, CA 94035, USA

A bipolar structure and shocks surrounding the stellar-merger remnant V1309 Scorpii

T. Steinmetz¹ , T. Kamiński¹ , M. Schmidt¹ , and A. Kiljan²

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Monthly Notices



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3D hydrodynamic simulations of white dwarf–main-sequence star collisions – I. Head-on collisions

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Nova 1670 (CK Vulpeculae) was a merger of a red giant with a helium white dwarf

Romuald Tylenda¹, Tomek Kamiński¹ , and Radek Smolec² 

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e-mail: smolec@camk.edu.pl

A radical transition in the post-main-sequence system U Equulei★

Tomek Kamiński¹ , Mirek R. Schmidt¹, Anlaug Amanda Djupvik^{2,3}, Karl M. Menten⁴, Alex Kraus⁴ , Krystian Hkiewicz⁵ , Thomas Steinmetz¹, Muhammad Zain Mobeen¹, and Ryszard Szczerba¹ 

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Plus >5 papers submitted or in production

Reconstructing the near- to mid-infrared environment in the stellar merger remnant V838 Monocerotis

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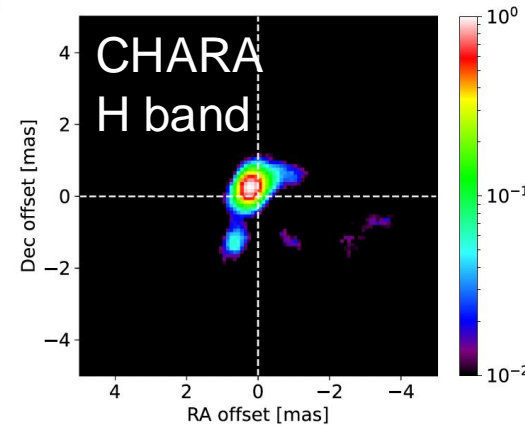
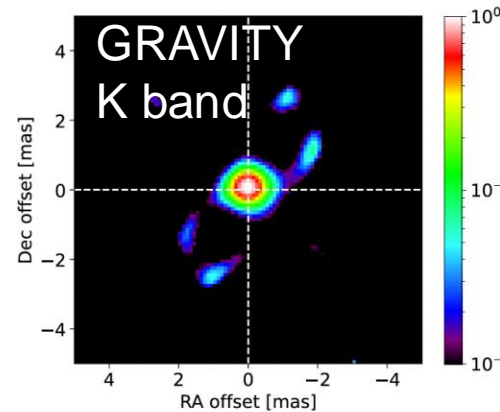
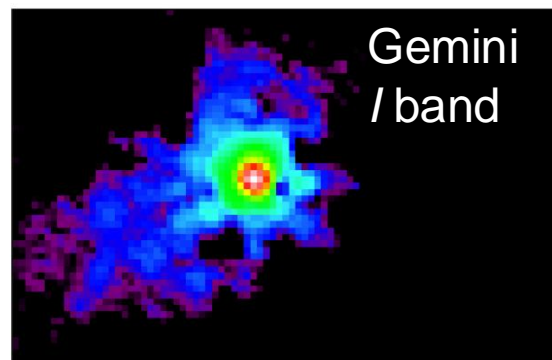
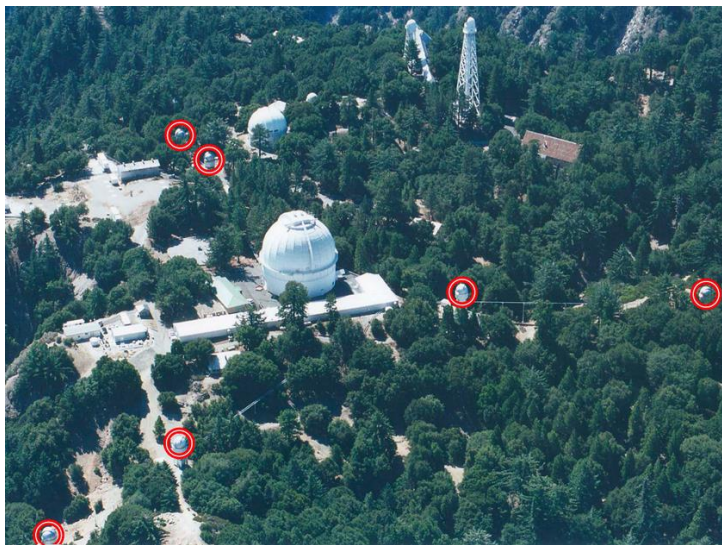
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⁹ NASA Ames Research Center, Moffett Field, CA 94035, USA



**Irregular shape
&
unclear origin**

VLT (MATISSE+GRAVITY) & CHARA interferometry and Gemini speckle observations

Image reconstruction experiments

Nature of the matter surrounding V838 Mon still unclear

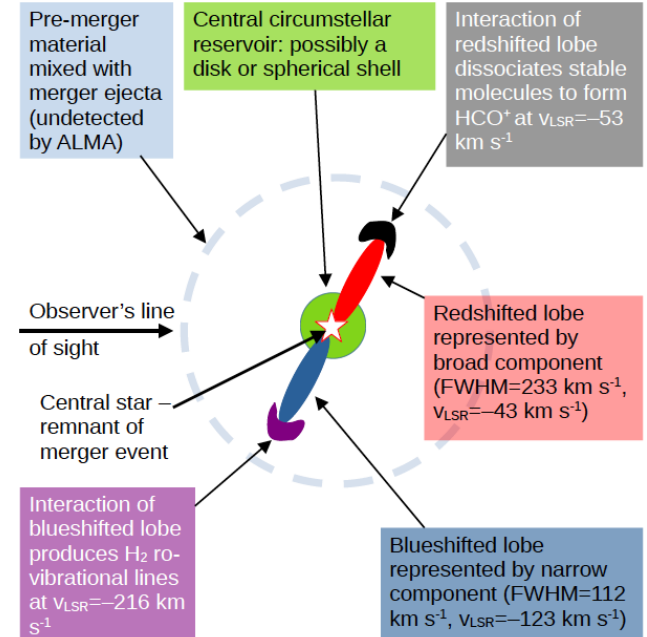
Supergiant-like mass loss?

V1309 Sco ~10-15 yr after merger

Steinmetz et al. 2024, A&A

**Bipolar
&
shocked**

- ALMA resolved the source
- Excitation analysis of ALMA and Xshooter/VLT spectra
- Bipolar and inhomogeneous nature of the remnant



A&A, 682, A127 (2024)
<https://doi.org/10.1051/0004-6361/202347818>
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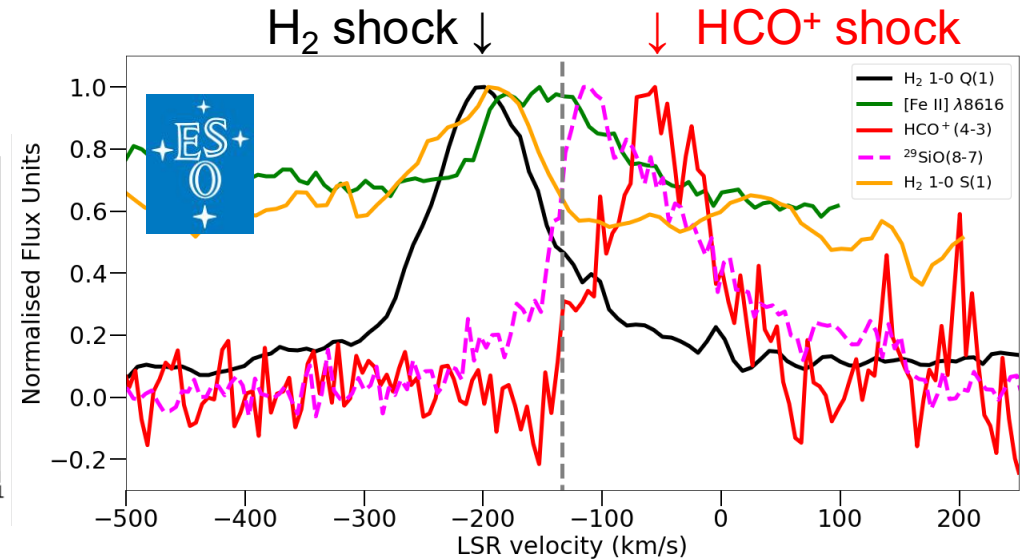
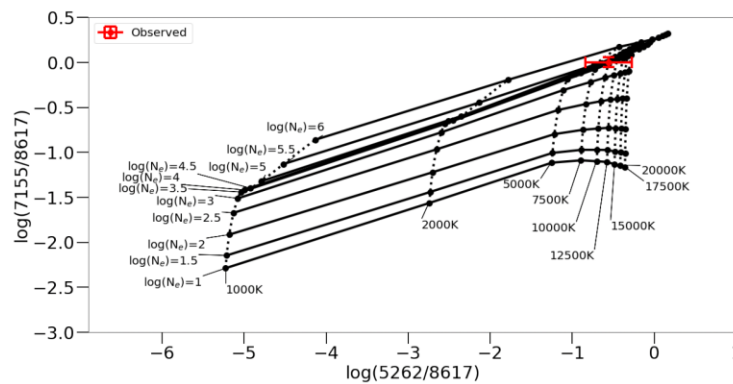
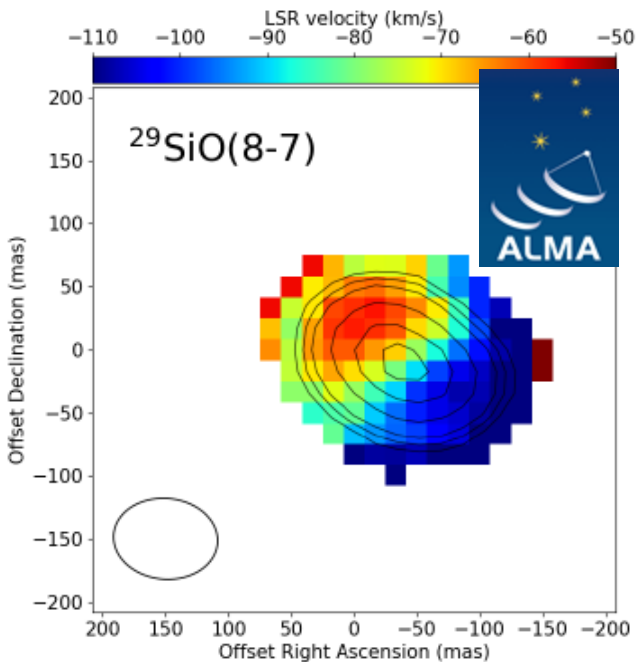
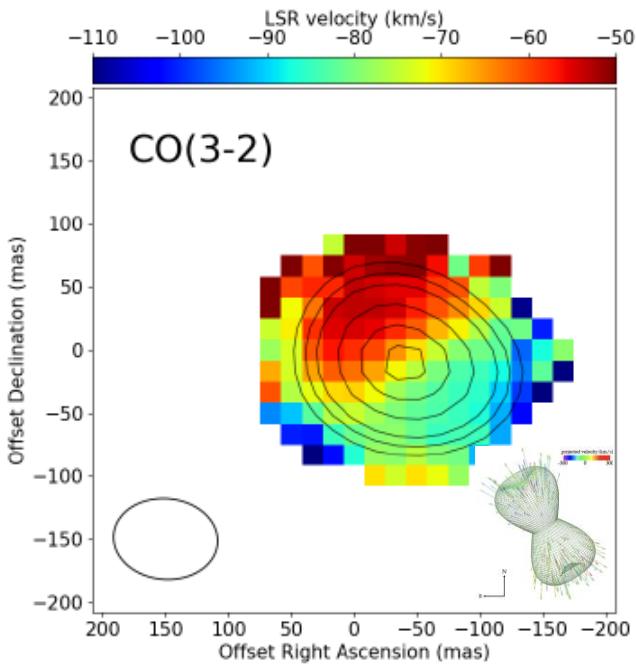
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Astronomy & Astrophysics



3D hydrodynamic simulations of white dwarf–main-sequence star collisions – I. Head-on collisions

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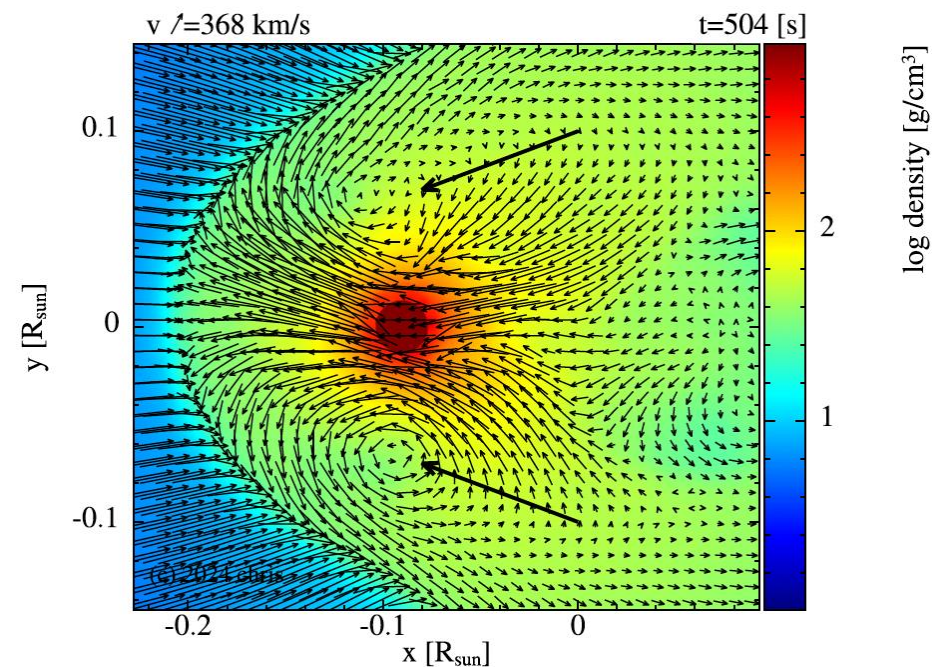
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Ratio	$q = 0.5$	$q = 1$	$q = 2$	Solar
C	2.33×10^{-3}	2.99×10^{-3}	3.02×10^{-3}	3.03×10^{-3}
N	1.88×10^{-3}	1.13×10^{-3}	1.16×10^{-3}	1.10×10^{-3}
O	8.57×10^{-3}	9.53×10^{-3}	9.60×10^{-3}	9.6×10^{-3}
N/C	0.69	0.461	0.391	0.36
C/O	0.257	0.303	0.314	0.319
N/O	0.178	0.140	0.123	0.115
$^{12}\text{C}/^{13}\text{C}$	42	51.49	60.0	90
$^{14}\text{N}/^{15}\text{N}$	6.62	19.71	48.79	440
$^{16}\text{O}/^{17}\text{O}$	22.11	73.84	296.1	2600
$^{16}\text{O}/^{18}\text{O}$	645	498.9	463.2	500

SPH head-on collisions in globular clusters

Transient characteristics (energetics)

Nucleosynthesis

Morphology



Abundances by mass

	CK Vul	Error
H	0.458	±17%
He	0.538	±24%
N	1.59E-3	±28%
O	8.30E-4	±30%
Ne	6.70E-4	±28%
S	1.26E-4	±10%
Ar	2.98E-5	±15%

CK Vul	Solar
$^{12}\text{C}/^{13}\text{C} = 3.8 \pm 1.0$	89.3
$^{13}\text{C}/^{14}\text{C} > 141$	
$^{14}\text{N}/^{15}\text{N} = 20 \pm 10$	441
$^{16}\text{O}/^{18}\text{O} = 36 \pm 14$	498.8
$^{18}\text{O}/^{17}\text{O} \gtrsim 5$	5.4
$^{27}\text{Al}/^{26}\text{Al} = 6.0 \pm 0.9$	
$^{28}\text{Si}/^{29}\text{Si} = 6.7 \pm 0.4$	19.7
$^{29}\text{Si}/^{30}\text{Si} = 1.0 \pm 0.1$	0.7
$^{32}\text{S}/^{34}\text{S} = 14 \pm 3$	22.5
$^{32}\text{S}/^{33}\text{S} > 34$	126.6

A&A, 685, A49 (2024)
<https://doi.org/10.1051/0004-6361/202244896>
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**Astronomy
&
Astrophysics**

Nova 1670 (CK Vulpeculae) was a merger of a red giant with a helium white dwarf

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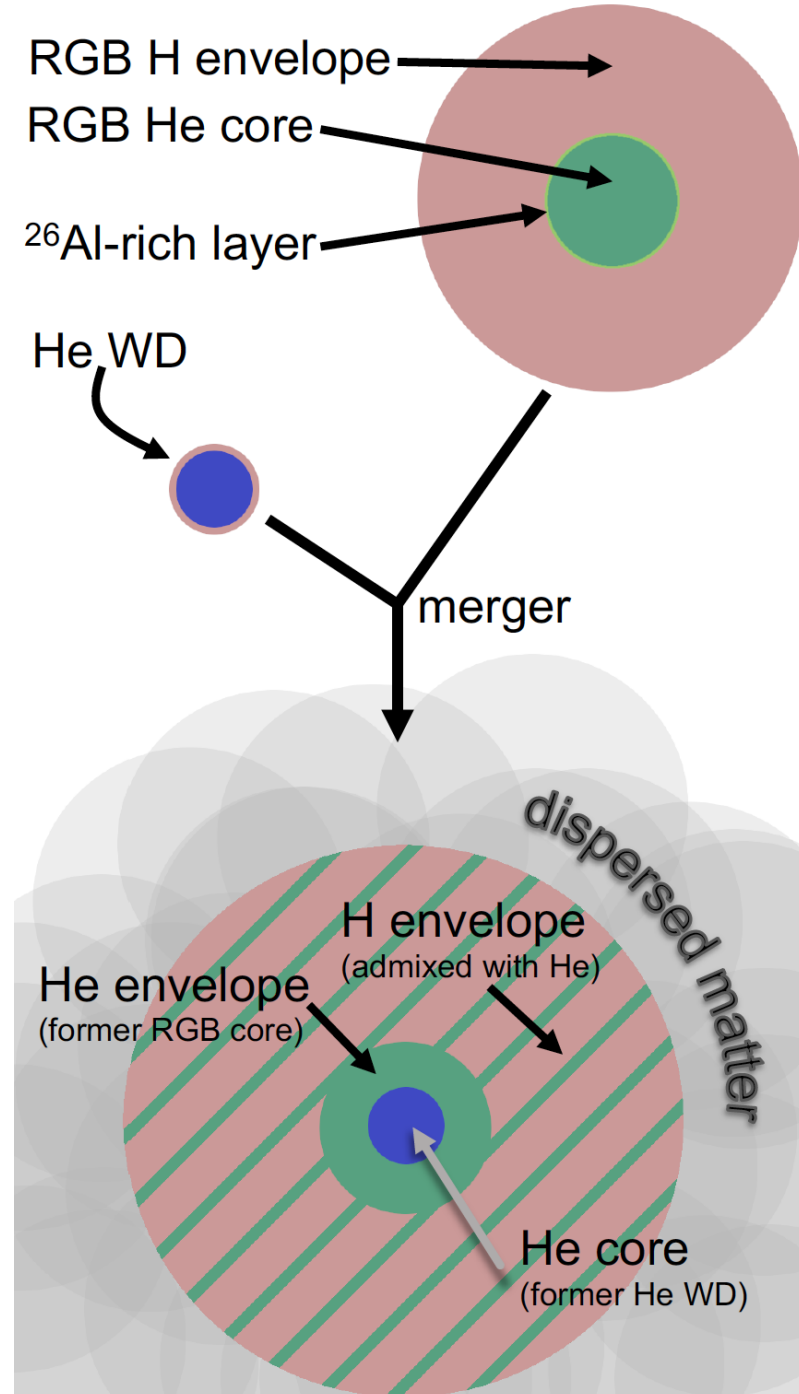
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Most peculiar isotopic composition:
CNO and partial He burning

Models (incl. MESA) of composition for
 merger of a HeWD and RGB star

Some burning during the merger!
 (max 20% energy)

The remnant will become an R-type
 carbon star



A radical transition in the post-main-sequence system U Equulei[★]

Tomek Kamiński¹, Mirek R. Schmidt¹, Anlaug Amanda Djupvik^{2,3}, Karl M. Menten⁴, Alex Kraus⁴, Krystian Ikiewicz⁵, Thomas Steinmetz¹, Muhammad Zain Mobeen¹, and Ryszard Szczerba¹

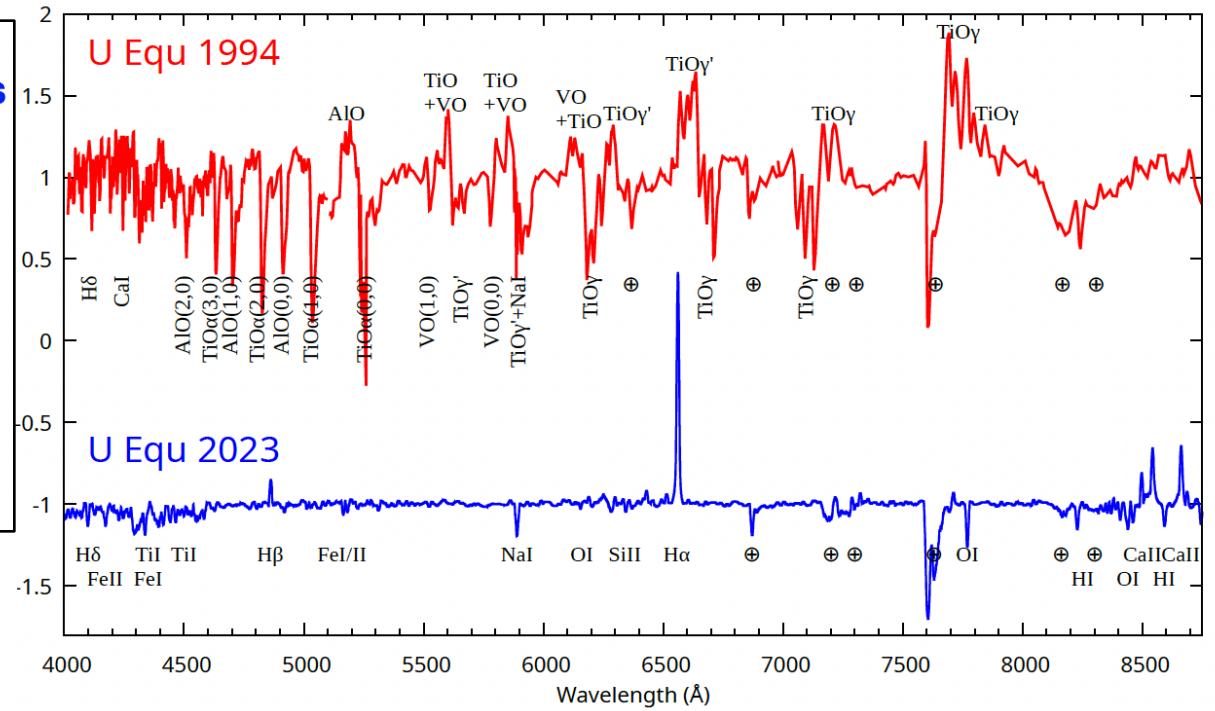
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Accretion in post-AGB
 or
 slow common envelope ejection?

