

Origins of dust in the Universe

Dust production in novae

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- ◆ Dave Lynch, Rick Rudy (Aerospace Corporation)
- ◆ Tom Geballe (Gemini)

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Nature of white dwarf can determine nature of nova:

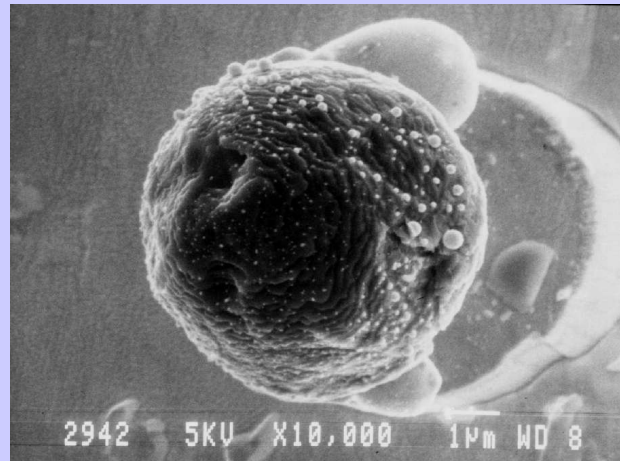
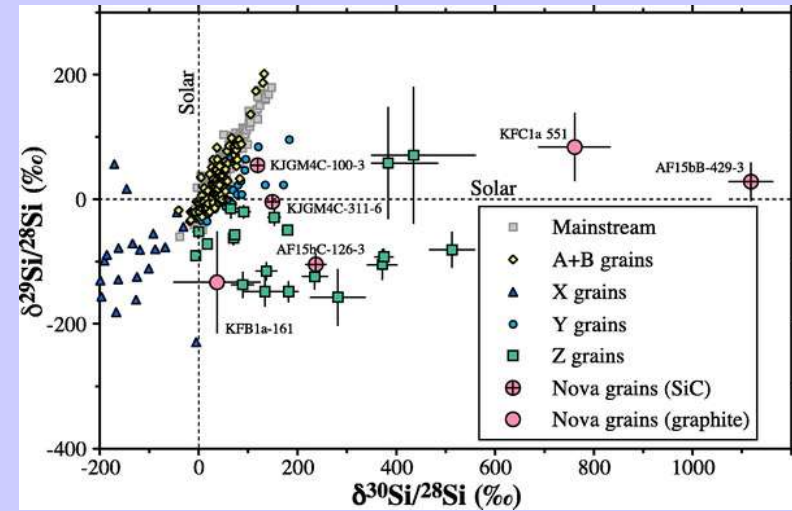
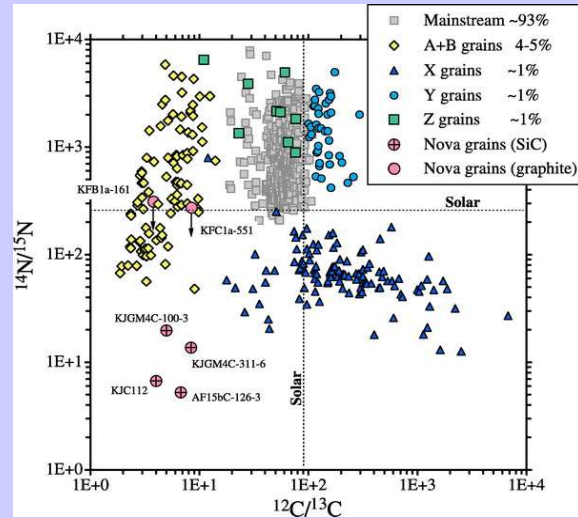
- ♦ O-Ne WD ----> coronal (dust-free) nova
- ♦ CO WD ----> dusty nova
- ♦ ~25% of well-studied novae form dust, with optical depth from ~0.1 to ~5

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Stellar type	Contribution to ISM dust	
Miras	35.00%	
OH/IR stars	32.00%	
Carbon stars	20.00%	
Supernovae	8.00%	
M supergiants	4.00%	
WR stars	0.60%	
PNe	0.20%	
Novae	0.10%	Prime sources of ^{13}C , ^{17}F , ^{22}Na , ^{26}Al
etc	0.10%	

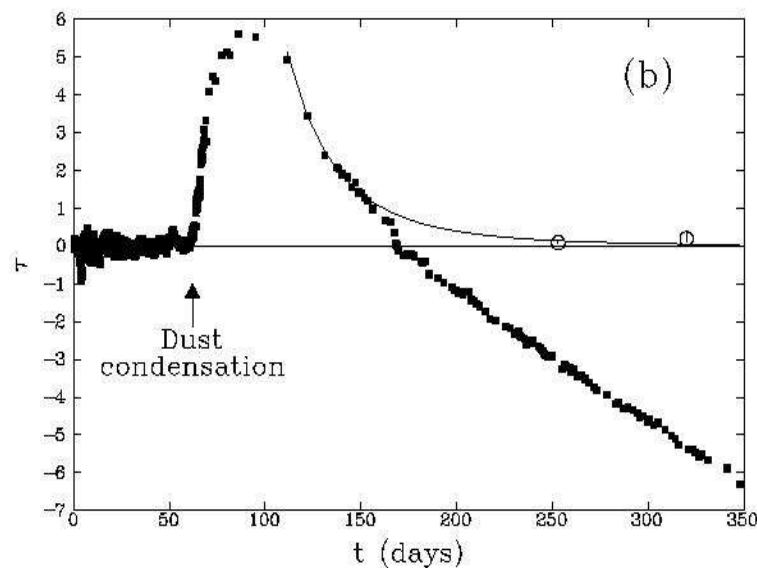
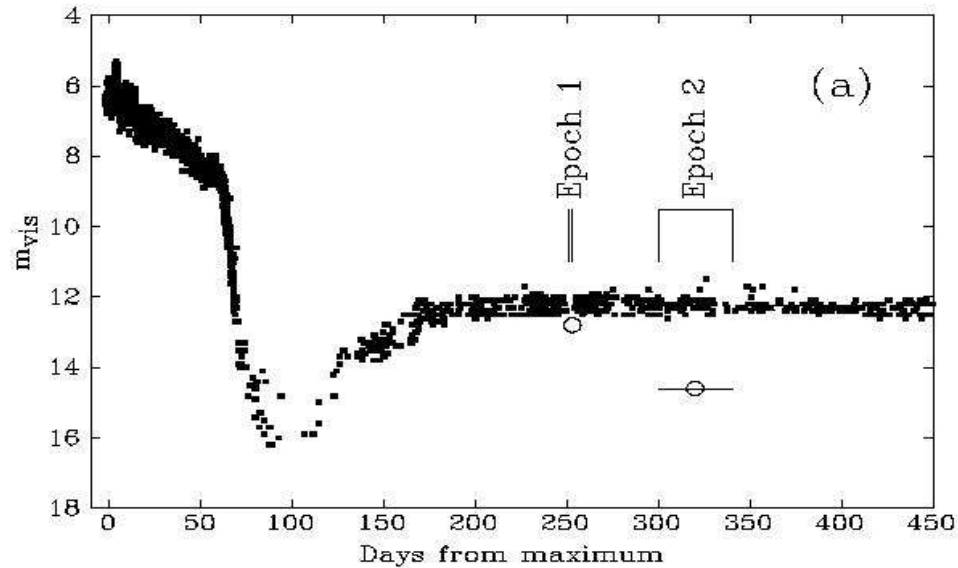
From Gehrz, 1988, IAU Symp 135

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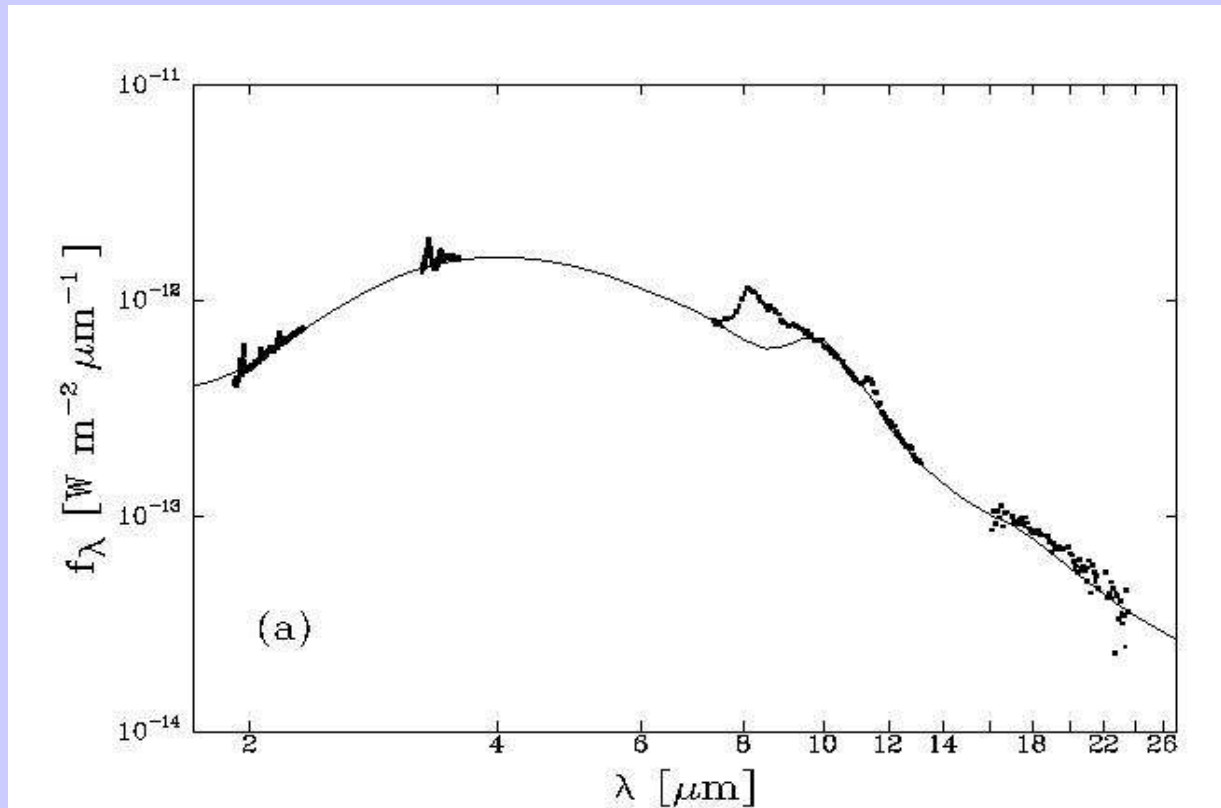
Isotopic ratios in meteoritic inclusions Jose et al., 2004, ApJ, 612, 414. Nova grain from S. Amari

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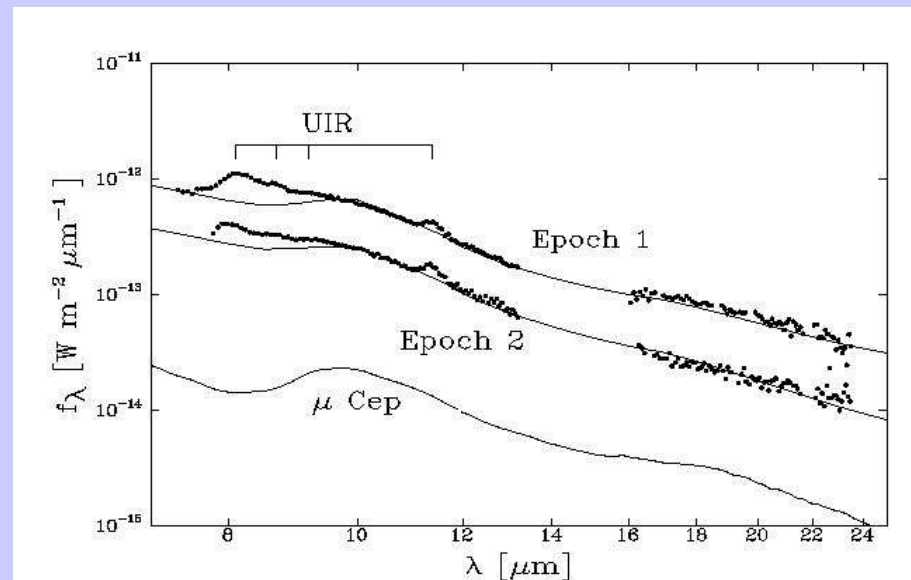
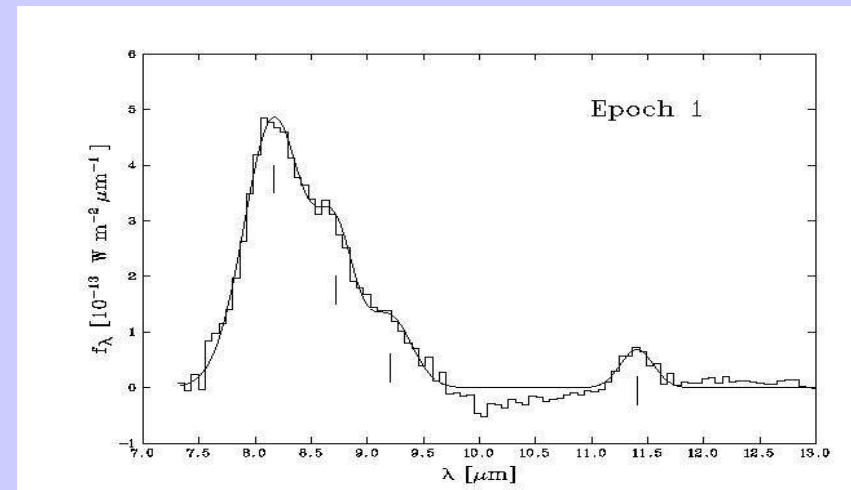
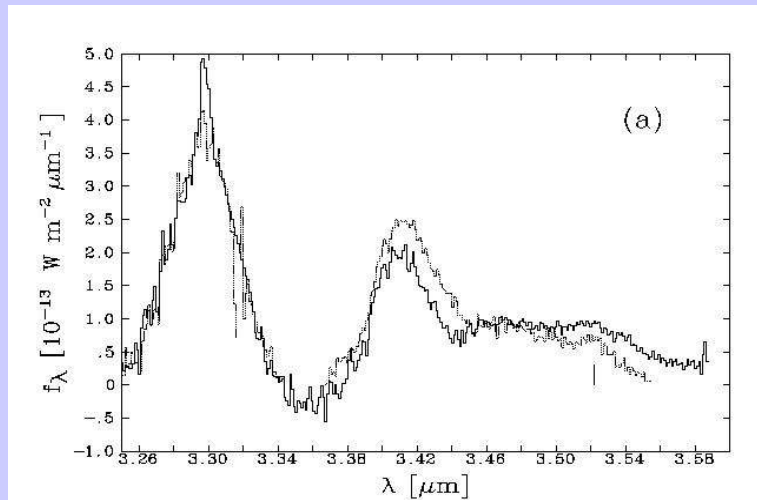
V705 Cas (1993) Evans et al., 2005,
MNRAS, 360, 1483

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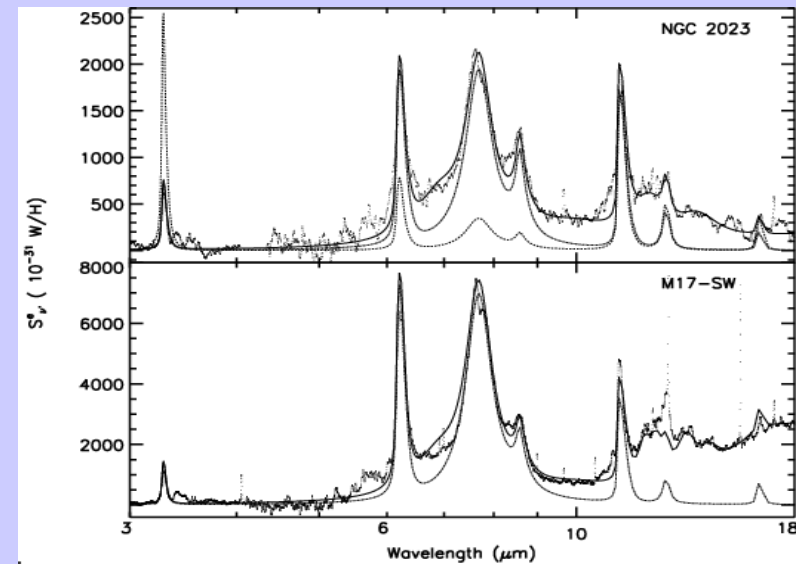
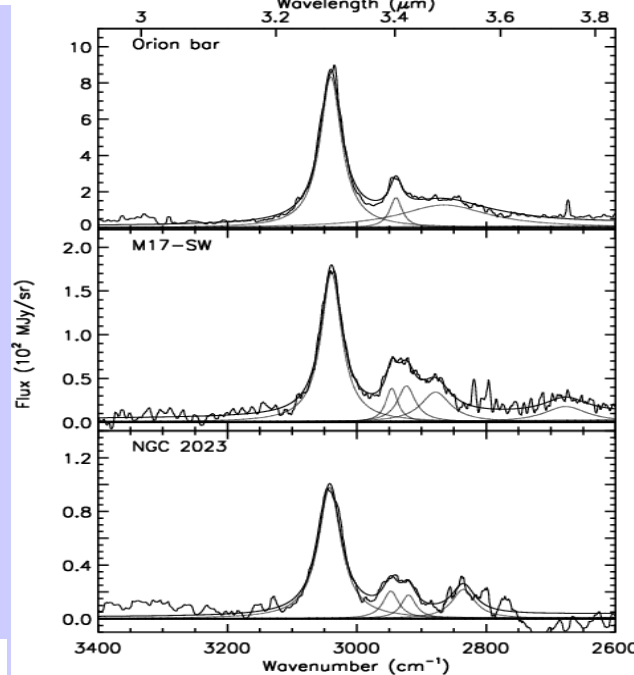
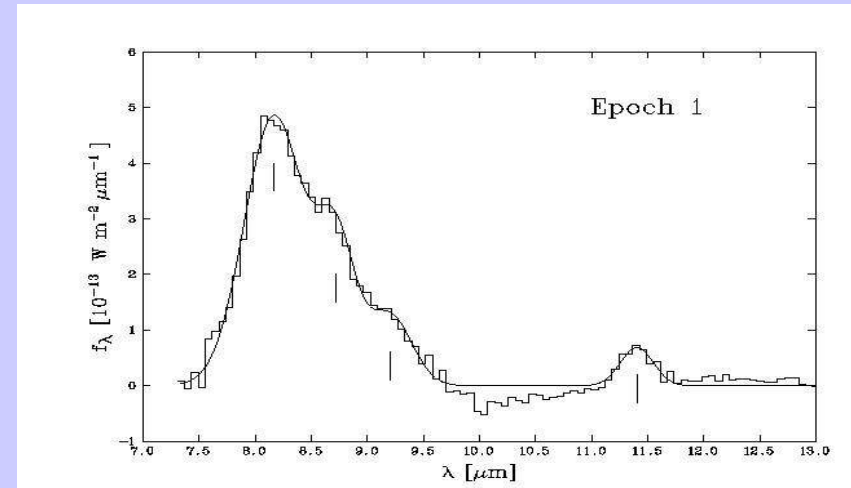
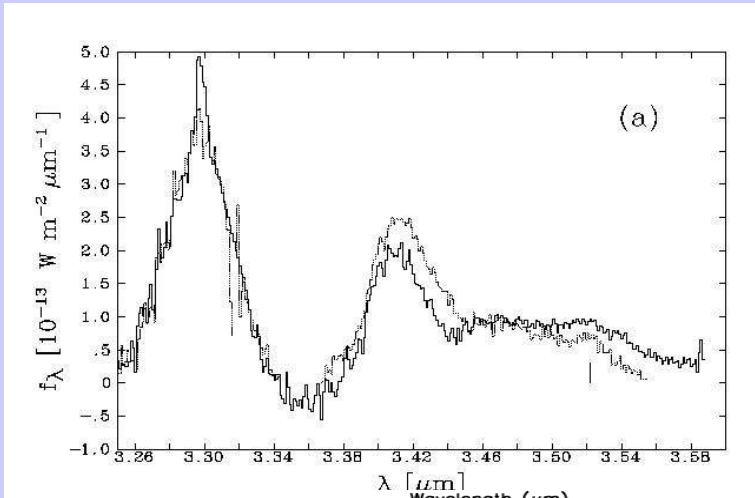
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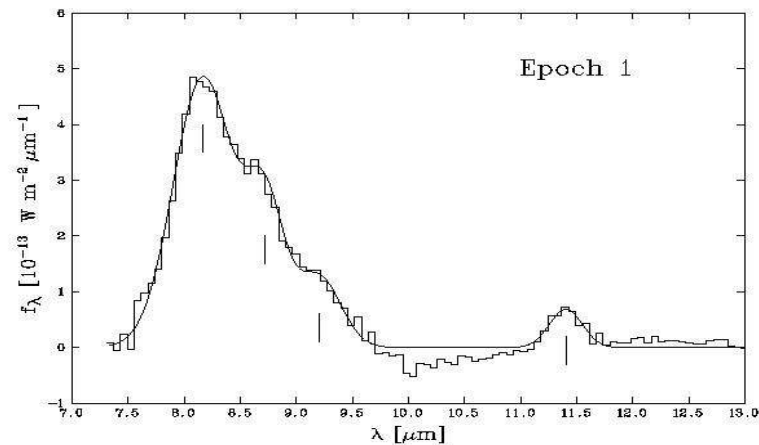


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Astrophysical PAH/UIR/OIR/AEF features

Class A	PNe, HII, Reflection Neb, Diffuse ISM
Class B	Post AGB stars
Class C	Post AGB stars, YSOs
Class D	Novae

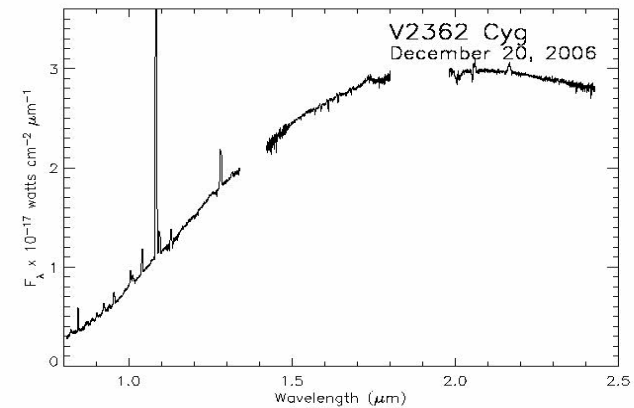
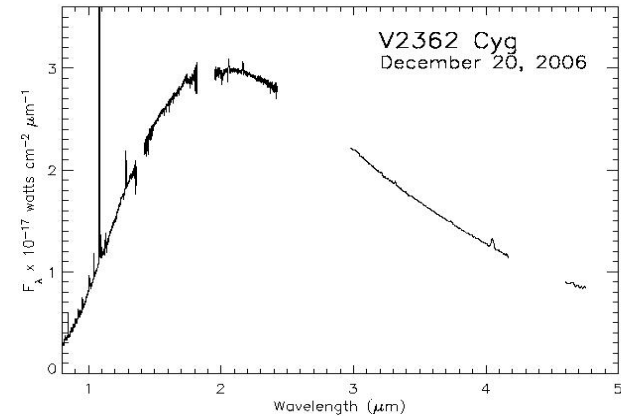
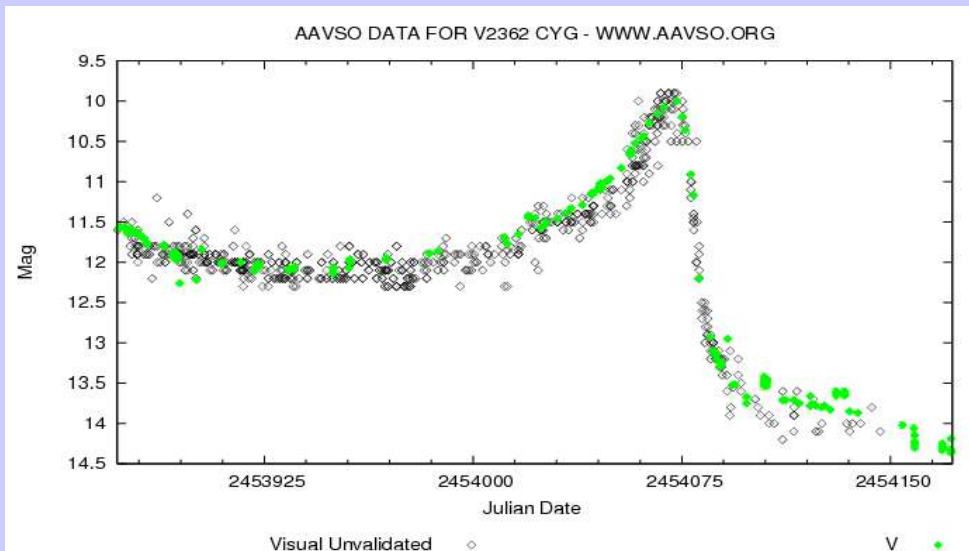
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λ (μm)	FWHM (μm)	Flux ($10^{-14} \text{ W m}^{-2}$)	Identification	Standard λ (μm) for Class A UIRs
8.17 ± 0.01	0.68 ± 0.03	$32.1 (\pm 1.4)$	Si-CH ₃ vibration?	...
8.72 ± 0.02	0.41 ± 0.03	$10.8 (\pm 0.1)$	NH ₂ rock?	...
9.20 ± 0.02	0.46 ± 0.04	$6.27 (\pm 0.43)$	?	...
11.41 ± 0.04	0.34 ± 0.08	$2.53 (\pm 0.51)$	Aromatic C-H bend	11.3

Evans et al., 2005, MNRAS, 360, 1483

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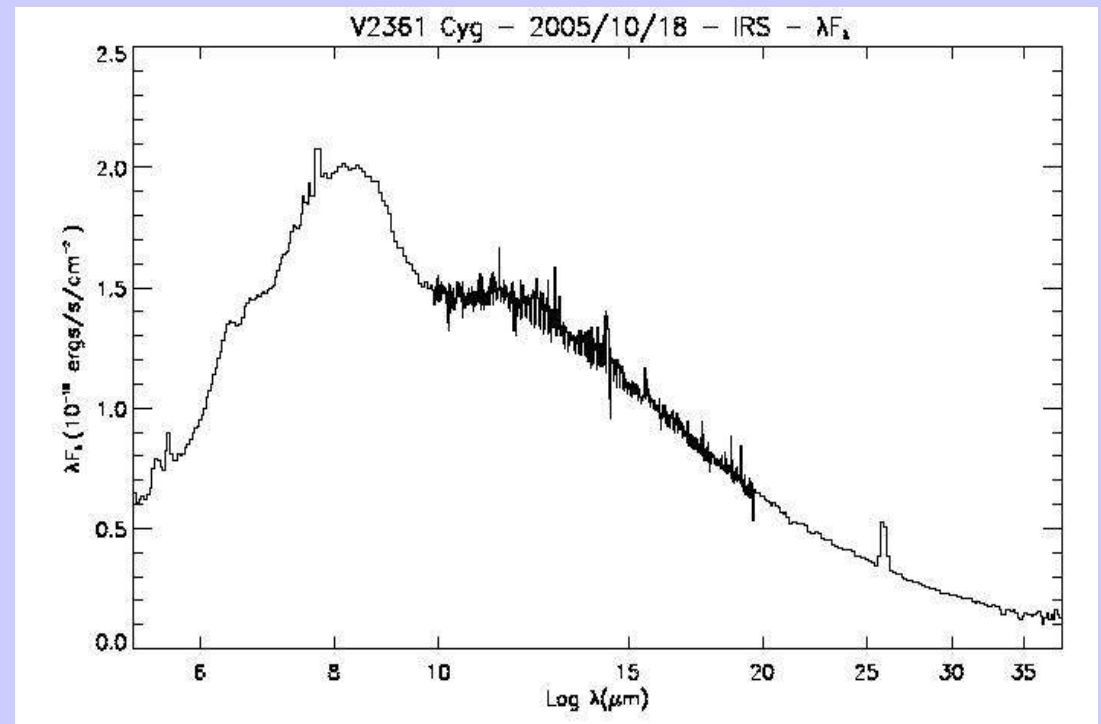
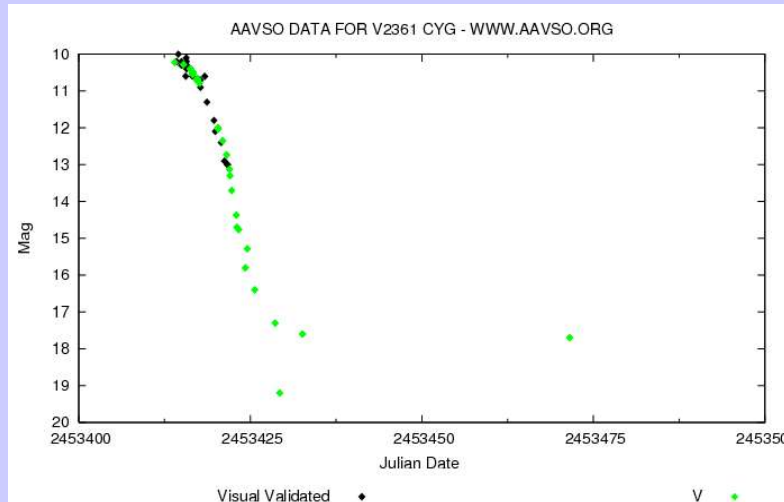
V2362 Cyg (2005) Light curve [!] courtesy AAVSO. IR data courtesy Rick Rudy, Aerospace Corp



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V2361 Cyg (2005). Light curve courtesy AAVSO. Spitzer IRS Courtesy Minnesota Group

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- ♦ ***Novae are not major players in the production of universal dust BUT...***
- ♦ ... they do provide a rare opportunity of seeing rapid dust-formation in real time;
- ♦ formation of dust when CO formation does not go to saturation;
- ♦ can observe near-simultaneous formation of both C- and O-rich condensates;
- ♦ can use dust as 'calorimeter' to get energy budget of nova eruption;
- ♦ can observe real-time depletions of elements as dust condenses;
- ♦ understanding the chemical pathways that lead to formation of nova dust can impact on understanding of astrochemistry of molecular clouds.

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400 roller-costing pages, full of sizzling novae

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