

Classical and recurrent novae



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“The Exploding Suns” - Isaac Asimov

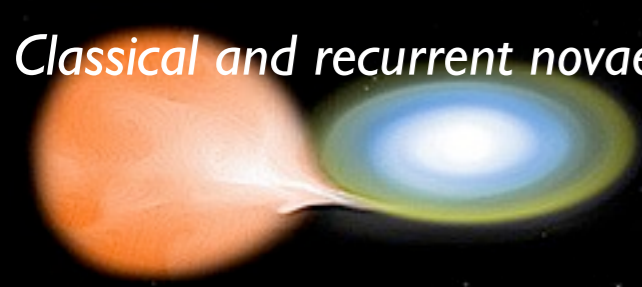


“Samguksagi” (The History of the Three Kingdoms)

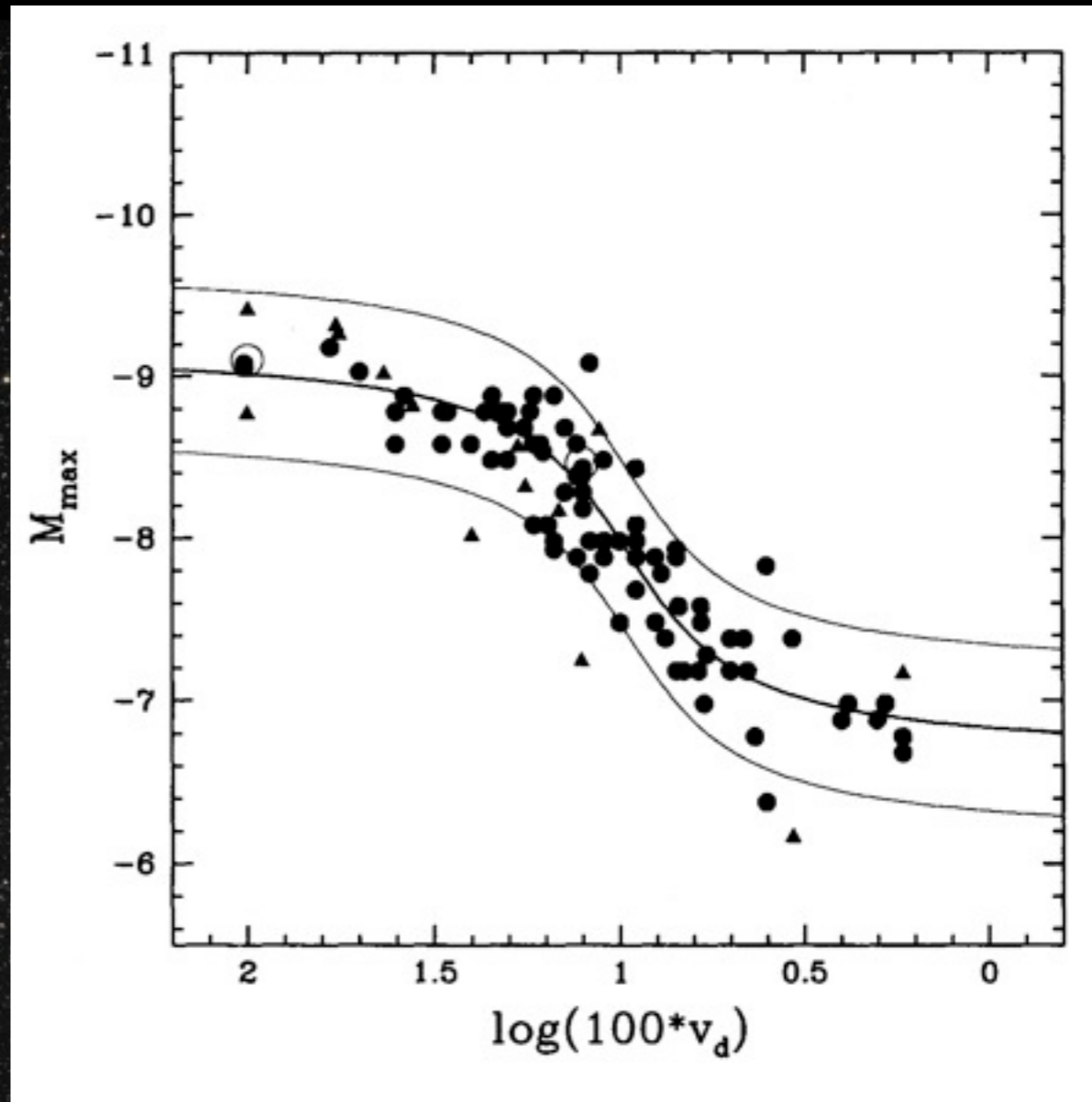
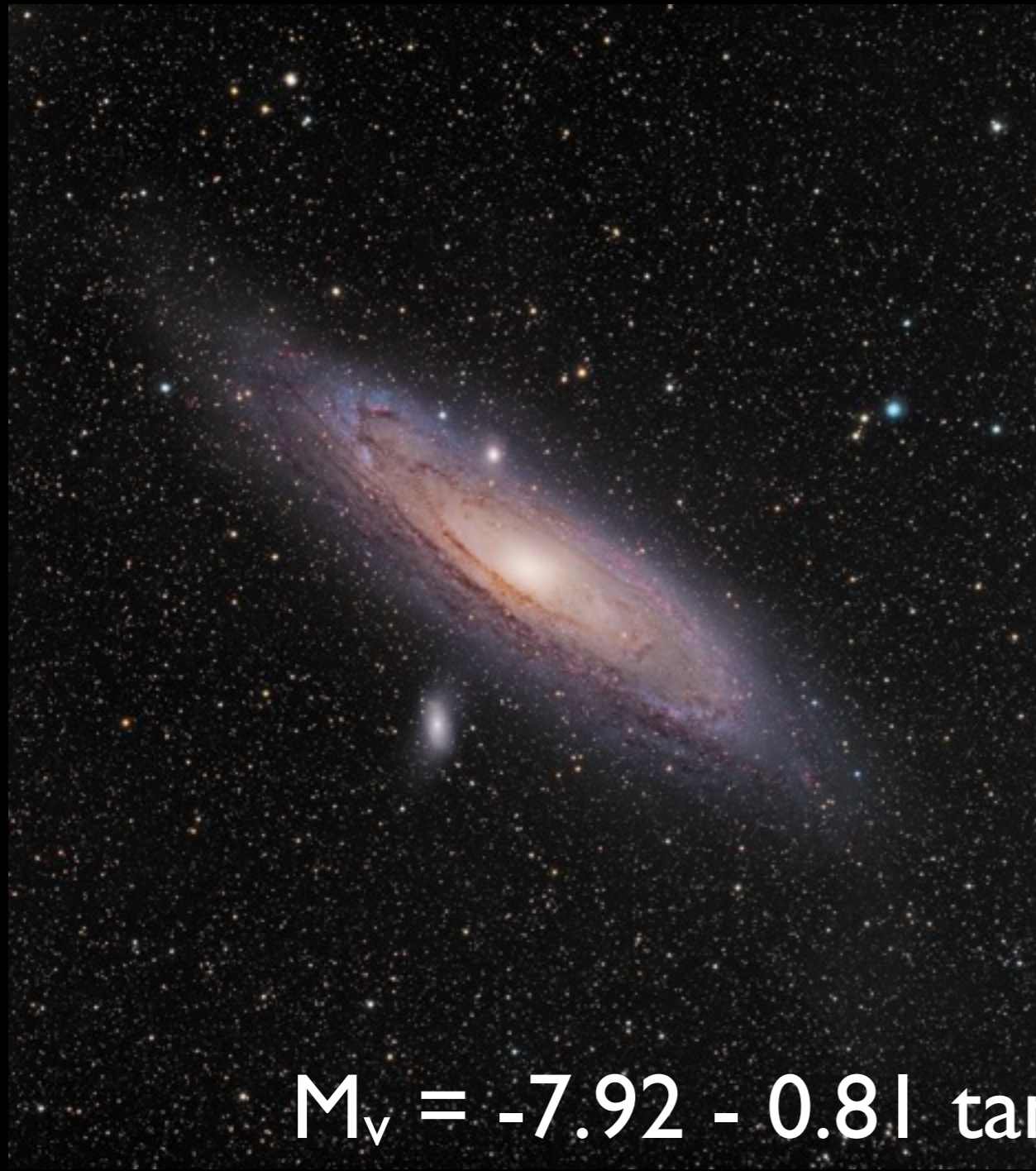
“GUEST STARS”
A.D 1073 AND
A.D 1074

餘日 八年七月丁未彗星流轉十一月甲
 中月食 九年二月乙卯彗感太白並失度
 九月癸未月犯昴星 十一年四月辛丑月
 食
 文宗三年二月癸酉流星出郎將東入大角
 攝提閉大如木瓜光芒照地 三年正月己
 酉月食七月丙午月食 四年六月壬午流
 管室丙辰羽林八月 二十七年正月己酉
 流星出大角入北斗魁中癸酉流星出大陵
 入婁胃南二月甲午月犯南斗三月戊午月
 食七月丙午流星出王良入河鼓辛亥月犯
 南斗魁丁巳入羽林八月丁丑太白晝見客
 星見于東壁星南九月庚戌夜天苑星南天
 裂廣可五六寸中有赤色辛亥月入羽林乙
 卯月食密雲不見己巳太白犯南斗魁第三
 星十月癸酉月入南斗魁甲戌有流星出柳
 入軒轅大如鉞十一月丙寅夜文昌西天裂
 長十五尺廣三尺色青赤 二十八年正月
 壬戌月入南斗魁癸亥又犯第二星二月戊
 寅流星出參西行大如木瓜乙酉月暈光芒
 如彗長三十餘尺七月庚申客星見東壁星
 南大如木瓜九月辛丑月犯南斗魁中第一
 星己酉月食十一月己亥流星出文昌抵西
 北而沒大如鉞十二月丁亥月入氐星 二
 十九年四月戊寅流星出角入井鬼聞七月
 癸酉流星出南斗彗行至尾而散長丈餘庚
 辰月犯昴九月辛巳流星入天樞大如木瓜
 壬午流星出天津入河鼓大如杯丁亥流星
 出下台東北入軒轅戊子流星入華蓋大如
 燈十月癸巳流星出天南入軫大如木瓜丙
 申彗見于軫星長七尺餘 三十一年正月
 丙寅月食 三十二年正月庚申月食六月
 甲寅月食宋使救之國人不知覺以日官翠
 塵正崔士謙撰曆失於推步不以聞奏有司
 請論如法宥之九月癸酉朔彗感犯鬼十月





MMRD Relationship



$$M_v = -7.92 - 0.81 \tan^{-1} |32 - \log(t_2)/0.32|$$

Della Valle & Livio 1995, ApJ, 452, 704



Bright Novae

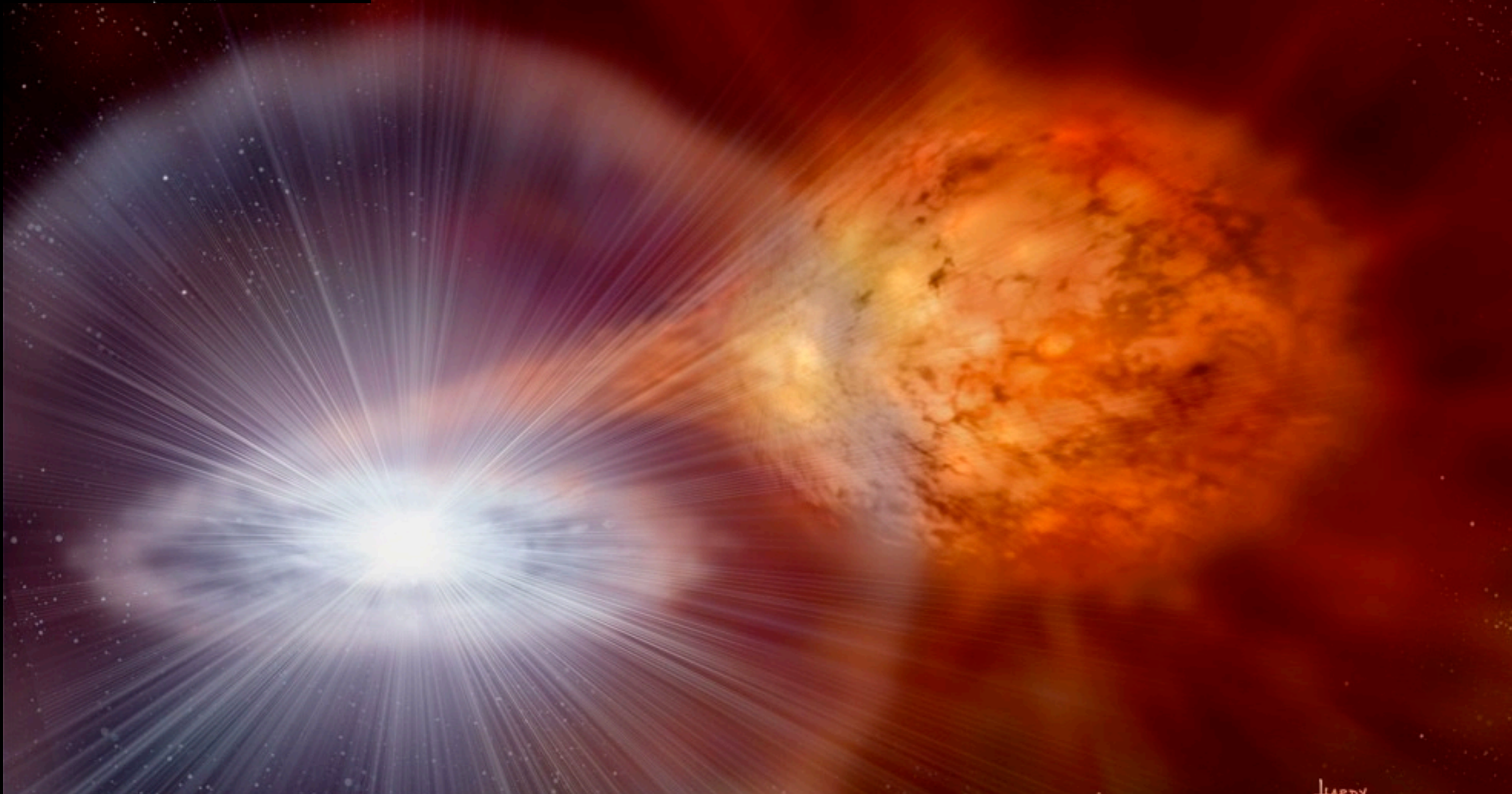


Year	Nova	Peak Mag	Notes
1902	GK Per	0.2	First light echoes
1918	V603 Aql	-1.4	The star of victory
1942	CP Pup	0.5	The socks star
1975	V1500 Cygni	2.2	Fastest on record
2007	V598 Pup	4.1	Nova everyone missed

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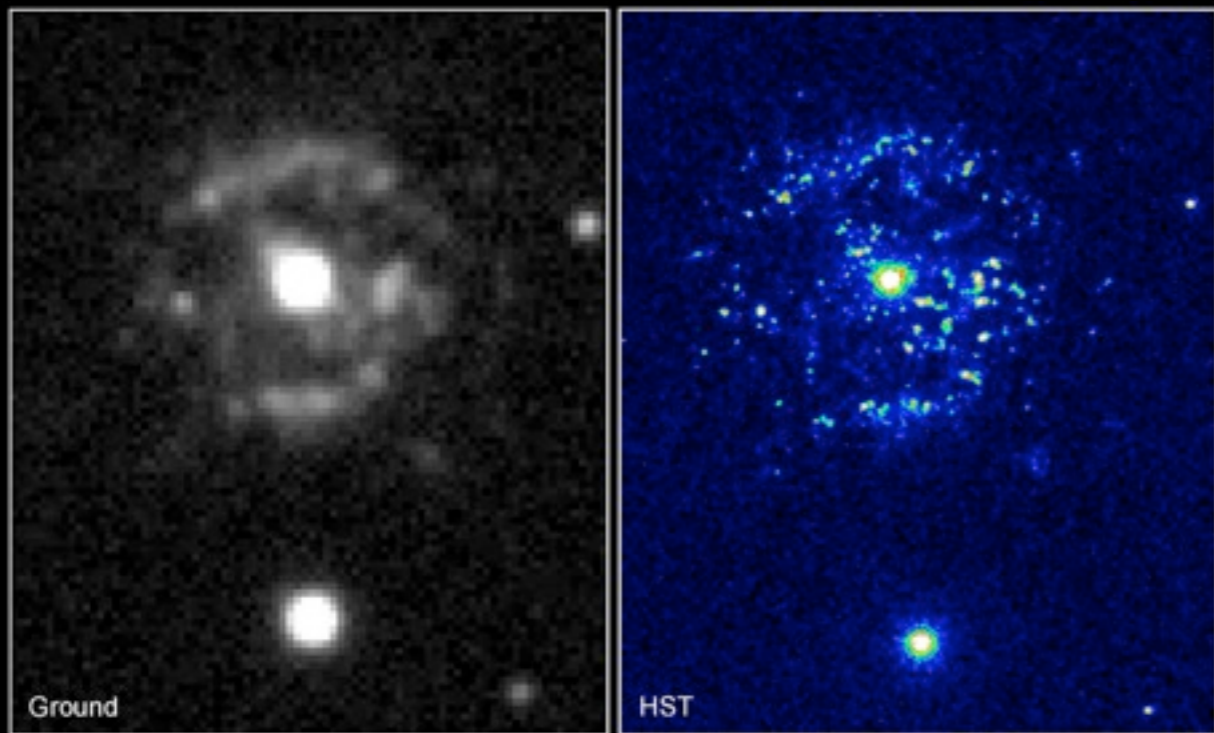
HARDY



Recurrent novae

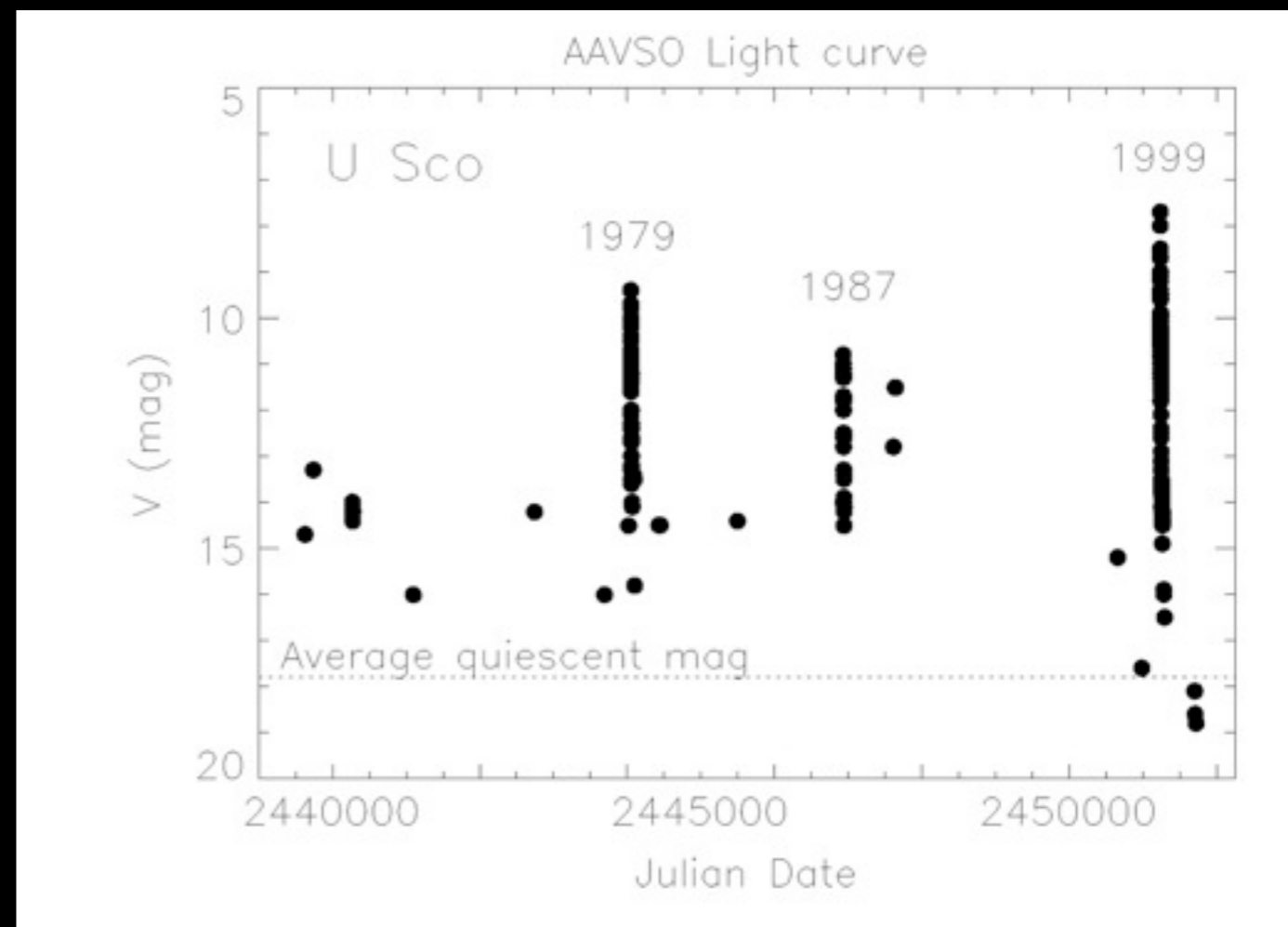


Nova systems erupting every 100 yrs or less.



Recurring Nova T Pyxidis
PRC97-29 • ST ScI OPO • September 18, 1997
M. Shara and R. Williams (ST ScI), R. Gilmozzi (ESO) and NASA

The white dwarfs are near the Chandrasekhar mass.

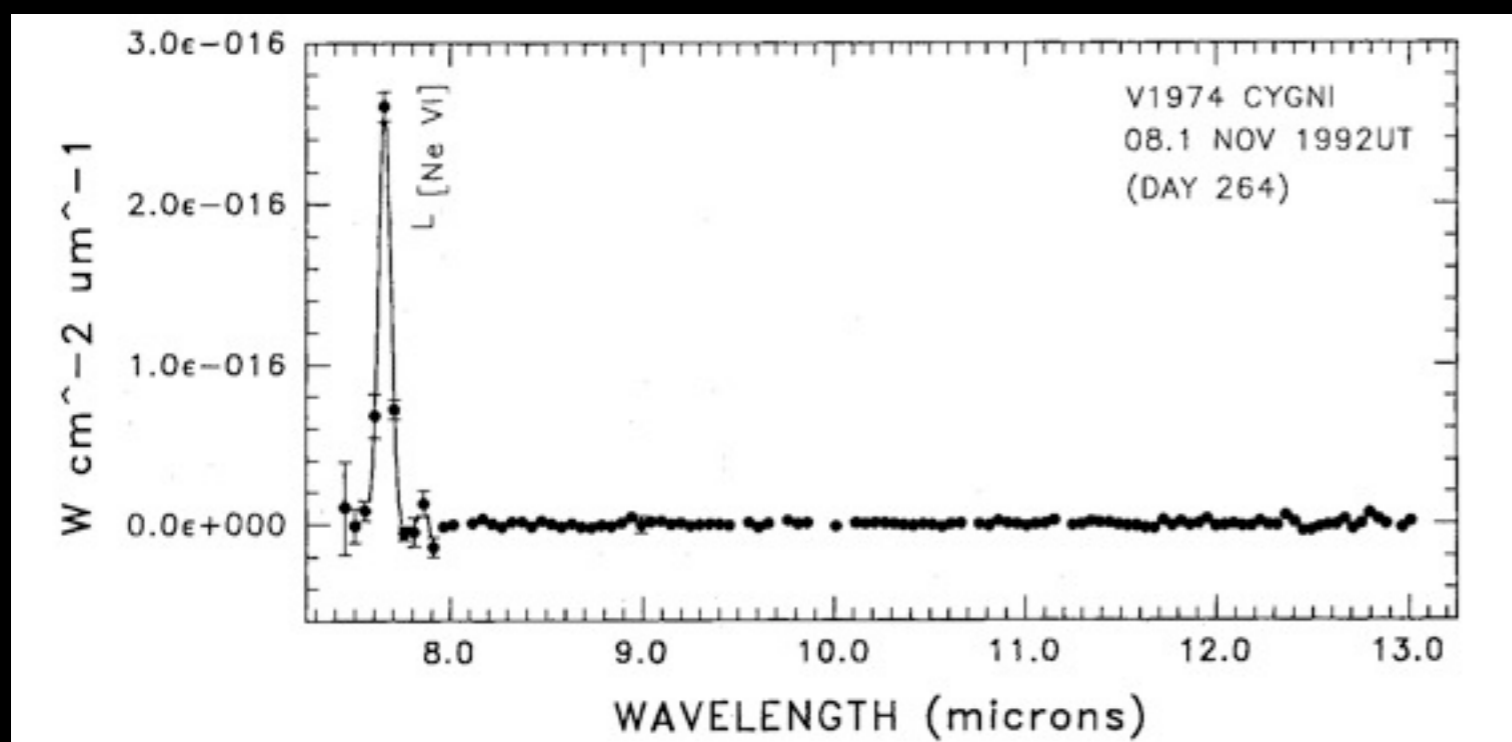




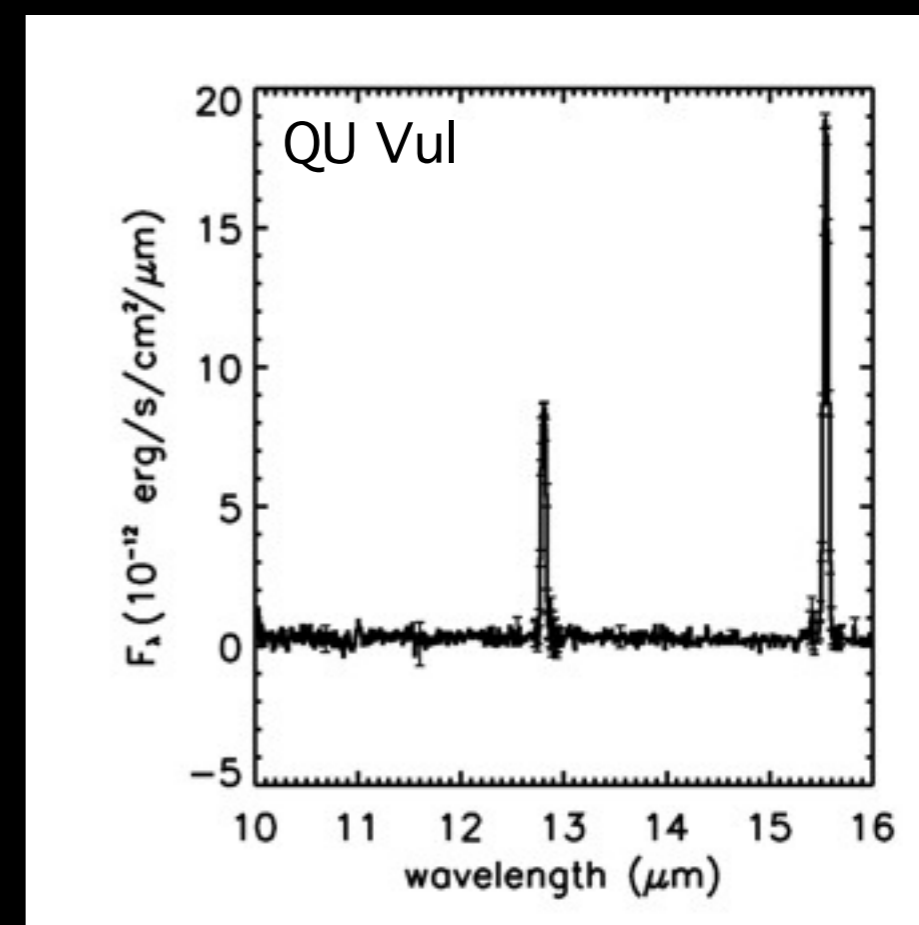
“neon novae”

Characterised by strong neon lines in the infrared.

Gehrz et al. 2008, ApJ, 672, 1167



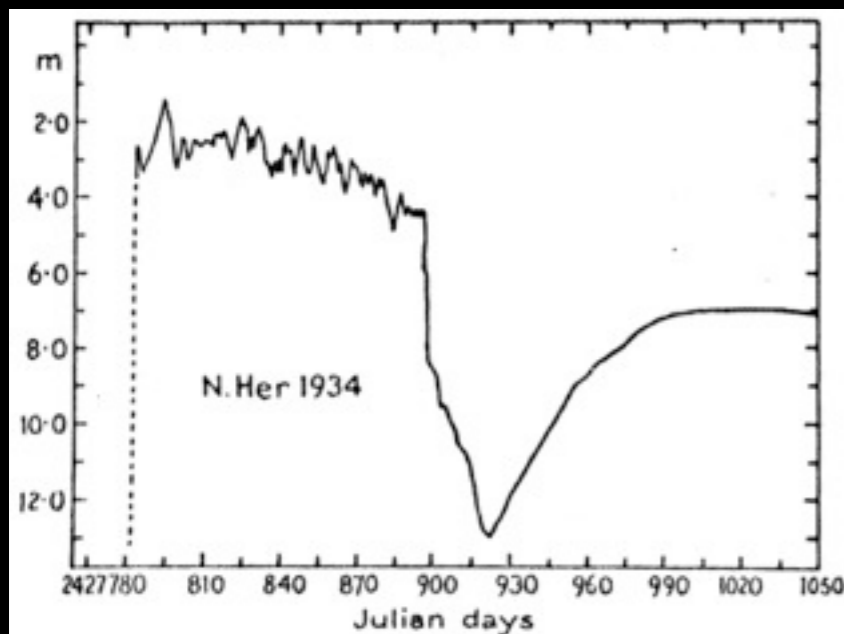
Gehrz et al. 1994, ApJ, 421, 762



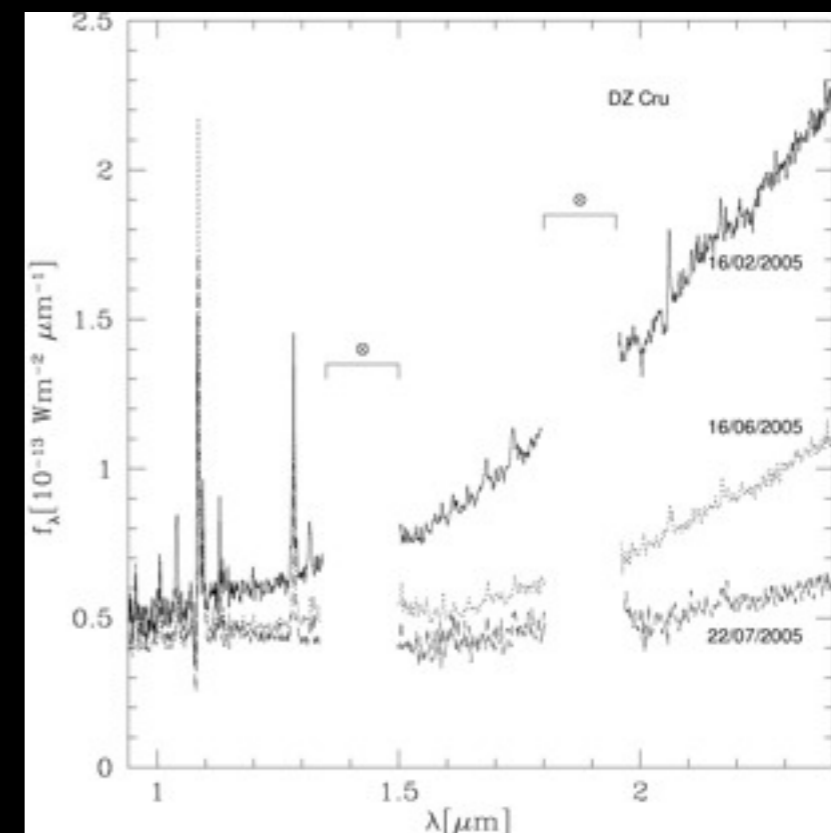
Neon abundance in QU Vul is 100-200 times solar.



dusty novae

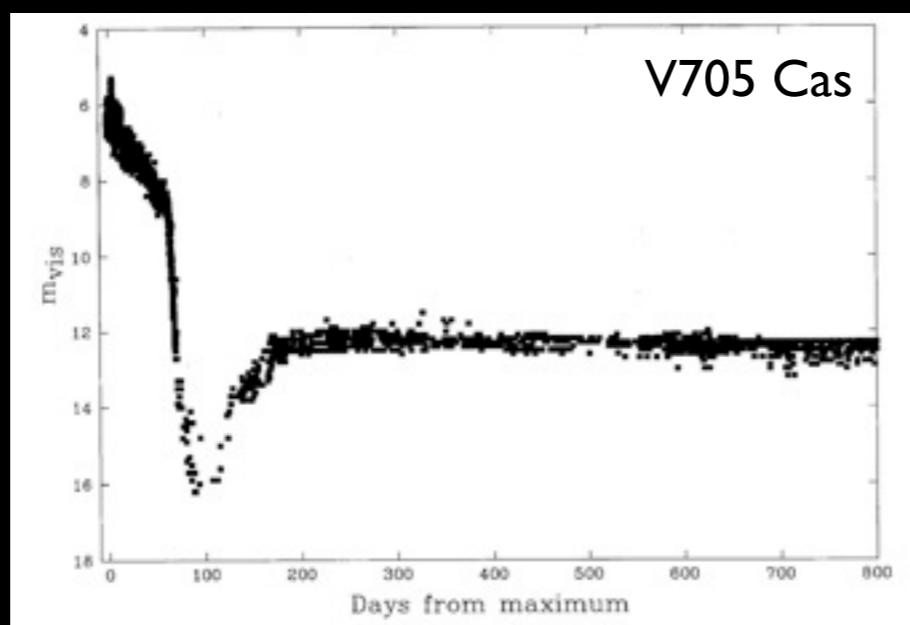


Thermal emission at
> 2 micron.

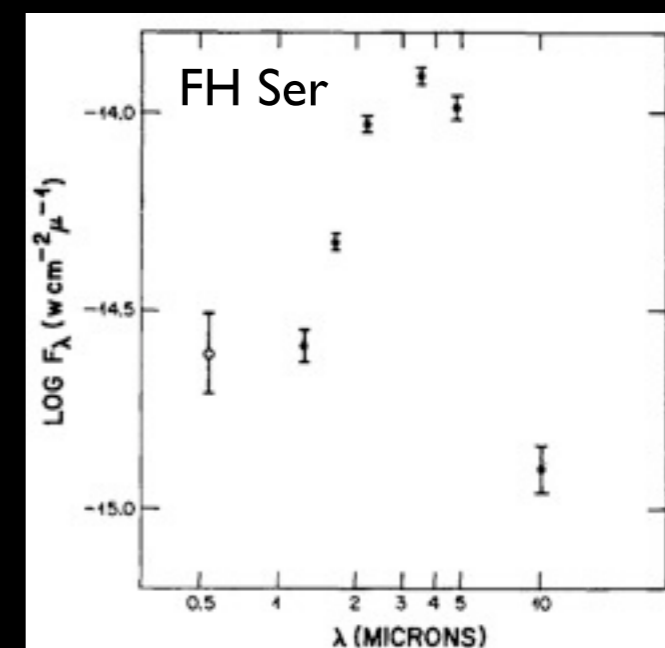


Rushton et al. 2008, MNRAS, 386, 289

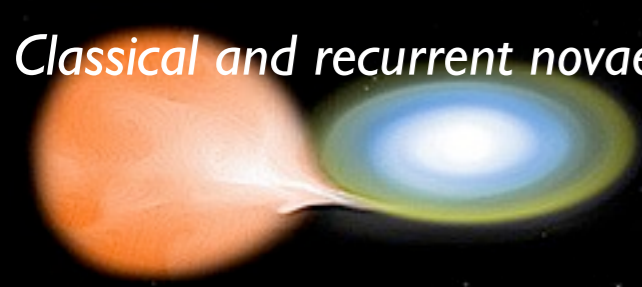
Dust dips in the
light curves.



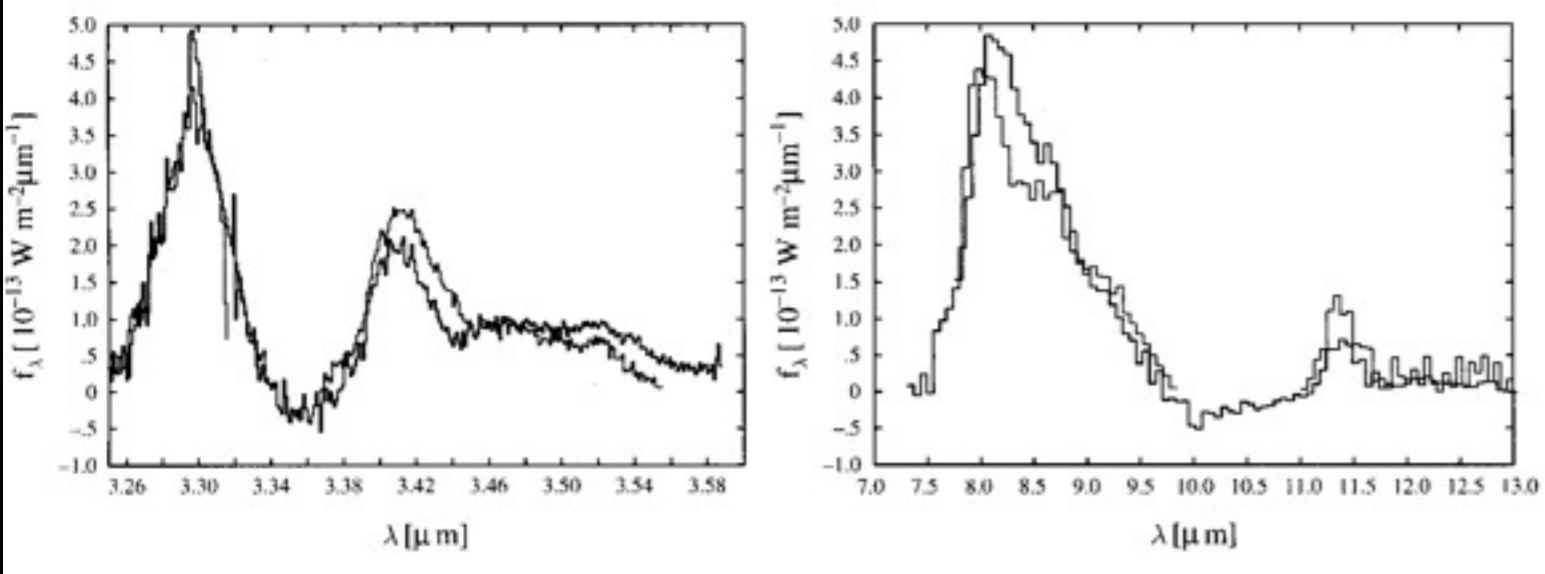
Evans et al. 1997, MNRAS, 292, 192



Hyland & Neugebauer 1970, ApJ, 160, L117



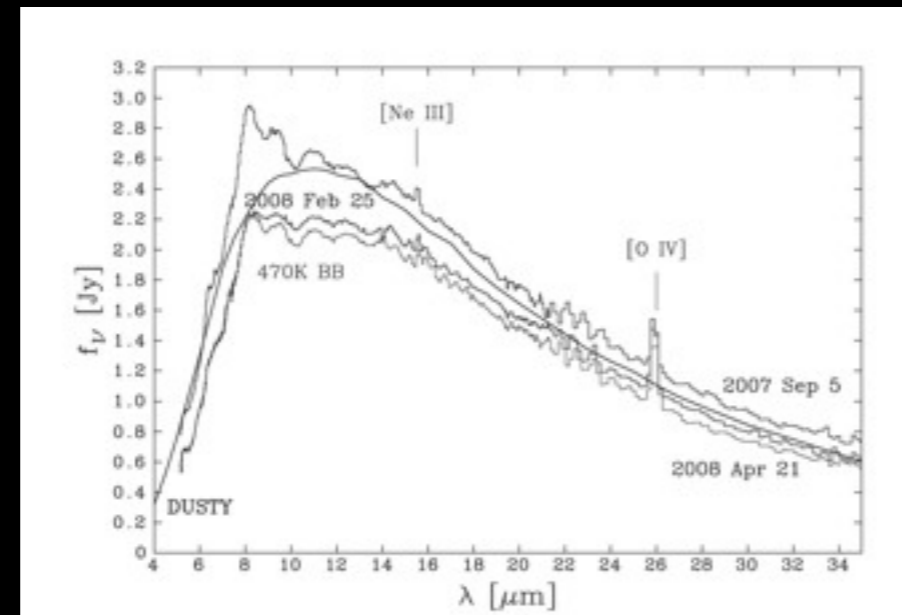
Novae in the infrared



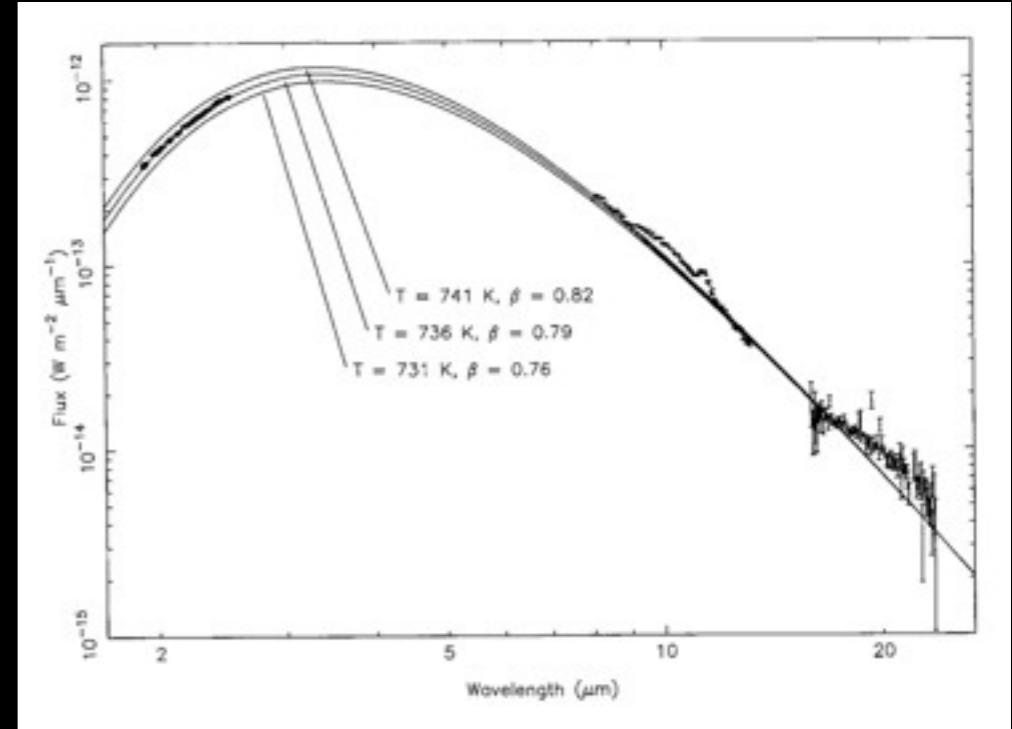
UIR emission in
V705 Cas.

Evans et al. 1997, MNRAS, 292, 192

HAC
in DZ Cru.



Evans et al. 2010, MNRAS, 406, L85



V705 Cas dust emissivity.

Evans et al. 1997, MNRAS, 292, 192



SOFIA Basic Science 81-0024

SOFIA observations of recurrent novae

M T Rushton, R. D. Gehrz, A. Evans,
C. E. Woodward, S. Starrfield, J. Krautter,
S. P. S. Eyres, M. P. Maxwell

SOFIA
STRATOSPHERIC OBSERVATORY
FOR INFRARED ASTRONOMY



SOFIA Basic Science

81-0024

FORCAST 5-25 micron observations of symbiotic recurrent novae.

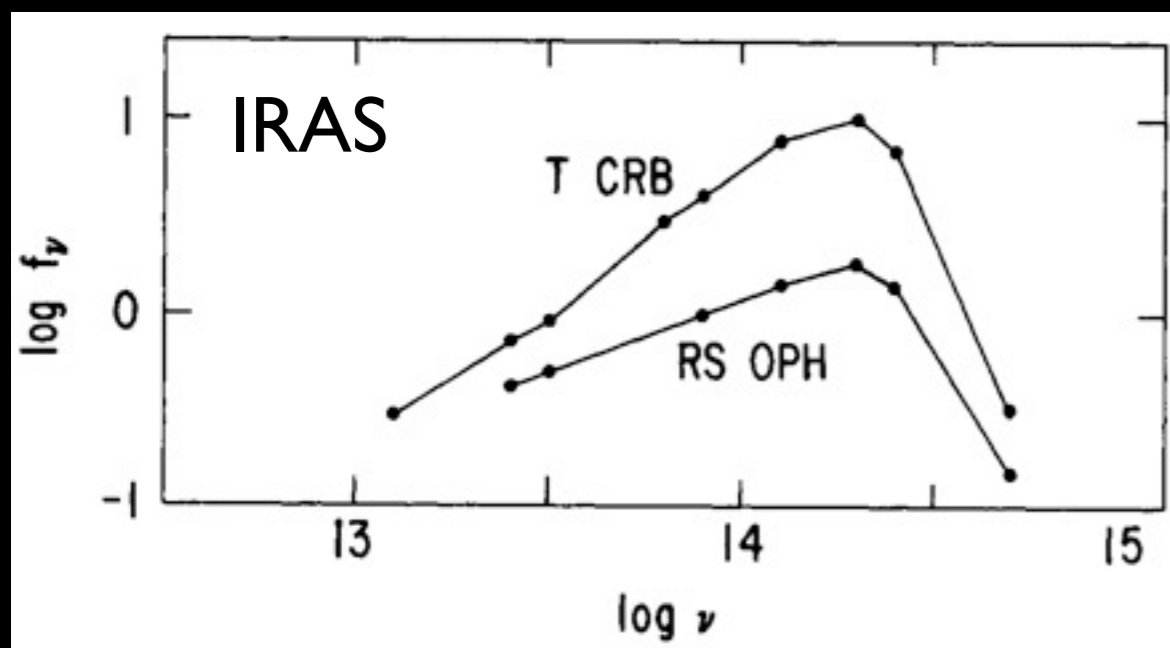
Dust emission from the secondary wind, which is shocked by the nova ejecta.

RS Oph, T CrB and V407 Cyg.

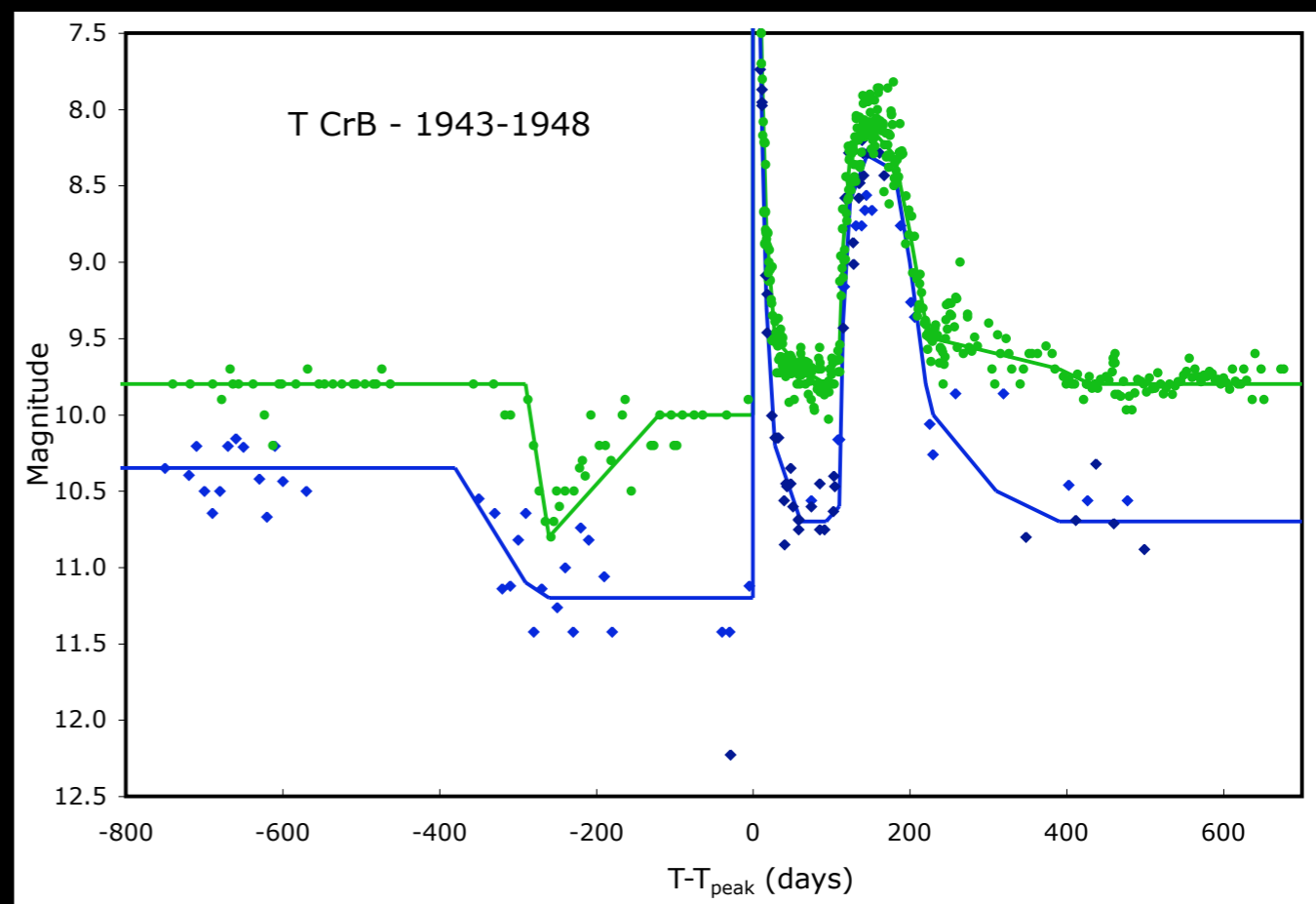


T Coronae Borealis

Outbursts in 1866 and 1946.



Schaefer 1986, PASP, 98, 556



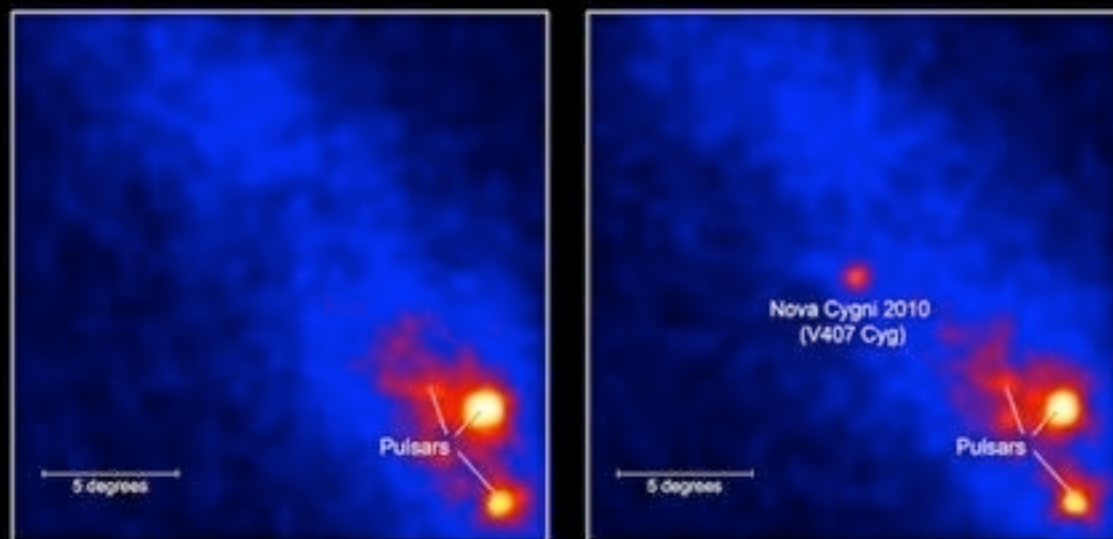
Schaefer 2010, ApJS, 187, 275

Next outburst 2026?



V407 Cygni

Fermi Detects Gamma Rays from Nova Cygni 2010



Feb. 19 to March 9, 2010

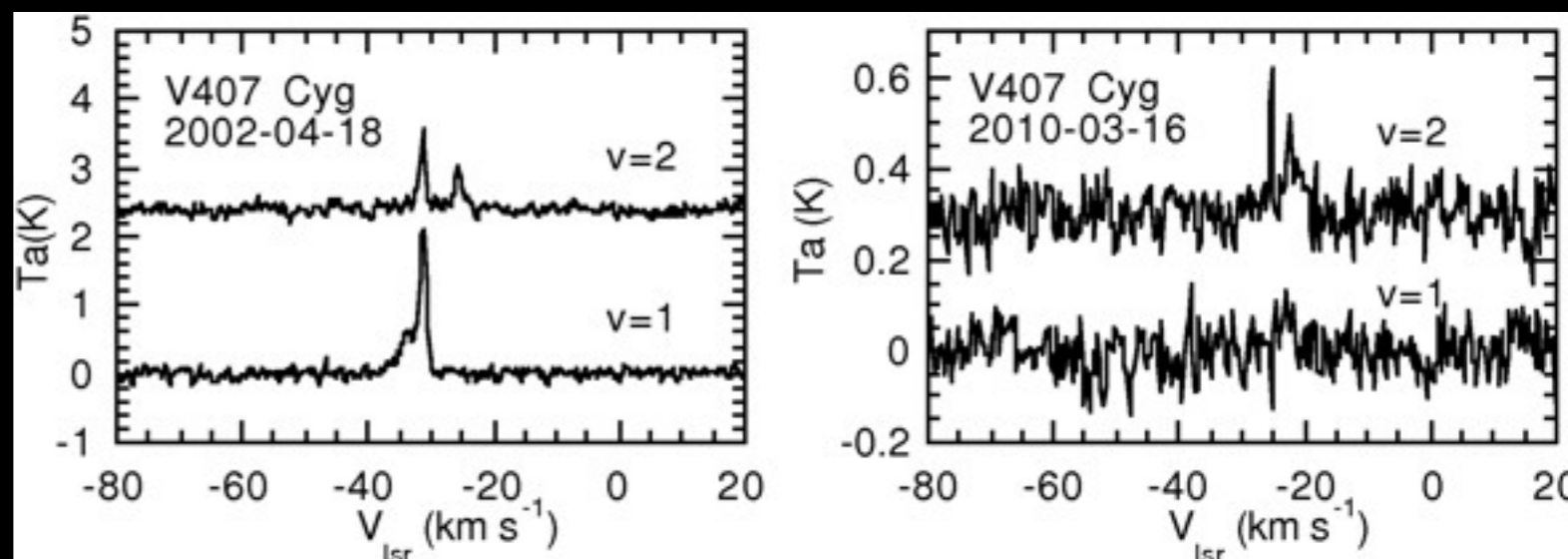
March 10 to 29, 2010

Mira-type secondary star.

D-type symbiotic system.

Abdo et al. 2010, Sci, 329, 817

Shock interaction visible in SiO masers.



Deguchi et al. 2011, PASJ, 63, 309



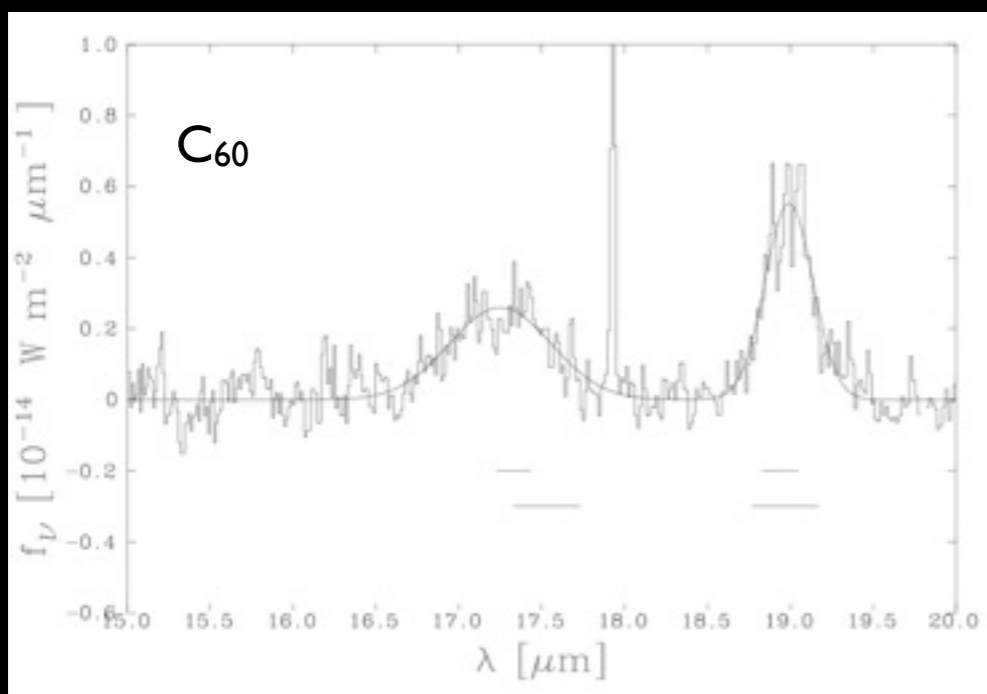
Summary of 81-0024

**V407 Cyg was observed on flight 0055 at 43K ft;
it was easily detected in all 5-25 micron bands.**

**T Crb was observed on flight 0056 at 39K ft;
it was fainter than expected at >11.1 micron.**



For the future...

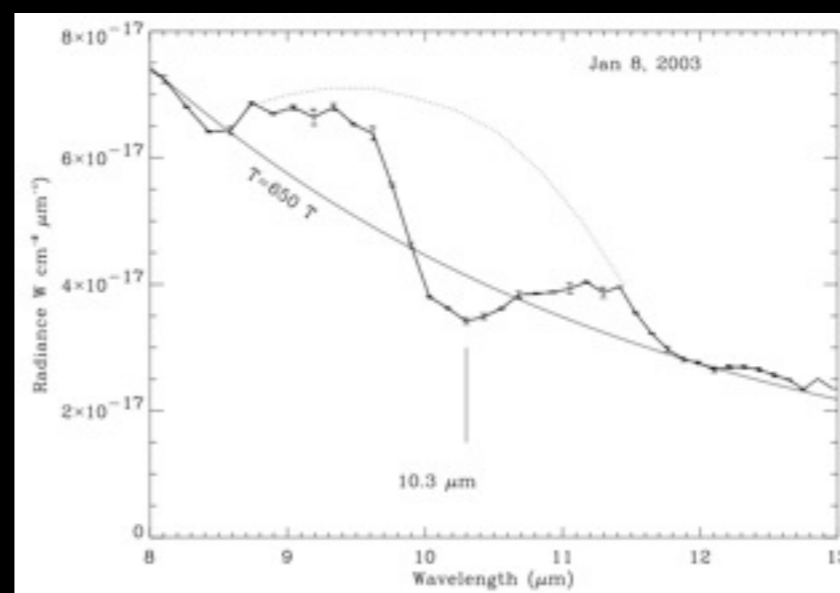


Bond et al. 2003, Nat, 422, 405

Luminous red novae

Evans et al. 2011, MNRAS, submitted

The weird symbiotic binary XX Oph



Unknown dust(?)
feature
in V838 Mon

Lynch et al. 2004, ApJ, 607, L460