COMPREHENSIVE PHOTOMETRIC HISTORIES OF ALL KNOWN GALACTIC RECURRENT NOVAE

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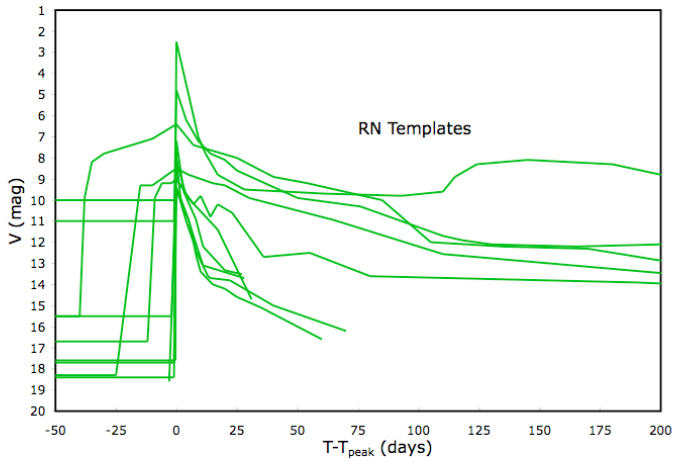
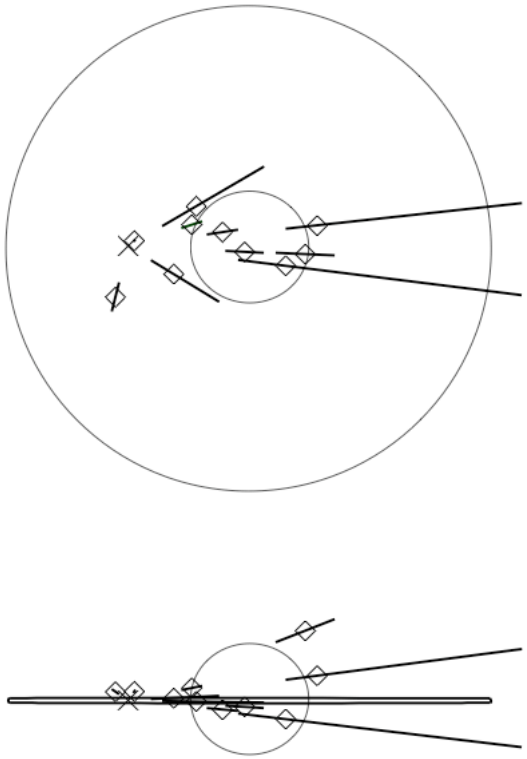
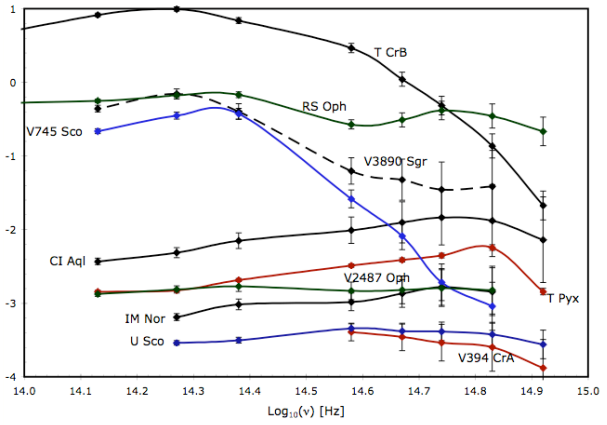
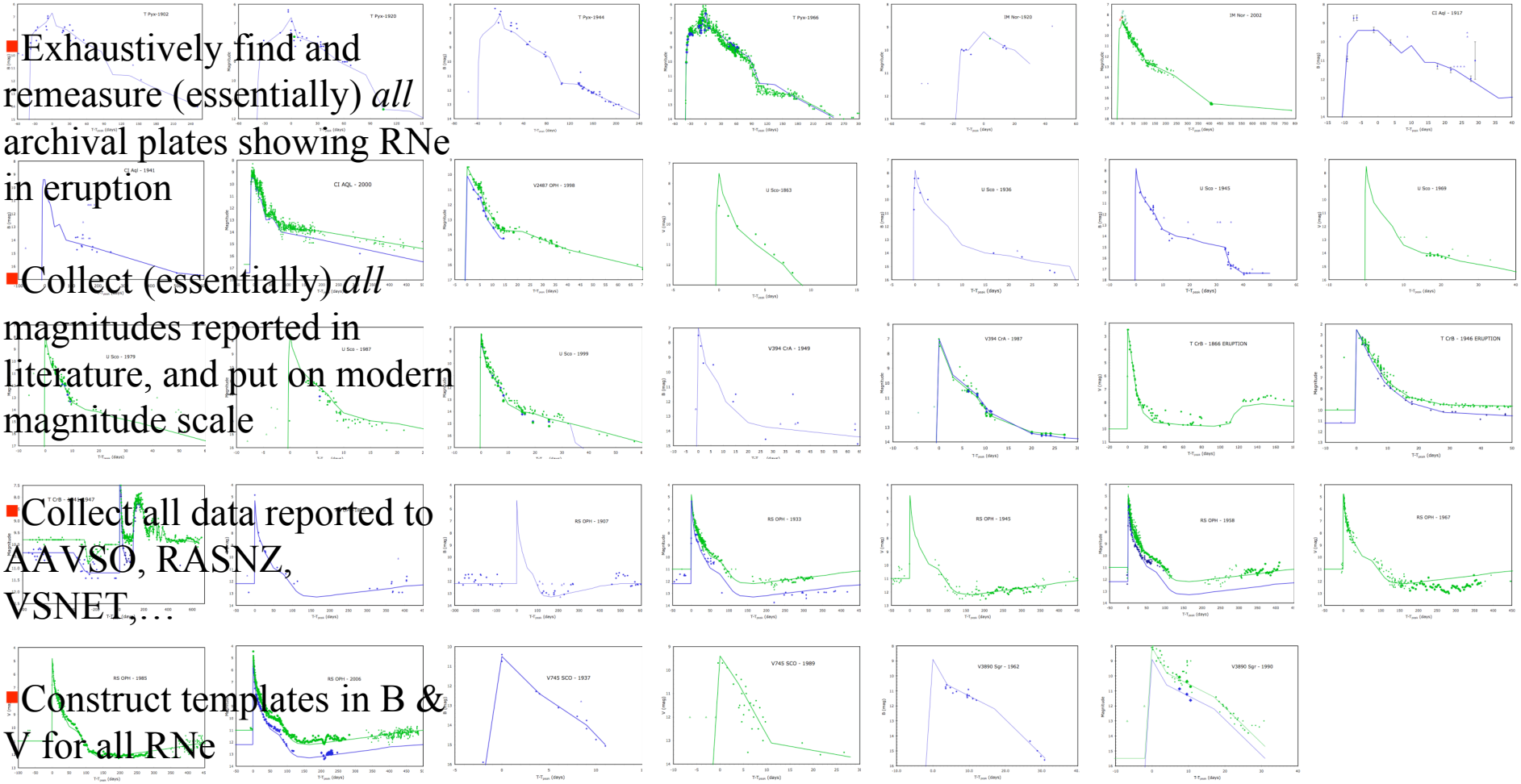






EXHAUSTIVE MODERN LIGHT CURVES FOR ALL 37 KNOWN ERUPTIONS:

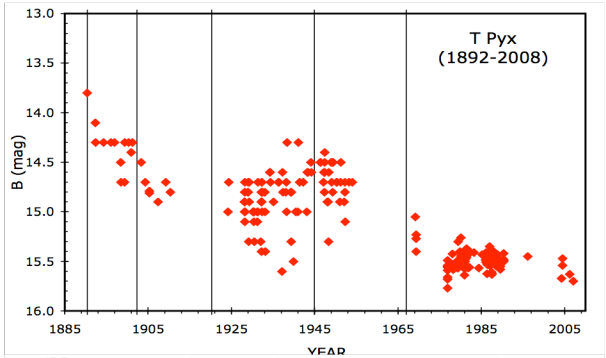
- Get *modern* UBVRIJHK magnitudes for all comparison stars

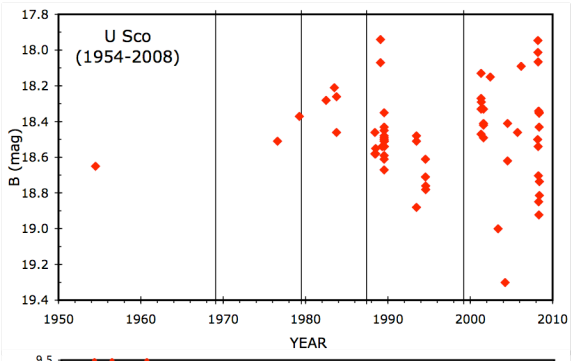


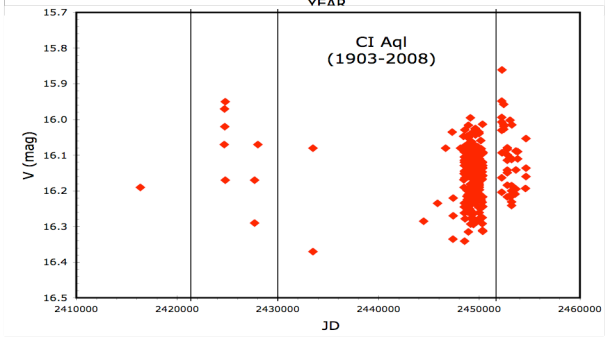
- Exhaustively find and remeasure (essentially) *all* archival plates showing RNe in eruption
- Collect (essentially) *all* magnitudes reported in literature, and put on modern magnitude scale
- Collect all data reported to AAVSO, RASNZ, VSNET,…
- Construct templates in B & V for all RNe

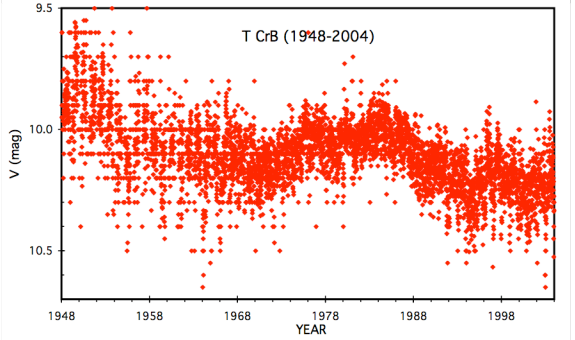
EXTENSIVE MONITORING OF ALL TEN RNe IN QUIESCENCE

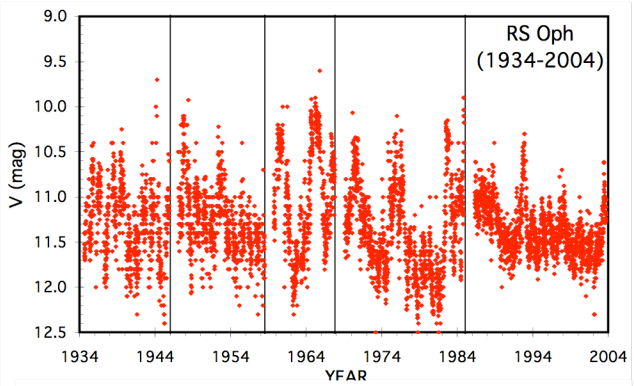
- Huge datasets from CTIO, McDonald, ROTSE since 1987
- Remeasured essentially *all* archival plates showing RNe in quiescence (mainly from Harvard, Sonneberg, Maria Mitchell, UK Schmidt)
- My datasets now constitute essentially the world's entire supply of magnitudes at quiescence for seven RNe
- Collect the huge AAVSO datasets for T CrB and RS Oph

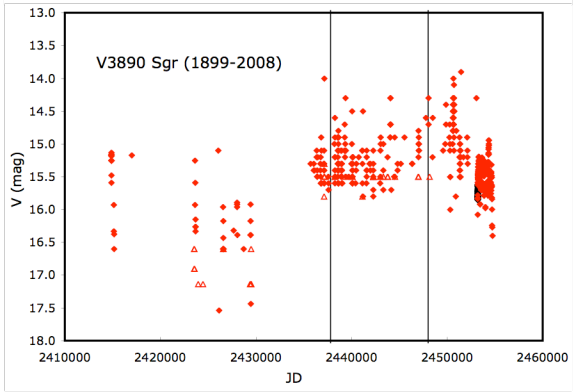


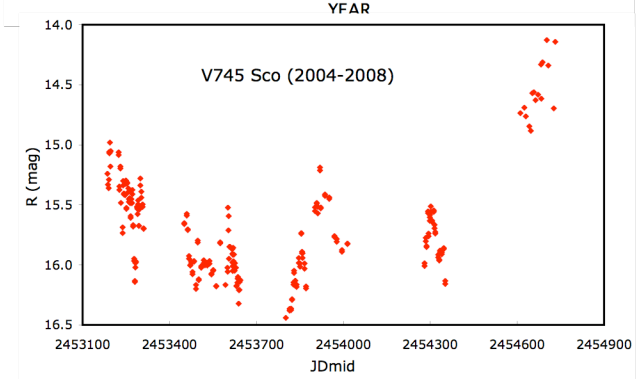


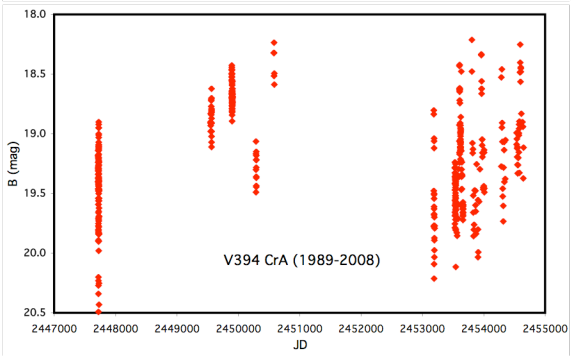












EASY-TO-POINT-TO DISCOVERIES:

★One New Recurrent Nova -- V2487 Oph with eruptions in 1900 and 1998
(Pagnotta, Schaefer, & Xiao 2008)

★Six Previously-Undiscovered Eruptions --

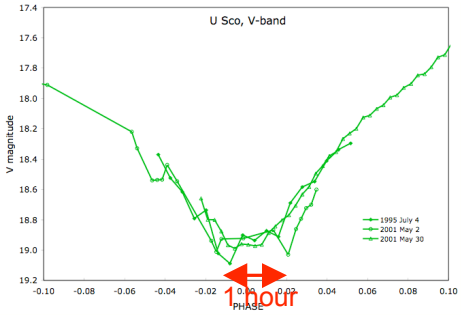
U Sco in 1917, 1945, 1969;
RS Oph in 1907;
V2487 Oph in 1900;
CI Aql in 1941

★Five Orbital Periods --

V745 Sco with P_{orb}=510±20,
V3890 Sgr with P_{orb}=519.7±0.3,
V394 CrA with P_{orb}=1.515682±0.000008,
U Sco with P_{orb}=1.2305631±0.0000030,
T Pyx with P_{orb}=0.07616±0.00017

★Five Reliable Distances based on Companion Star --

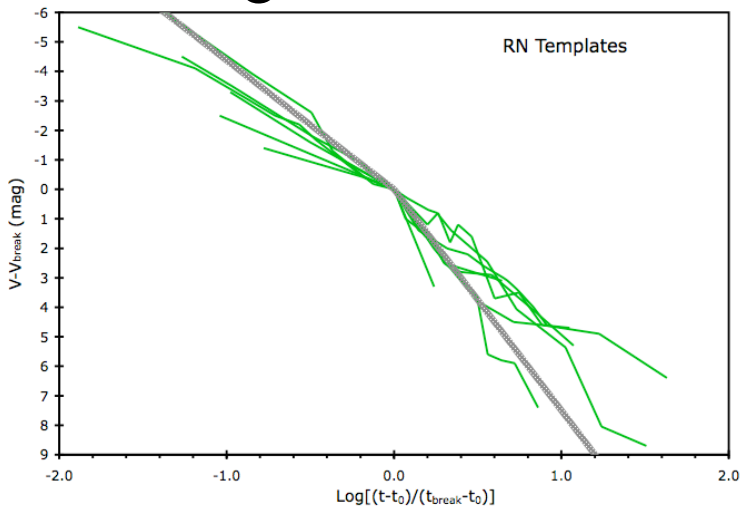
U Sco at 12000±2000 pc,
T CrB at 800±140 pc,
RS Oph at 4300±700 pc,
V745 Sco at 7300±1200 pc,
V3890 Sgr at 6000±1000 pc



RESULTS:

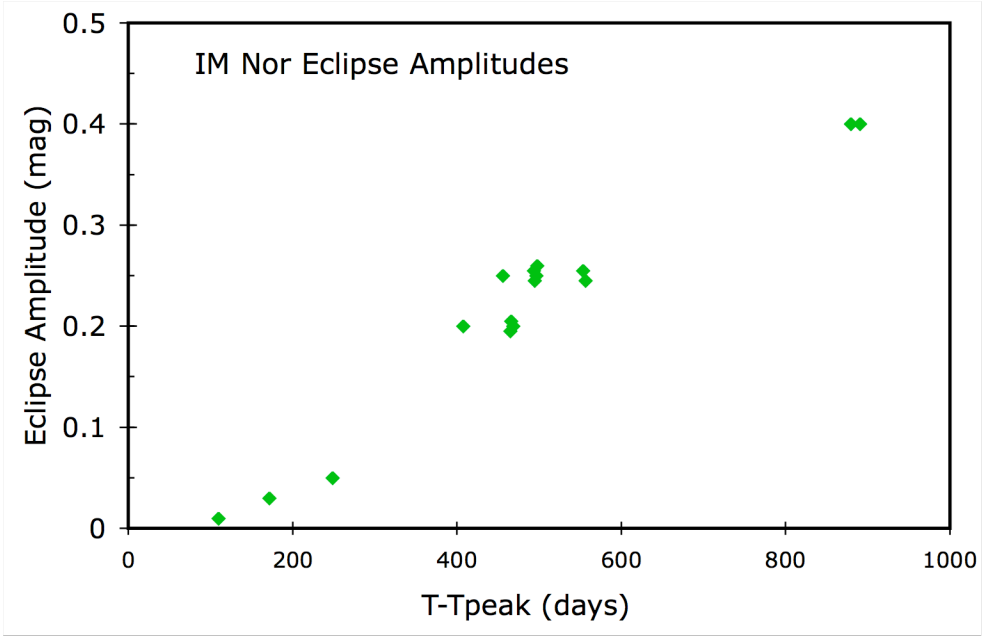
★ All eruption light curves from a single RN are *identical*

★ Diverse light curves well described by 'universal decline law' of Hachisu & Kato

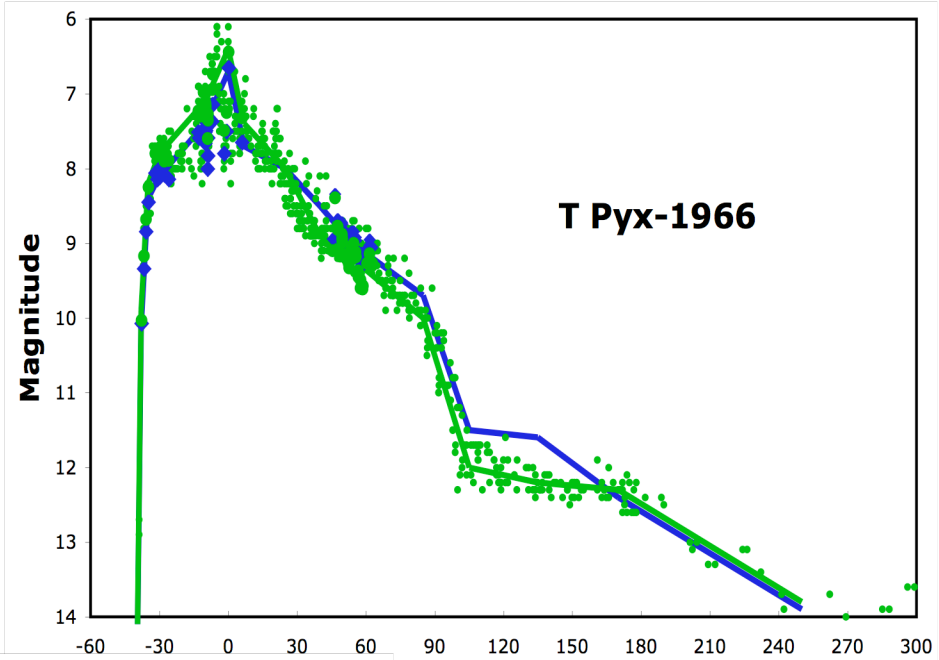


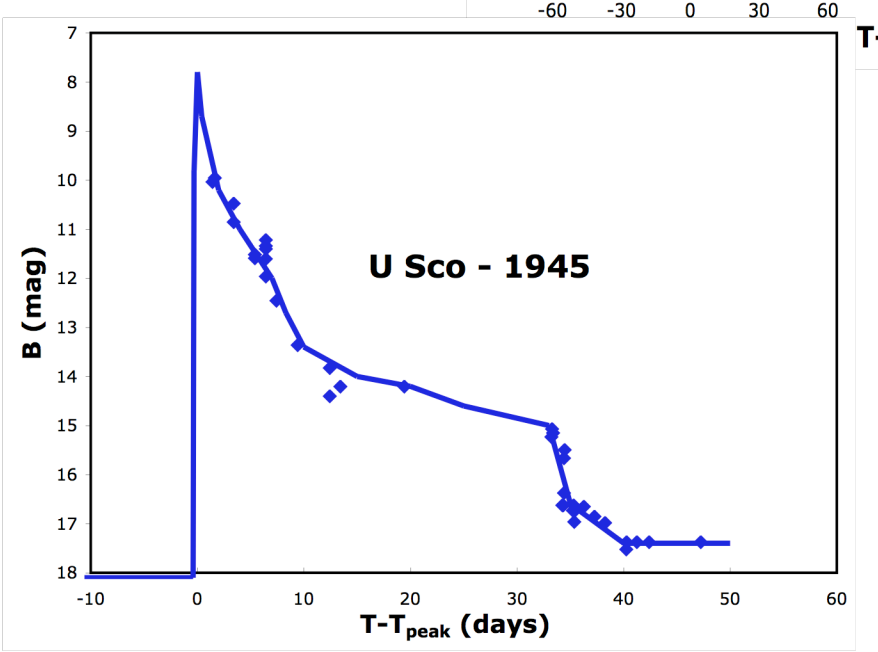
★ 50%-90% of RNe light curves have plateaus

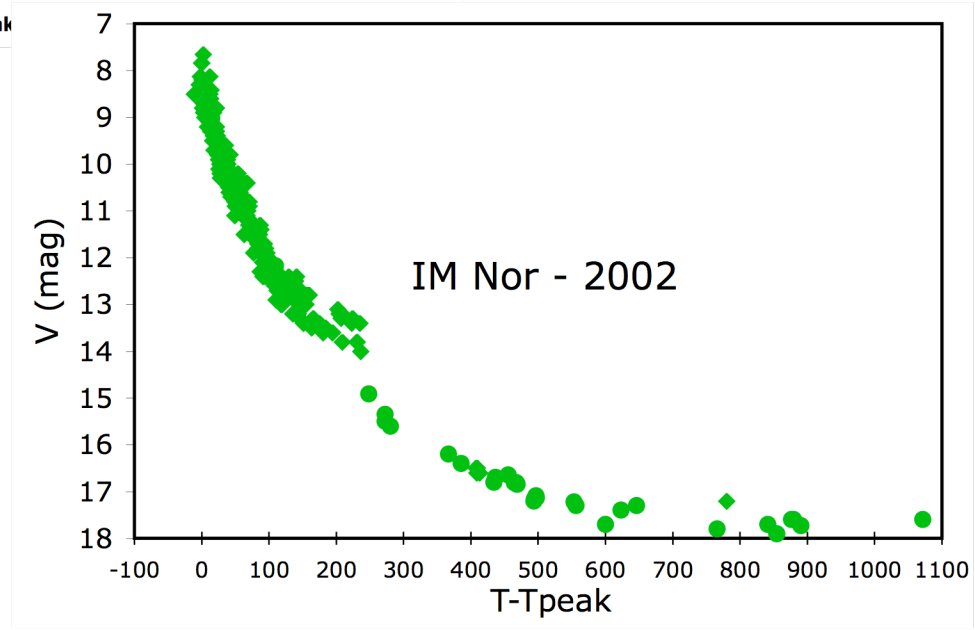
★ Eclipse amplitude changes greatly throughout the eruption light curve



SUDDEN DROPS IN LIGHT CURVES:

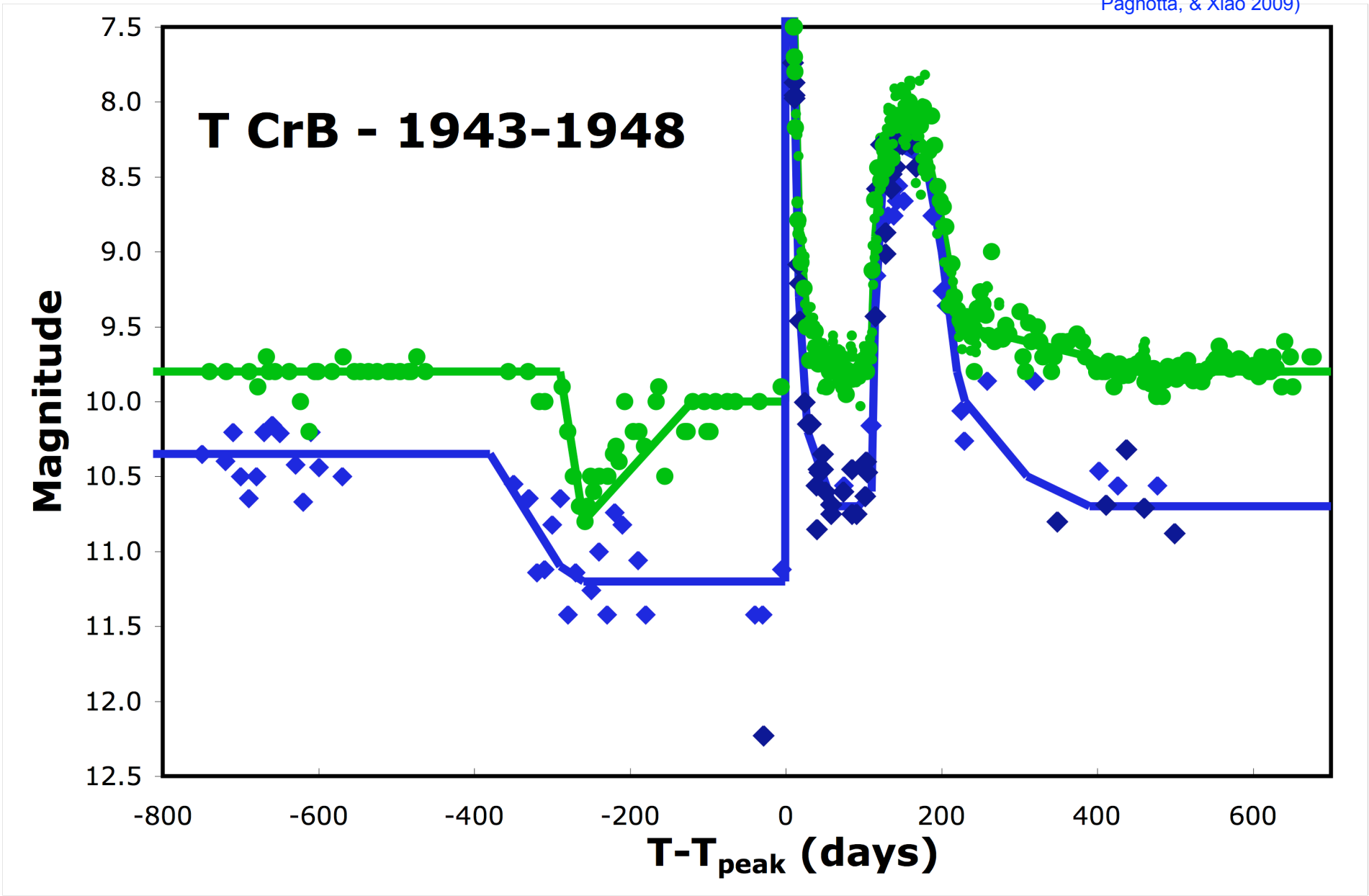






PRE-ERUPTION DIP:

Note - all claimed pre-eruption rises in classical novae have been found to be non-existent, *except* for the blatant rise by V533 Her (Collazzi, Schaefer, Pagnotta, & Xiao 2009)



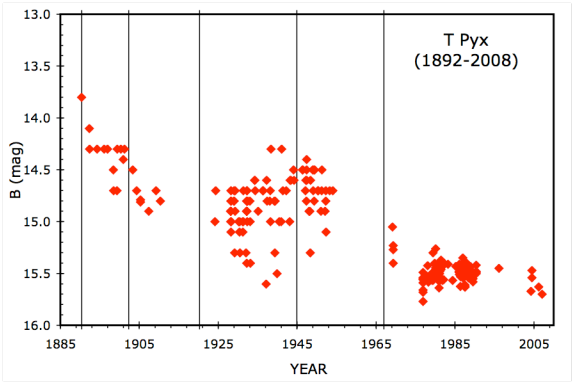
ALL RNe VARY BY UP TO 10x ON ALL TIME SCALES MINUTES←→CENTURY

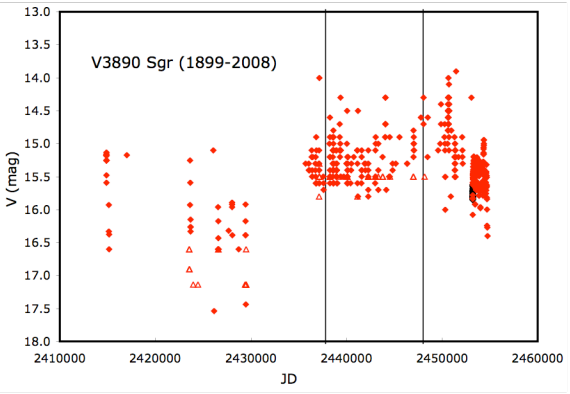
- *All* RNe:
  - Minutes➔
  - Hours➔
  - Days➔
  - Weeks➔
  - Months➔
  - Years➔
  - Decades➔
  - Century

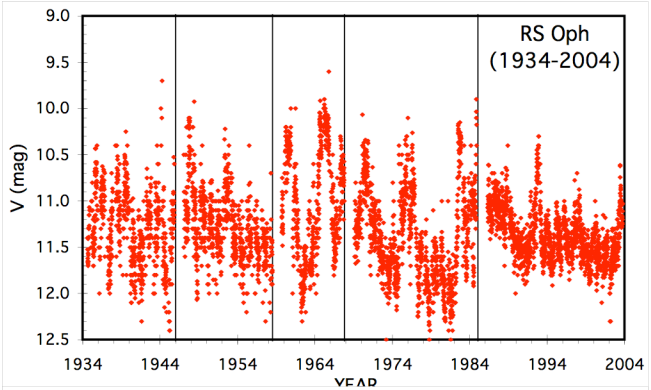
- Long-term variations on RS Oph and T CrB caused by ordinary convection on the red giant

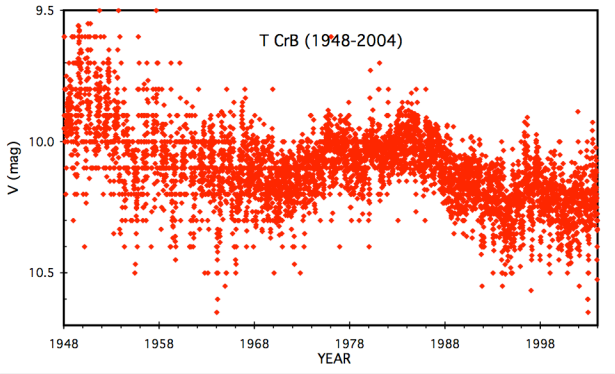
- Other long-term variations have no known cause

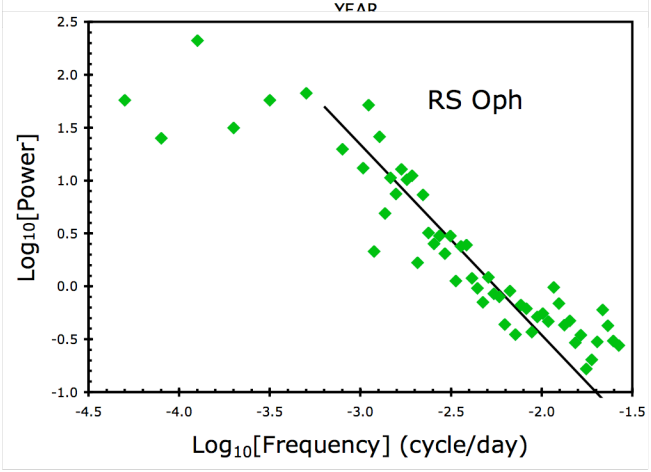
- Accretion in T Pyx has turned off by 10X in last century

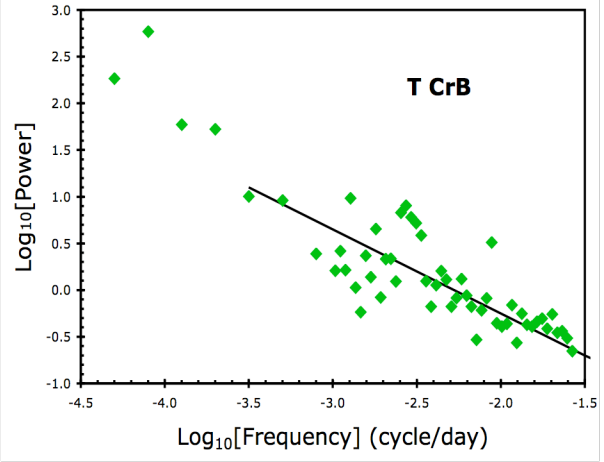












HORRIFYINGLY-LOW DISCOVERY EFFICIENCY:

- UNDIRECTED SEARCHES: For discovering RNe

  Archival plates & amateur searches (for all 1st and 2nd discovered eruptions)

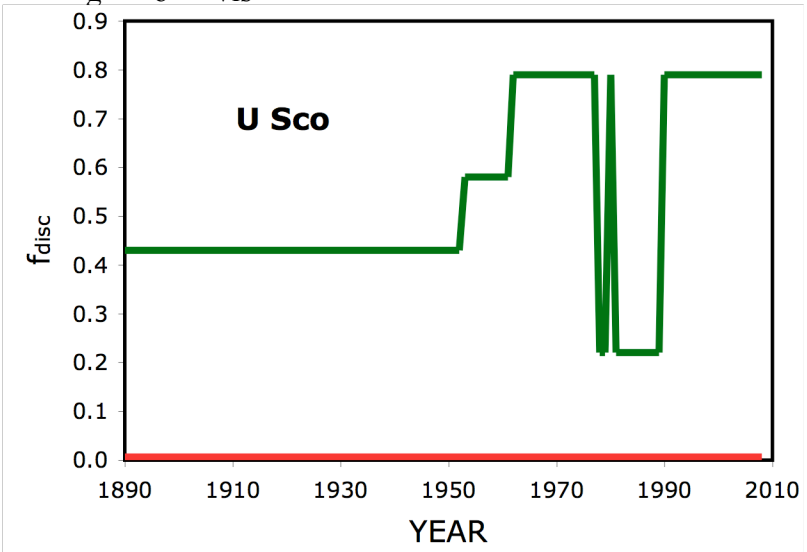
  $f_{disc} = (2/3)*10^{(2-Vpeak)/7}*(\tau_3/44^d)$

- DIRECTED SEARCHES: For measuring recurrence time scales

  Archival plates, AAVSO monitoring (for 3rd and higher discovered eruption)

  $f_{disc} = [365 - (G_s-T_{vis}) - N_g(G_o-T_{vis})]/365$

	Undirected	Directed
T Pyx	0.19	1.0
IM Nor	0.15	0.68
CI Aql	0.05	0.83
V2487 Oph	0.012	0.30
U Sco	0.006	0.53
V394 CrA	0.013	0.48
T CrB	0.09	0.99
RS Oph	0.06	1.00
V745 Sco	0.014	0.36
V3890 Sgr	0.03	0.43



➔Most known RNe have majority of eruptions in the last century being undiscovered

➔Vast majority of RNe are never discovered (only ~1% discovered)

➔RN number in galaxy ~100X larger

NEXT ERUPTIONS ARE OFTEN *SOON*

	Recurrence Time Scale	Date of Next Eruption
U Sco	10.3	**2009.3±1.0**
V745 Sco	21	2010
V3890 Sgr	25	2015
V2487 Oph	18	2016
V394 CrA	30	2017
RS Oph	14.7	2021
CI Aql	24	2024
T CrB	80	2026
IM Nor	41	2043
T Pyx	24	2052±3

➔Five known RNe will likely go off in next decade

➔Given uncertainties, these could go up any year now

➔Intensive monitoring of V2487 Oph, U Sco, V394 CrA, V745 Sco, and V3890 Sgr is needed

➔U Sco should go up any month now

➔Join our *USCO2009 Collaboration* for intensive study of its eruption