

Flickering in polars

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Astronomical Observatory of the University of Warsaw



Cataclysmic variables

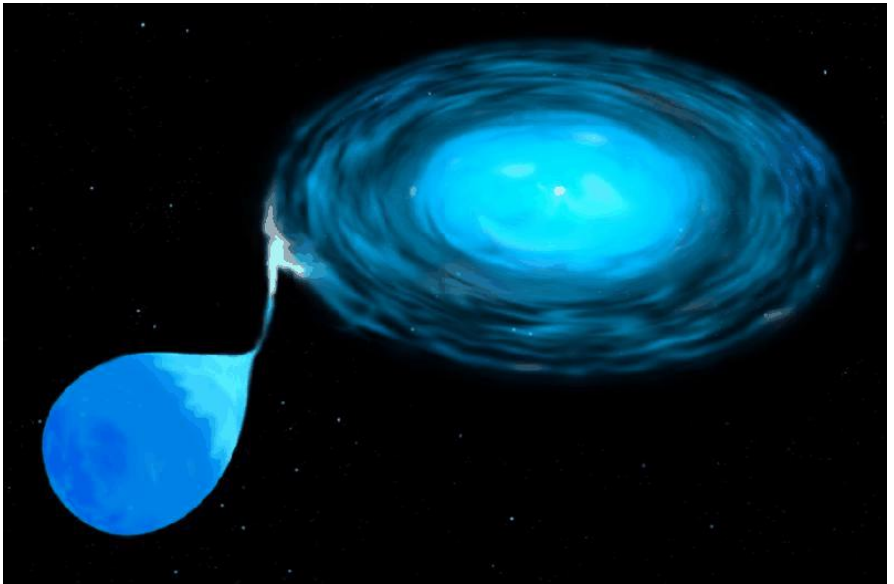


Image credit: NASA

Cataclysmic variables

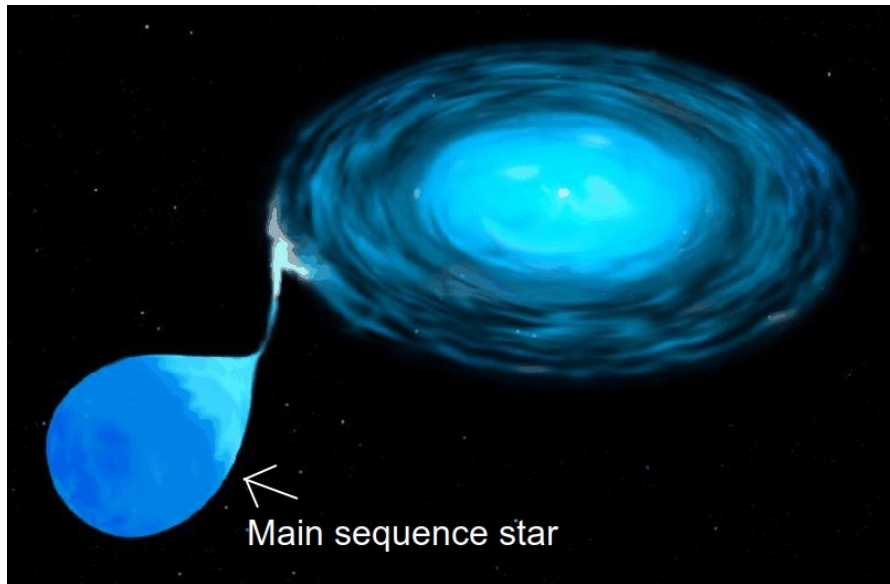


Image credit: NASA

Cataclysmic variables

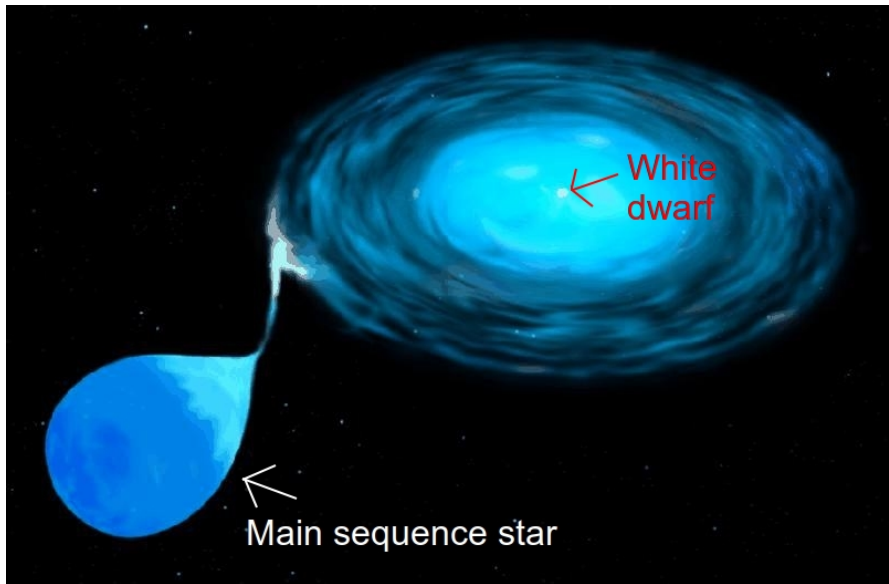


Image credit: NASA

Cataclysmic variables

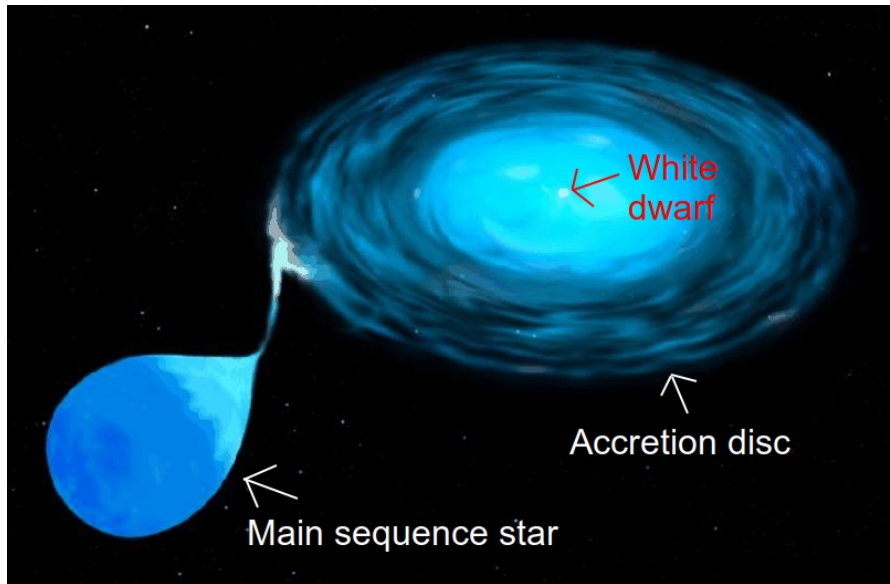


Image credit: NASA

Cataclysmic variables

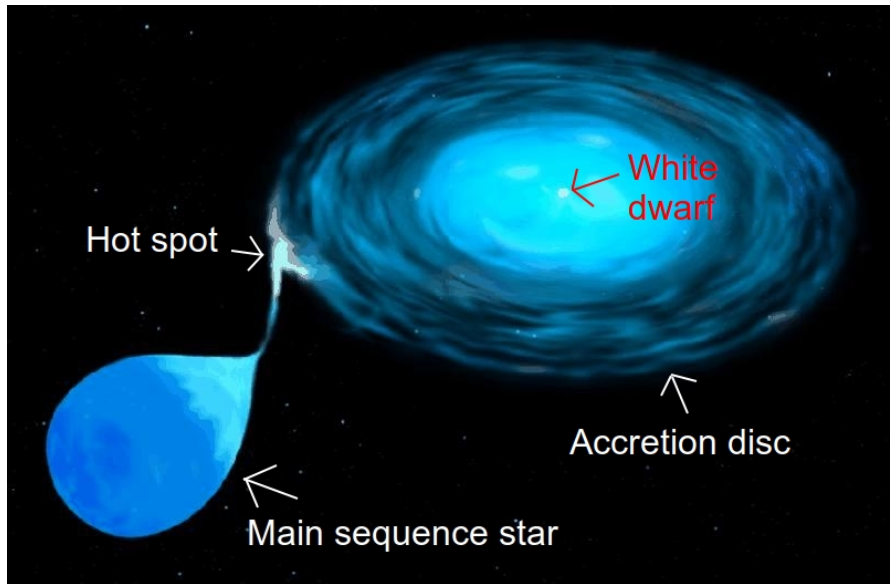
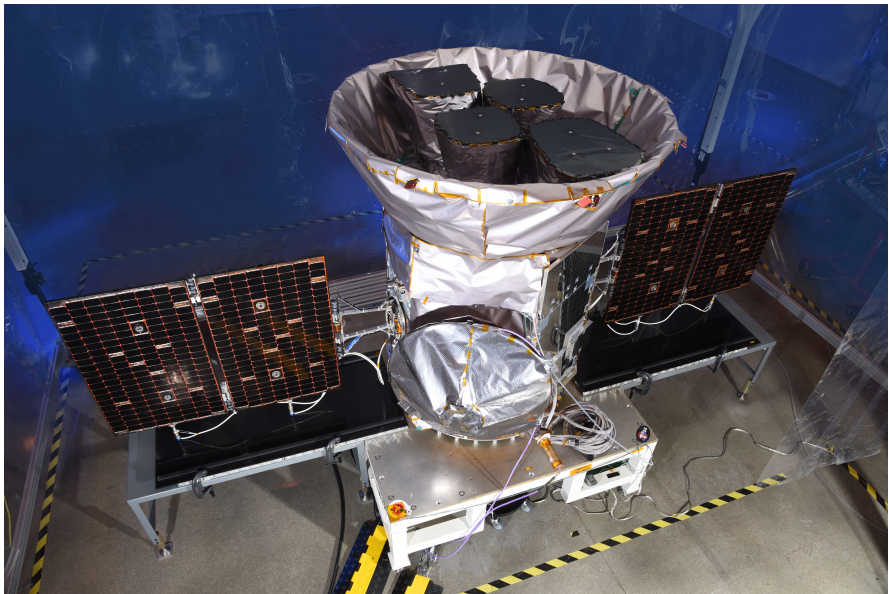


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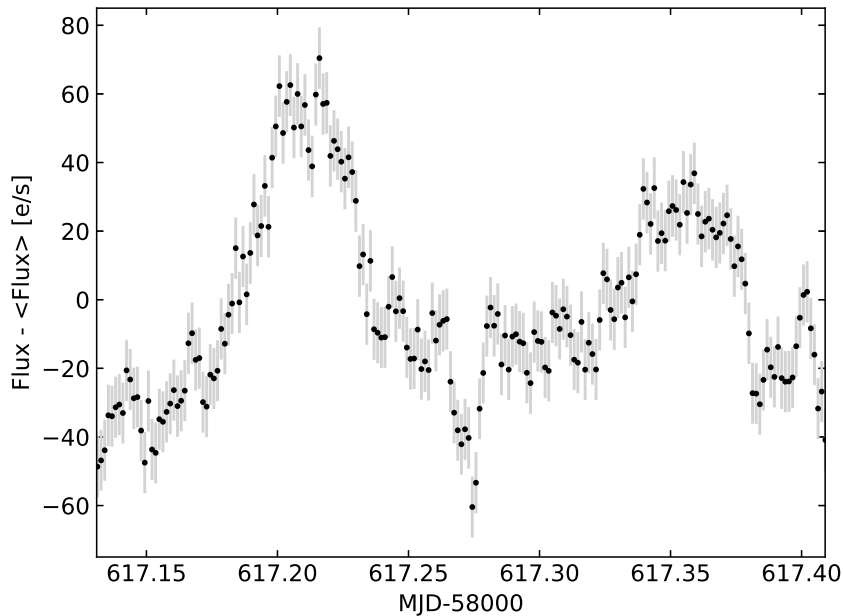
Cataclysmic variables in TESS:

- Over 300 cataclysmic variables observed
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- 28 days of almost continuous monitoring

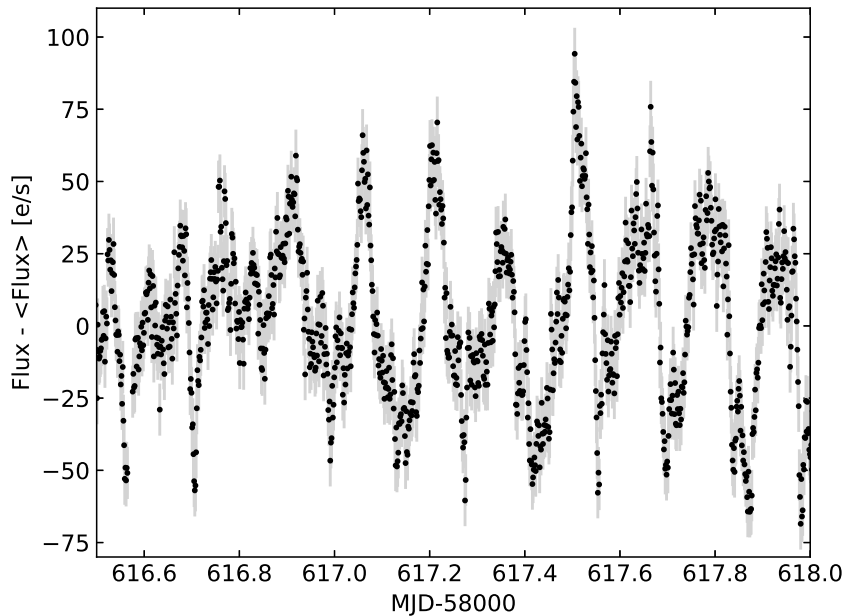
Cataclysmic variables in TESS:

- Over 300 cataclysmic variables observed
- Typical cadence of data is 120s
- 28 days of almost continuous monitoring
- Orbital periods < 1 day

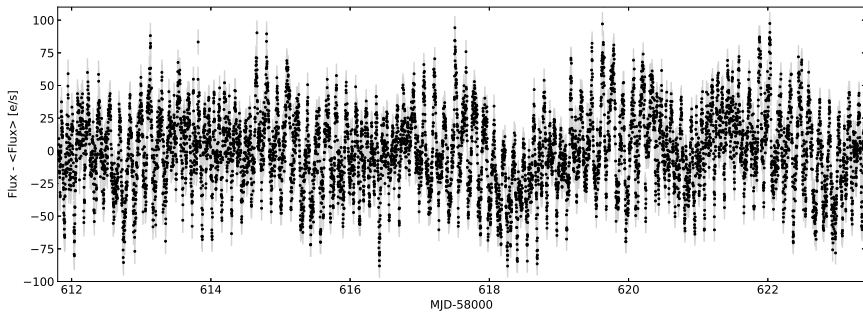
AQ Men with TESS



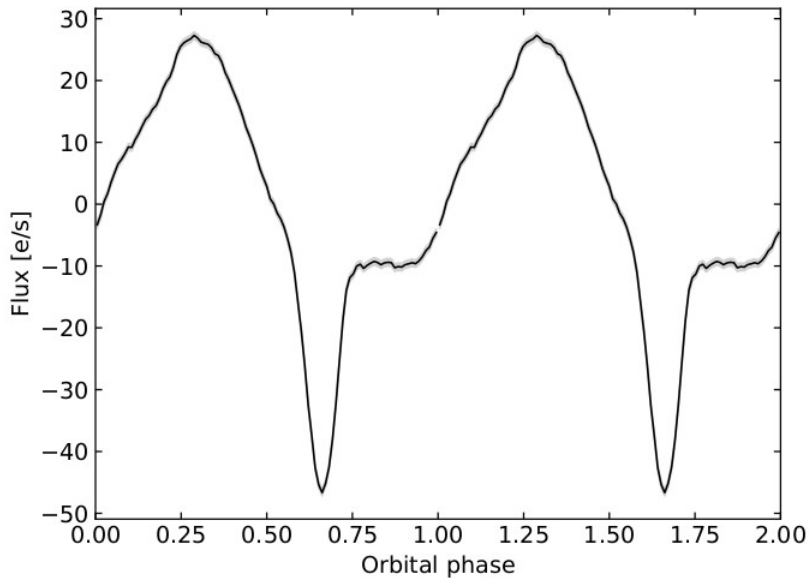
AQ Men with TESS



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AQ Men orbital variability



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Flickering

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- Power spectral density shape approximately described by a broken power-law (e.g. McHardy et al. 2004)

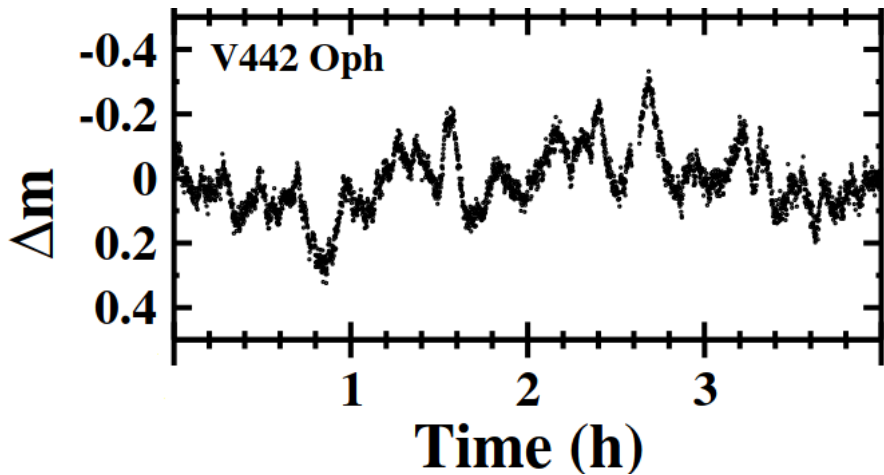
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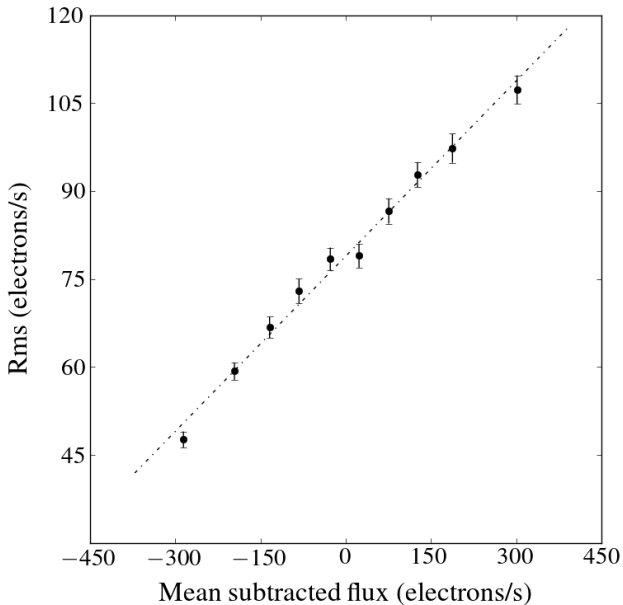
- Power spectral density shape approximately described by a broken power-law (e.g. McHardy et al. 2004)
- Linear relationship between the amplitude of flickering and the average flux (Uttley & McHardy 2001)

Light curve with flickering

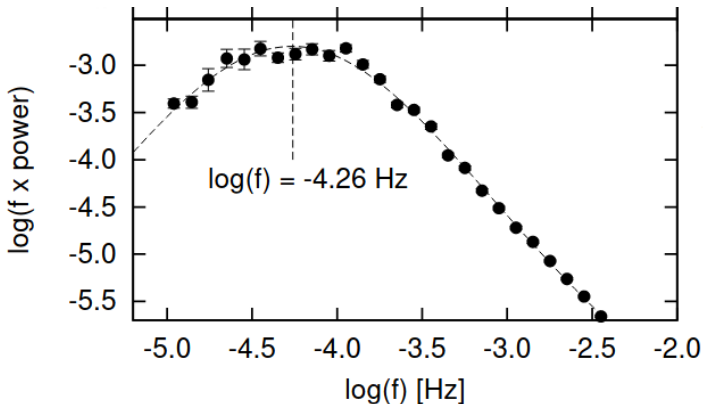


Bruch (2021)

Flickering amplitude - mean brightness relation

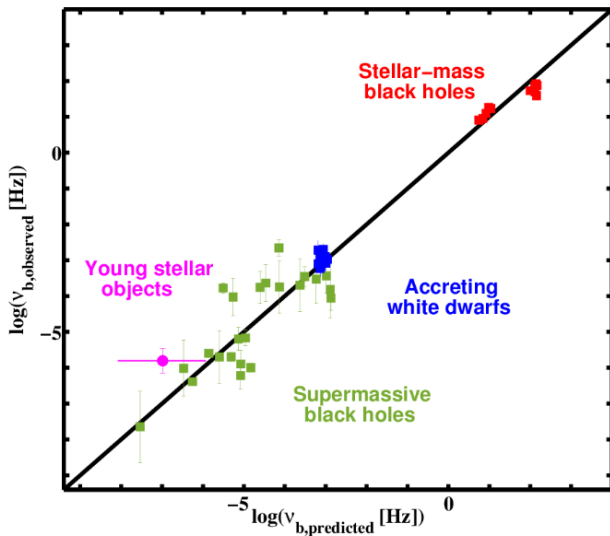


Power spectral density of flickering



Dobrotka et al. (2014)

Universality of flickering



Scaringi et al. (2015)

Why study accretion in cataclysmic variables?

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Where does flickering originate?

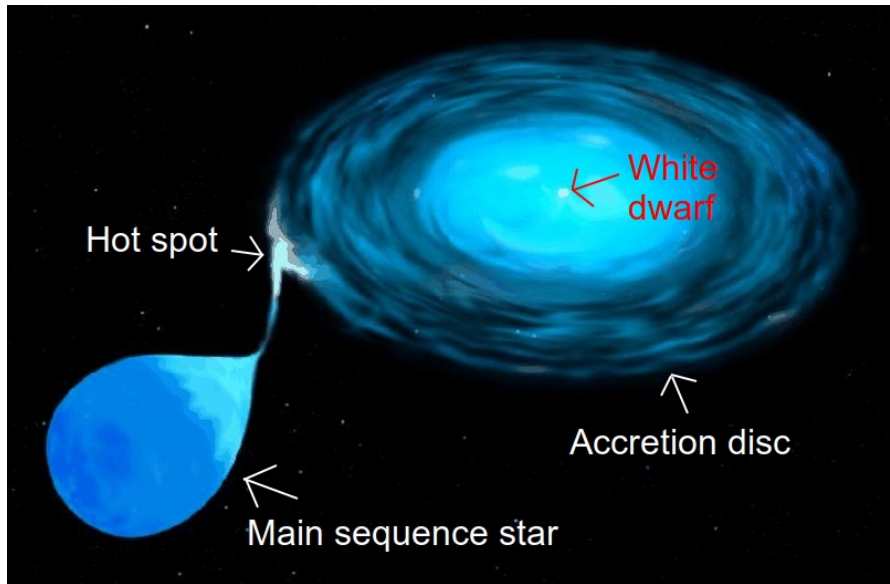


Image credit: NASA

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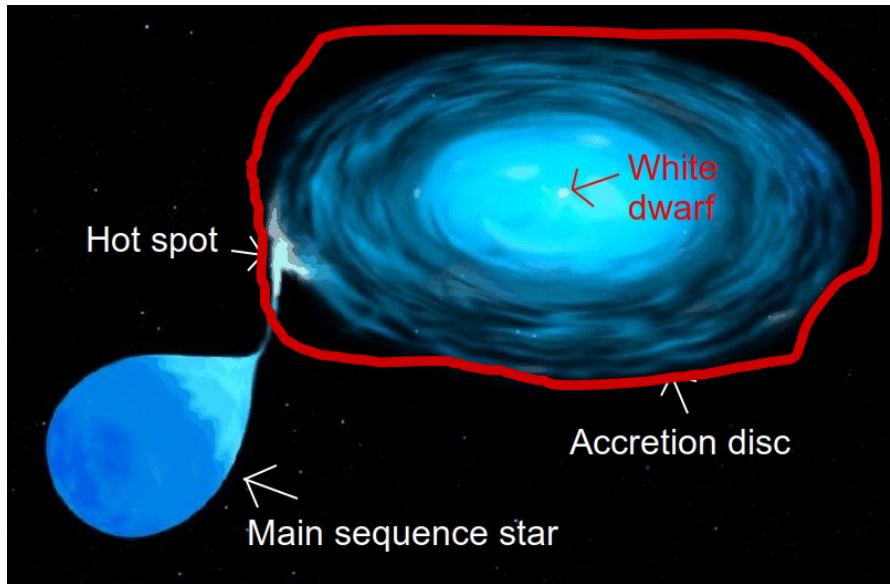
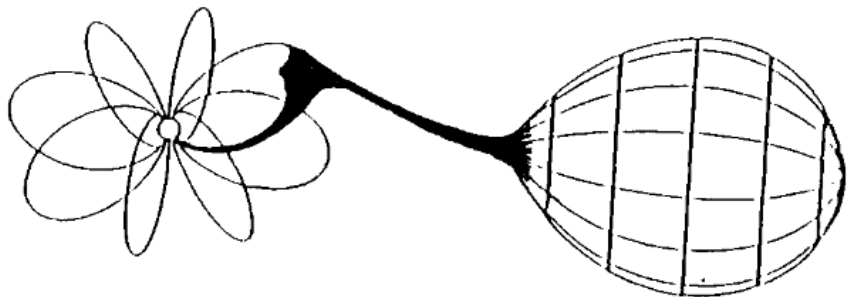
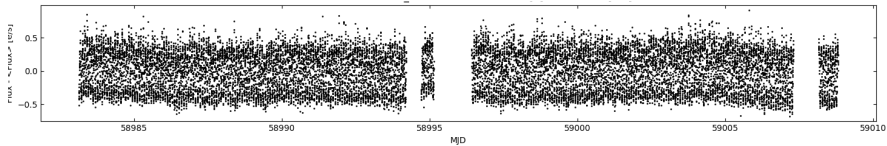


Image credit: NASA

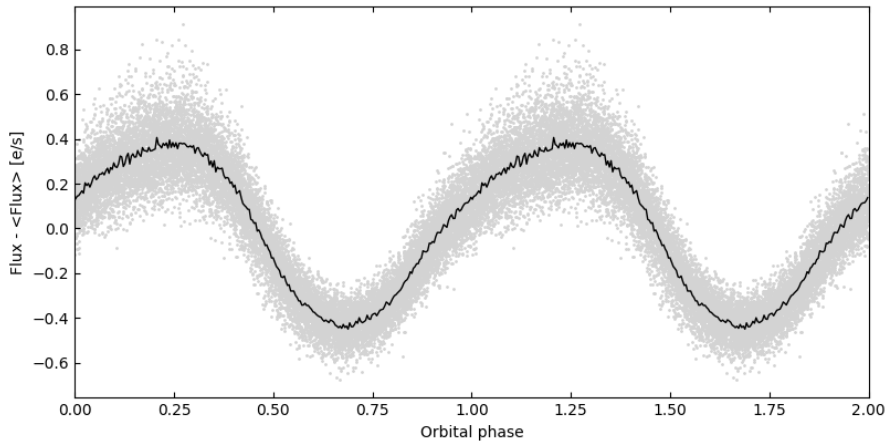


Warner (1995)

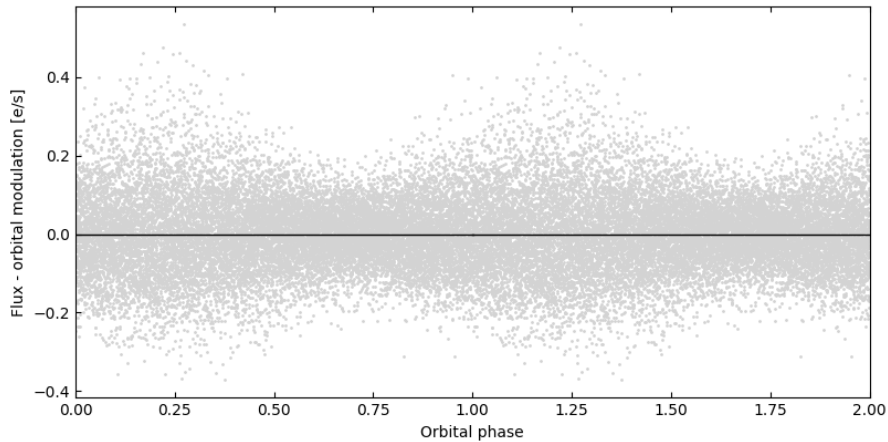
TESS light curves



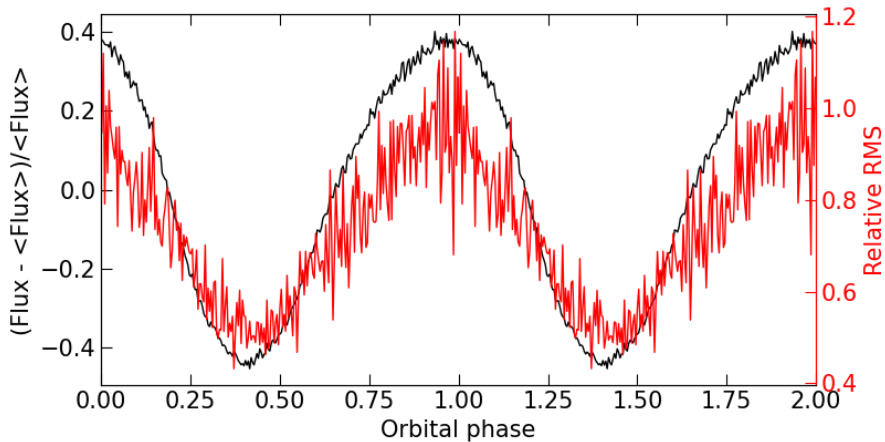
TESS phase plot



Cleaned phase plot

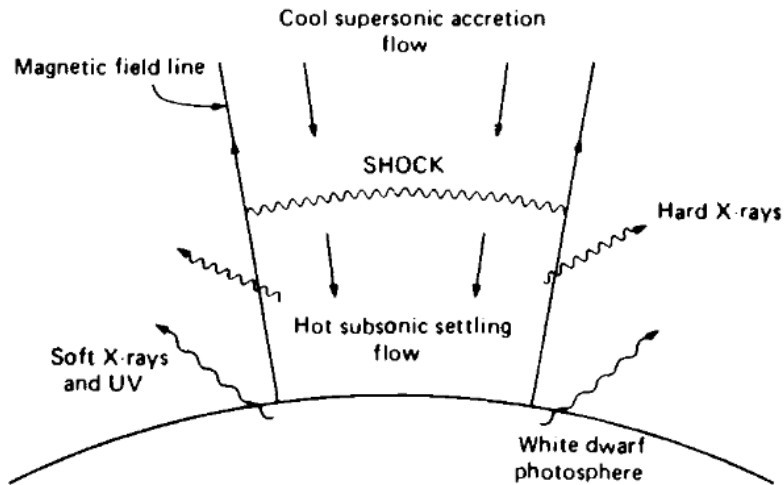


Phase plot of rms - amplitude of flickering

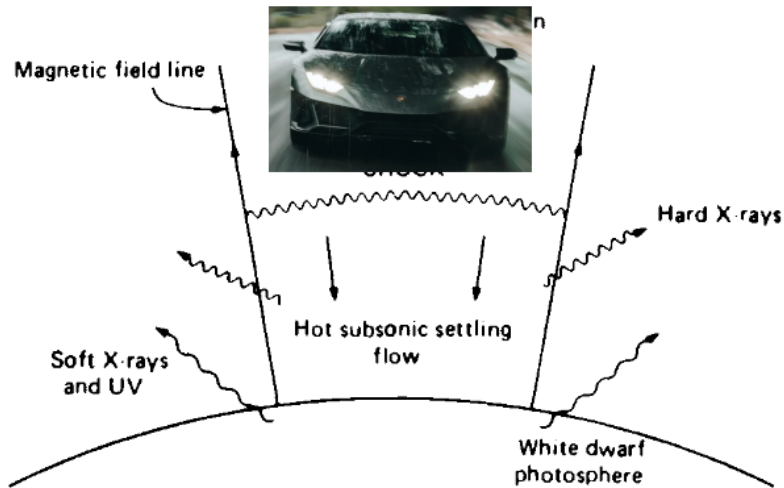


Where does flickering originate in polars?

Accretion column

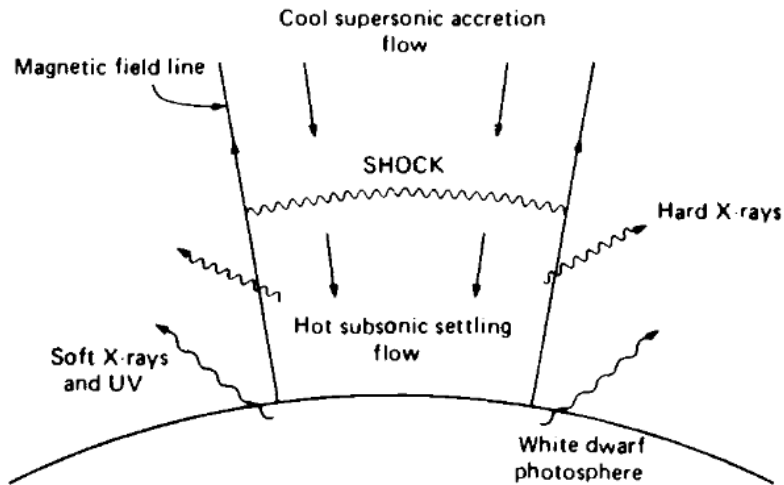


Accretion column



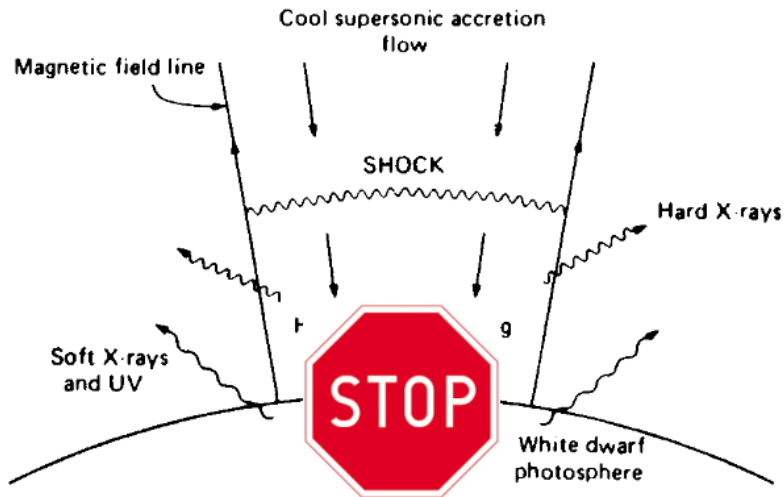
Watson (1986)

Accretion column



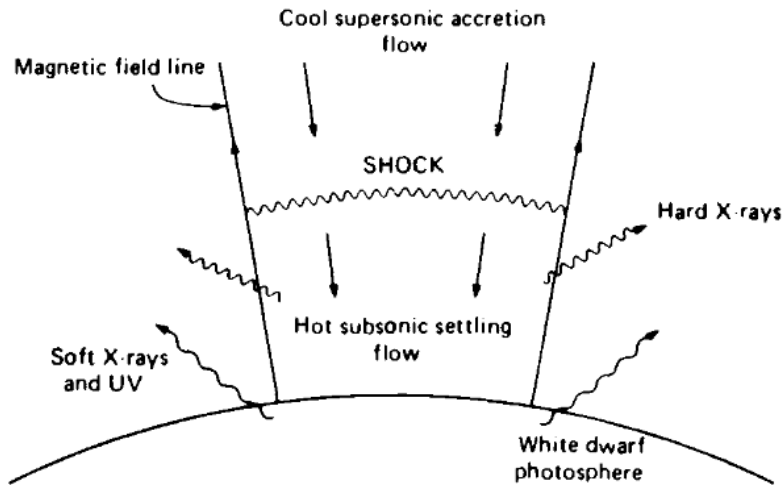
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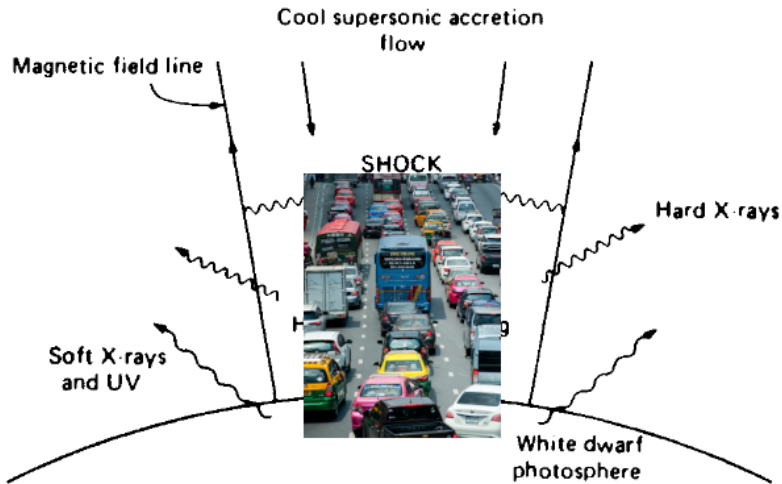
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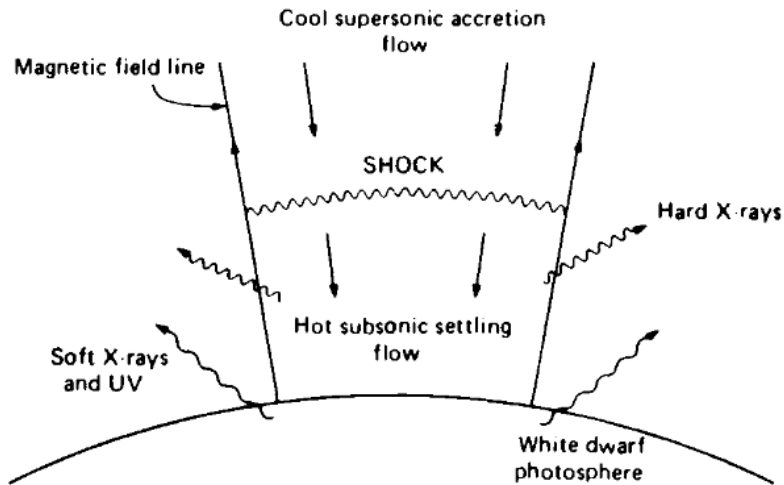
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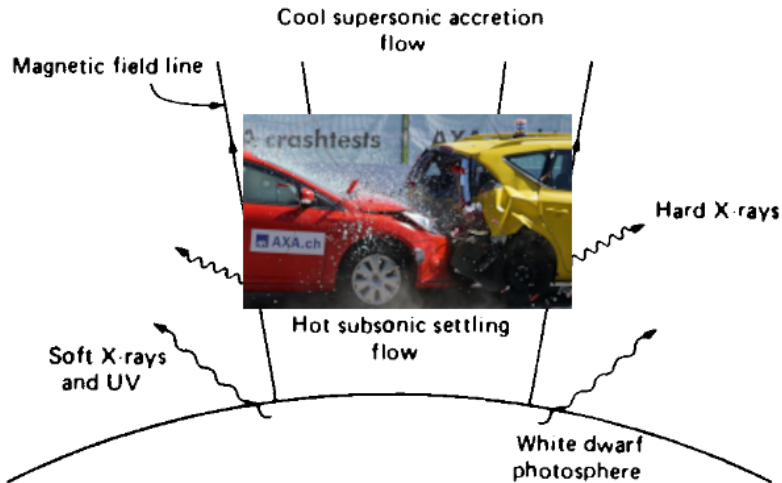
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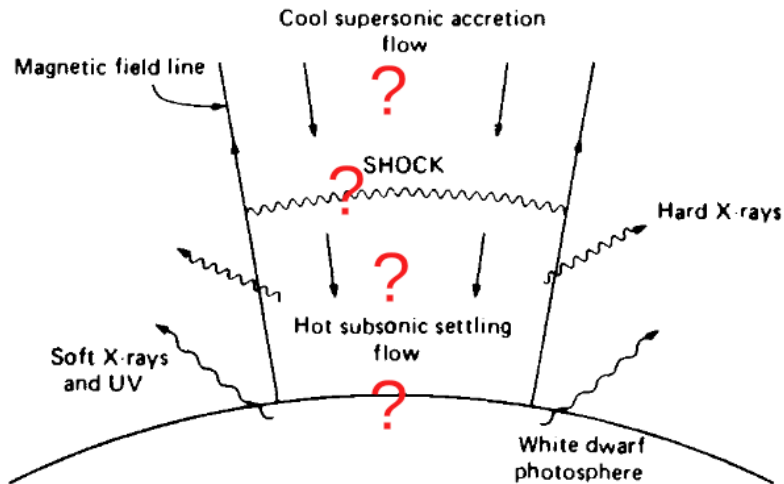
Watson (1986)

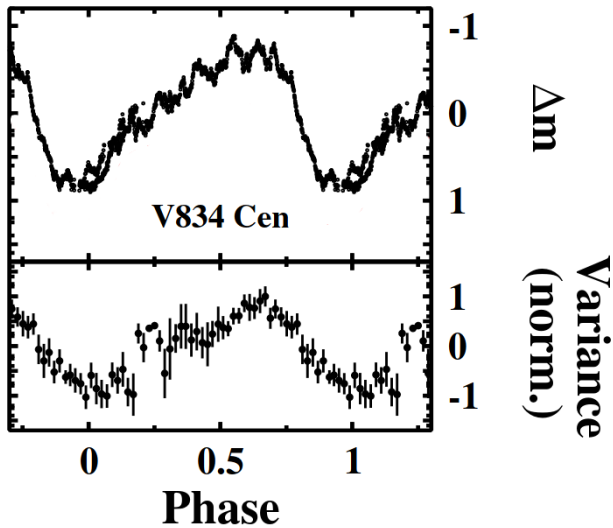
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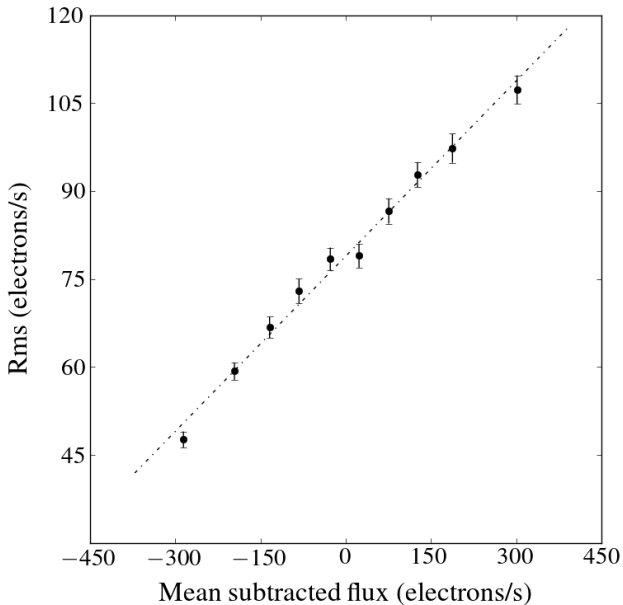
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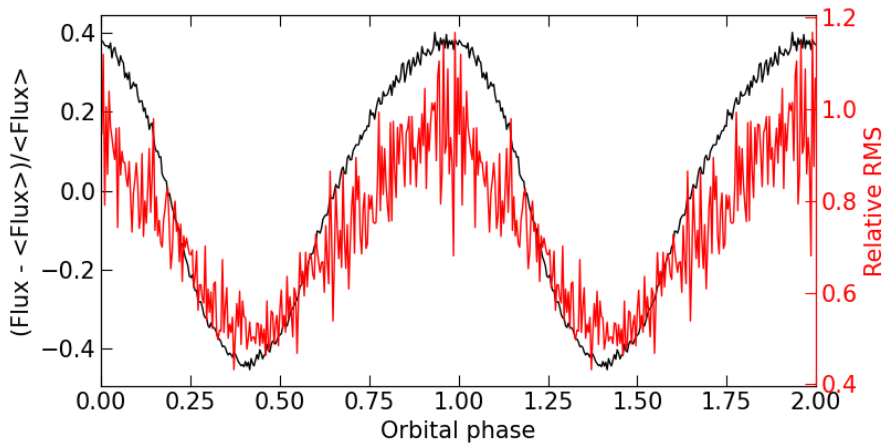




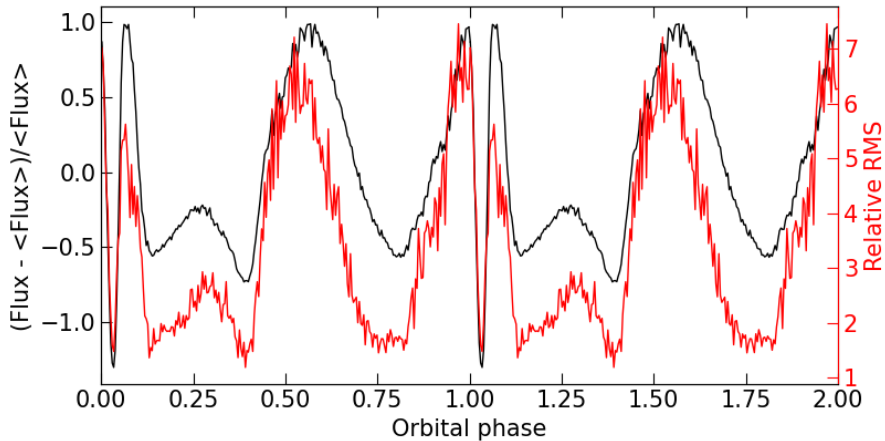
Flickering amplitude - mean brightness relation



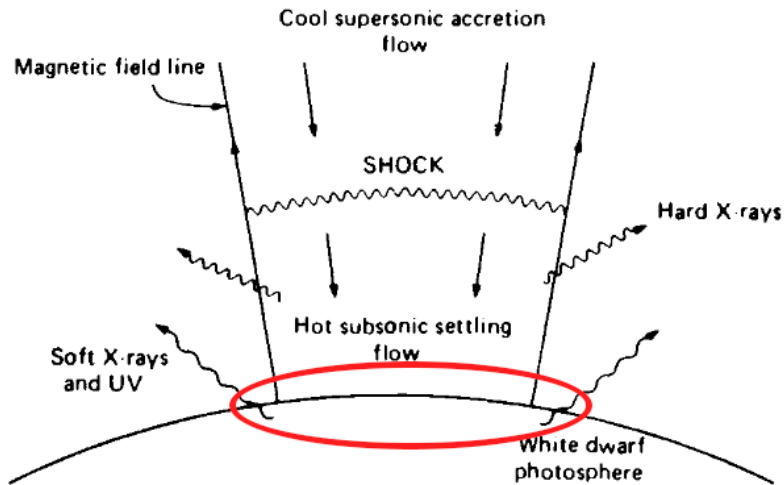
Phase plot of rms - amplitude of flickering



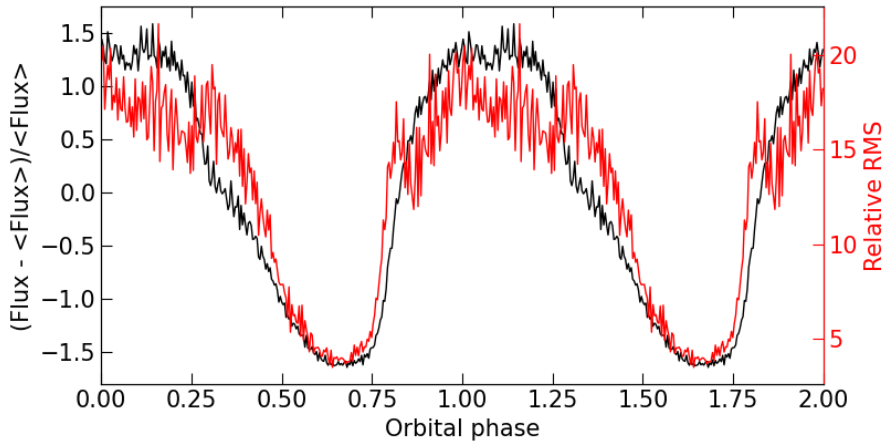
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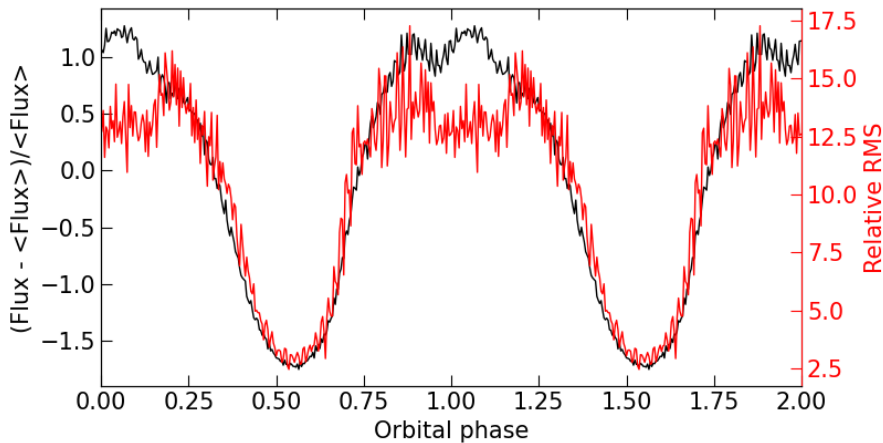
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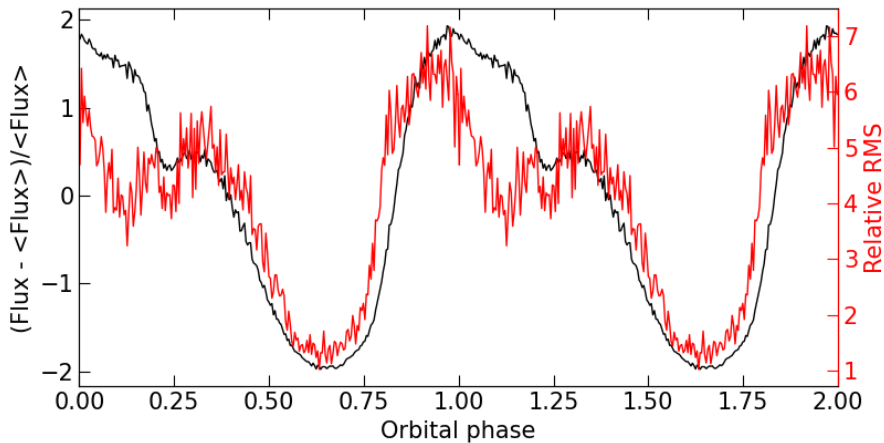
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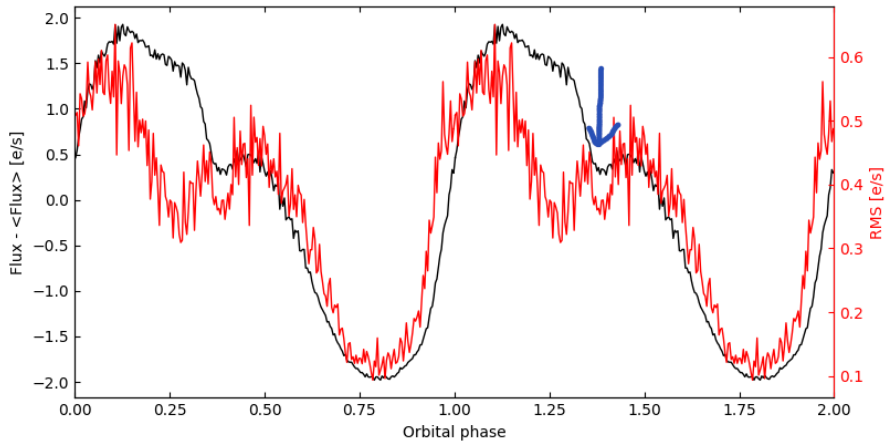
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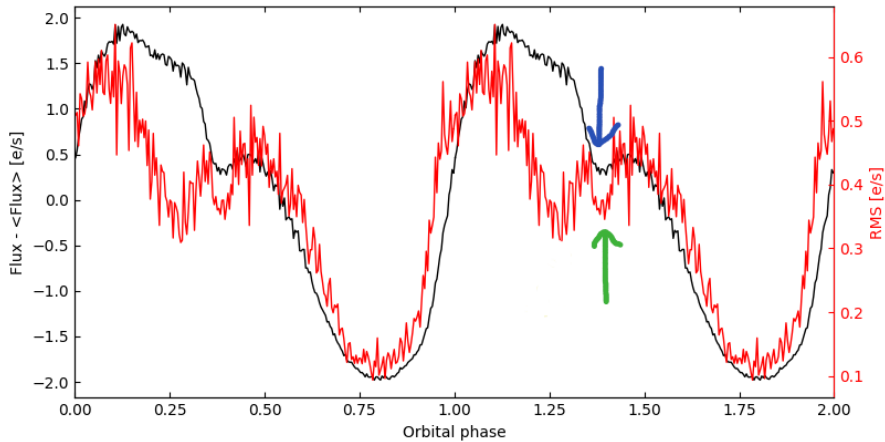
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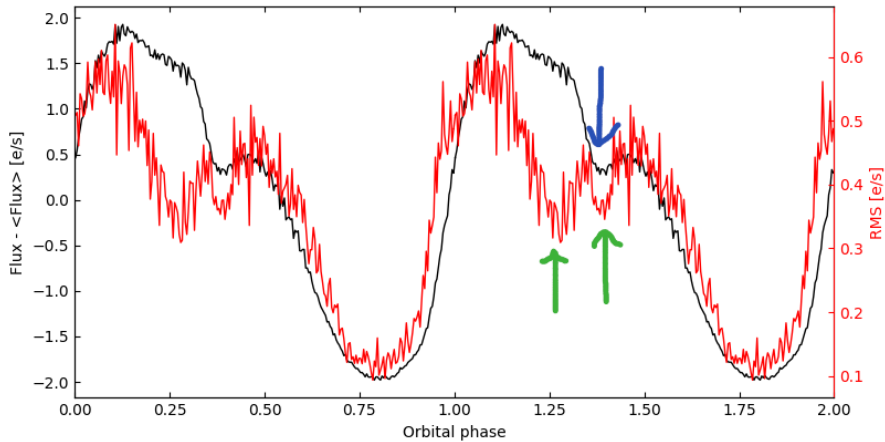
Polar orbital variability

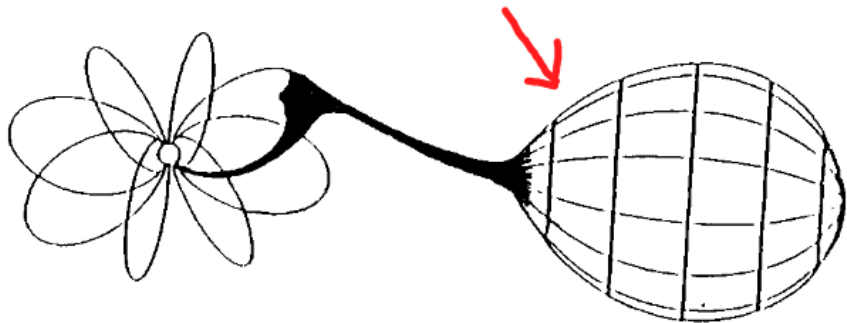


Phase plot of rms - amplitude of flickering

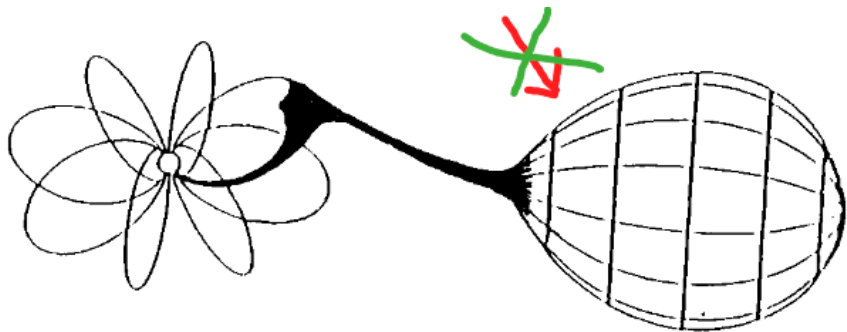


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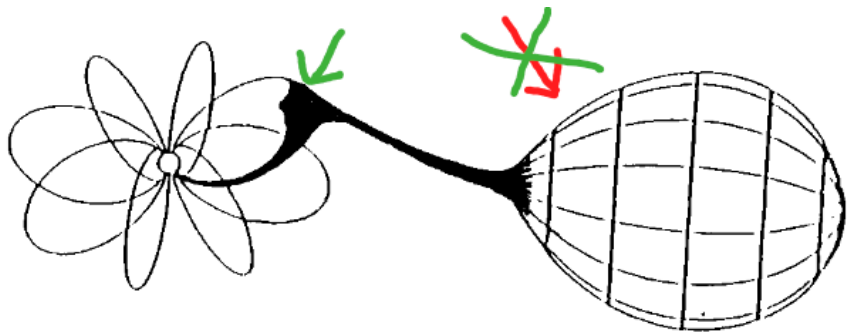




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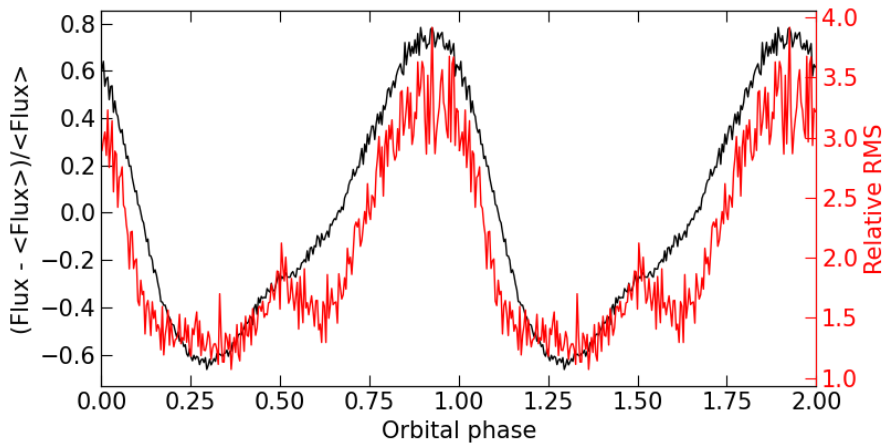


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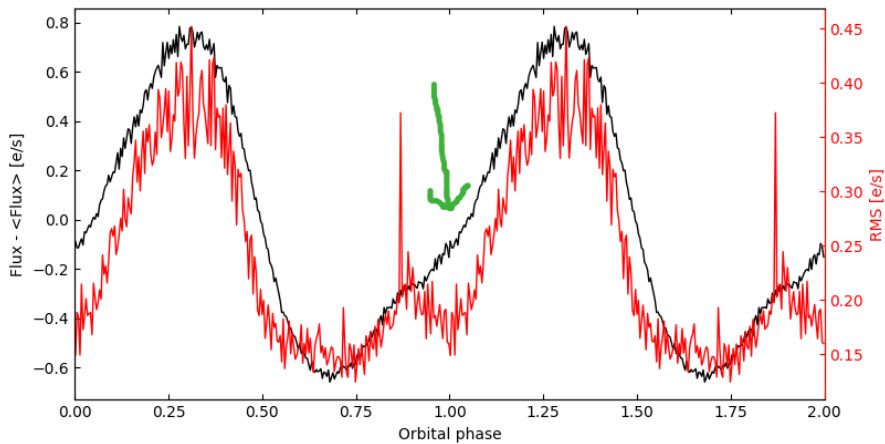


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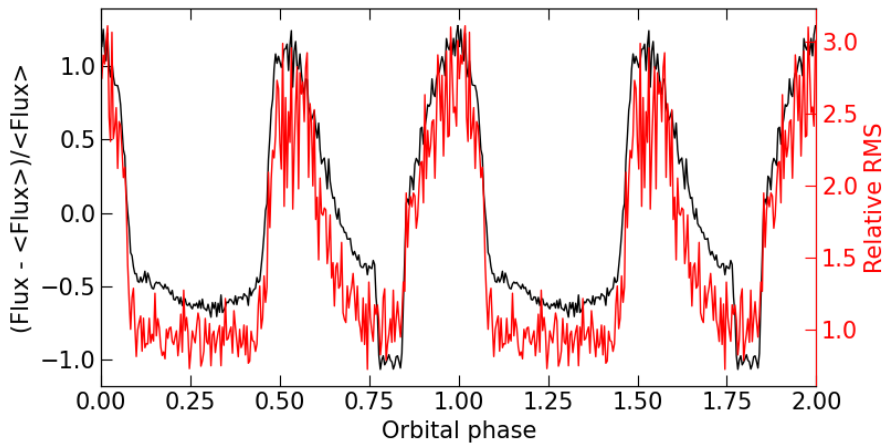
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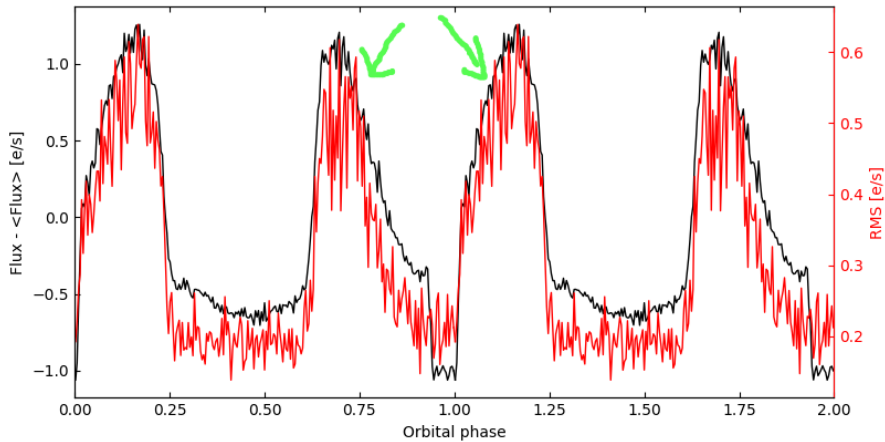
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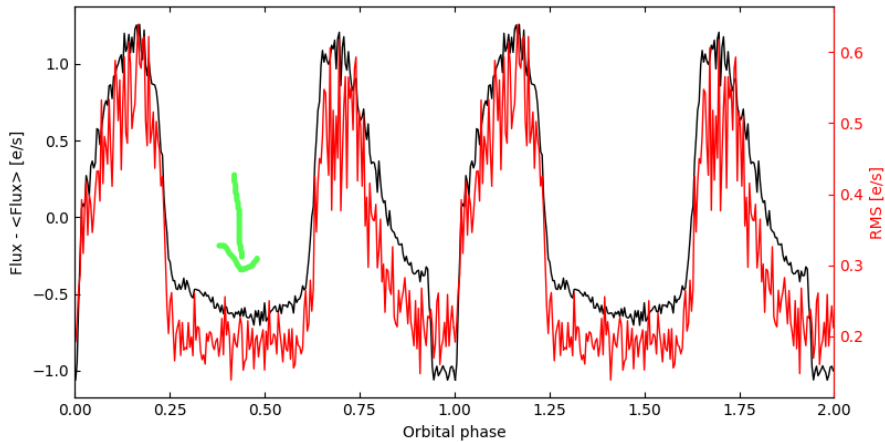
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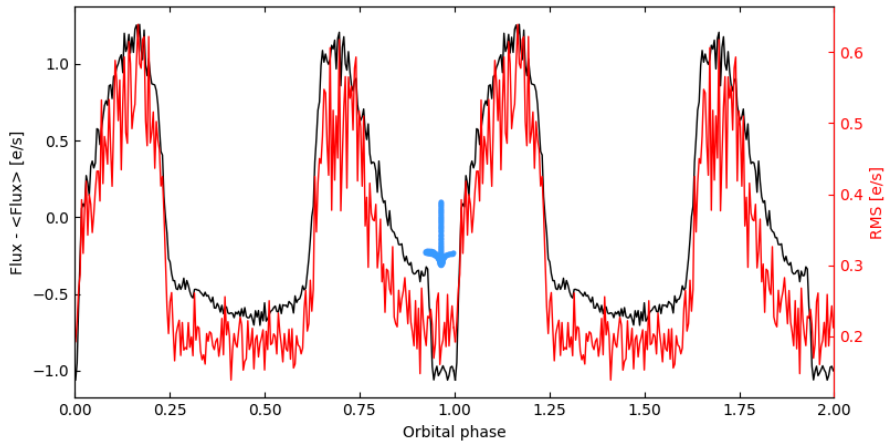
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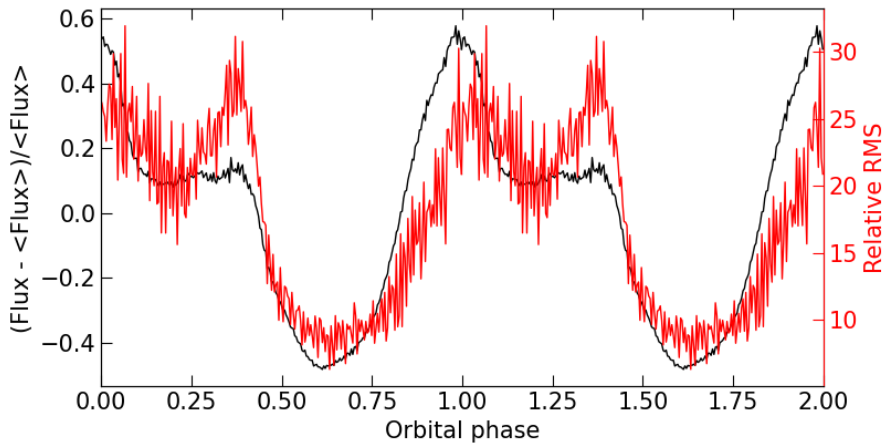
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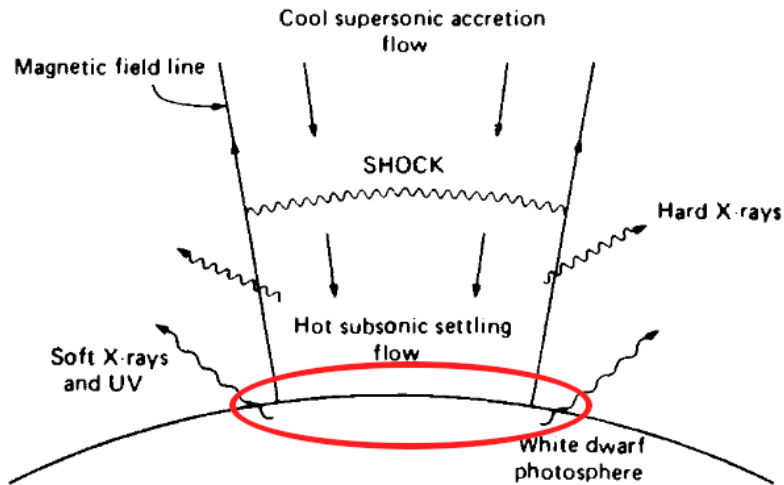
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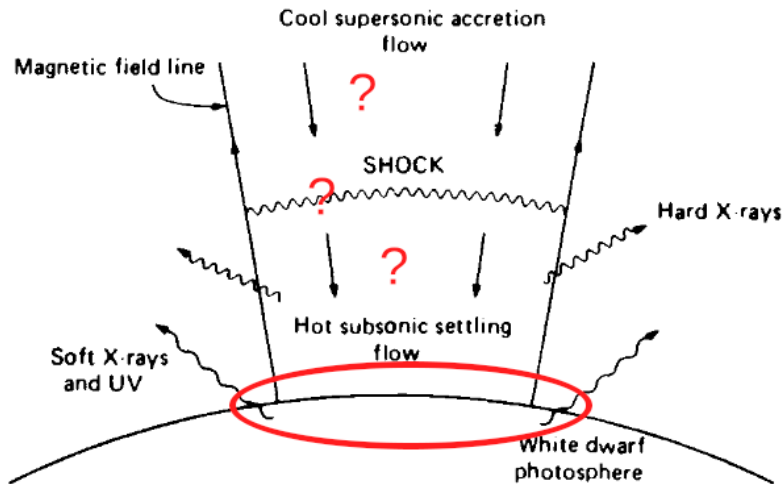
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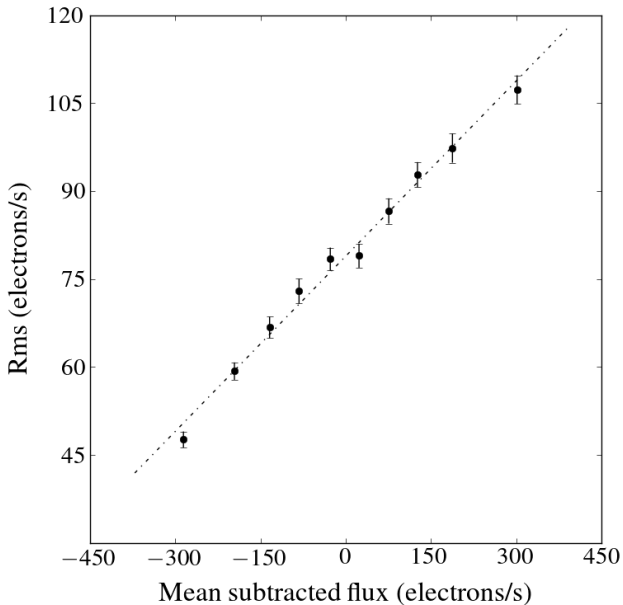
Accretion column



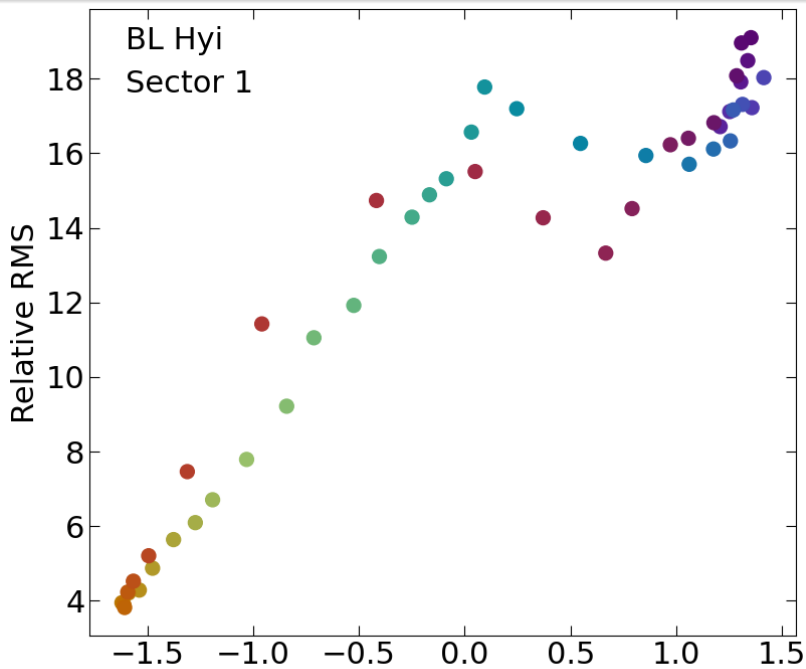
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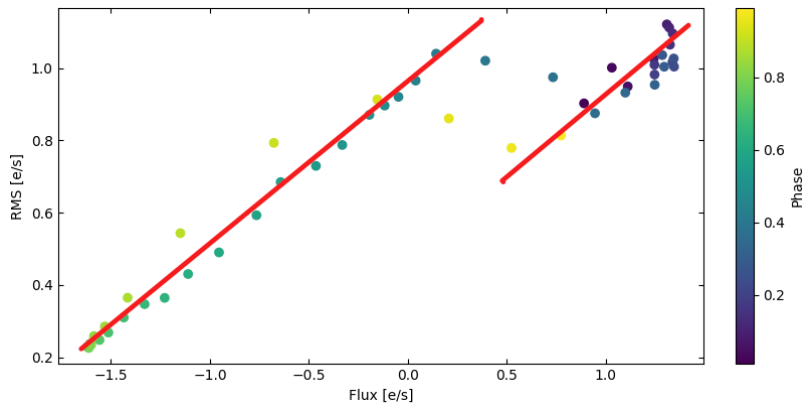
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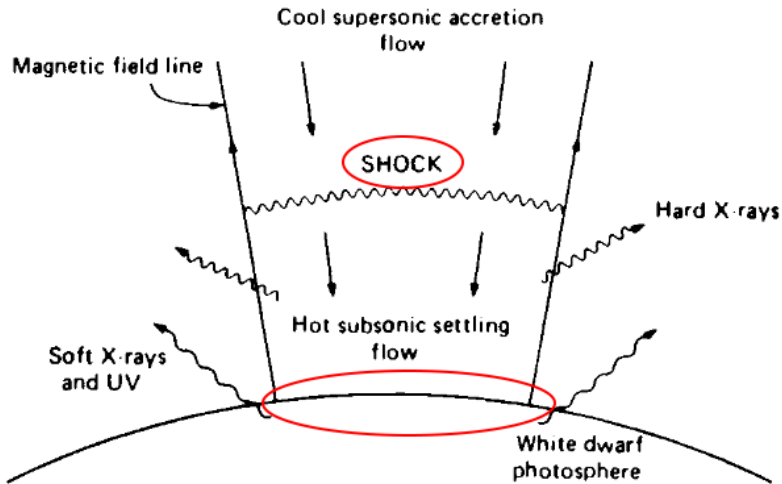
Amplitude - mean brightness relation in polars



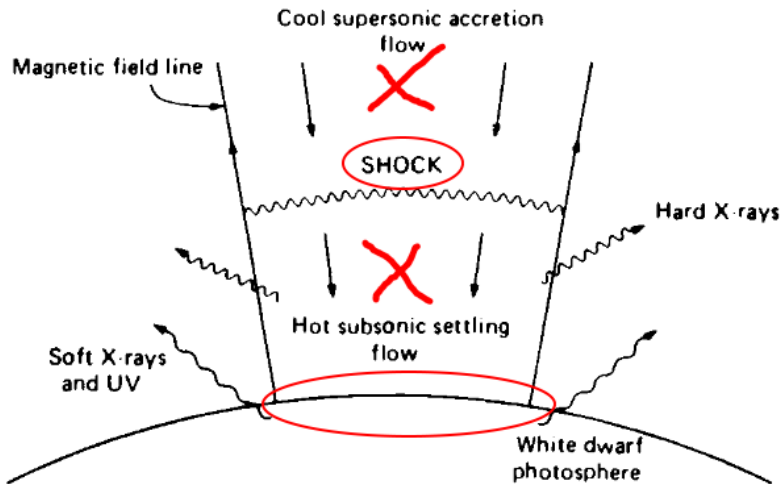
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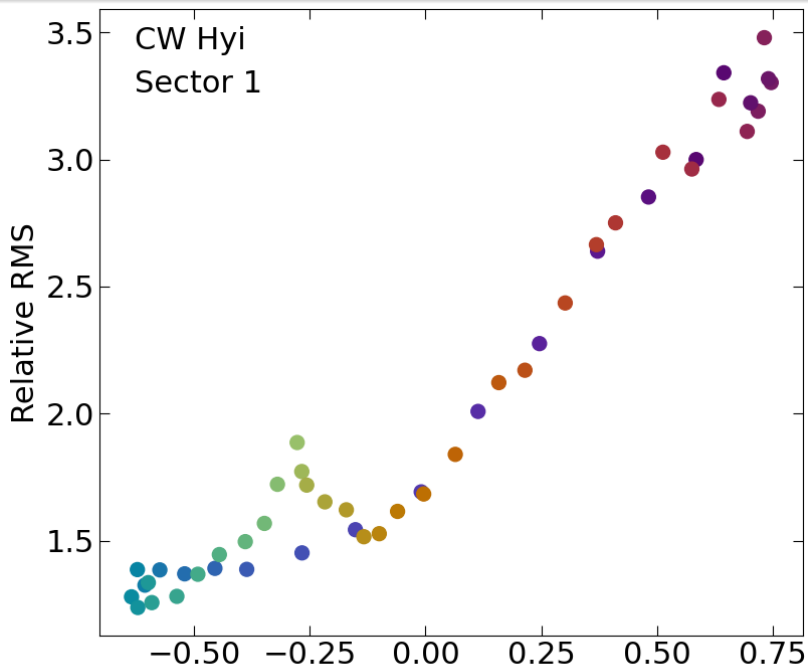
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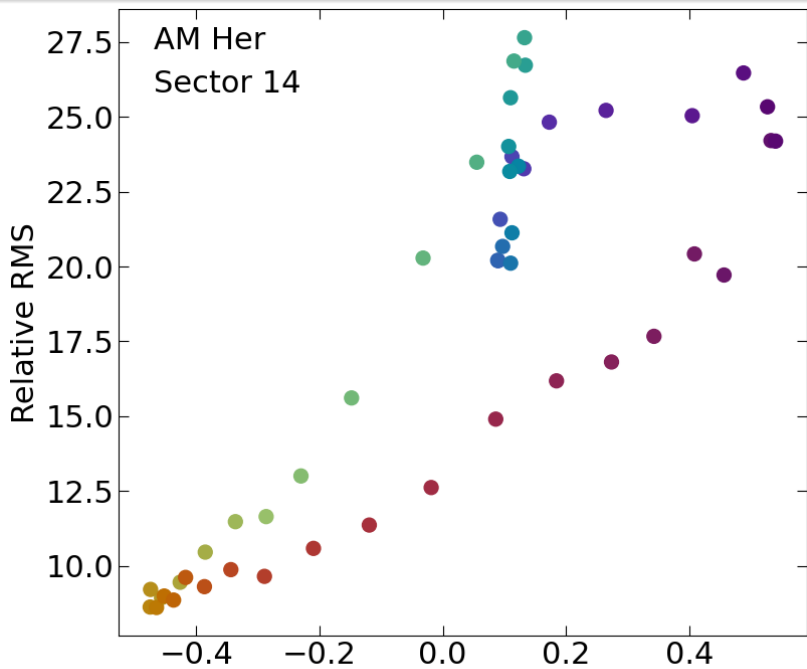
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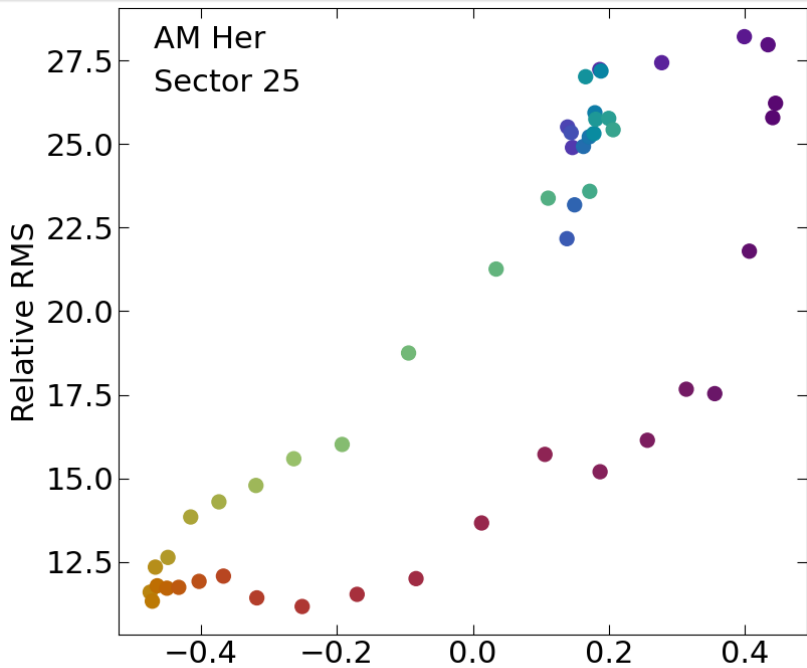
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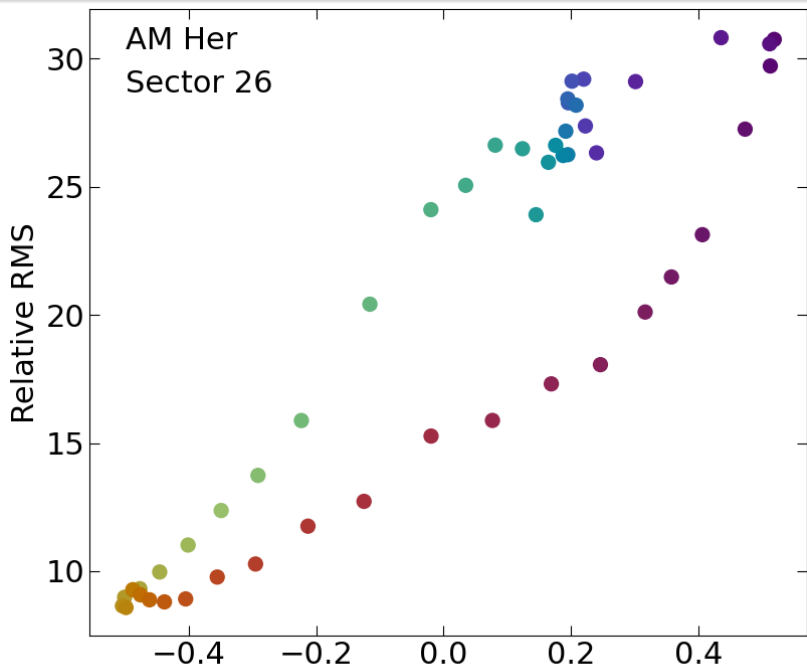
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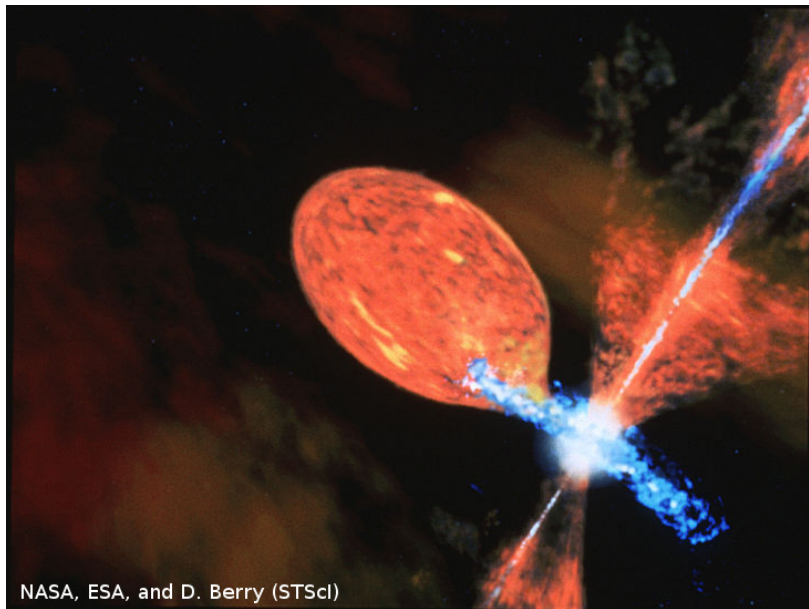
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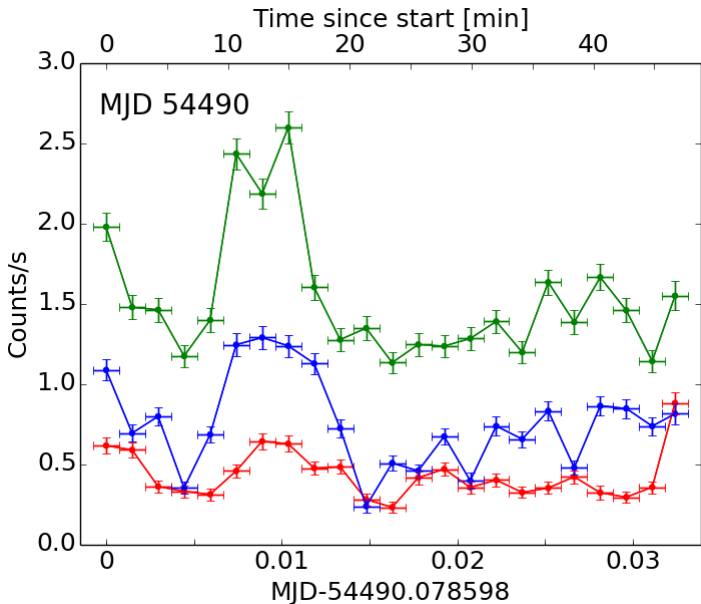


Symbiotic stars

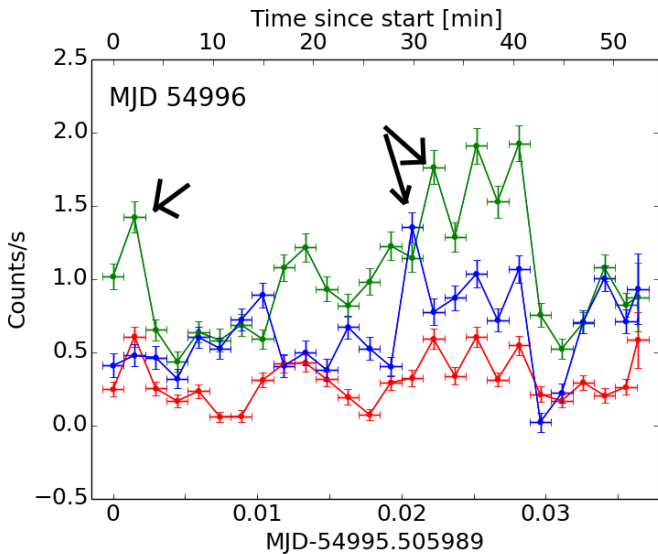


NASA, ESA, and D. Berry (STScI)

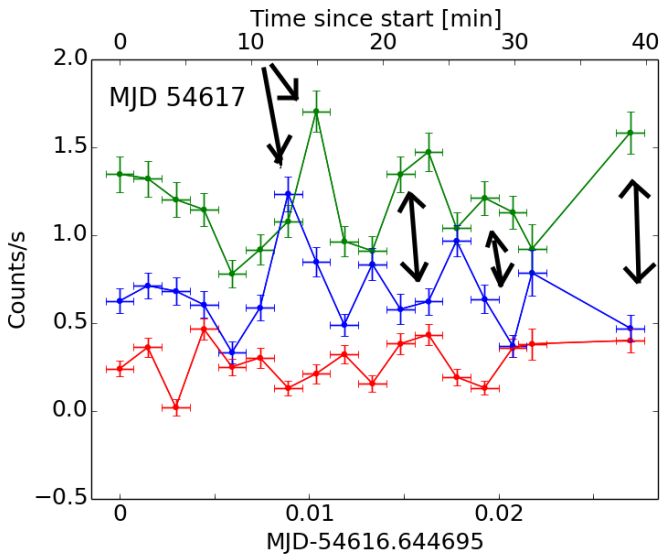
Flickering in T CrB in X-ray



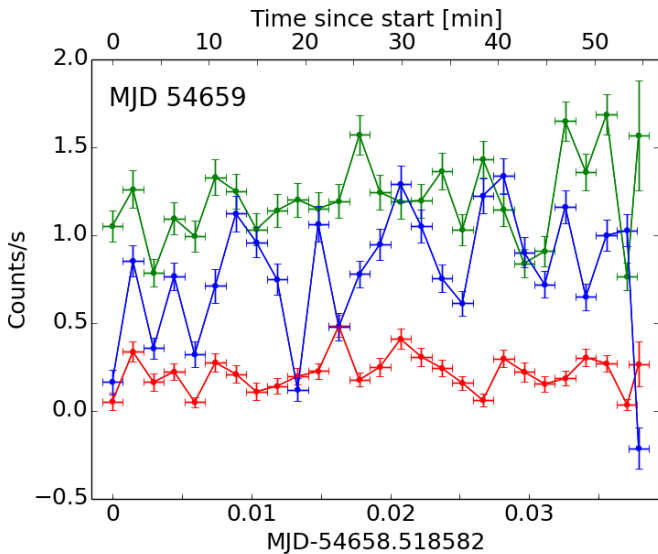
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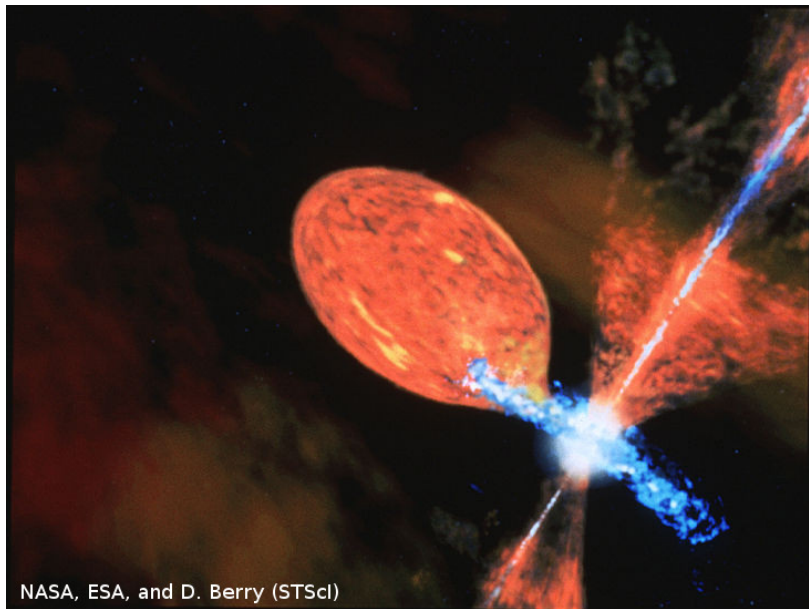
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Flickering in T CrB in X-ray



Symbiotic stars



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TESS will improve our understanding of flickering in all accreting objects