Intrabinary Interactions in Pulsars viewed by Fermi/LAT

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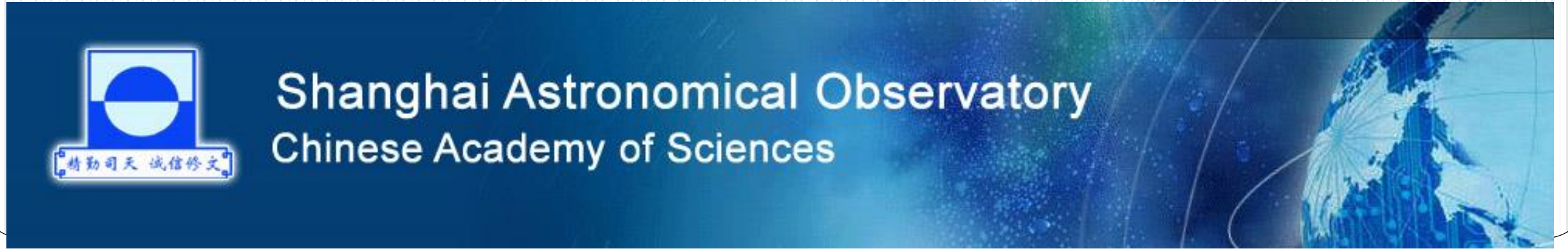
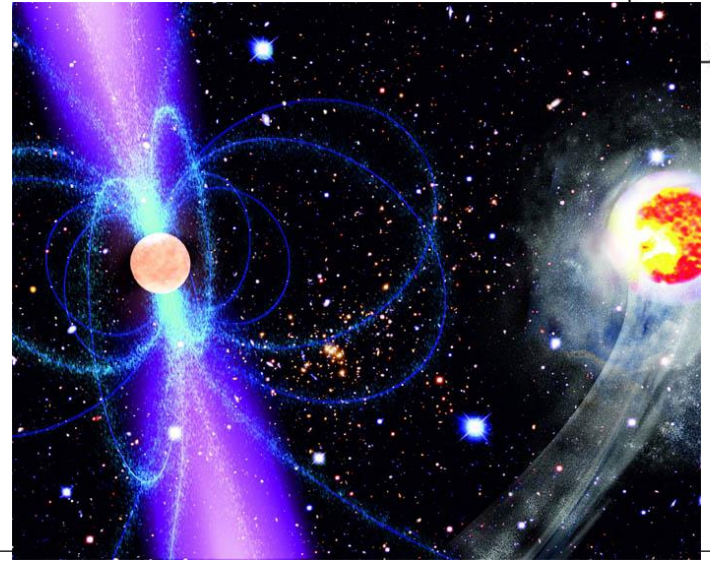
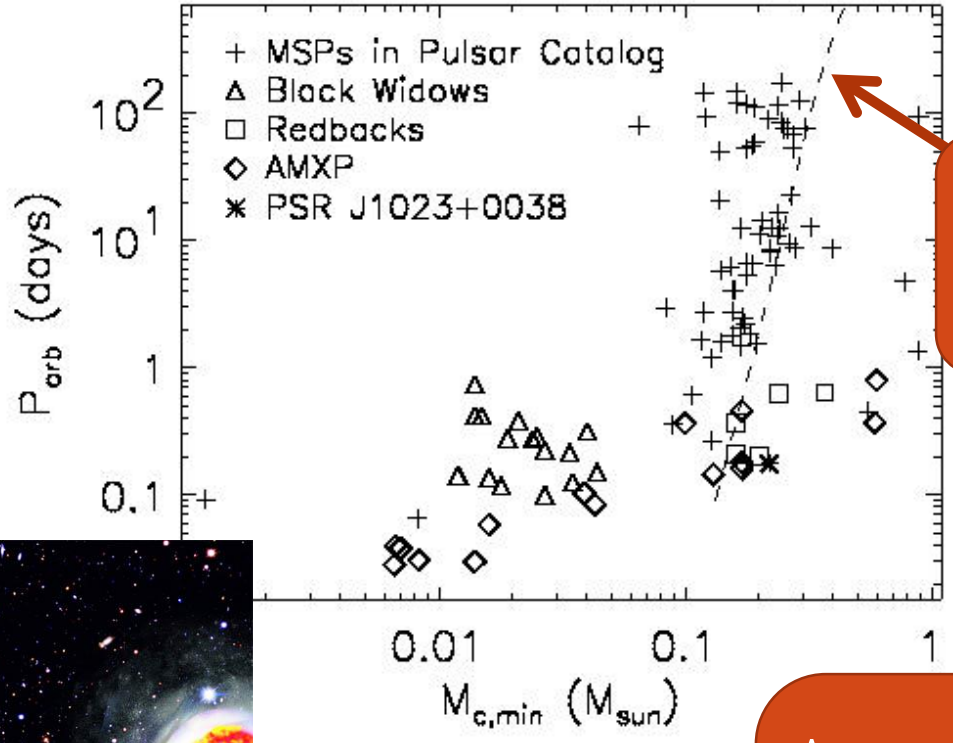


Millisecond pulsar binaries

Black widow pulsars (Fruchter et al. 1988): eclipsing systems at radio, low-mass 0.02 Msun companions

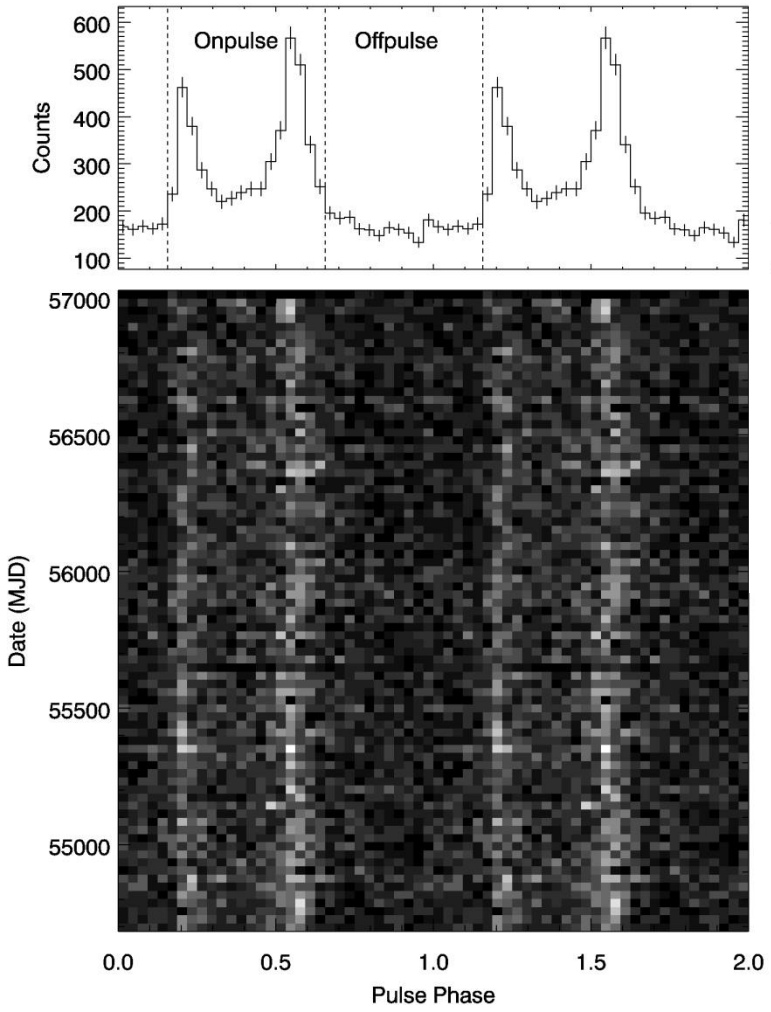


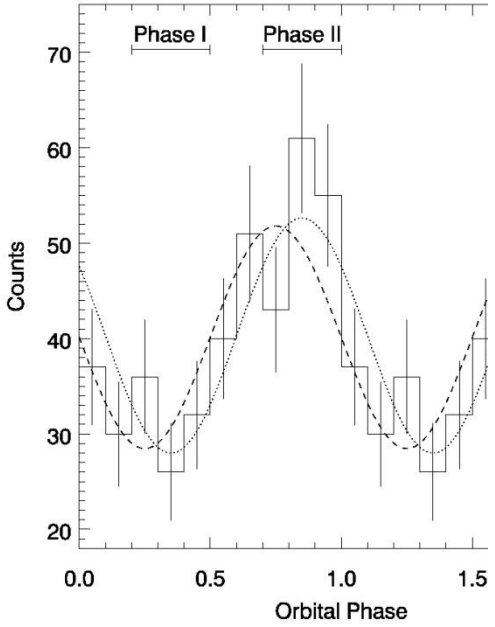


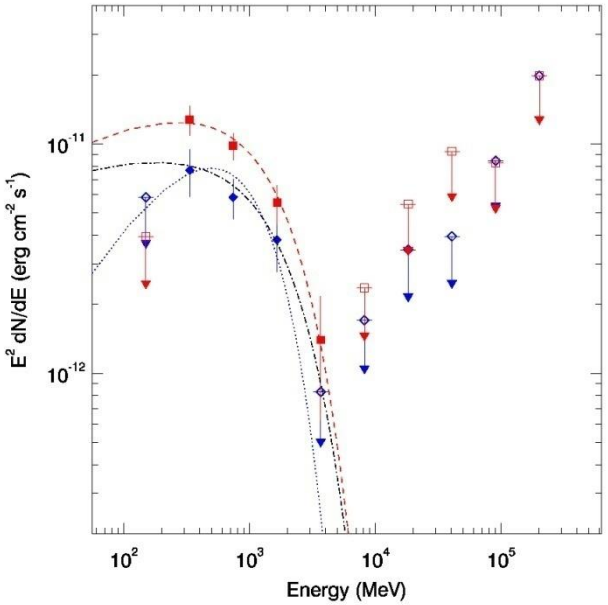
Regular binaries←theoretical prediction (Tauris & Savonije 1999)

A new class of eclipsing systems recently identified (**redbacks**; Roberts 2013): they have relatively massive companions (0.1-0.6Msun)

Intrabinary gamma-ray emission from black widow PSR J1311-3430



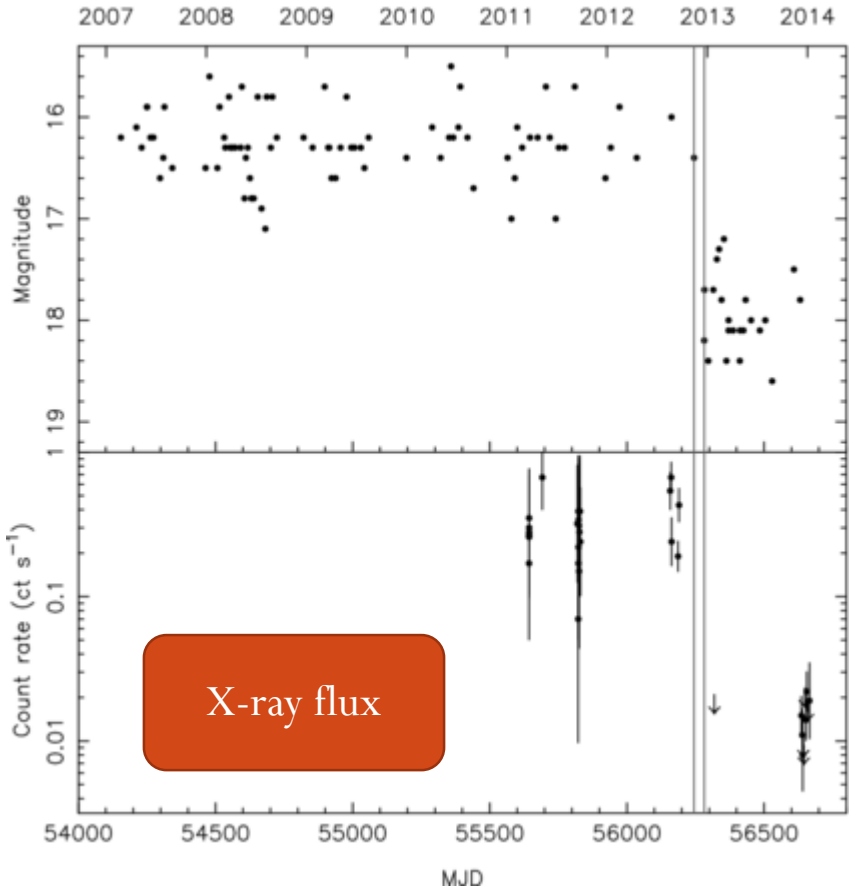




Xing & Wang (2015, ApJL)

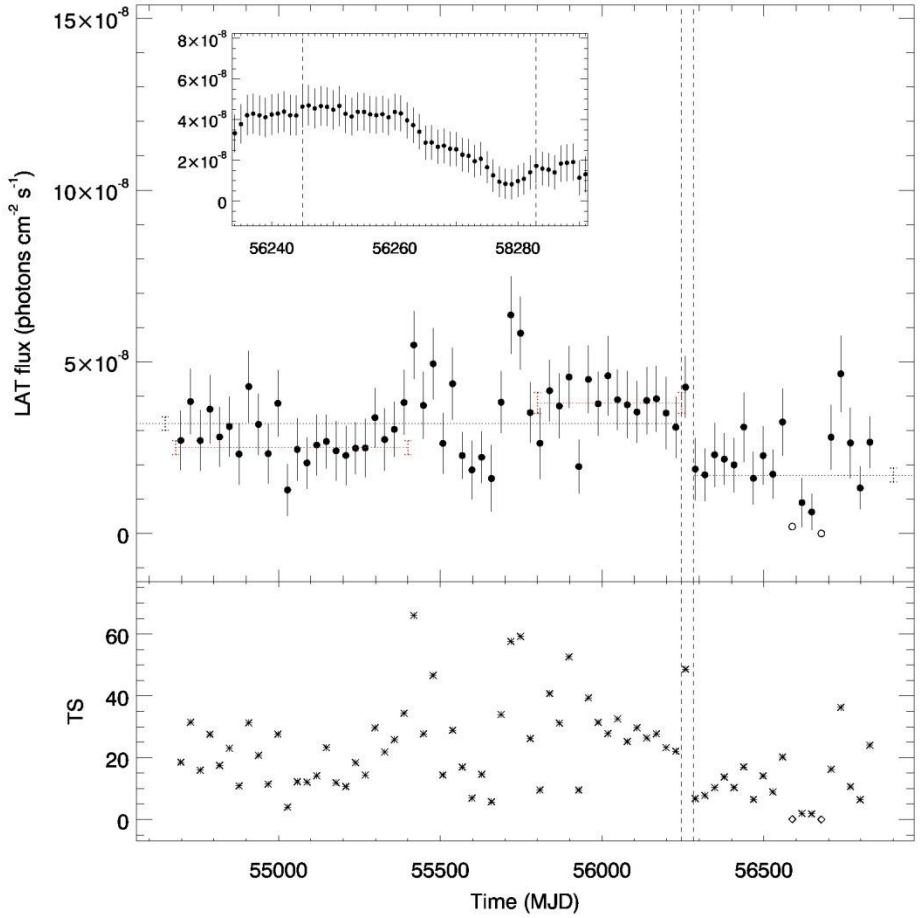
- The only MSP found from Fermi Gamma-ray timing（Pletsch et al. 2012, Science)
- Orbital period 94 min， companion mass 0.01Msun
- In off-pulse data, orbital modulation is found
- Provide clear evidence for intrabinary gamma-ray emission

2nd Transitional Redback XSS 12270-4859



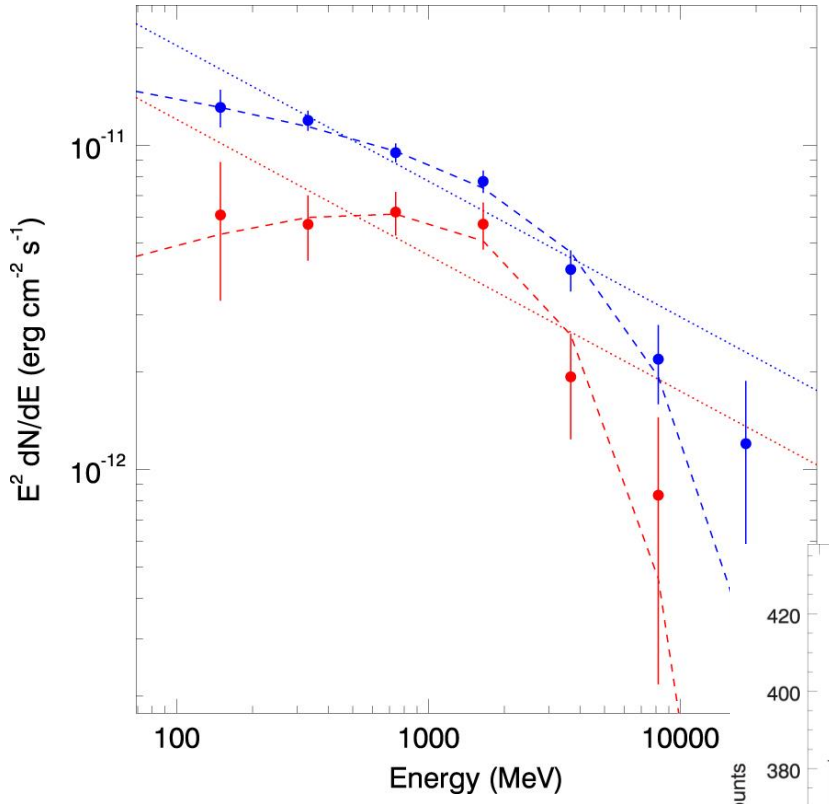
X-ray flux

Disk disappearance occurred at the end of 2012 (Bassa et al. 2014)

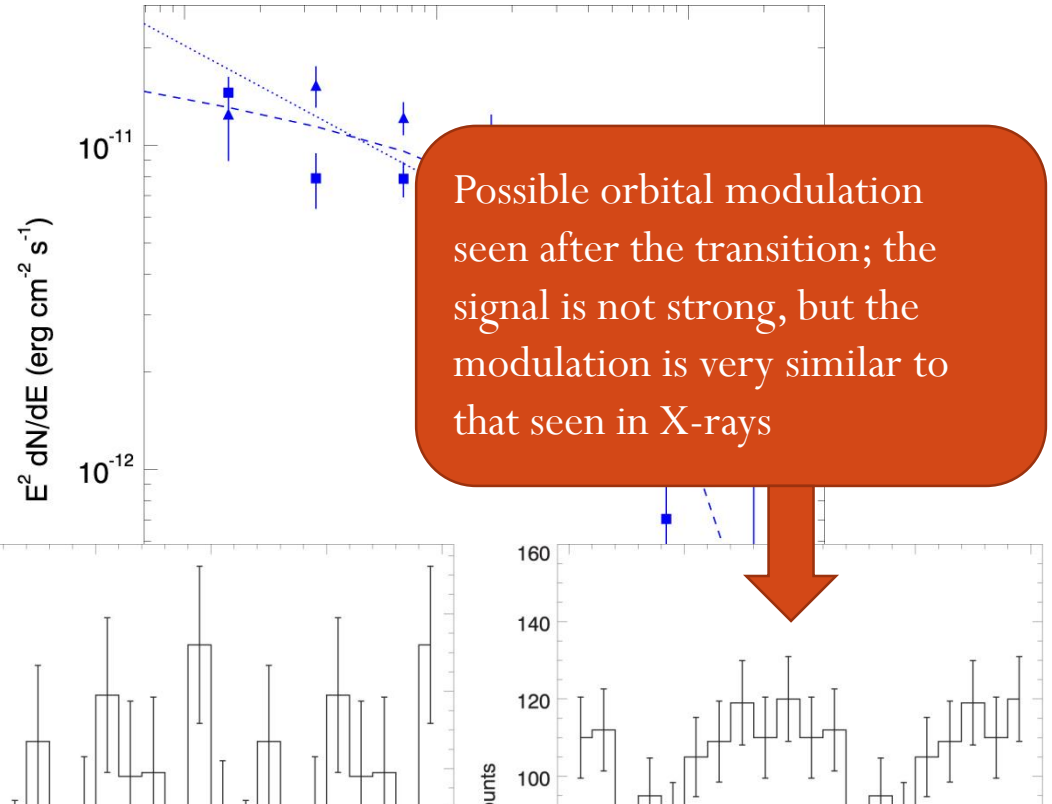


- A redback, but can switch between the states of having an accretion disk and being disk-free
- After the transition (to disk-free):
  - a P=1.69 ms pulsar is seen
  - X-rays are orbitally modulated
  - Gamma-ray flux has decreased by a factor of 2

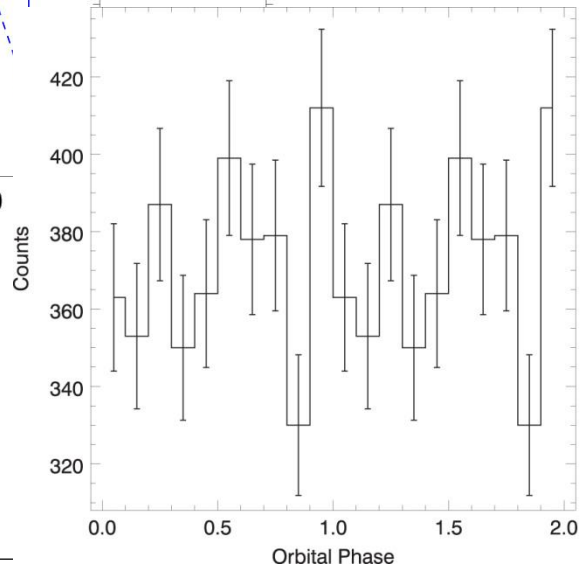
Spectra and Orbital Variability

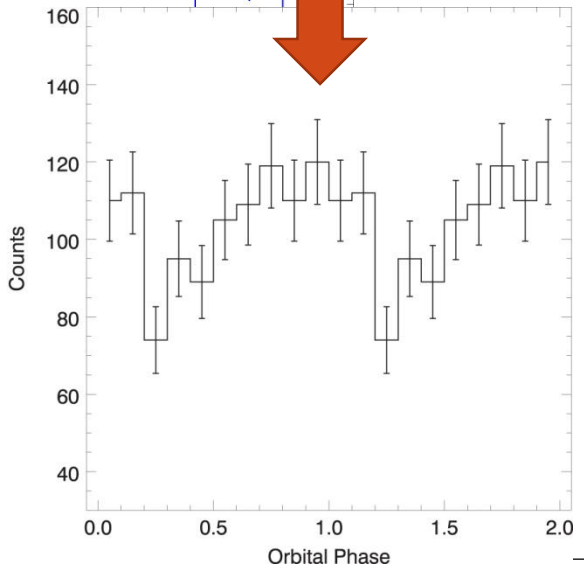


Fermi Speactra before and after the transition (Xing & Wang 2015)

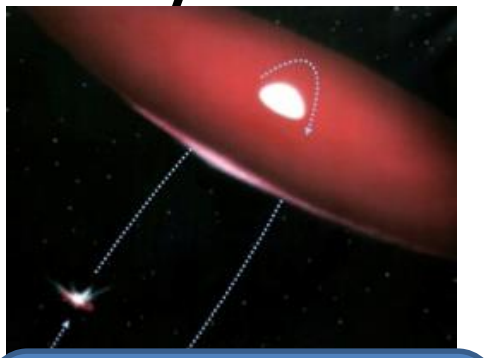


Possible orbital modulation seen after the transition; the signal is not strong, but the modulation is very similar to that seen in X-rays



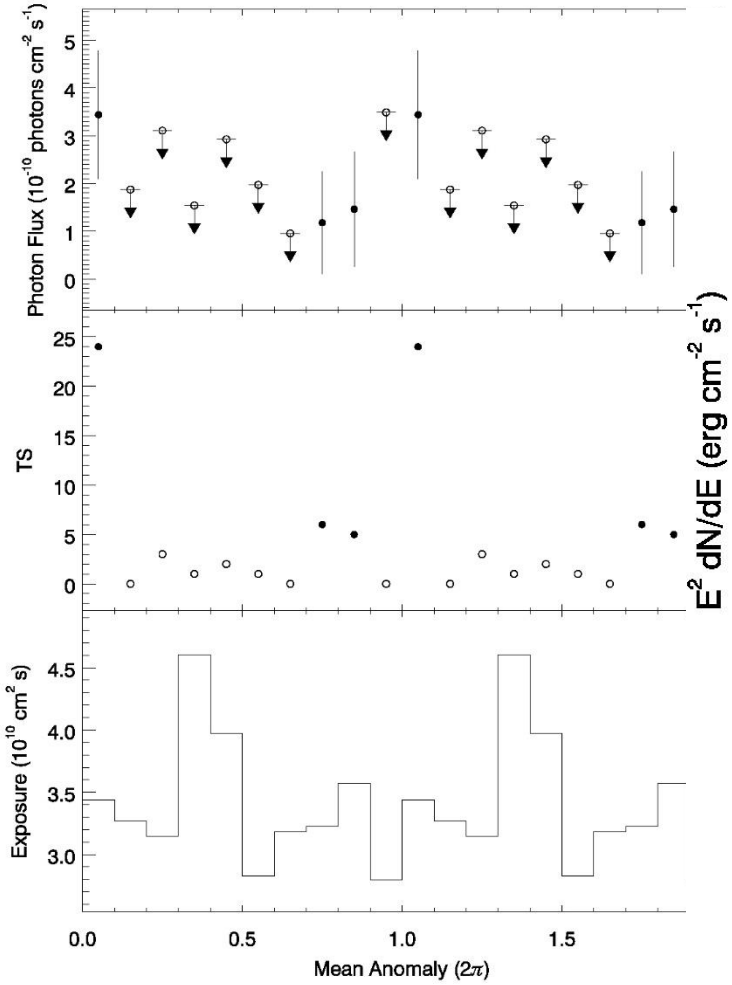


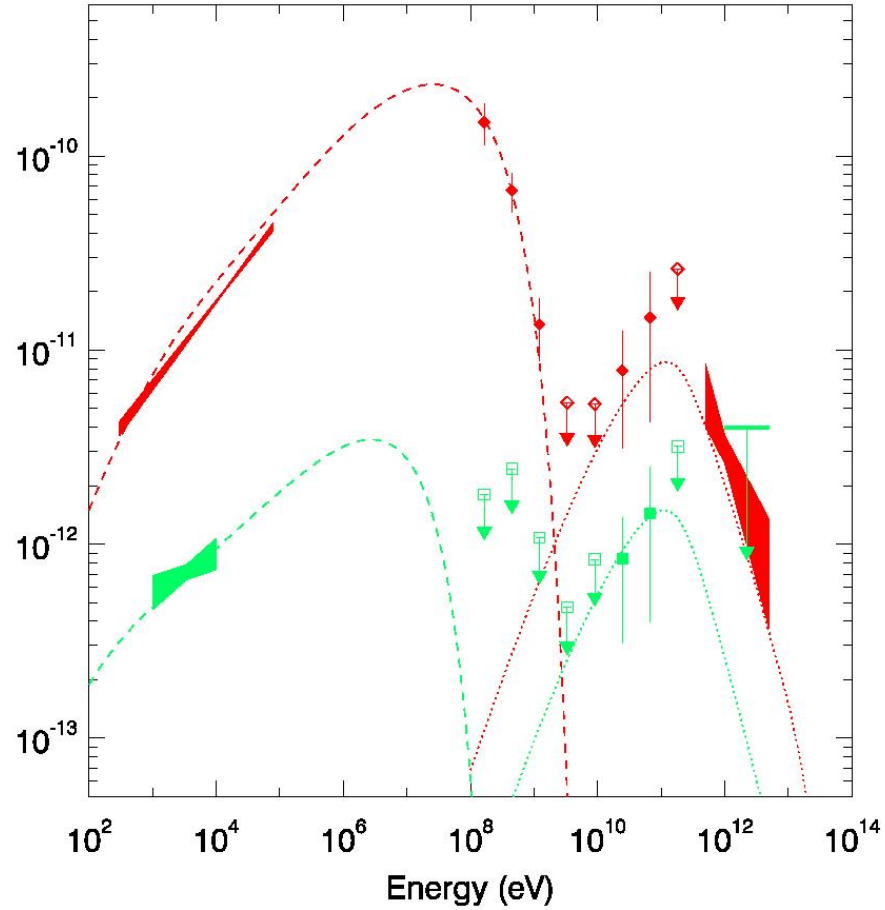
High-energy component of PSR B1259-63/LS 2883



Orbital Period 3.4 yr, enhanced emission is seen near periastron

- A 5-300 GeV component is detected during the flares (near periastron passages)
- The component is even present in the 2nd half orbit
- Inverse-Compton process: high-energy particles from the pulsar up-scatter seed photons from the companion





Xing, Wang, Takata (2016 ApJ)