Every second week for fourteen years: *RXTE* observations of Cyg X-1

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18 June 2012

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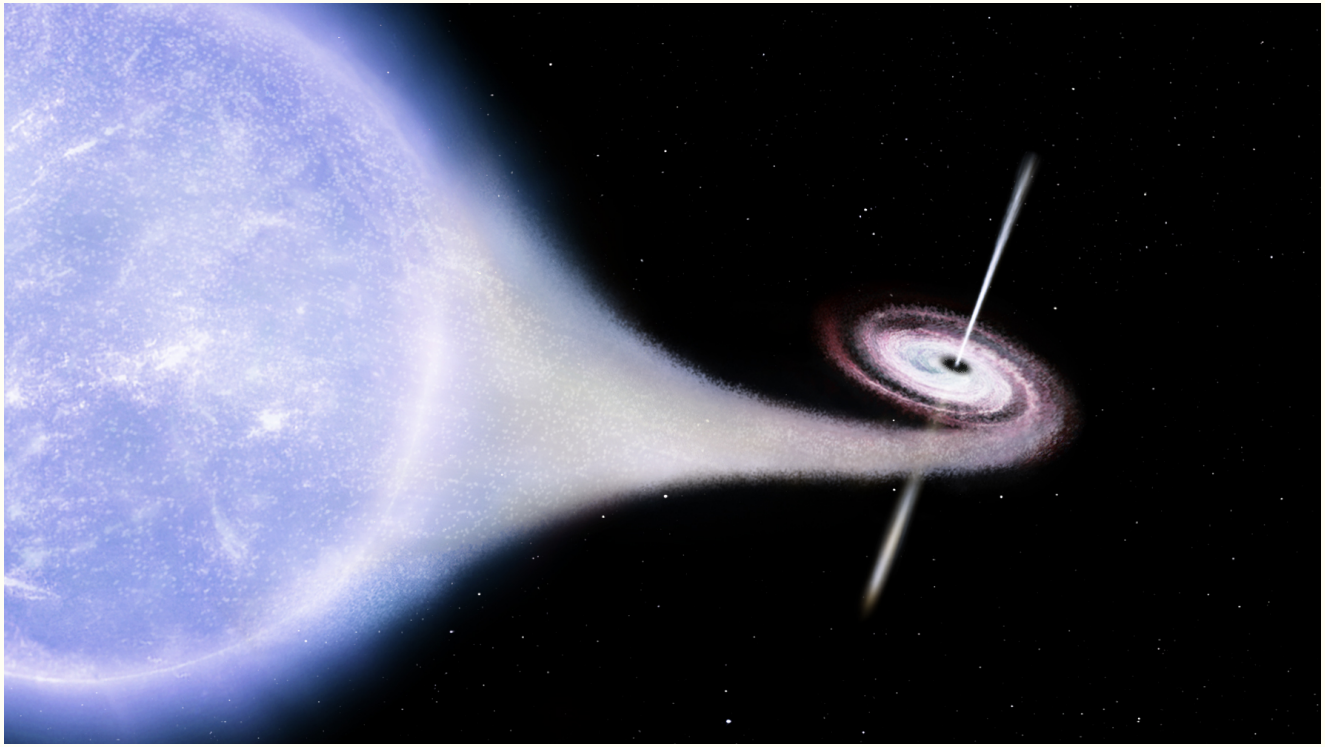
Cyg X-1 / HDE 226868 System



HMXB
(High Mass X-ray Binary)

companion:
HDE 226868,
O-type supergiant, close to filling its Roche lobe

- strong stellar wind $\Rightarrow$ accretion via focused wind
- orbital period ~ 5.6 days; distance $\sim 1.86^{+0.12}_{-0.11}$ kpc (VLBA parallax, Reid et al., 2011)
- persistent source, showing often state transitions

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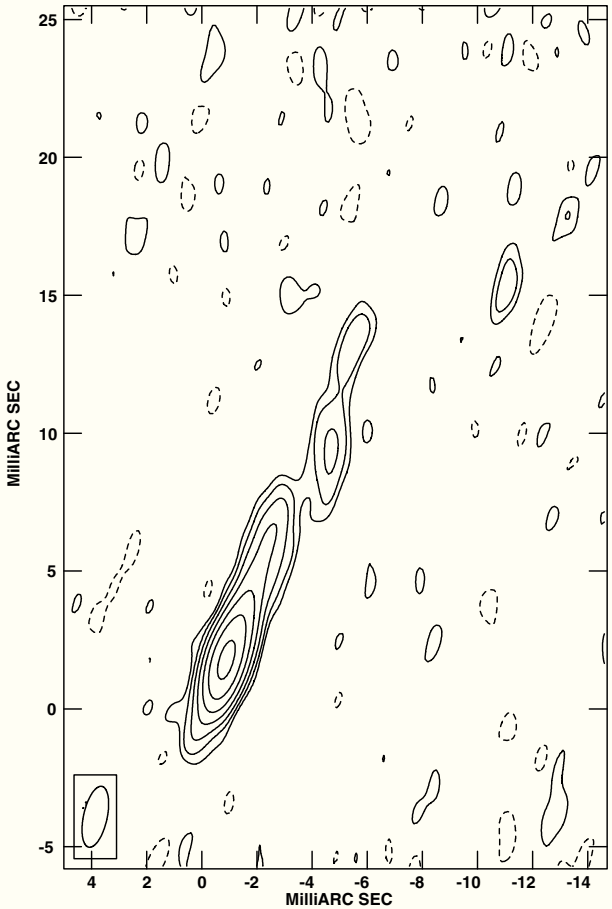
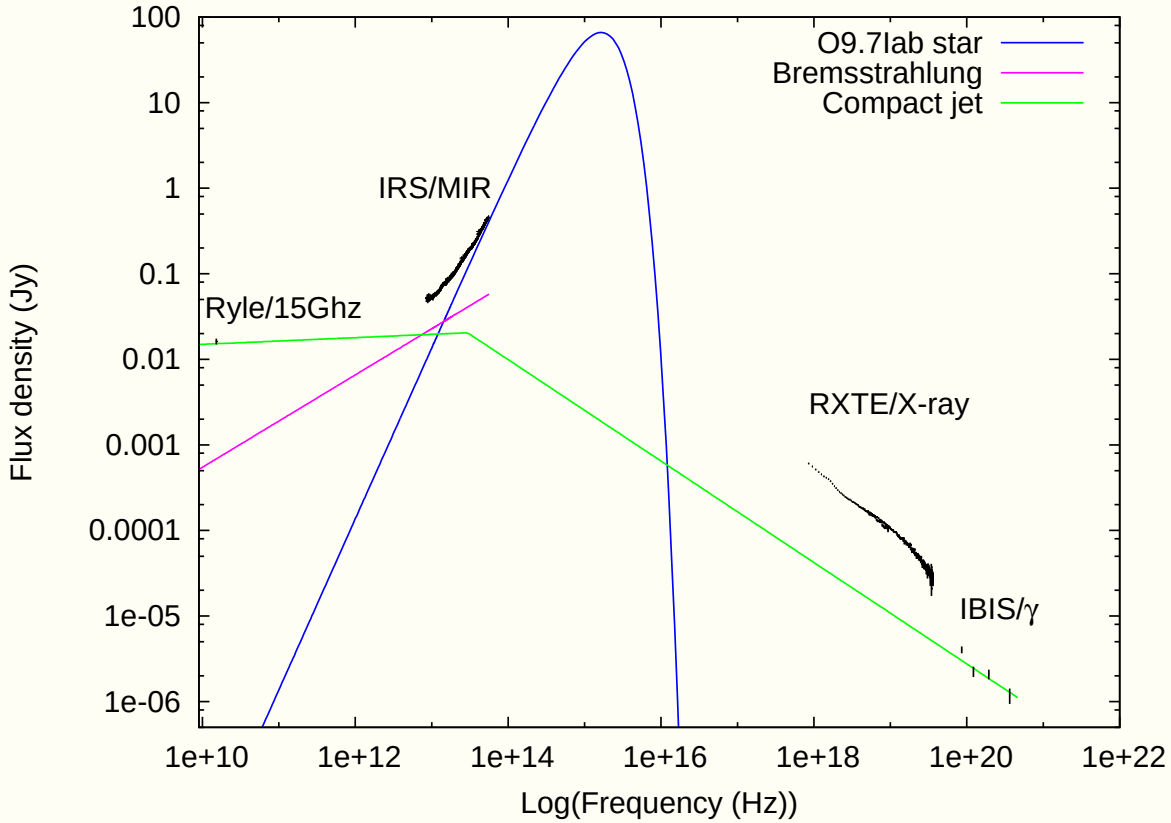
Jets



from: Stirling et al., 2001, Fig. 3



from: Rahoui et al., 2011

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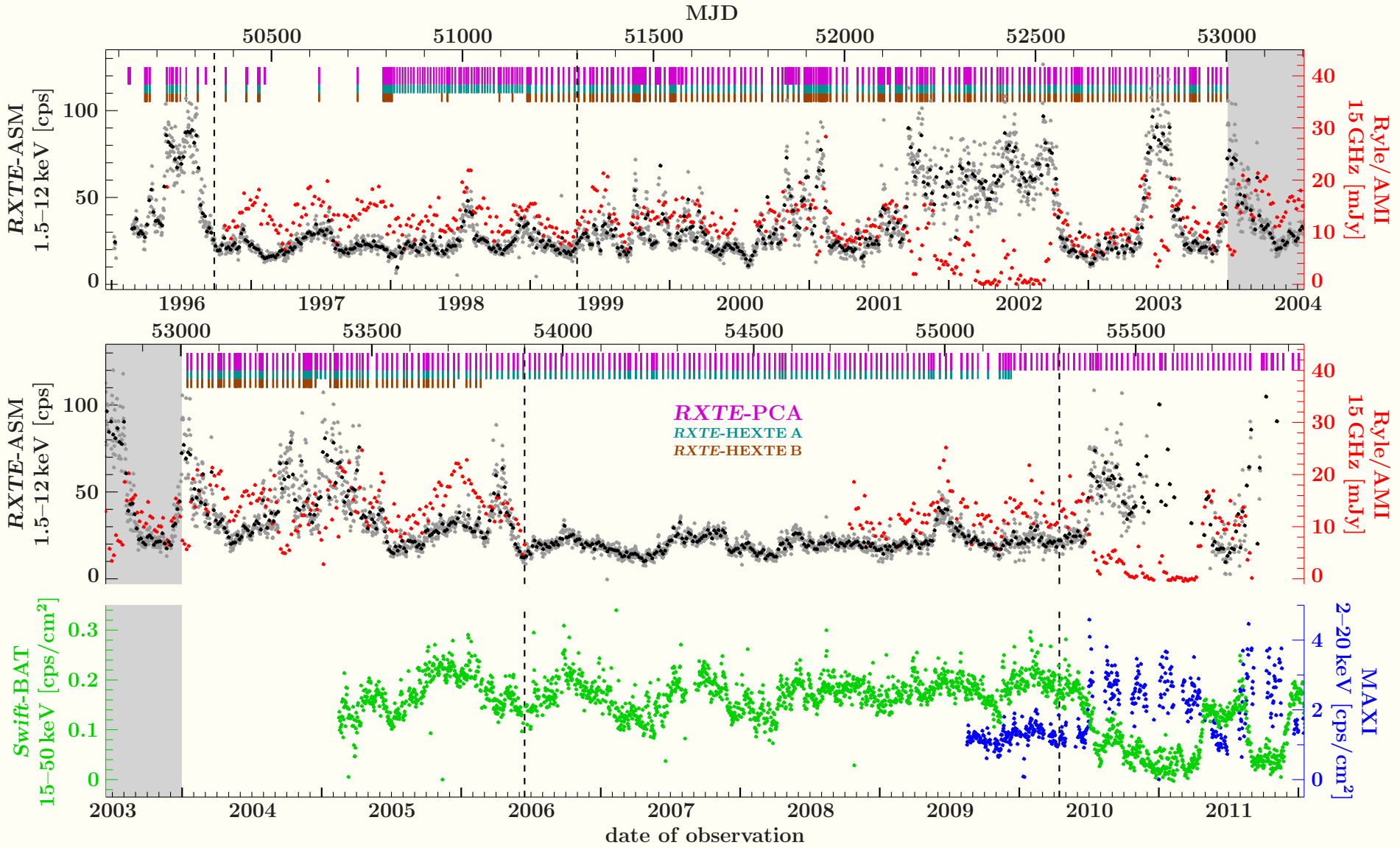
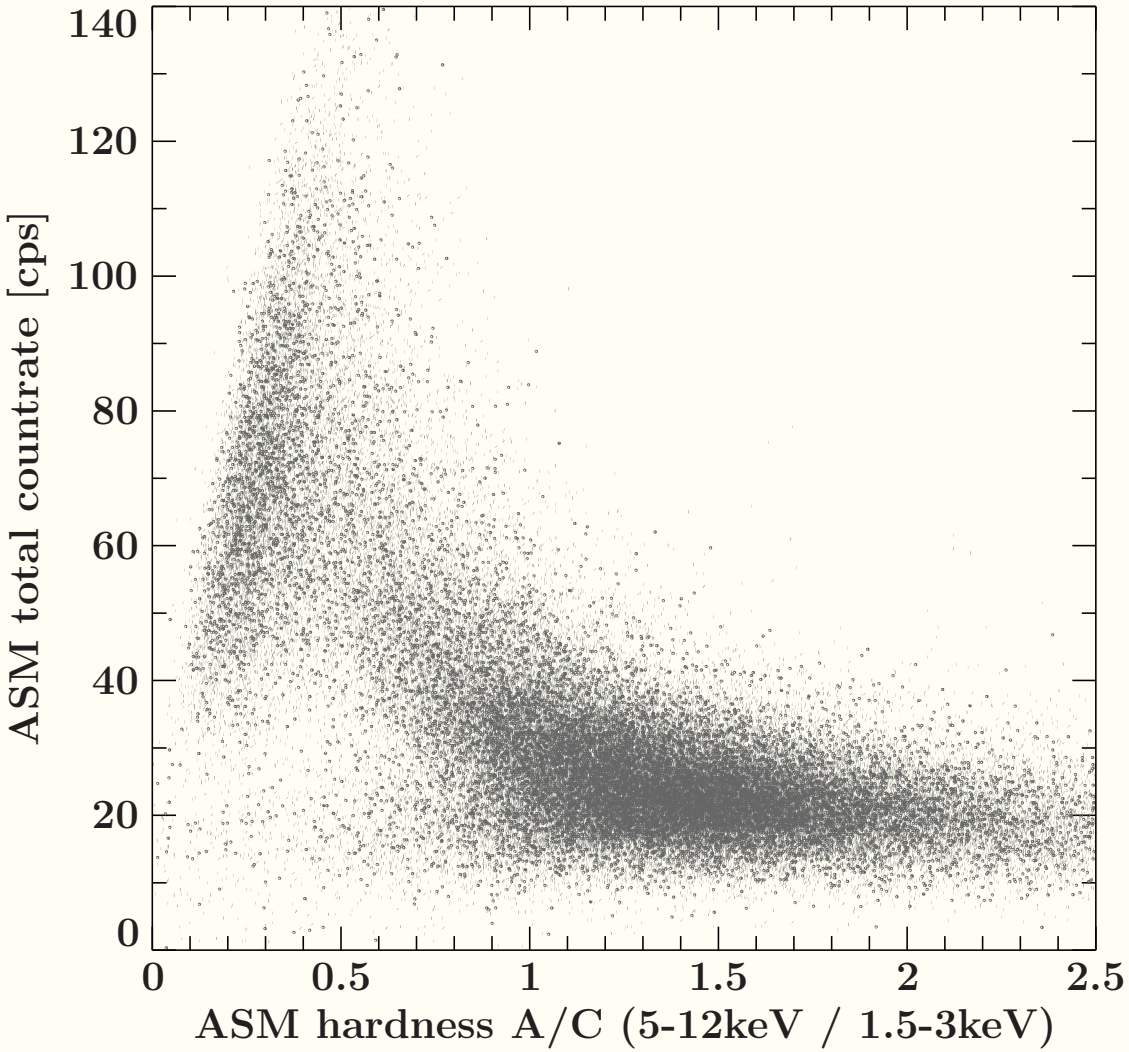
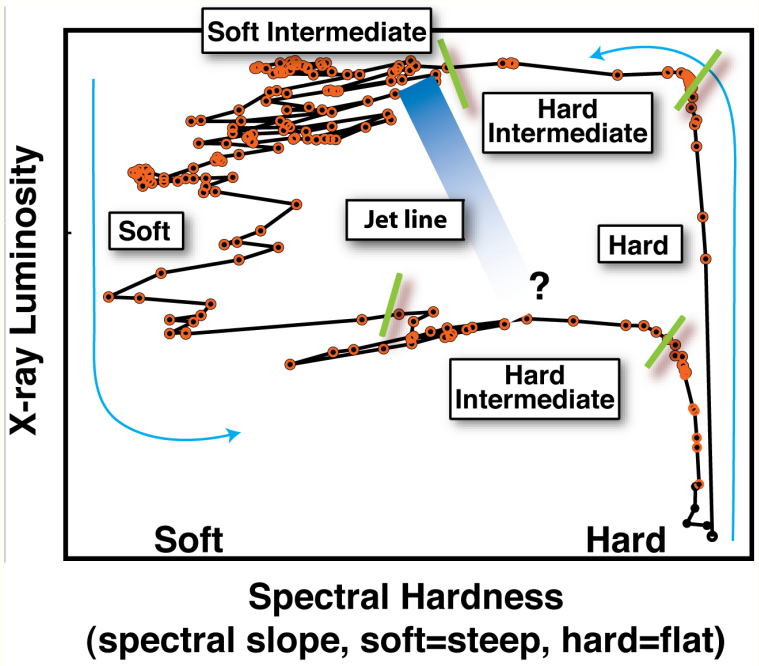
The *RXTE* Campaign



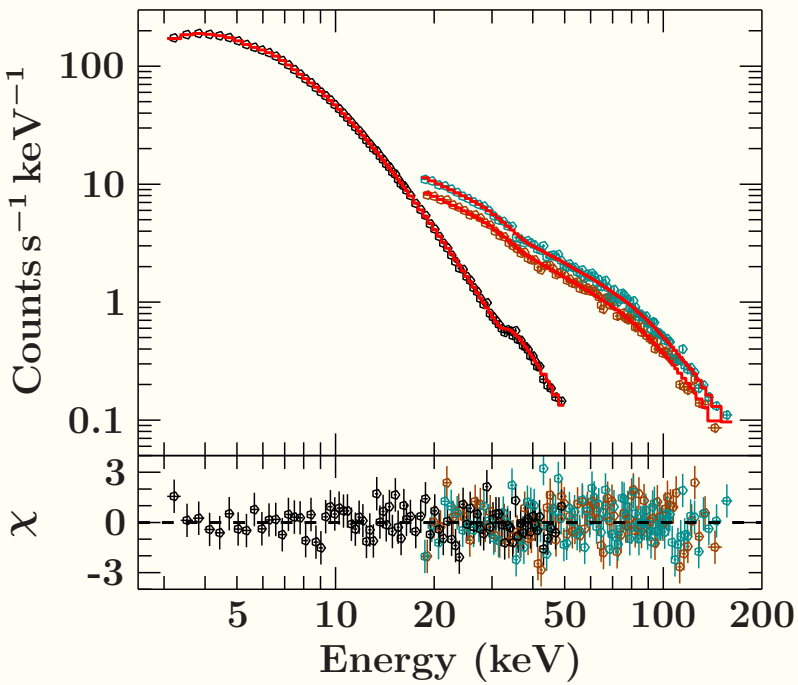
Cyg X-1 on the q-Track



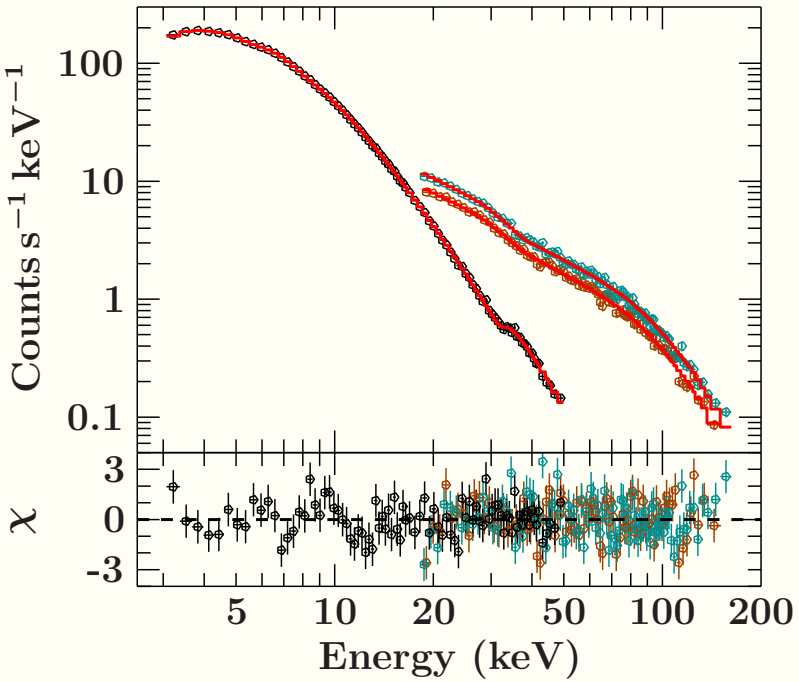


Spectral Modelling

two basic spectral models employed to describe the *RXTE* data:



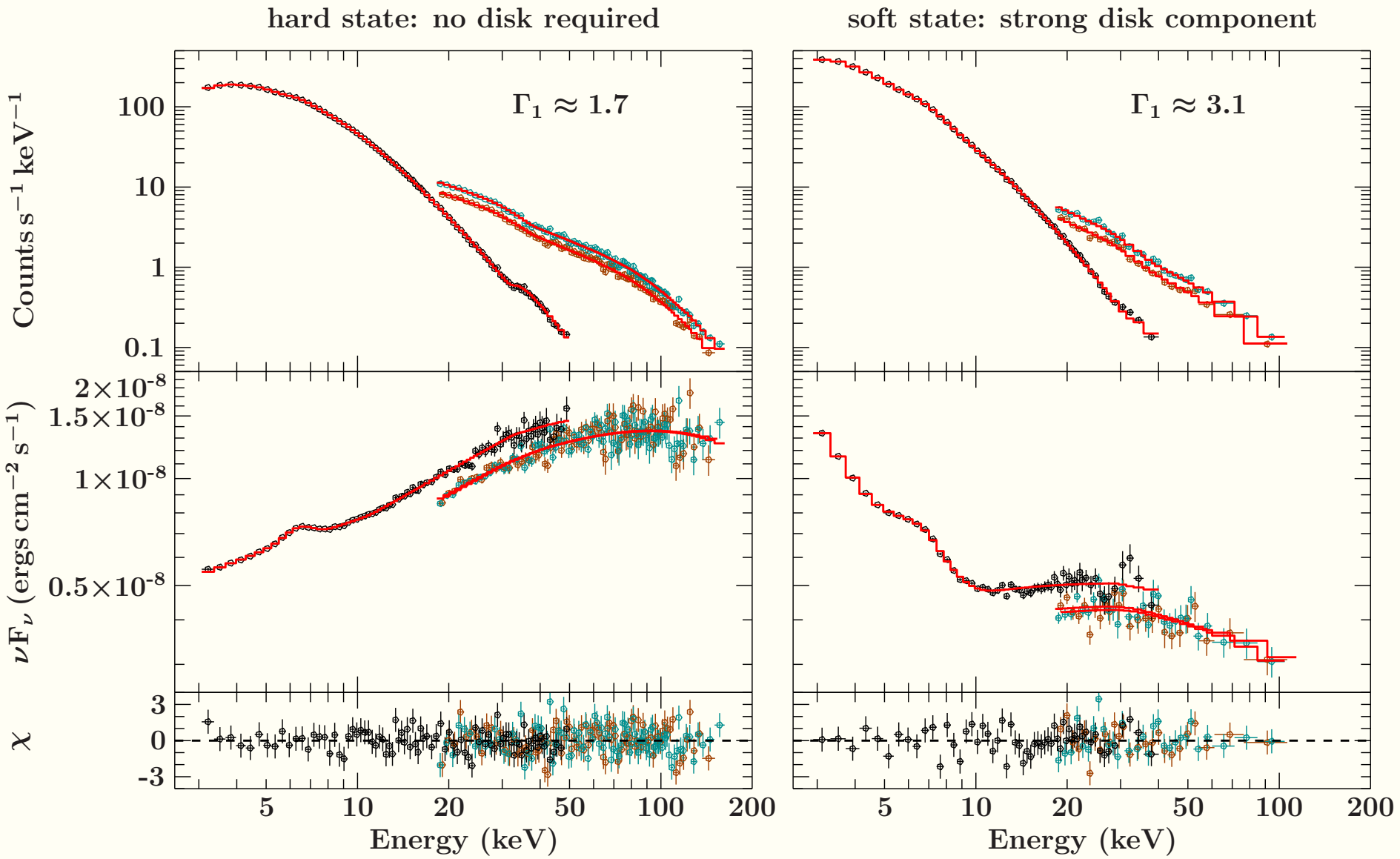
- broken power law
- modified by a high energy cutoff



- simple Comptonization model (Titarchuk, 1994)
- modified by reflection

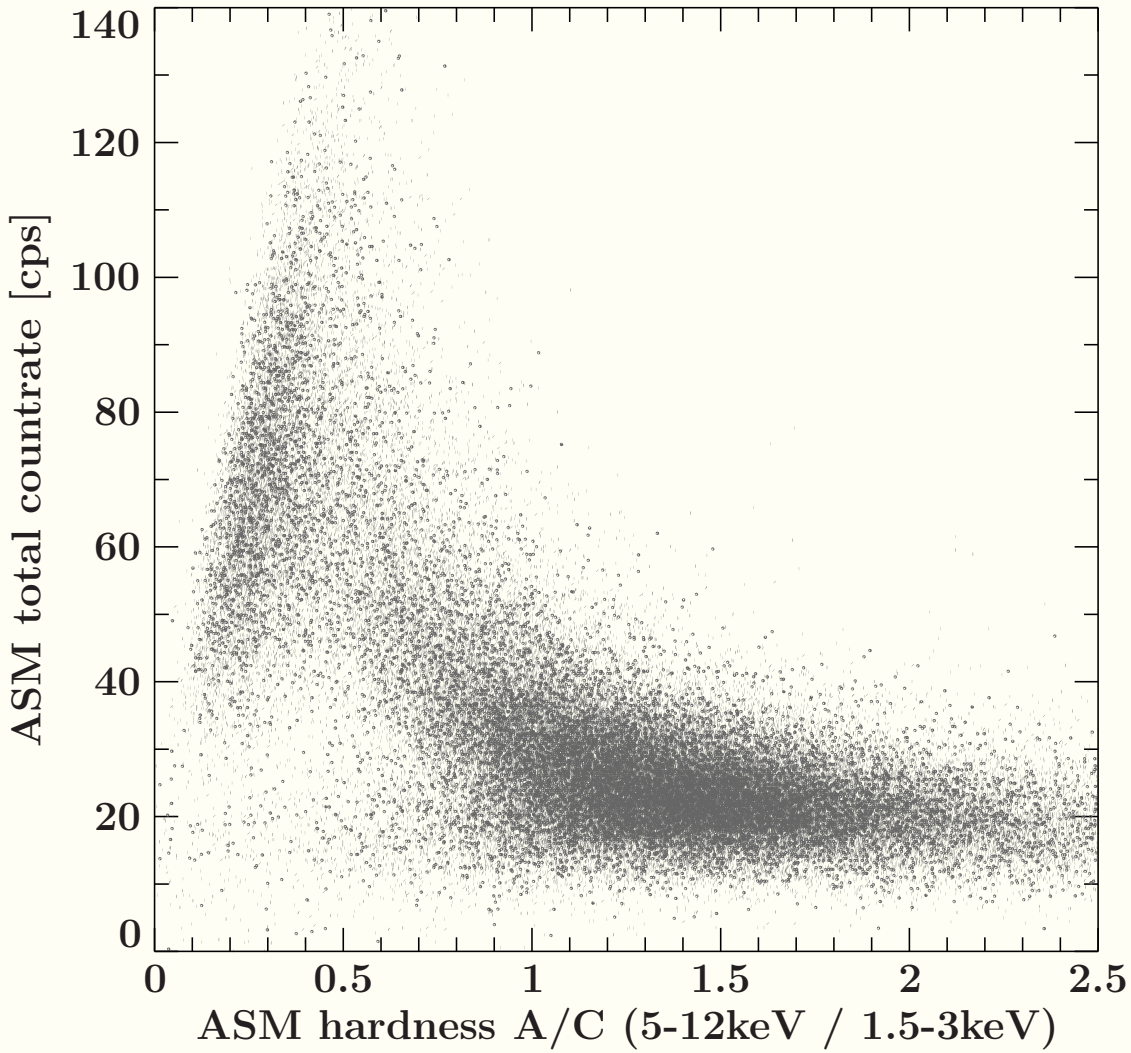
both models modified by an Iron Kα-line at $\sim$ 6.4 keV and by absorption

Hard and Soft Spectra



ASM Mapping

- idea: define states using ASM data ⇒ state definitions where no PCA data available



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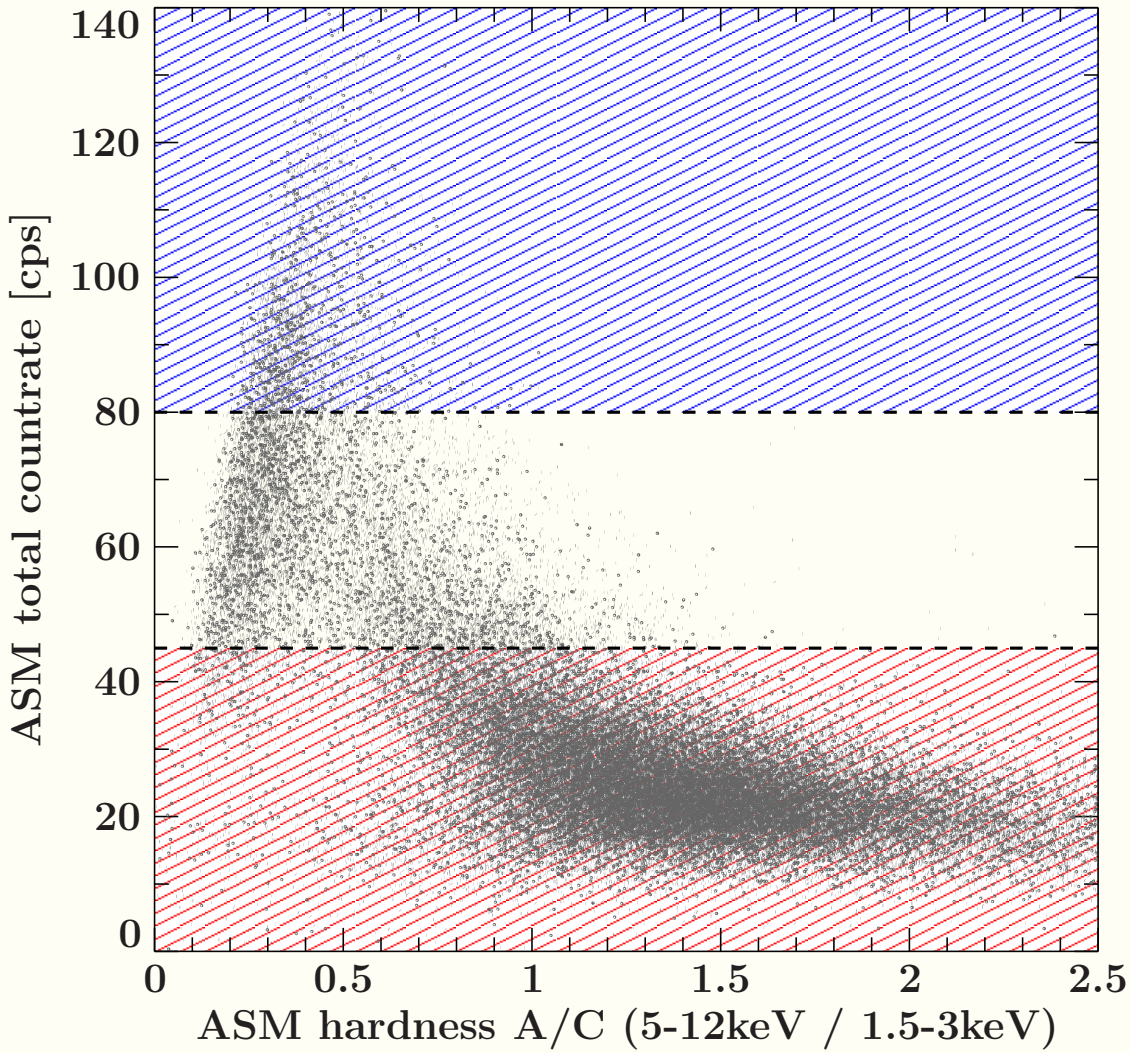
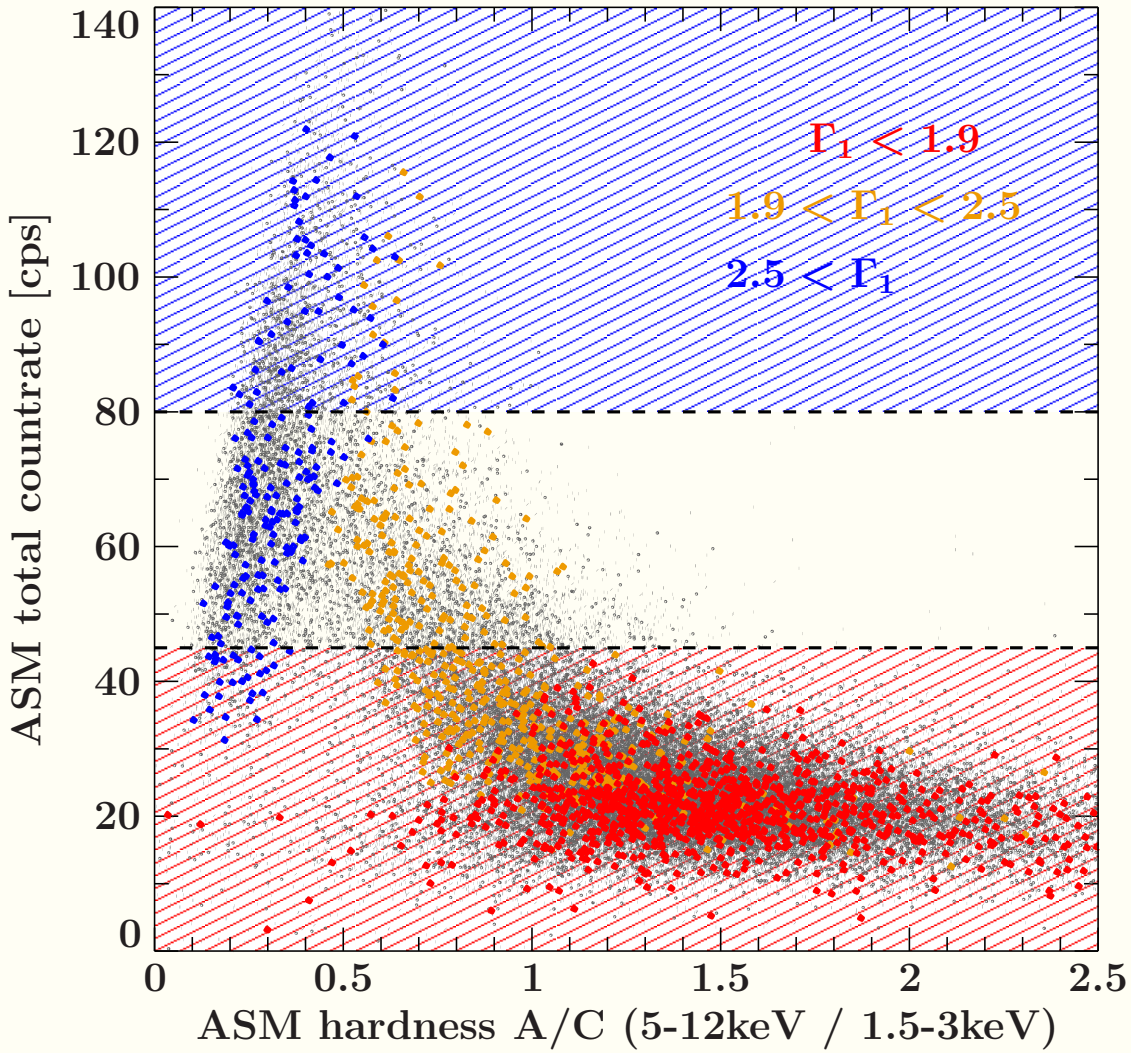
- simple solutions (using either only countrate or only the hardness)



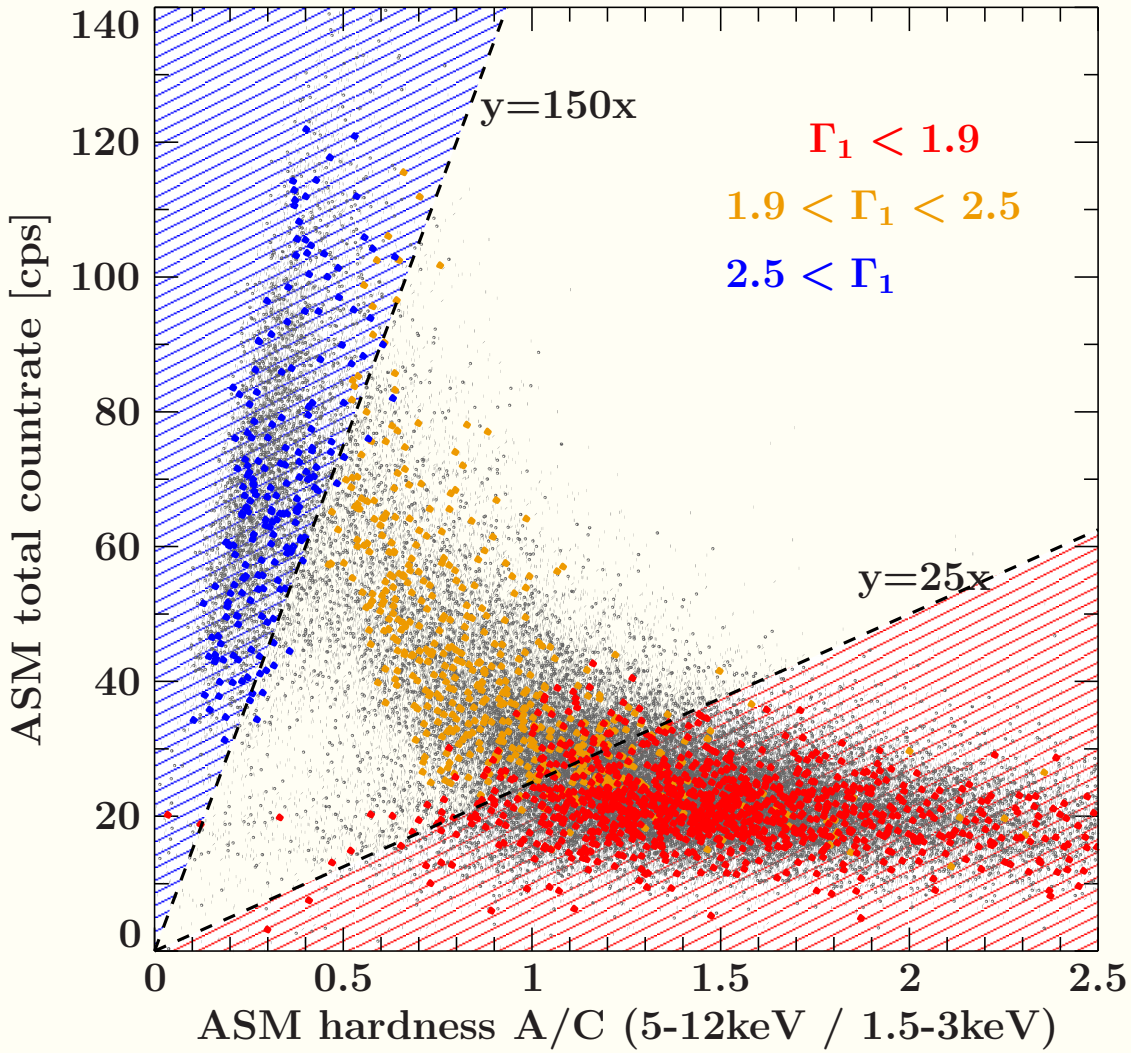
ASM Mapping

- idea: define states using ASM data $\Rightarrow$ state definitions where no PCA data available
- simple solutions (using either only countrate or only the hardness) do not clearly distinguish between states

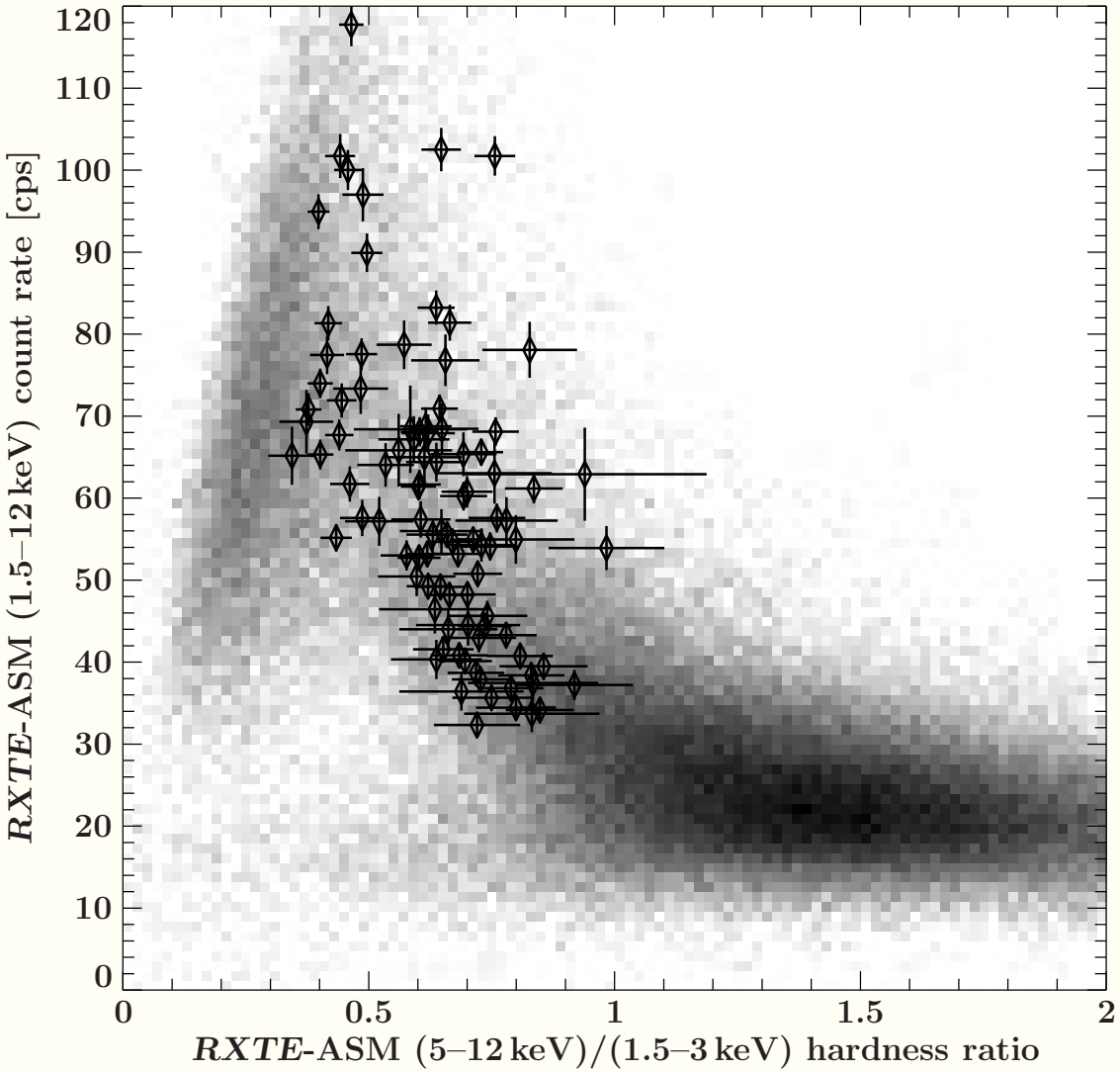


ASM Mapping

- idea: define states using ASM data ⇒ state definitions where no PCA data available
- simple solutions (using either only countrate or only the hardness) do not clearly distinguish between states
- solution: use a function of both countrate **and** hardness



State Transitions



from: Böck et al., 2011

- hard to soft state transition observed to occur in under 2.5 hours
- similar behaviour on short and long timescales

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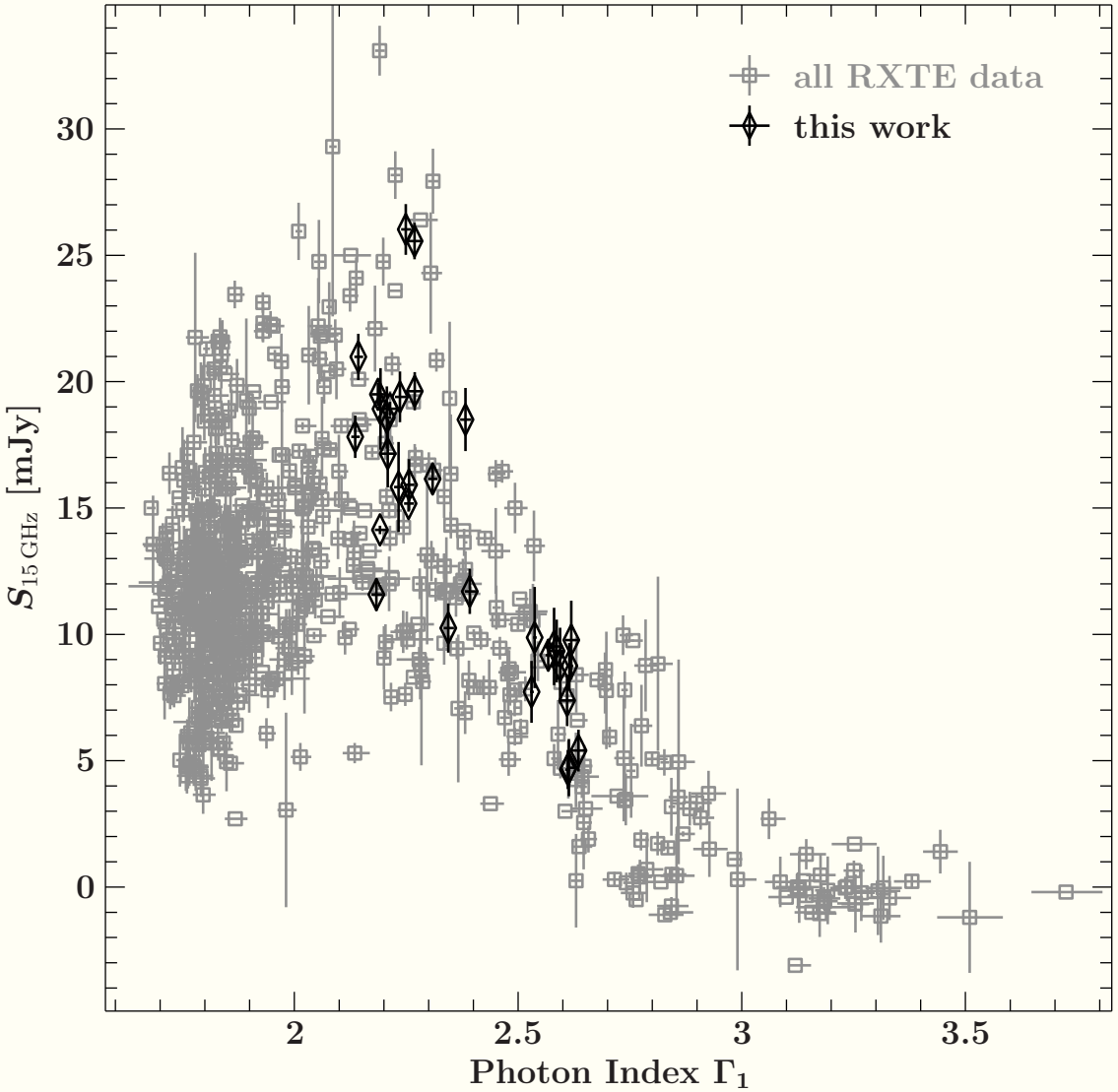

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- hard to soft state transition observed to occur in under 2.5 hours
- similar behaviour on short and long timescales
- radio flux and X-ray spectral shape correlated
- tight correlations between spectral and timing parameters

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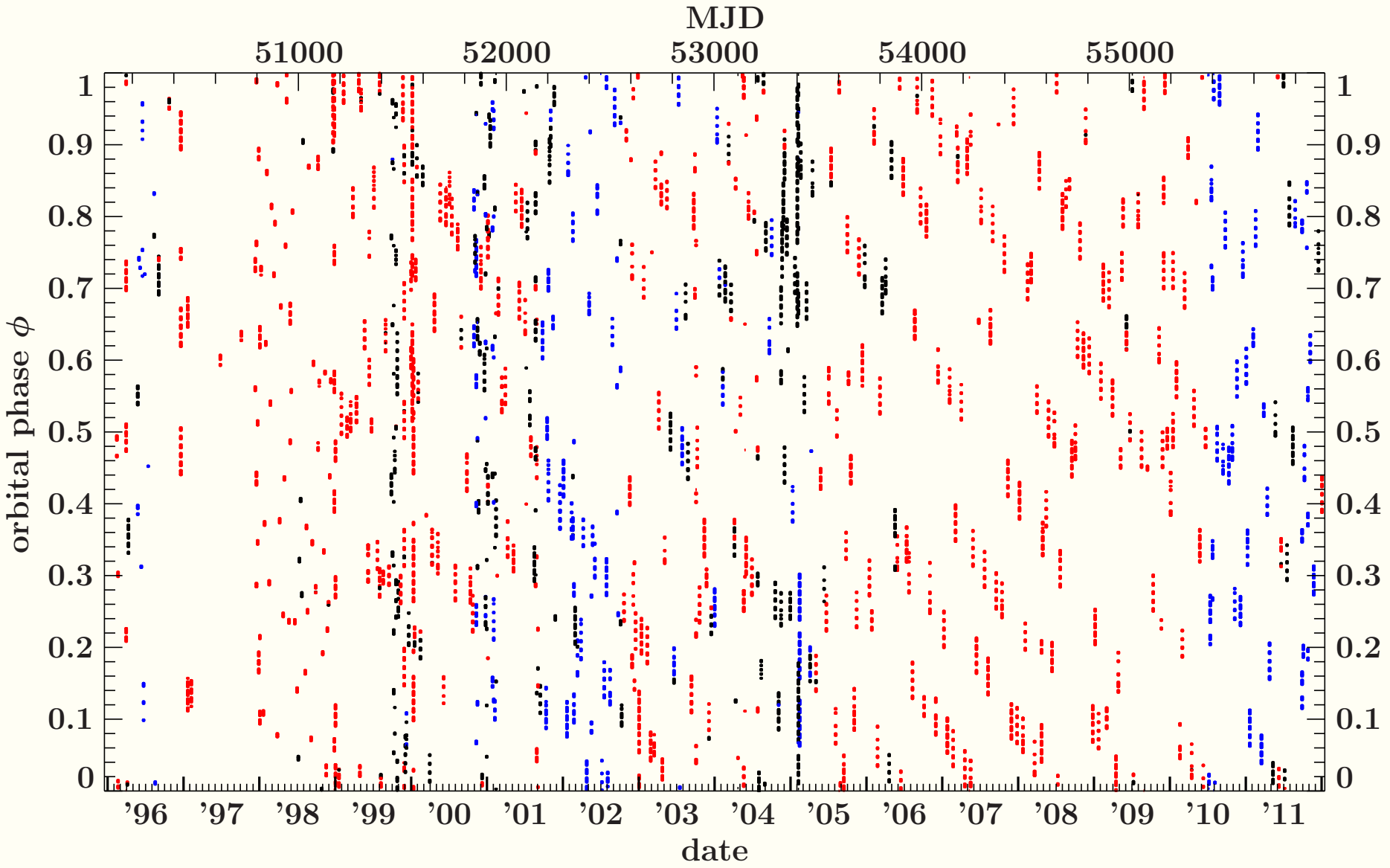
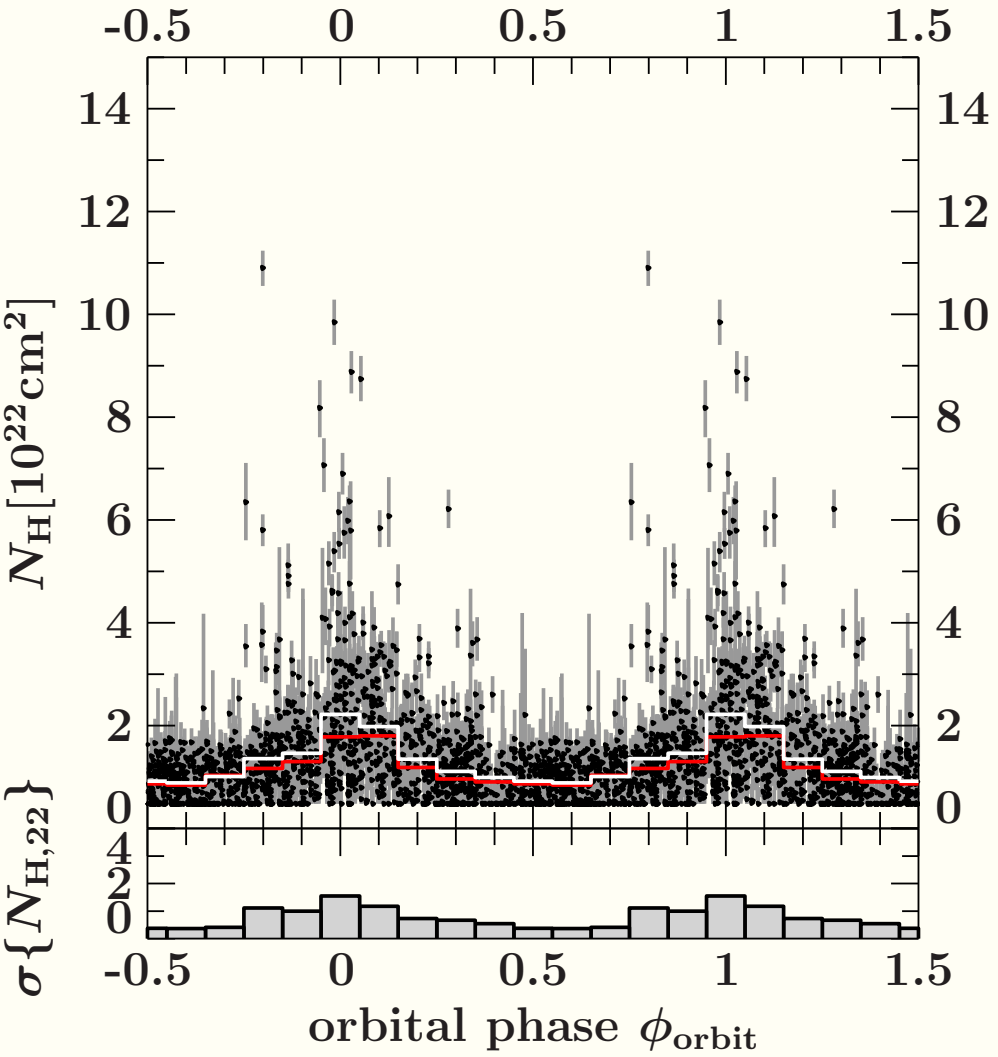
Orbital Coverage



Orbital Modulation of N_{H}



inclination of the system: $i = 27°$ (Orosz et al., 2011)

here: hard observations, with no disk required

$\Rightarrow$ at $\phi \approx 0$ stronger absorption due to material local to the system

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Summary/Outlook

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- Unique long term dataset covering different states and numerous state transitions
- Flux and hardness both important for state definitions in ASM
- Quick transitions, tight parameter correlations
- Orbital variations of N_{H}

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- consistent empirical description of all the orbit-wise *RXTE* spectra
- timing analysis of bi-weekly campaign data
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Thank you for your attention!

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