

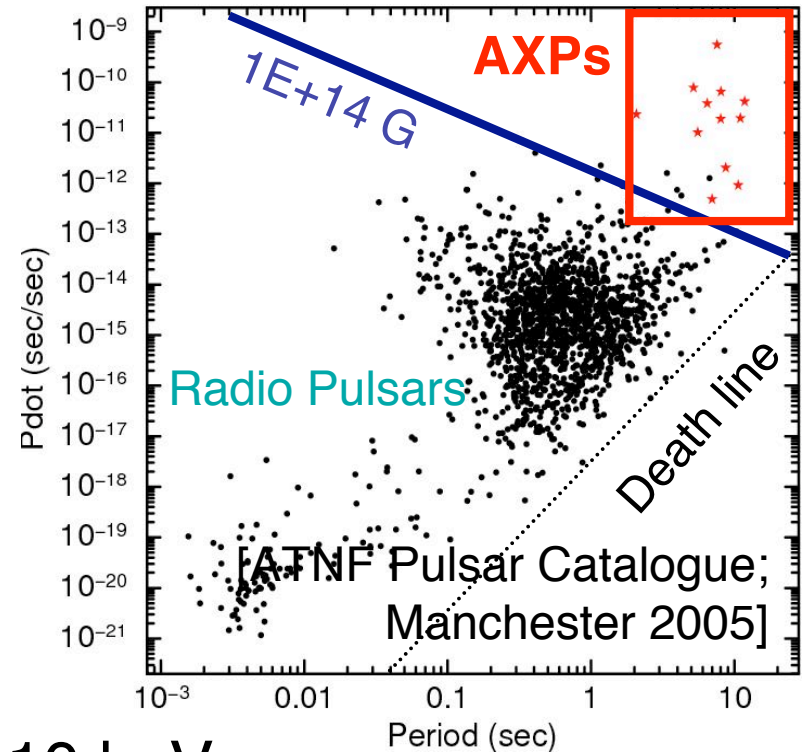
Suzaku Observation of Anomalous X-ray Pulsar 4U 0142+61

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Anomalous X-ray Pulsars

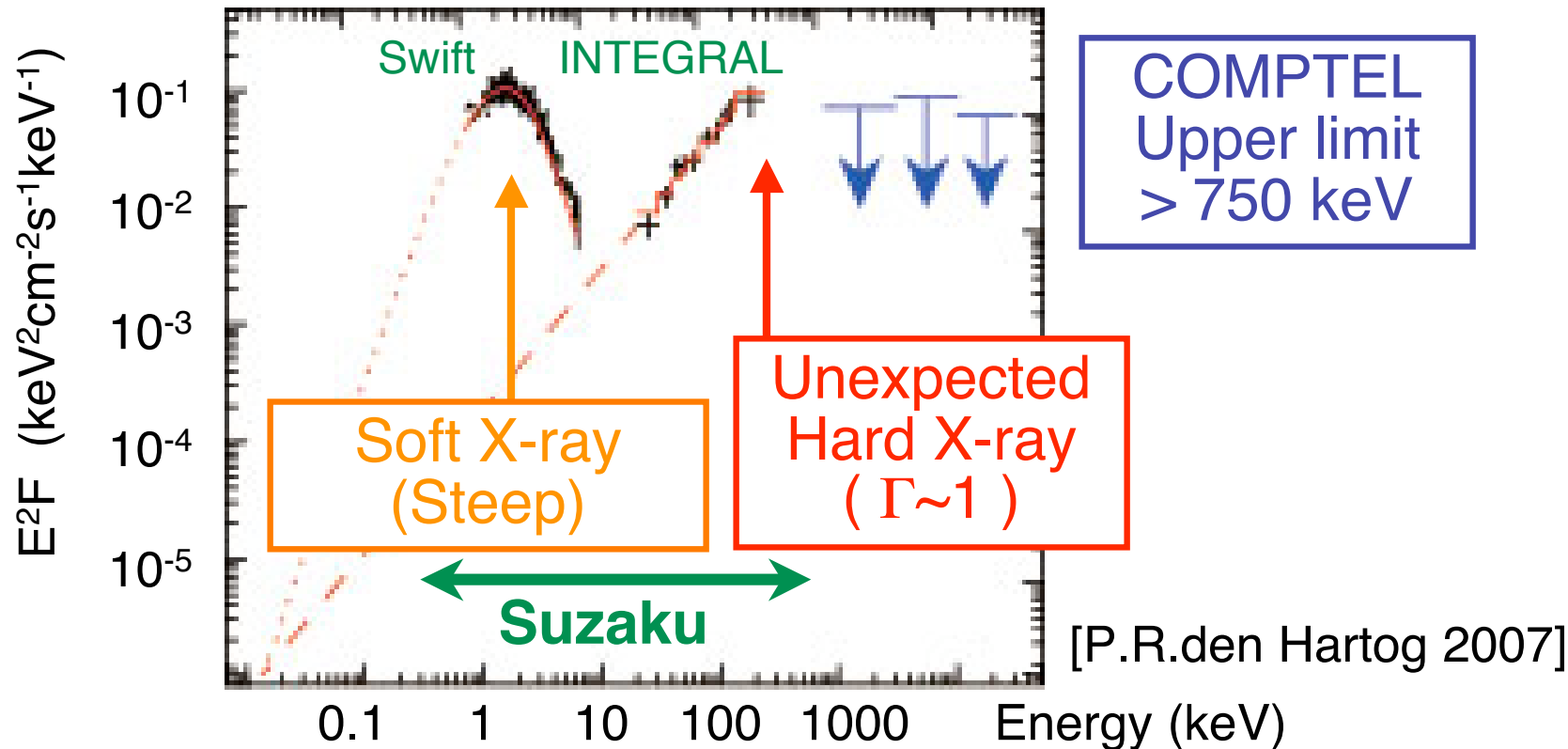
- Young rotating isolated NS
 - $P \sim 5\text{-}12$ s, $\dot{P} \sim 1\text{E-}11$ s/s
 - $L_{\text{X-ray}} \gg L_{\text{SpinDown}}$
 - $B > 1\text{E+}14$ G (Magnetar?)
 - 8 AXPs + a few candidates
 - X-ray observations
 - Pulsed steep spectra below 10 keV
 - Extremely hard γ emission discovered in >10 keV by INTEGRAL/RXTE (~ 4 AXPs)
- [Molkov 2004; Kuiper 2004]
- Hard X-ray properties are still unknown.



AXP 4U 0142+61

- Hard X-ray Emitting AXP with $P \sim 8.7\text{s}$, $D = 3.6\text{ kpc}$

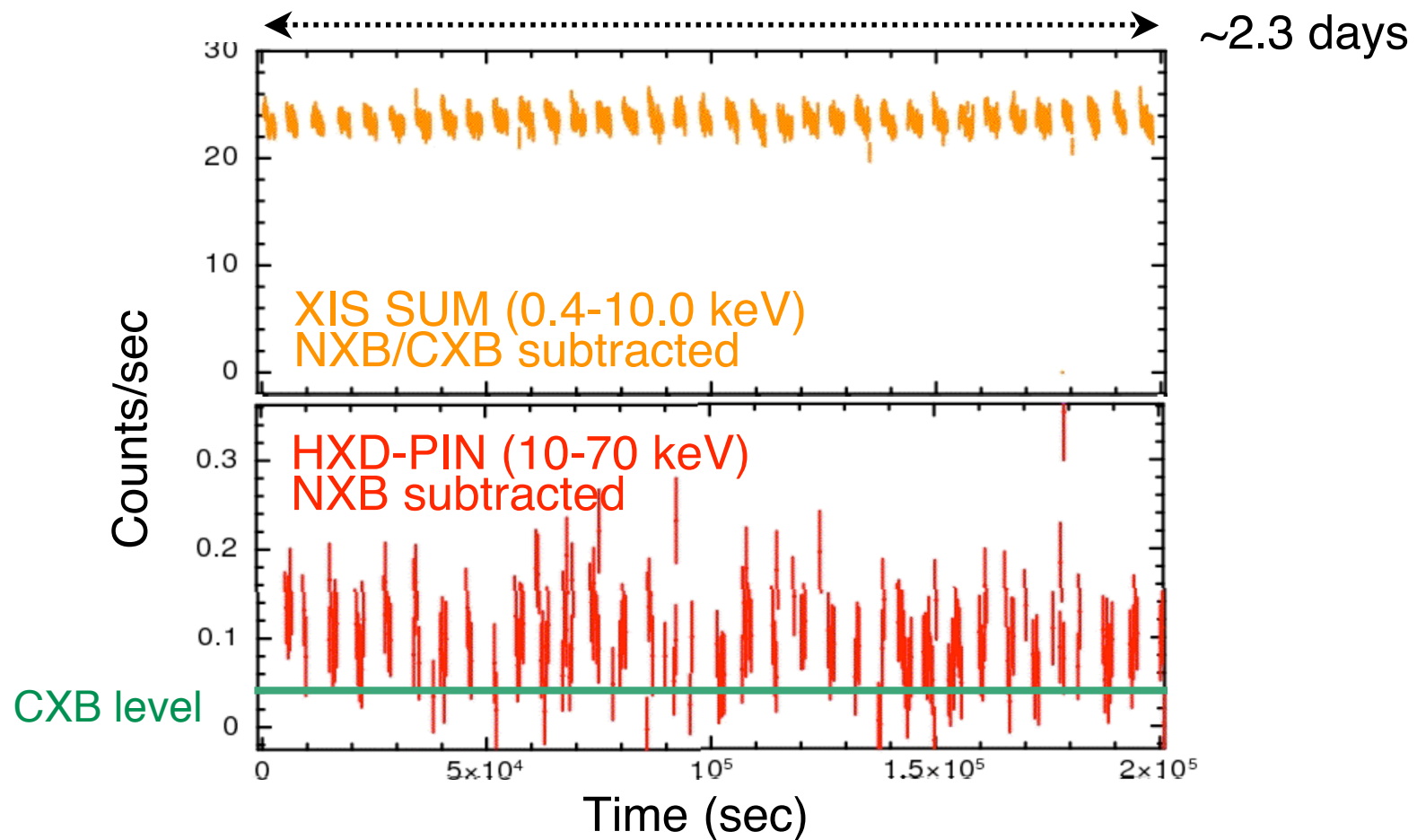
[Durant 2006]



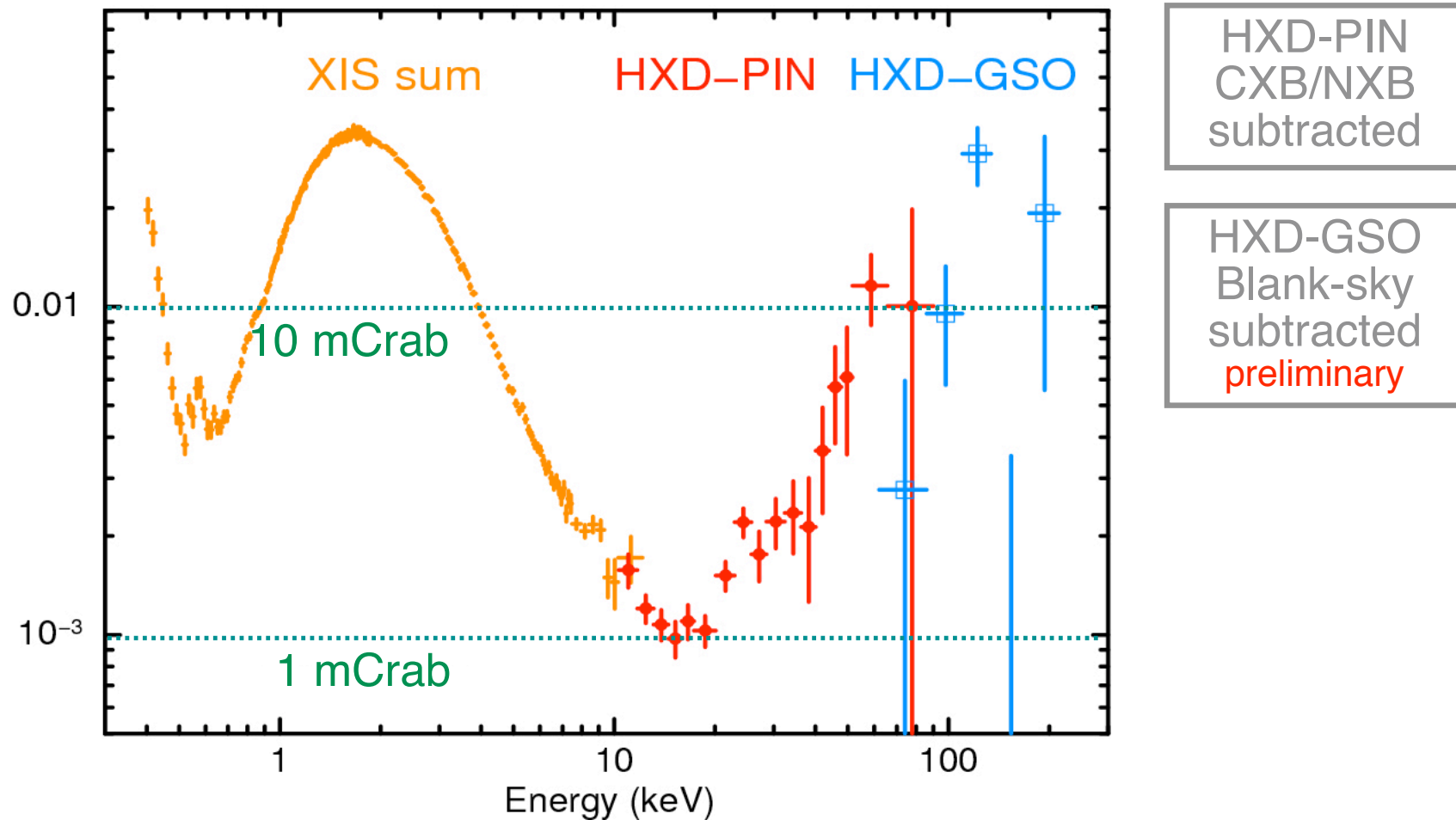
- Cutoff, photon index, time variation of the hard emission
- 4U 0142+61 is a good-aimed object for Suzaku

Light Curve

- 4U 0142+61 was observed with Suzaku on 2007 August 13-14 for a 100 ks exposure

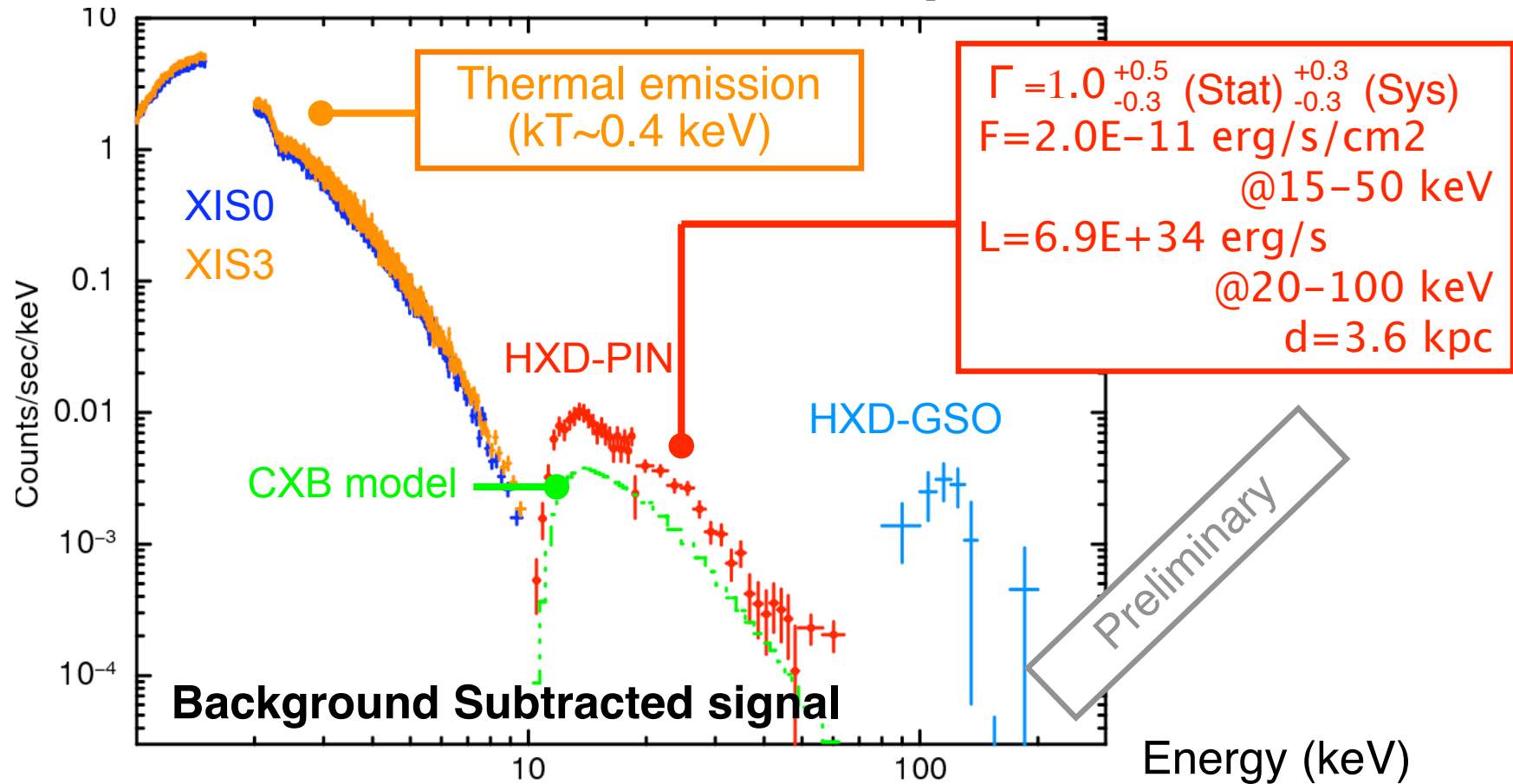


Crab Ratio



- Suzaku clearly detected the Hard X-ray Emission at least up to ~100 keV, possibly higher

Wideband Spectra



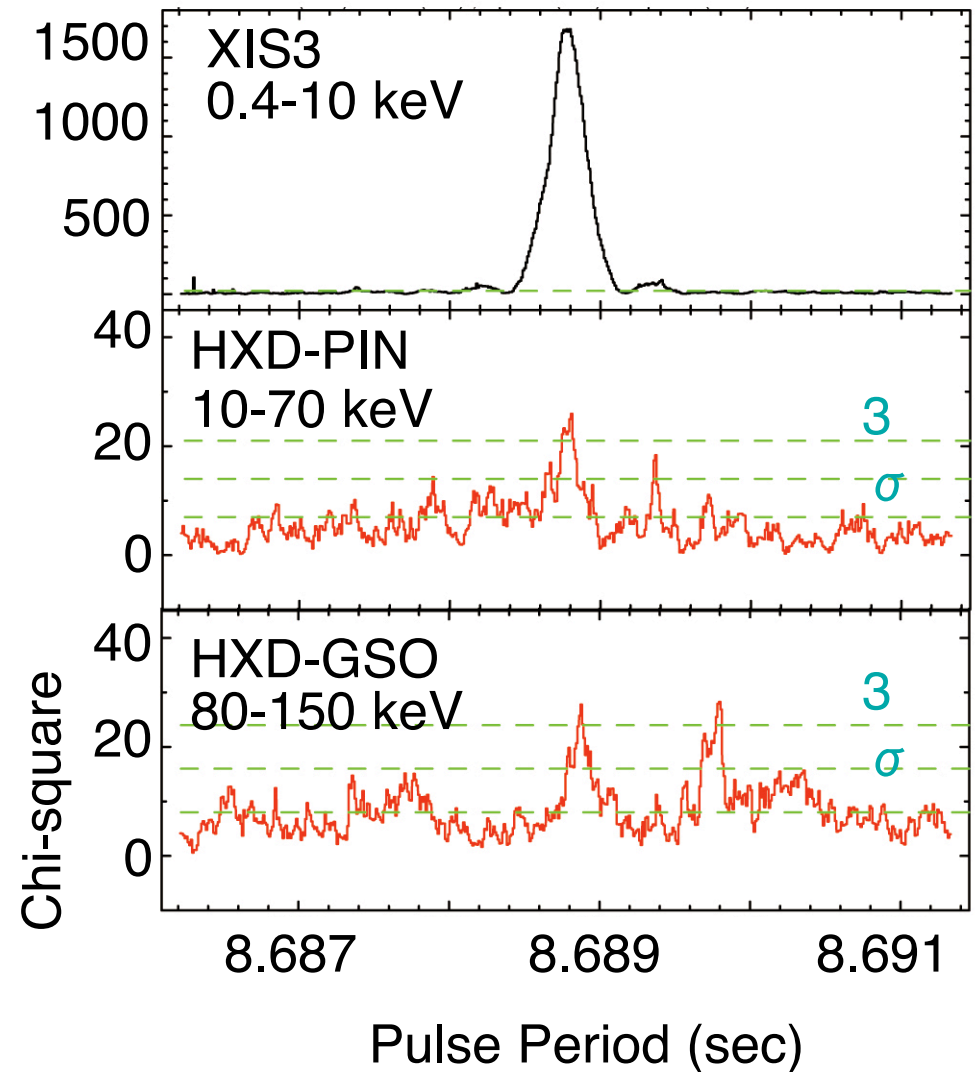
- Photon index and flux are consistent with those from INTEGRAL/RXTE ($\Gamma=1.05\pm 0.11$, $L=8.1E+34$ erg/s @ 20-100 keV)
- Hard X-ray emission appears to be long-term stable

Periodogram

- Pulsations were detected by XIS/HXD at $P = 8.6888 \pm 0.0001$ s, which is consistent with a previous ephemeris.

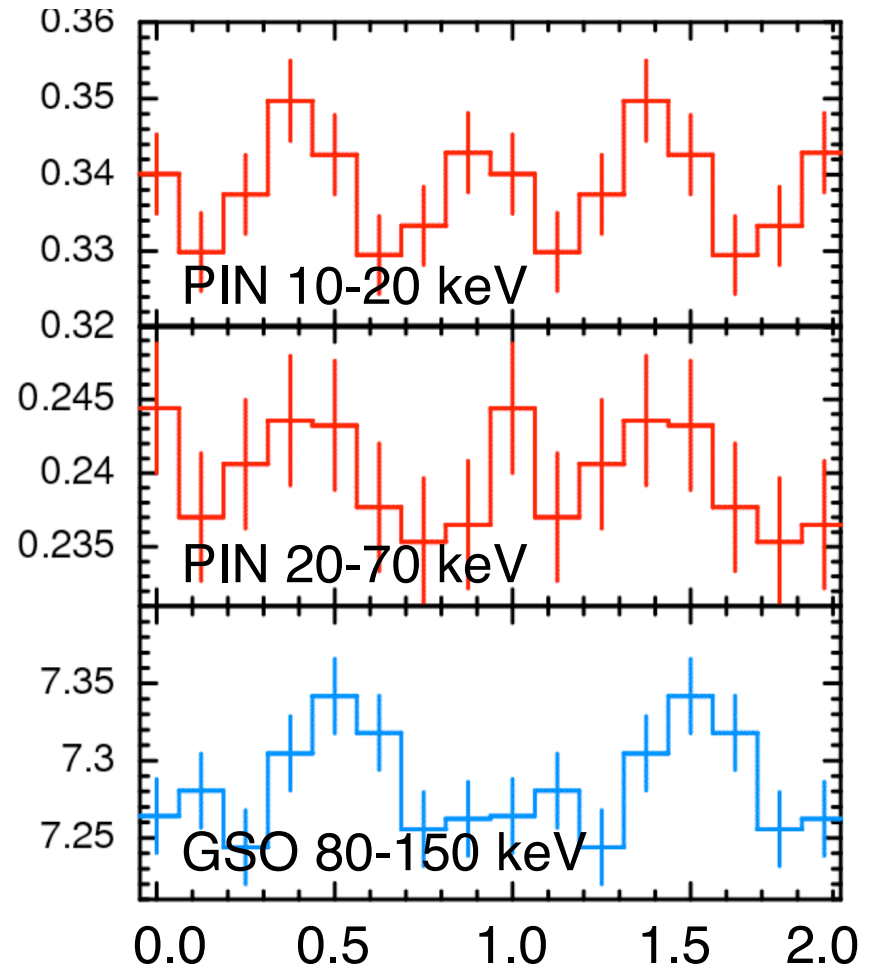
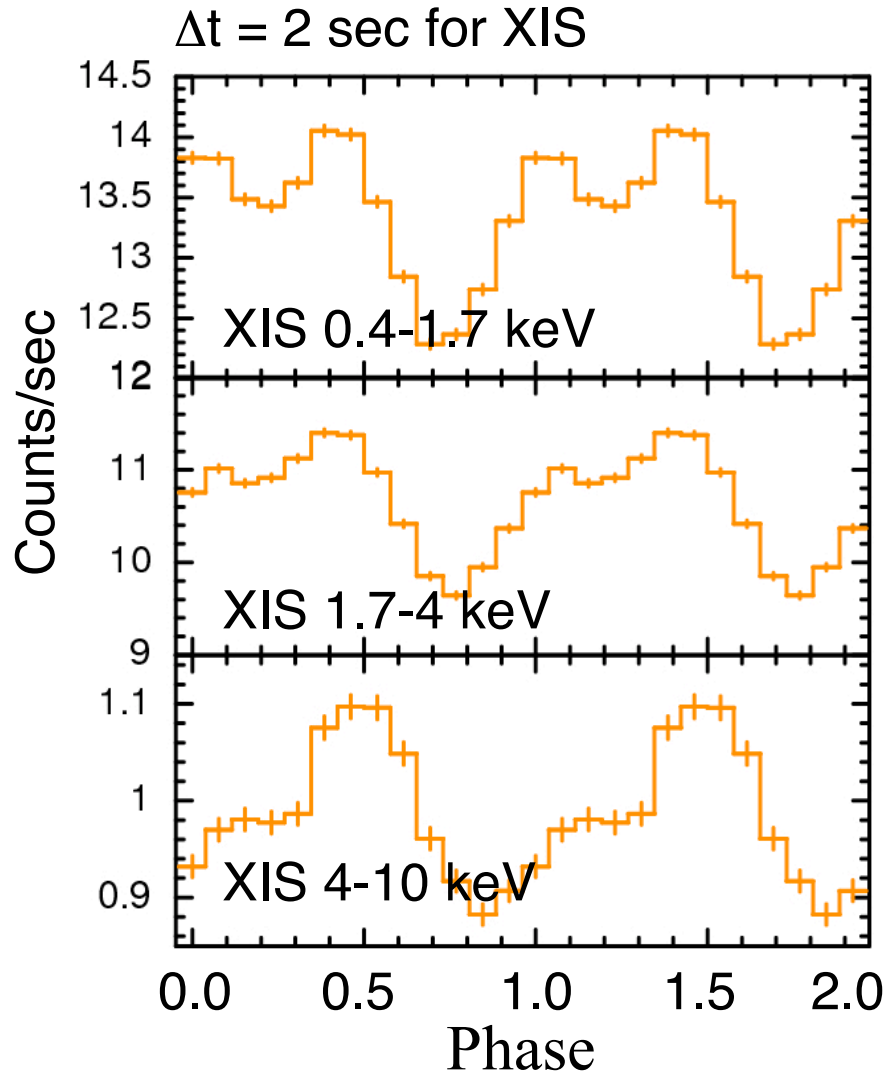
[R.Dib 2007]

- 3σ detection with HXD-GSO (80-150 keV)

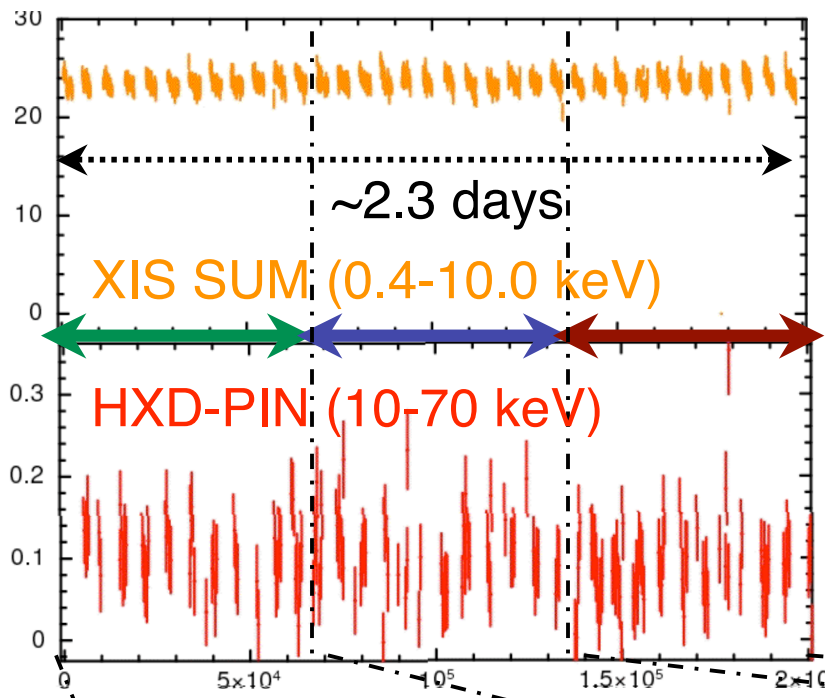


Folded Pulse Shape

- Folded pulse shape is strongly energy dependent.

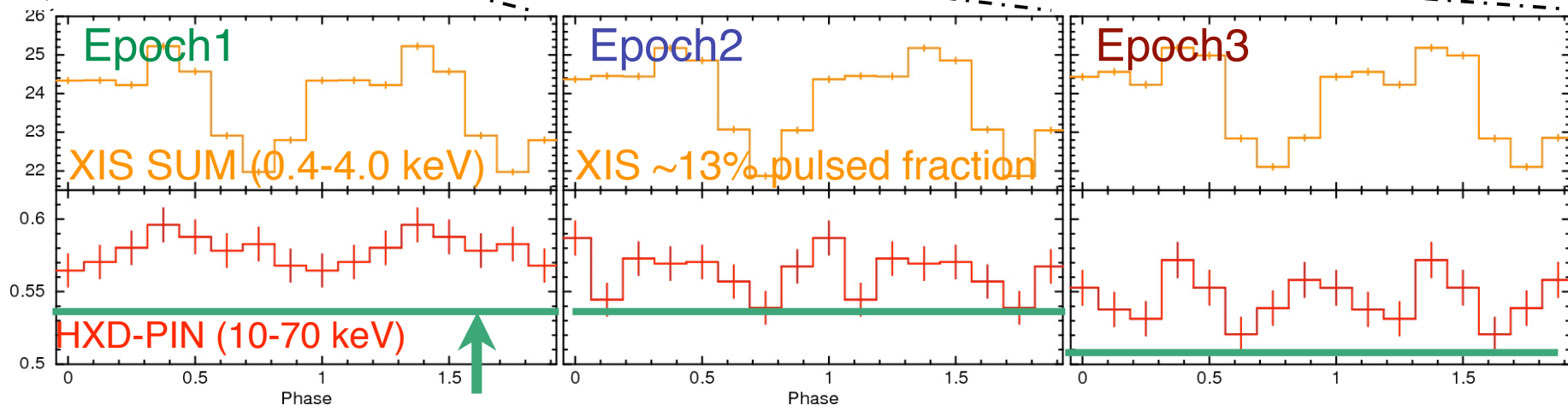


Short-term folded pulse shape



- Pulse folded for a short term,
- In low energy, pulse shape is stable

- In high energy, pulse shape
and pulsed fraction
appear to change from epoch
to epoch

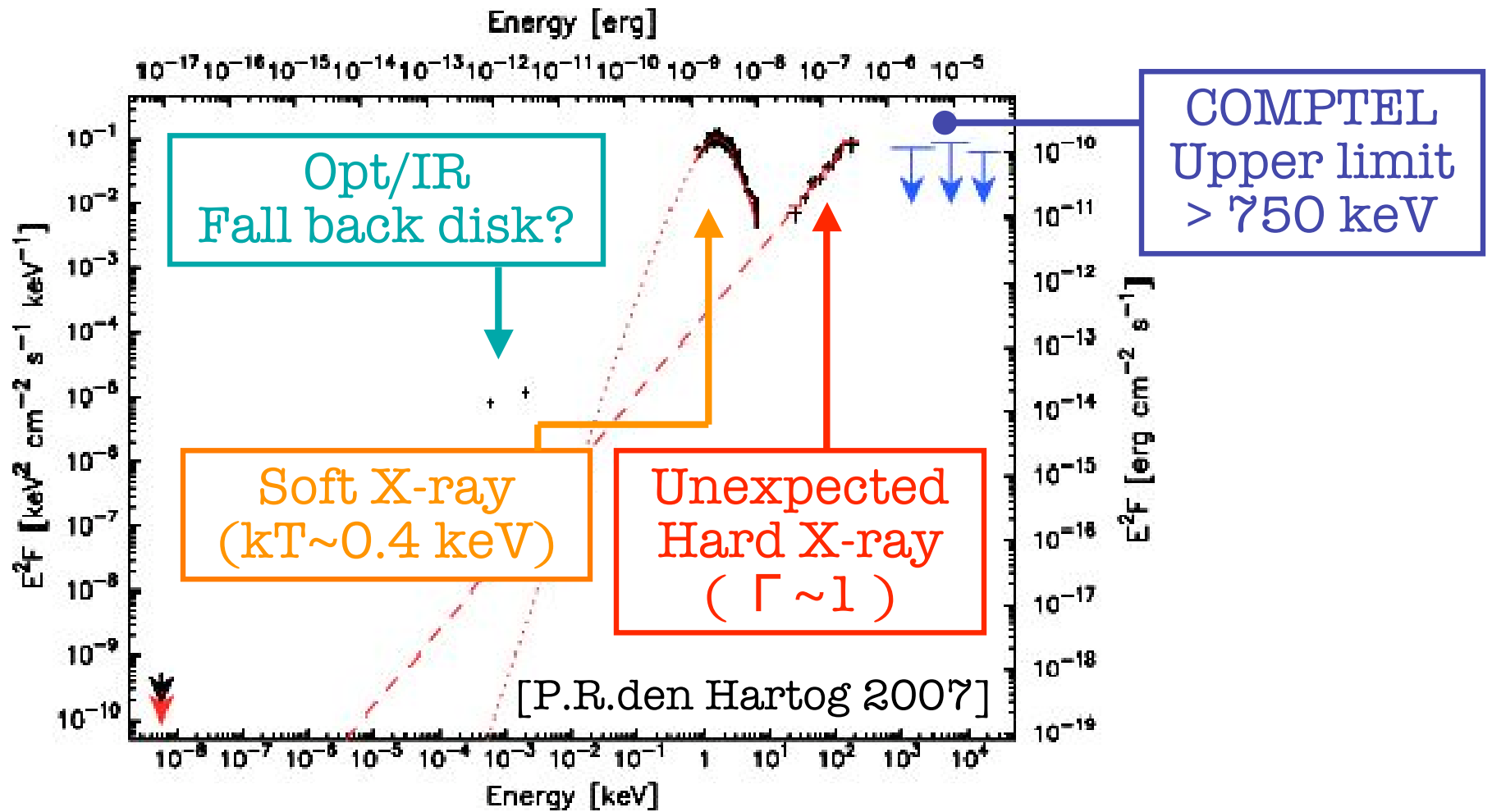


Summary

- AXP 4U 0142+61 was observed with Suzaku for a 100 ks.□
- Hard X-ray emission was clearly detected at least up to ~ 100 keV with photon index 1.0, which is consistent with previous observations.
- Pulse shape is stable in low energy band , but in high energy it appears $\hat{\sim}$ to change in a short-term during ~ 2 days.

Appendix

Multiband Spectra



Wideband spectra

