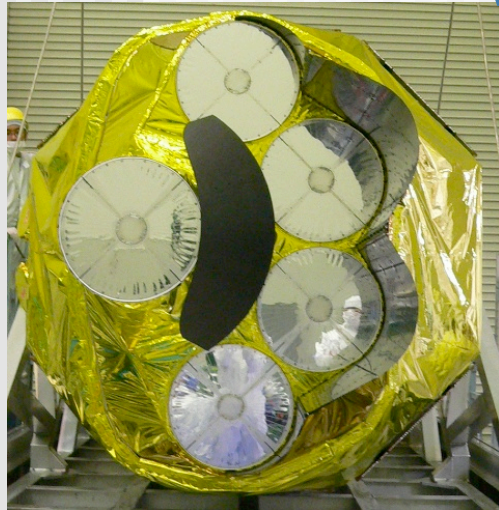


Suzaku First Results on Galactic Compact Objects

Manabu ISHIDA (ISAS/JAXA)
and the Suzaku team

Scientific Instruments

X-ray Telescopes



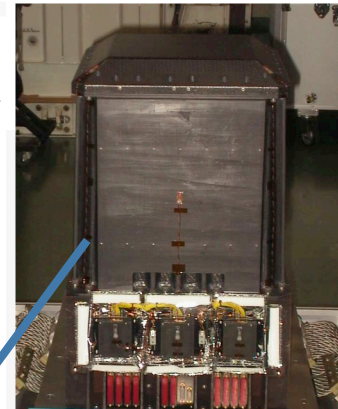
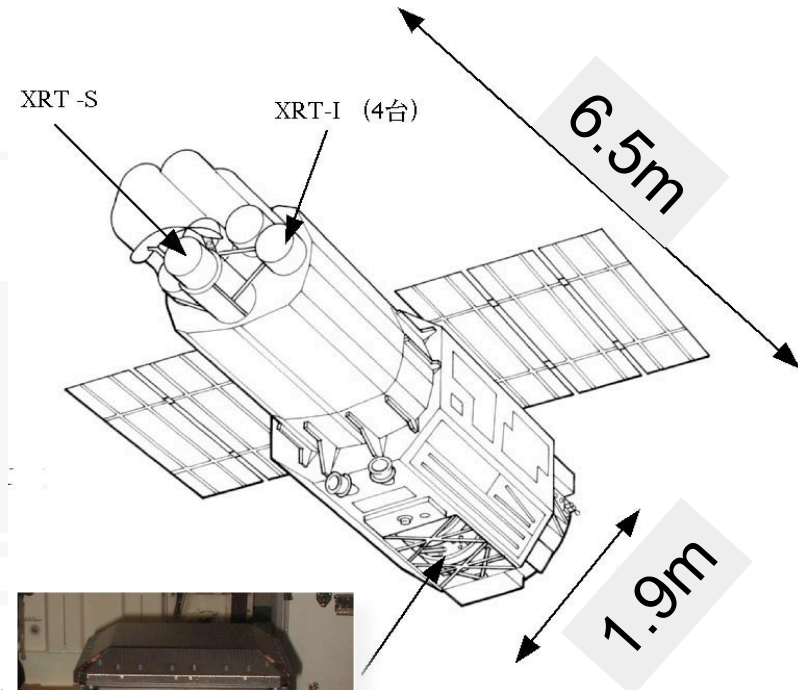
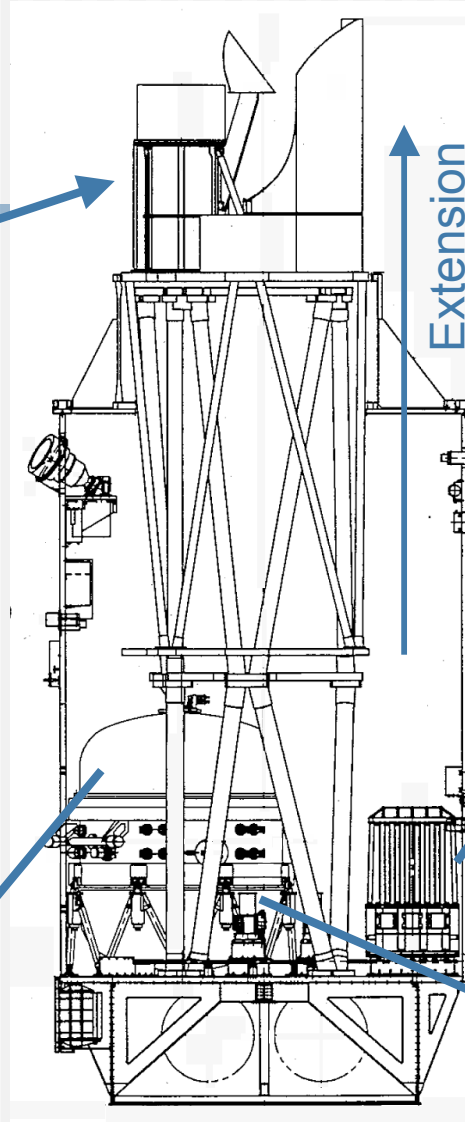
XRT

NASA/GSFC-Nagoya-
ISAS/JAXA

XRS

NASA/GSFC-Wisconsin
-ISAS/JAXA-TMU

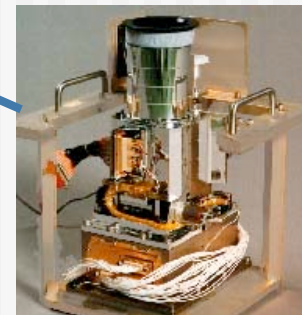
X-ray micro calorimeter



Hard X-ray detector

HXD (10-600keV)

Tokyo-ISAS/JAXA-
Riken-Saitama-
Hiroshima-Kanazawa-...

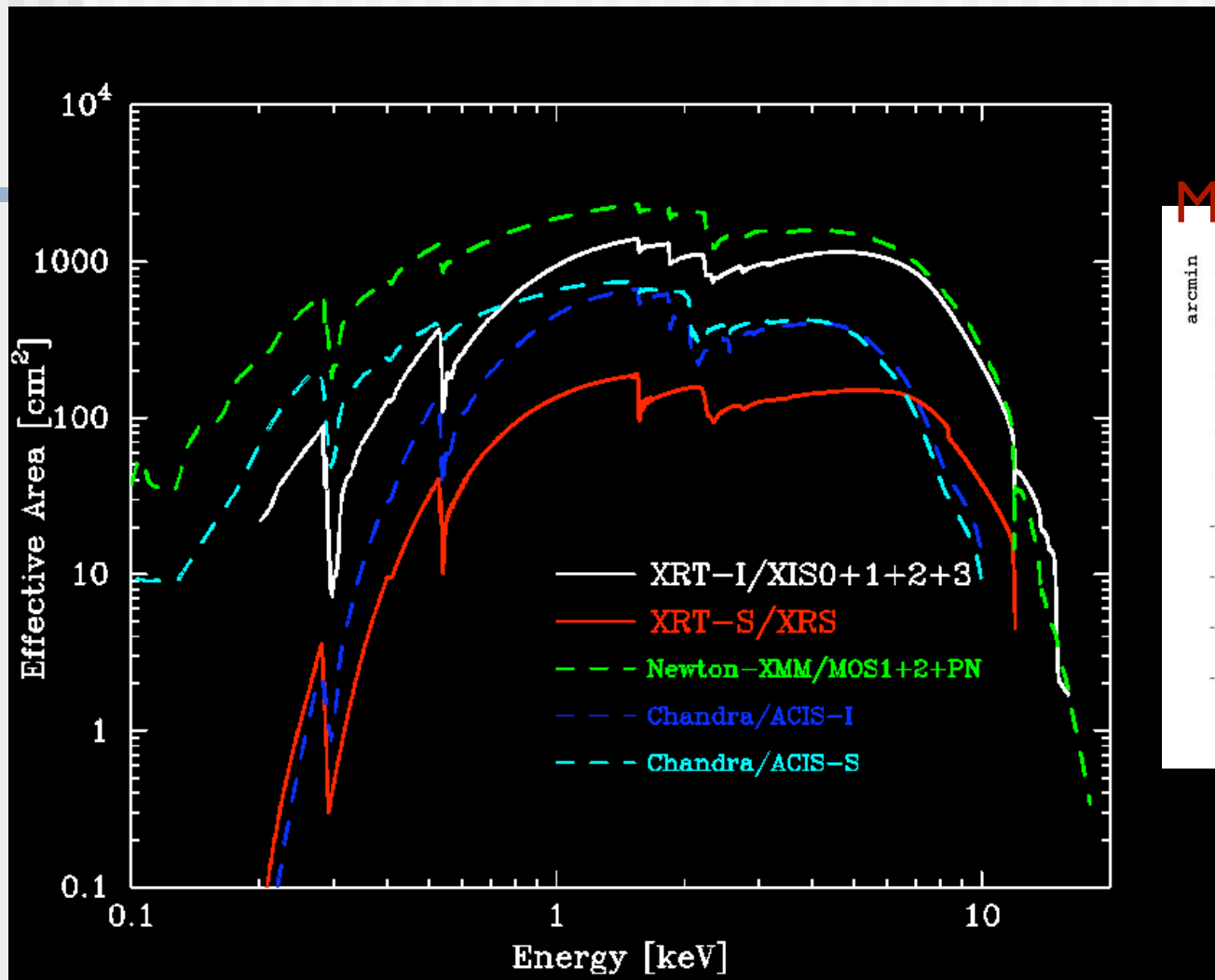


X-ray CCD camera
(4 modules)

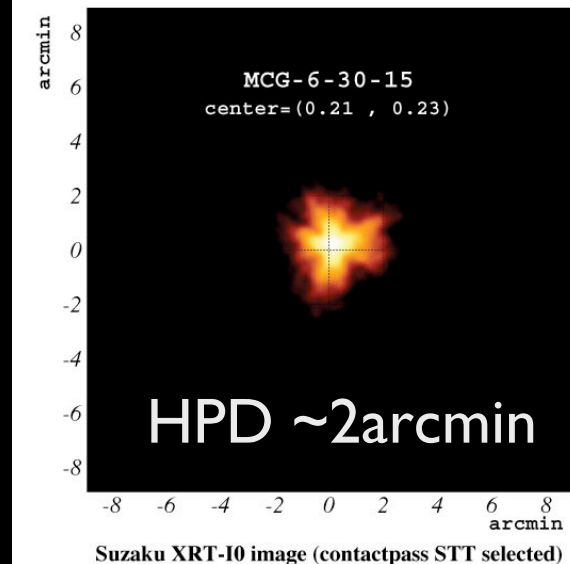
XIS (0.2-12keV)

MIT-Kyoto-Osaka -
ISAS/JAXA-.....

Large Effective Area of XRT+XIS



MCG 6-30-15 image

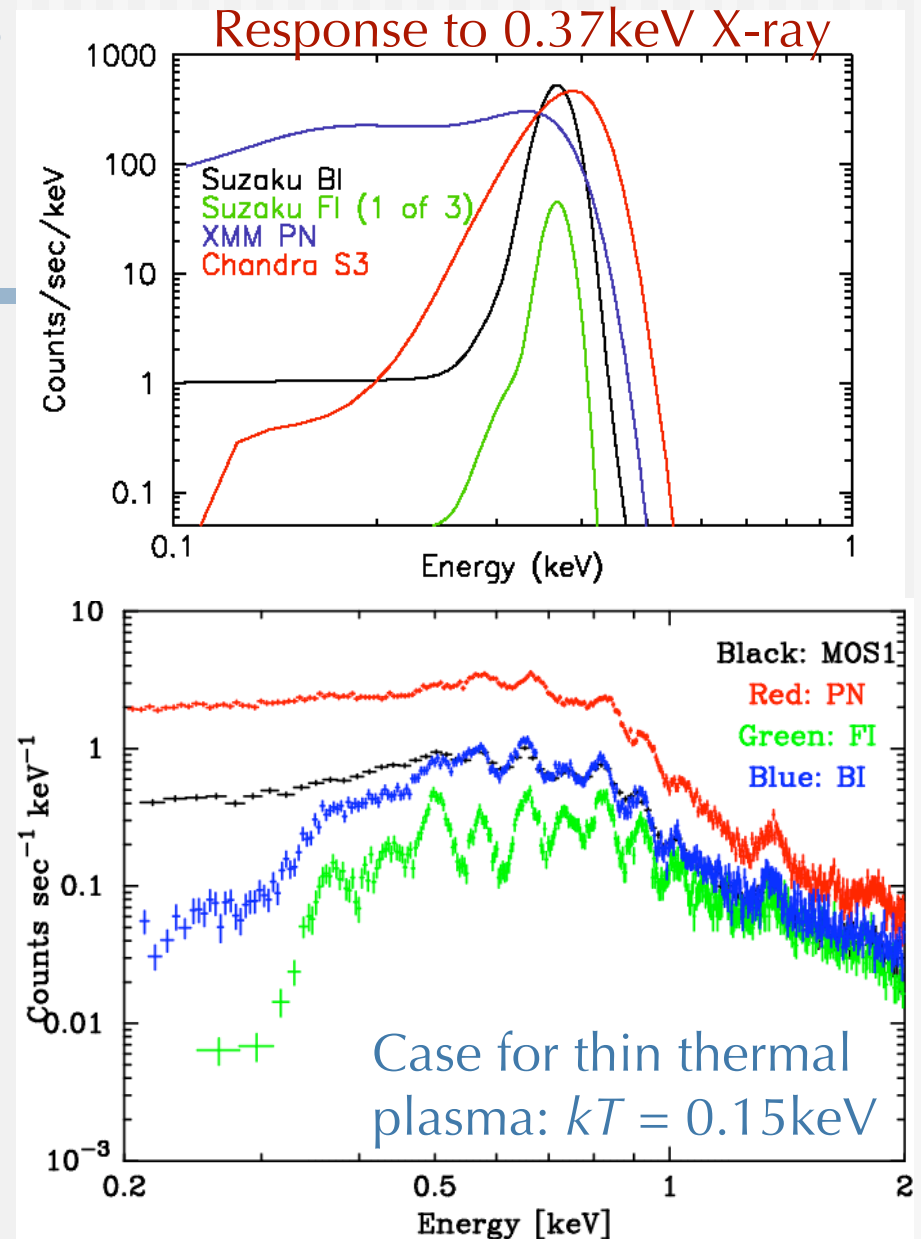


■ XIS EA in total is comparable with that of XMM.

For more detail about XRT, see the poster 18.13 Mori et al. 3

Unique Features of XIS

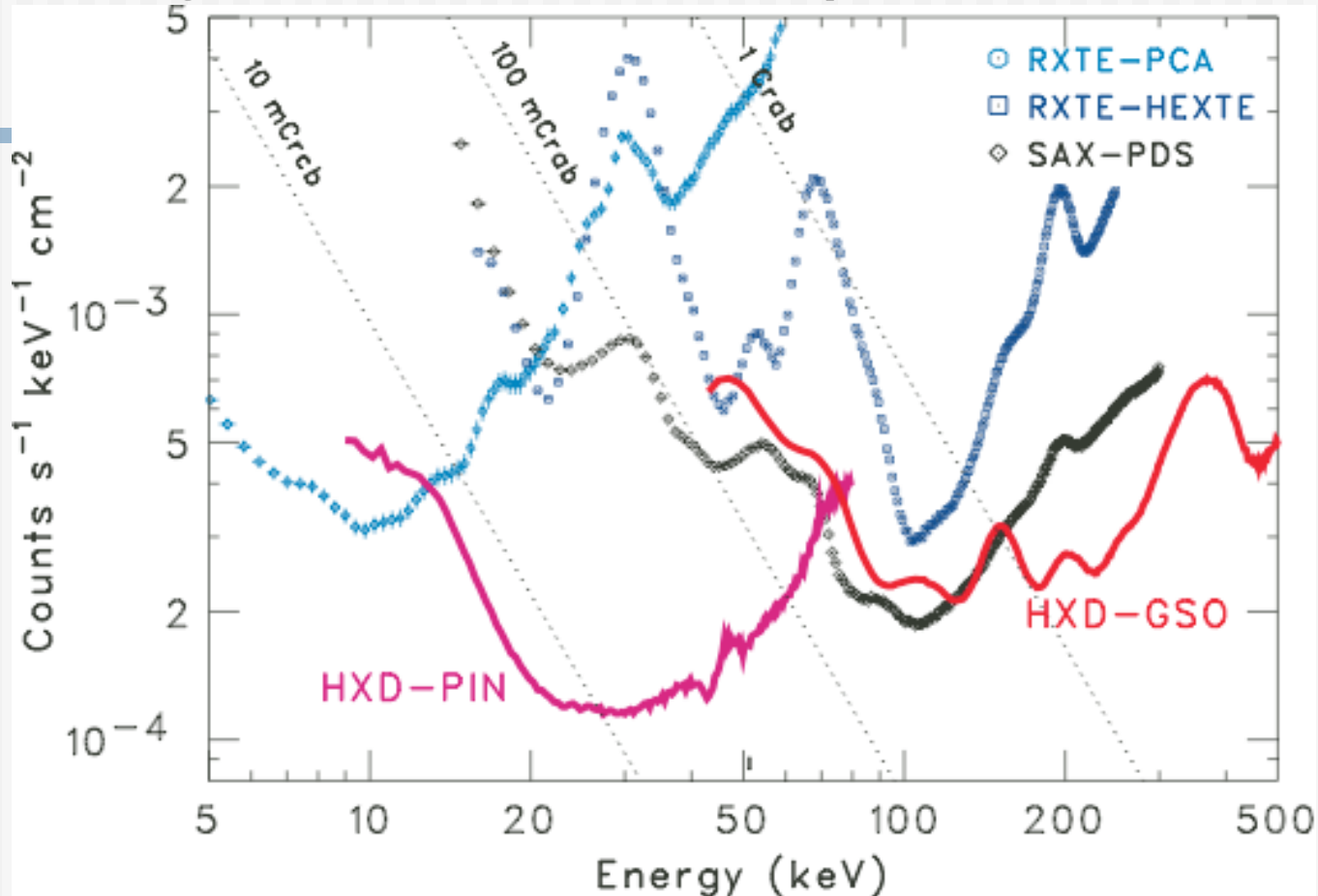
- Sharper line spread function, especially below $\sim 2\text{keV}$.
- Low & stable background, owing to a near-earth orbit ($h \approx 550\text{km}$).
- Needless to care about pile-up and telemetry saturation up to
 - $\sim 60\text{ mCrab}$ (with Window option)
 - $\sim 0.5\text{ Crab}$ (with Burst option)
- Time resolution
 - Nominally 8 sec.
 - At most 8 msec in timing mode.



For more detail about XIS, see the poster 18.24 Tsuru et al.

Low HXD background

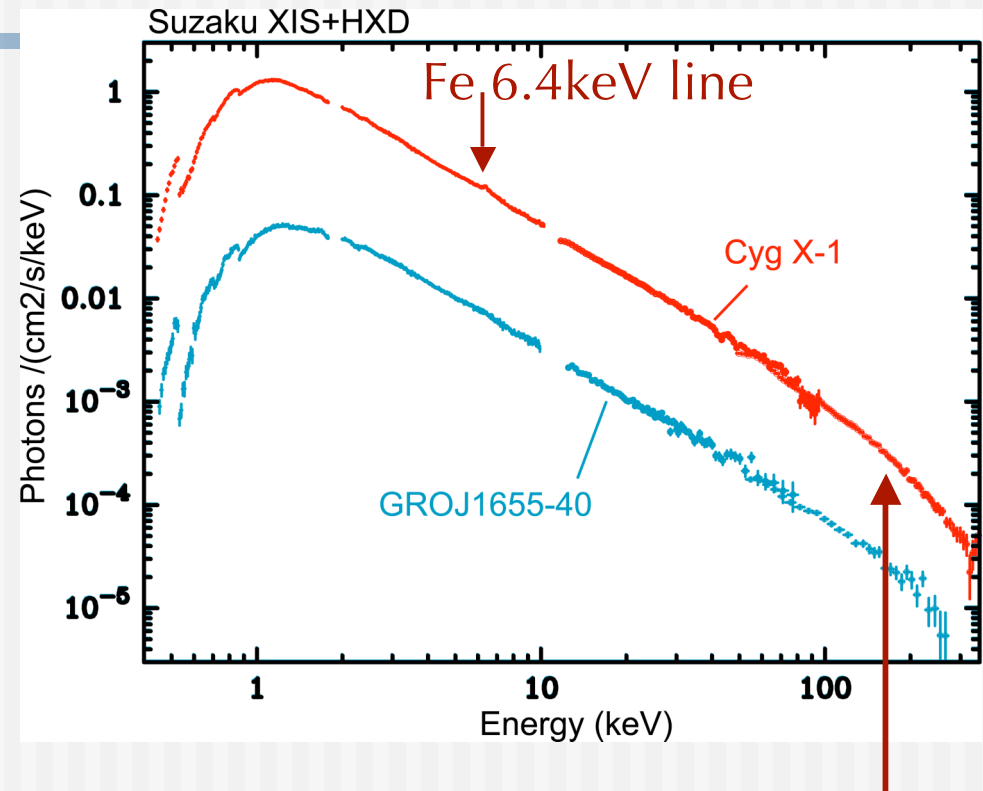
Background normalized by effective area



- Presently background is reproduced with accuracy of 5% both for PIN and GSO. For more detail about HXD, see the poster 18.29 Kokubun et al.
- Our goal is 2%.

Blackhole Candidate

- Wide energy coverage over three orders of magnitude.
- Coordinated observation is not necessary.
- High spectral resolution below 10keV.
- High sensitivity above 10keV.



Turnover: $kT \approx 110\text{keV}$

Cyclotron Absorption: A0535+262

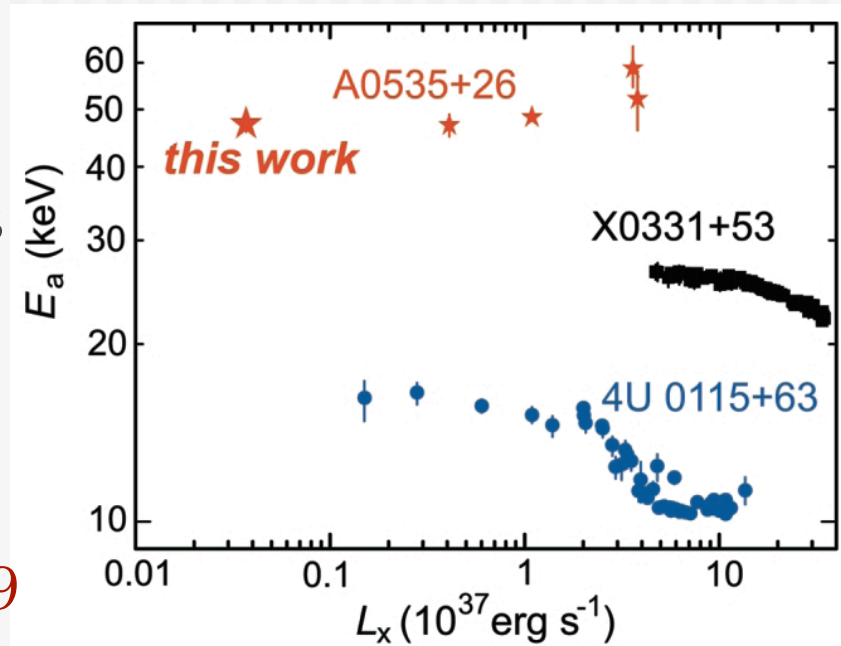
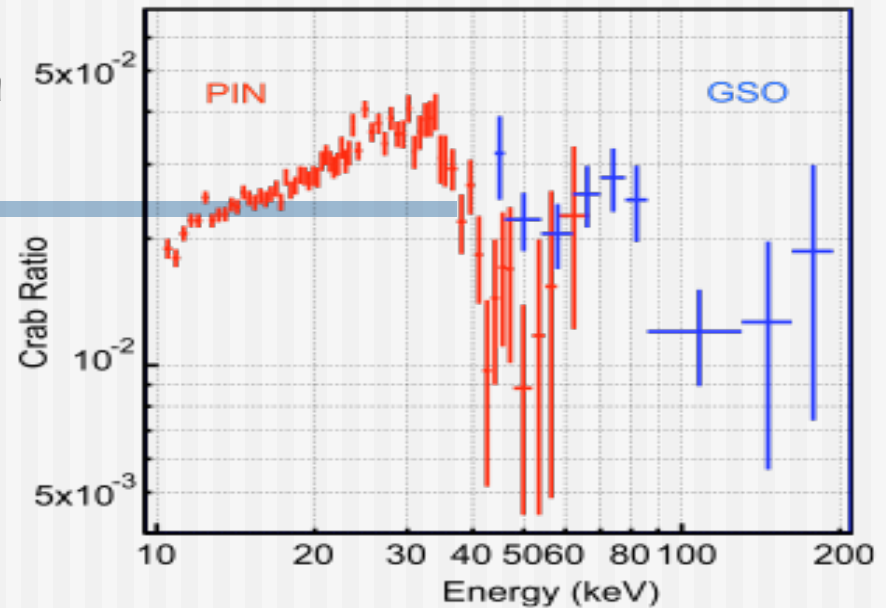
- Observation was carried out on 2005 Sep. 14, close to the end of a flare.

- Detection of cyclotron absorption line at

$$E_a = 45.5 \pm 1.3 \text{ keV}$$

for the first time at a low luminosity level $\approx 4 \times 10^{35} \text{ erg s}^{-1}$.

- The E_a drift did not occur in the luminosity range over ~ 2 orders of magnitude.
- Possible correlation between E_a transition and L_x .



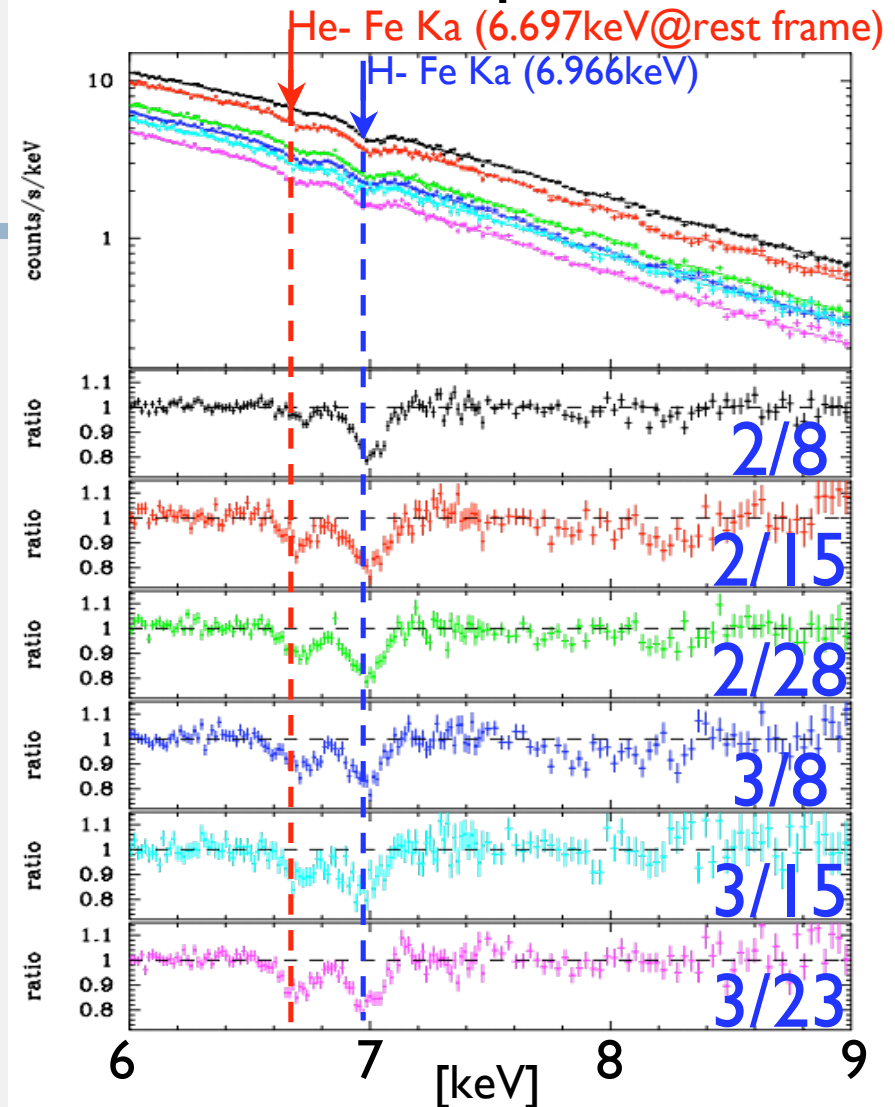
Terada et al. (2006) ApJL 648, L139

4U1630-472

- H/He-like Fe Ka absorption lines.
- Blue shift: $v/c \approx 3 \times 10^{-3}$
- Abs. stable for ~ 2 months
 - ☑ Disk wind
 - ☒ Jet
- Absorption line intensity ratio
 - $\Rightarrow \xi \approx (5-6) \times 10^4 = L_X / n_0 r_0^2$
 - $\Rightarrow \text{H+He-like fraction} \approx 25\%$
 - $\rightarrow N_H \approx 1 \times 10^{23} \text{ cm}^{-2} = n_0 r_0$
(Fe/H = 3.3×10^{-5})
- Disk wind occurs at
 - $r_0 \approx (3-4) \times 10^{10} \text{ cm}$
 - with $n_0 \approx 5 \times 10^{12} \text{ cm}^{-3}$

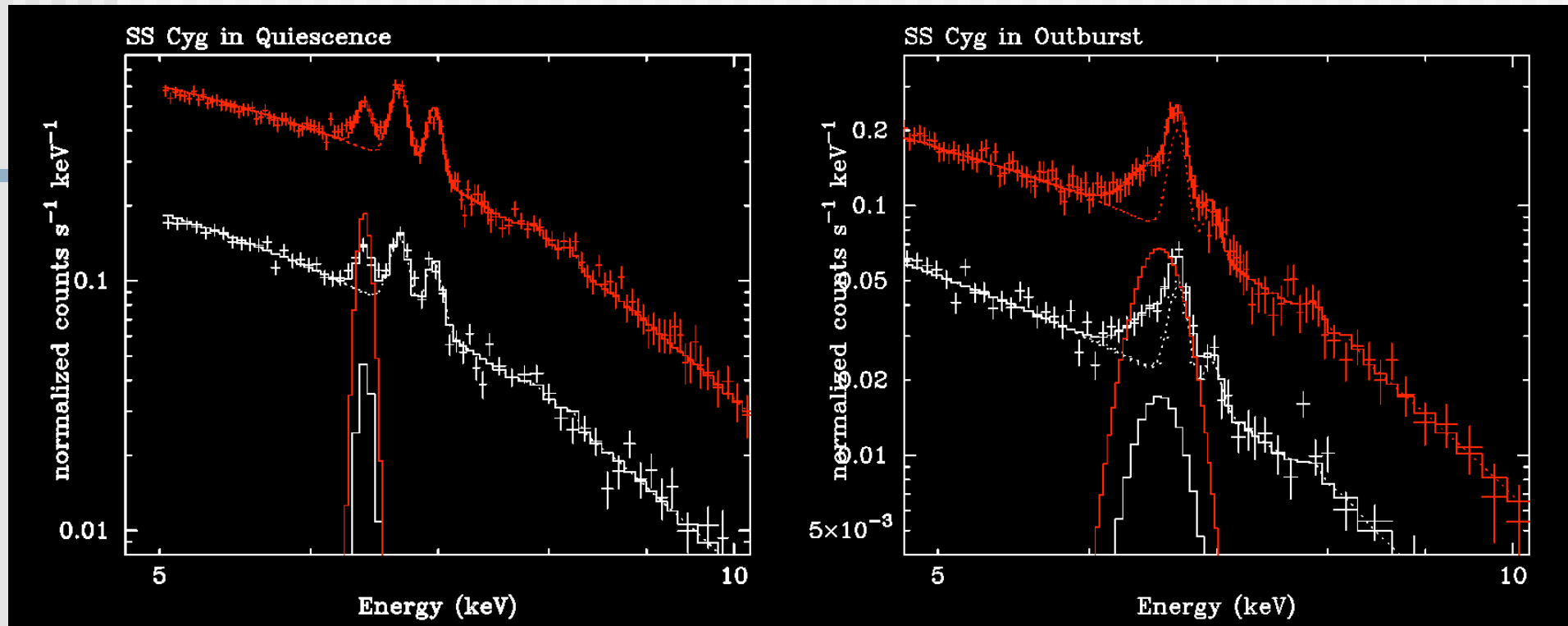
$$\dot{M}_{\text{wind}} \sim 0.3 \dot{M}_{\text{acc}}$$

6-9keV Spectra



Kubota et al. ; to appear in the PASJ Suzaku special issue (2006) ₈

SS Cyg: 6.4keV Iron K α Line



- Quiescence: Narrow (WD) + Broad (Accretion Disc)
→ $R_{BL} < 1.15 R_{WD}$
- Outburst: Broad dominant
- $E_{Fe} = 6.54 \pm 0.02 \text{ keV}$, $\sigma = 0.202 \pm 0.015 \text{ keV}$, $EW \sim 320 \text{ eV}$
 $v \approx 9300 \text{ km/s}$!! ($v_{ff} = 8800 \text{ km/s}$ for $1.19 M_{\odot}$ WD)
Really fluorescent? Need to consider other possibilities...
cf. [3.03 K. Mukai](#) for Suzaku CV observations

Summary:

Suzaku advantages in observing galactic compact objects are:

- ◆ Wide-band spectroscopy (0.2-700 keV) in one observatory.
- ◆ Low and stable background over a very wide X-ray band.
- ◆ Good energy resolution with a sharp line spread function, in particular $< 2\text{keV}$.
- ◆ Small pile-up, large telemetry capacity.

Suzaku CD-ROM for Free distribution

CD-ROM
Initial Results from
Suzaku

Cygnus Loop
X-ray image and spectra

Galactic center region
X-ray maps at 2.4-2.5 keV, 3-4 keV, 6.4 keV, and 6.7 keV

HESS J1804-216 Suzaku XIS Image and Spectra
X-ray image and spectra

The Cap (M82)
X-ray image and spectra

SN1006
X-ray image and spectra

4U1630-472
X-ray spectra

Blackhole candidates
X-ray spectra

A0535+262
X-ray spectra

Initial Results from
Suzaku

Compiled by the Suzaku team. Manuscripts are available by: F. S. Porter, S. Katsuda, E. Mitsuoka, Y. Hoshi, T. Inui, H. Uchiyama, K. Koyama, A. Rampa, T. G. Thuan, M. Ozawa, H. Yamaguchi, A. Kishida, Y. Terada.

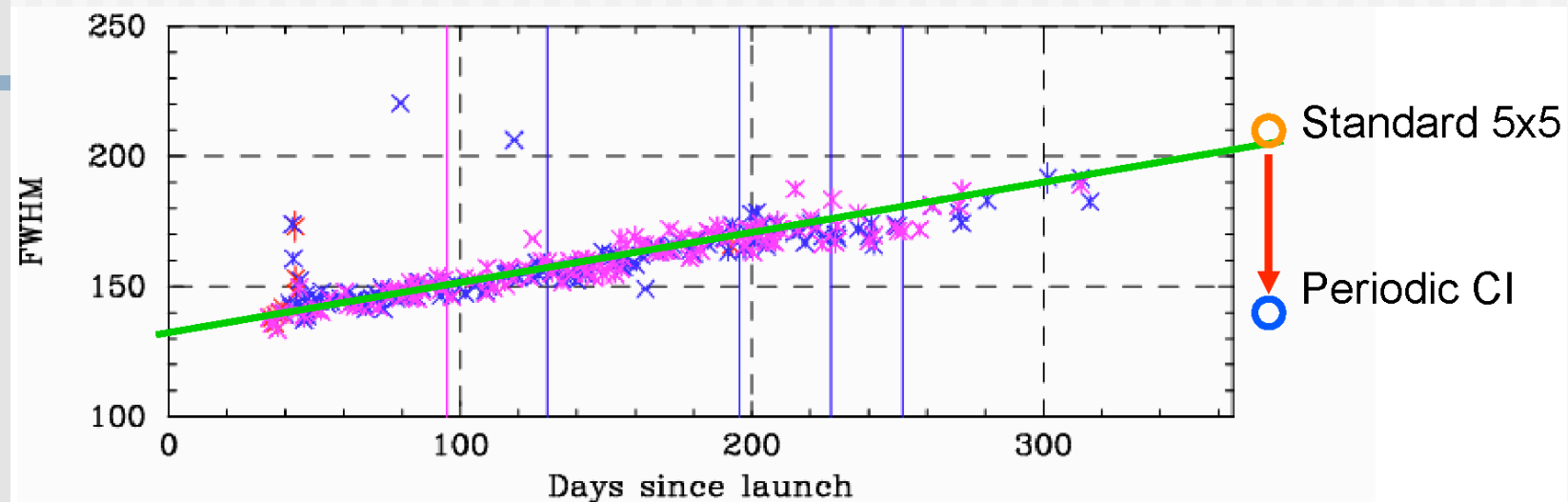
2006 October 1

- Initial Publications
- Conference Presentations
- Launch Videos

Suzaku AO-2

- Suzaku AO-2 is now open.
- ~~Deadline for proposal submission is 2006 December 1.~~
- Instrument status is reported in the posters on Saturday:
 - ★ 18.13 XRT by Mori et al.
 - ★ 18.24 XIS by Tsuru et al.
 - ✓ Recovery of the energy resolution with spaced-row CI.
 - ✓ Baking of OBF for recovery of detection efficiency below ~1keV.
 - ★ 18.29 HXD by Kokubun et al.
- Please visit Suzaku GOF homepage (NASA/GSFC) at:
 - ★ <http://heasarc.gsfc.nasa.gov/docs/suzaku/astroegof.html>for full detail about the AO-2.

Spaced-row Charge Injection for XIS



- History of energy resolution of XIS2 for ^{55}Fe calibration source (in a unit of eV).