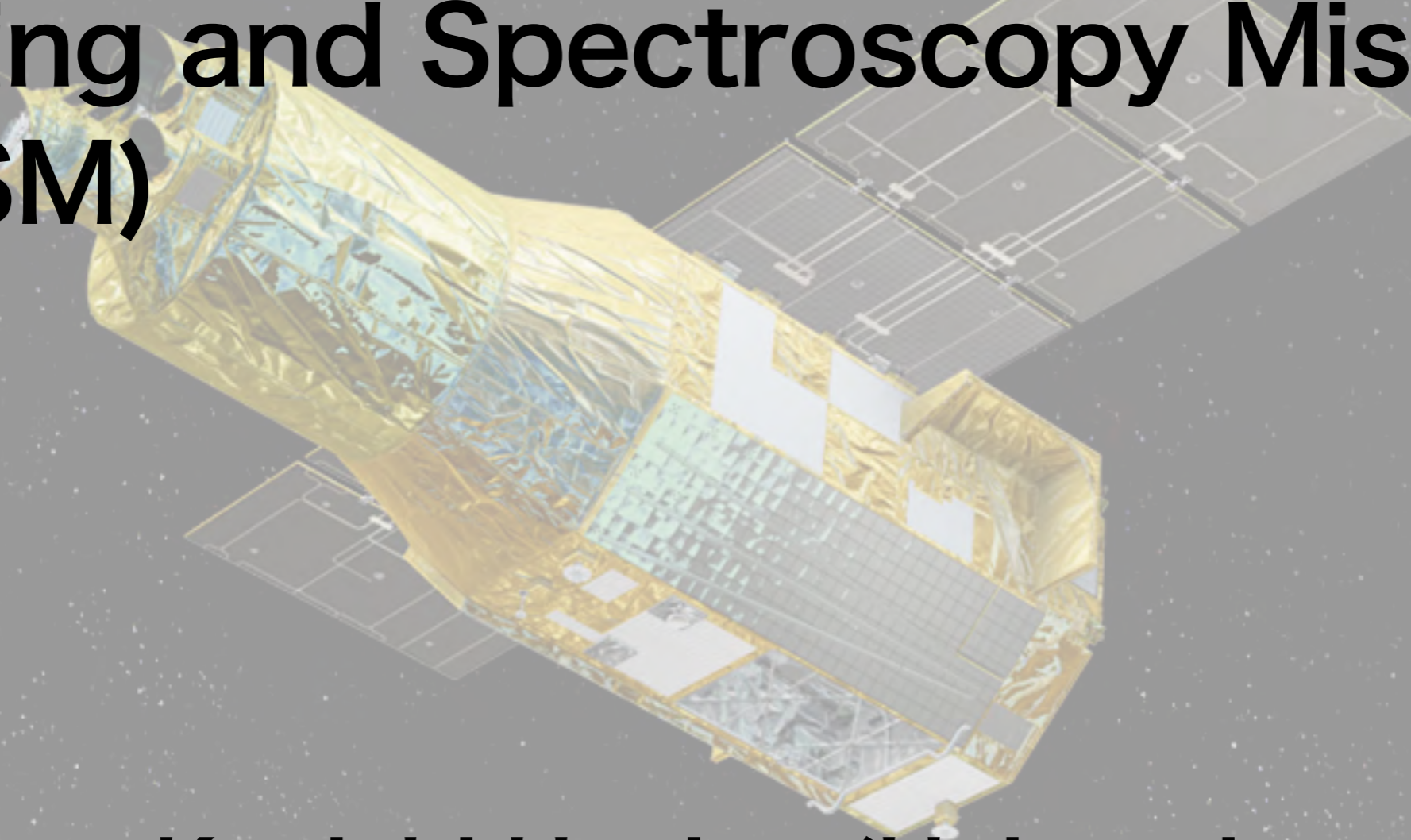


# Current status and early observational results of X-Ray Imaging and Spectroscopy Mission (XRISM)



**Kouichi Hagino (University of Tokyo)  
on behalf of the XRISM collaboration**

# XRISM collaboration



>100 Science Members + 39 Guest Scientists  
+ ~100 PD/Students + Engineers/Developers  
+ External Science Advisory Panel



XRISM Science Team Meeting #6 (2024.09) @TMU

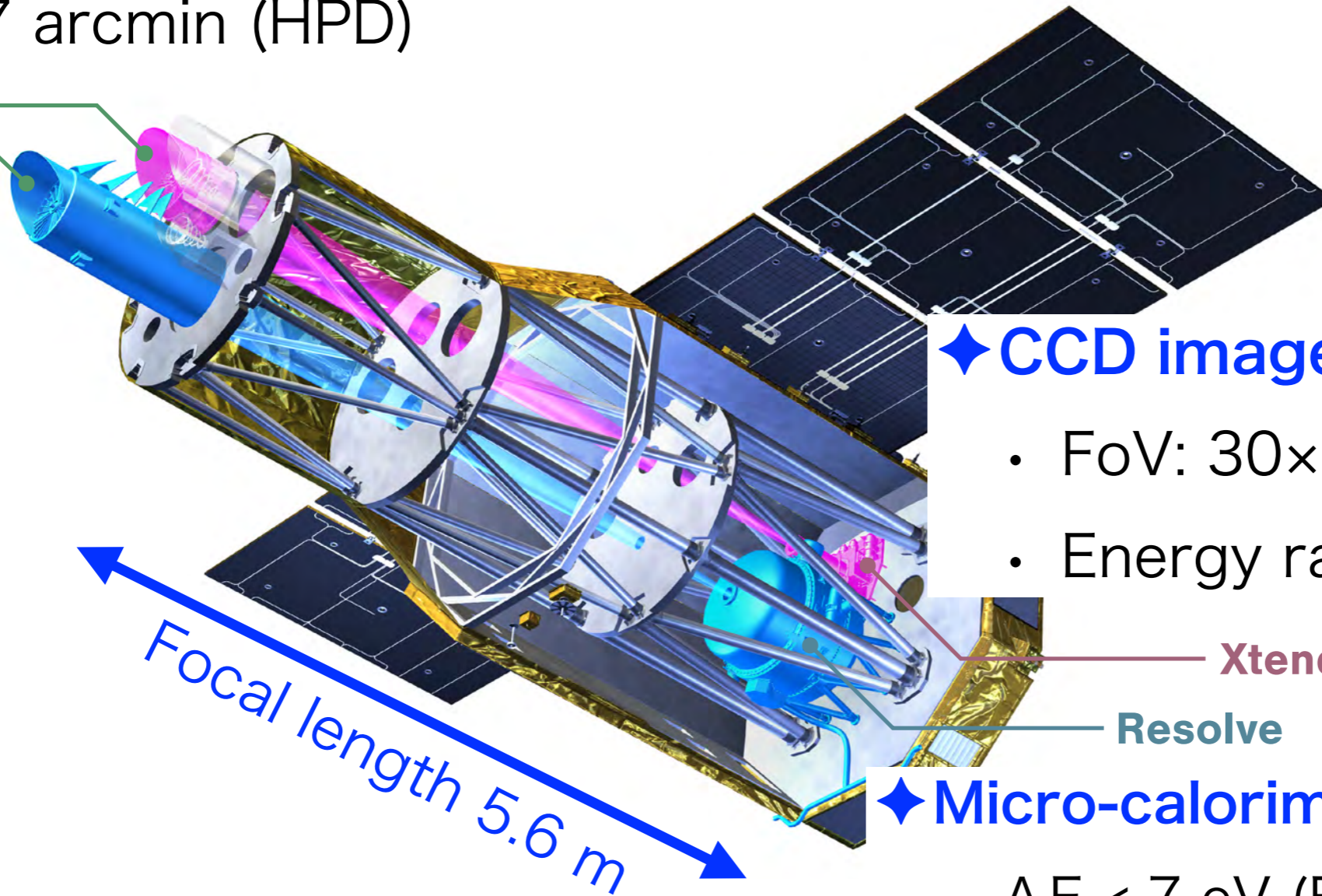
# XRISM instruments



## ◆ X-ray mirror

- <math><1.7</math> arcmin (HPD)

XMA



## ◆ CCD imager “Xtend”

- FoV:  $30 \times 30$  arcmin<sup>2</sup>
- Energy range: 0.4–12 keV

Xtend

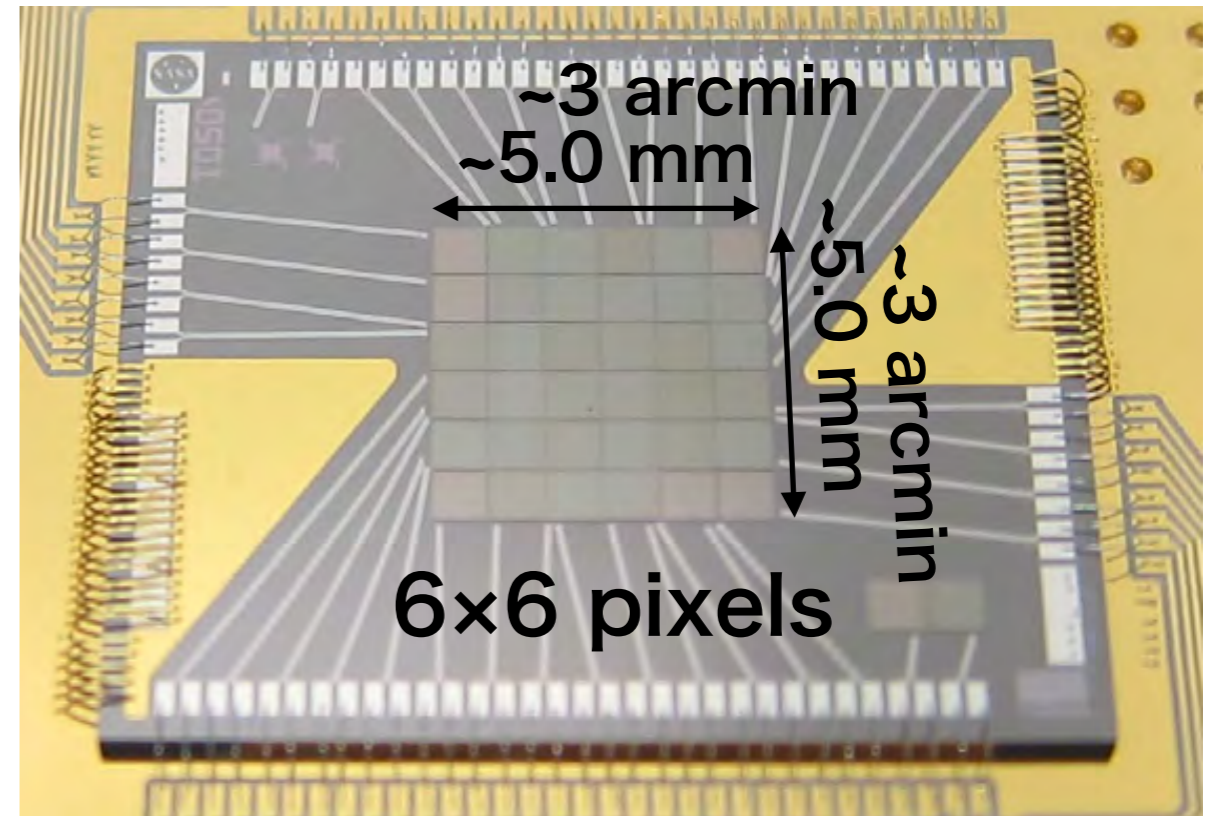
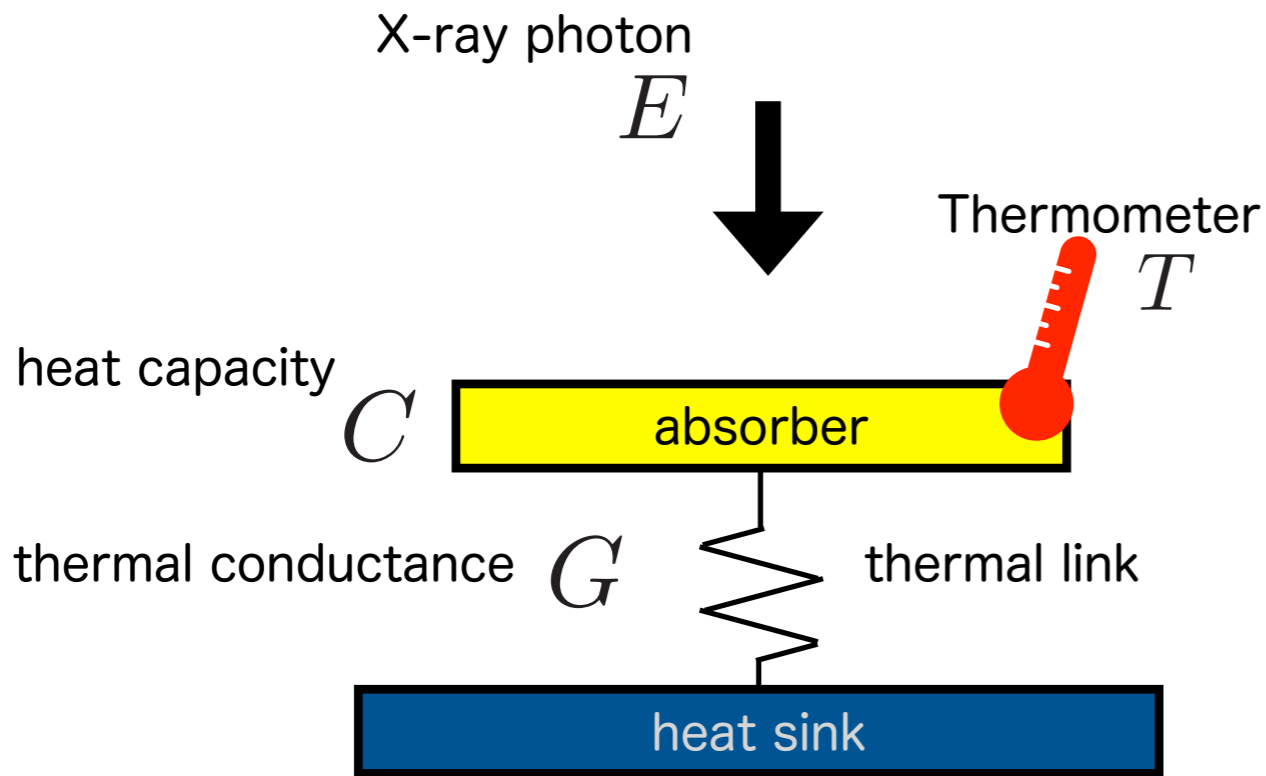
Resolve

## ◆ Micro-calorimeter “Resolve”

- $\Delta E < 7$  eV (FWHM) @ 6 keV
- Time tagging accuracy  $\leq 1$  ms
- Energy range: 2–12 keV

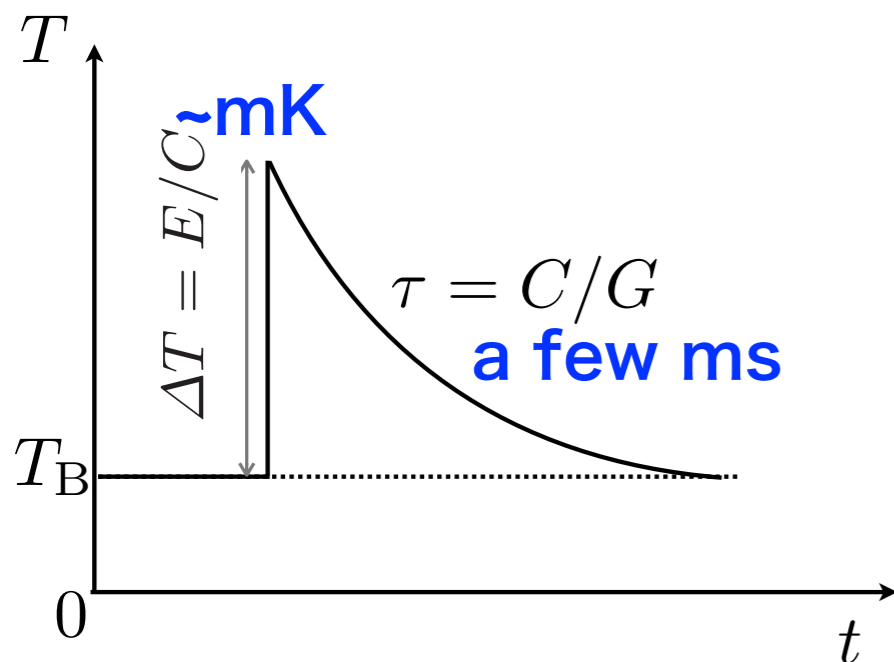
XRISM Media Kit (JAXA)

# Micro-calorimeter “Resolve”



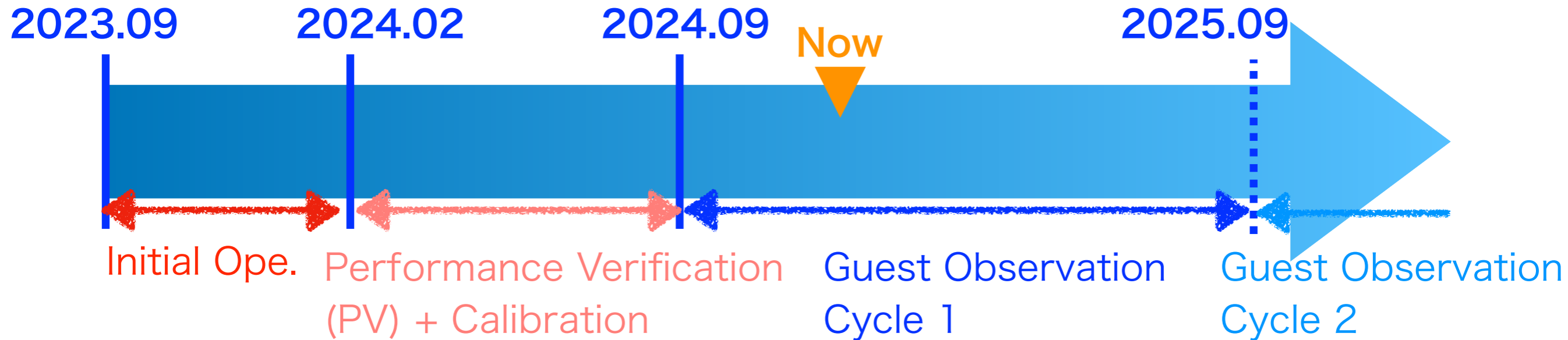
XRISM Media Kit (JAXA)

- X-ray energy  $E \sim 6 \text{ keV} \sim 10^{-15} \text{ J}$
- ➔ Temperature rises as  $\Delta T = E/C \sim \text{mK}$ , and decays with  $\tau = C/G \sim \text{a few ms}$
- ➔ **Good energy ( $< 7 \text{ eV}$ ) & time resolution ( $< 1 \text{ ms}$ )**



Sato+23

# Current status of XRISM



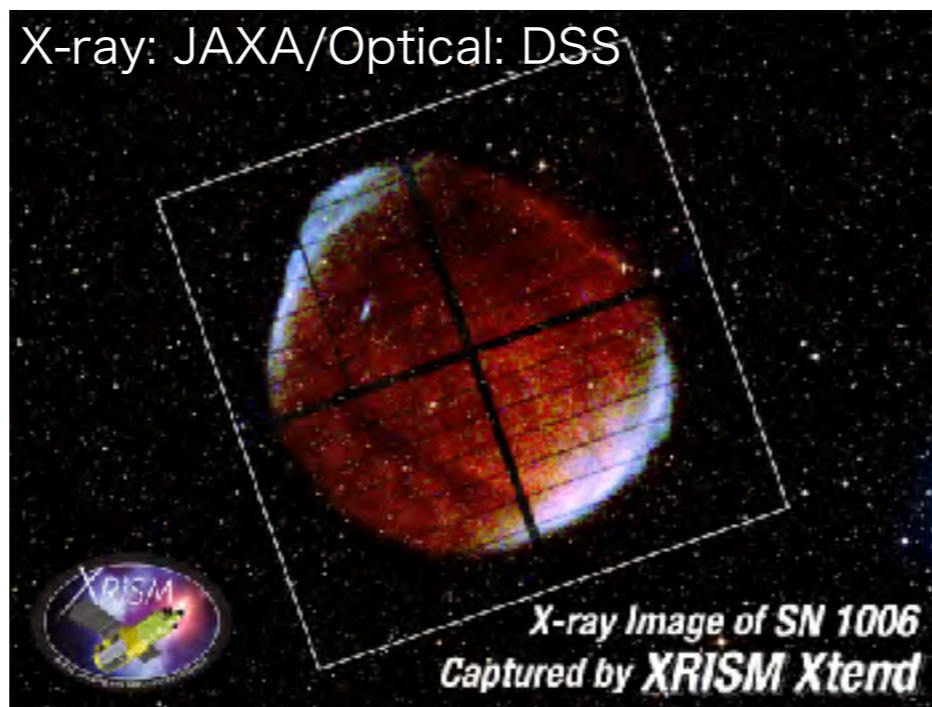
Successful launch on 2023.09.07

X-ray image obtained in initial ope.

## GO1 approved targets

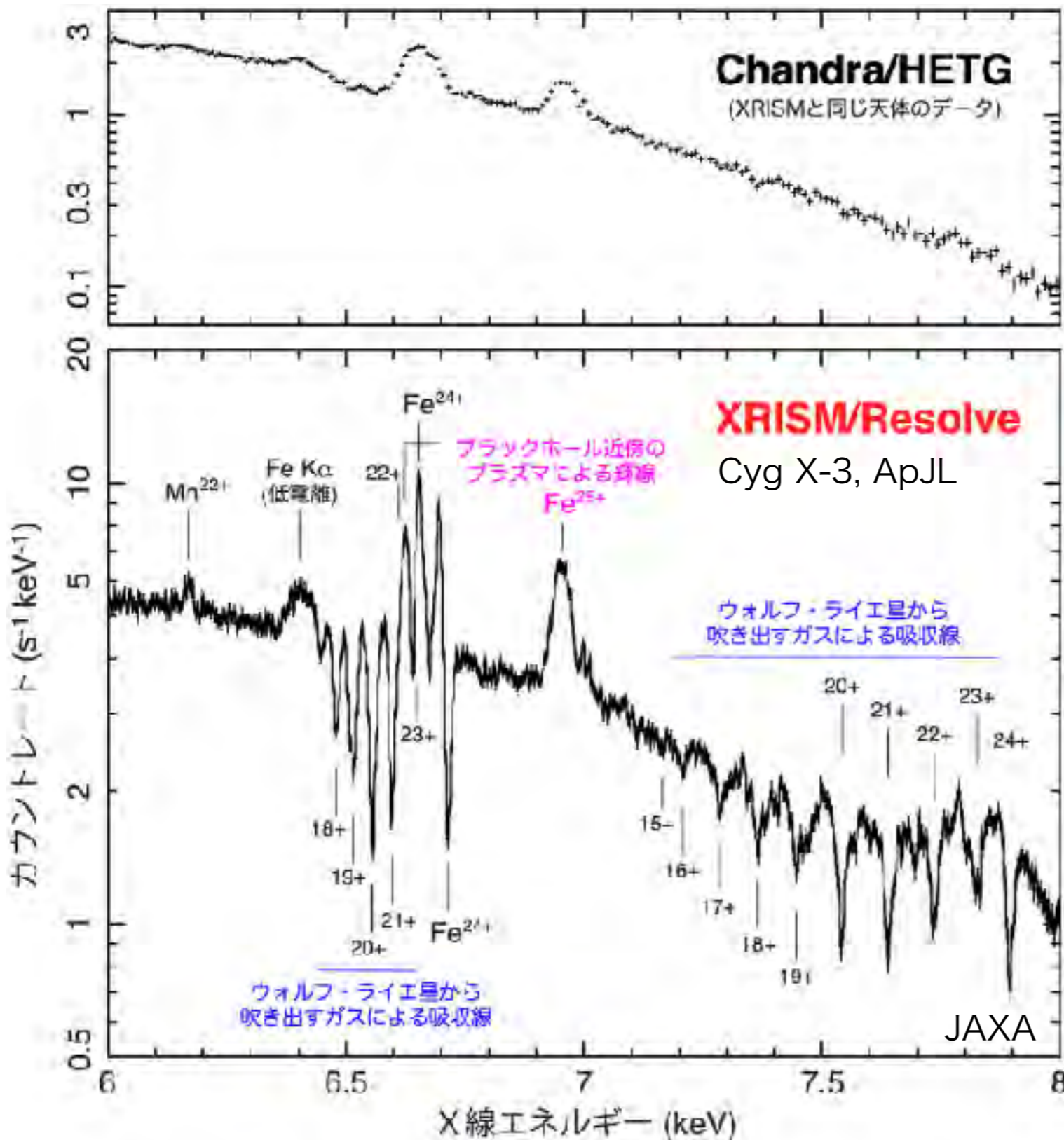
	JAXA	NASA	ESA	Total
BH, NS, WD, etc.	17	10	4	31
SNR etc.	10	6	1	17
AGN etc.	9	13	5	27
Clusters etc.	13	12	4	29
<b>Total</b>	<b>49</b>	<b>41</b>	<b>14</b>	<b>104</b>

Proposed/Approved = 5.6 (based on exposure)



JAXA

# Extreme spectral resolution

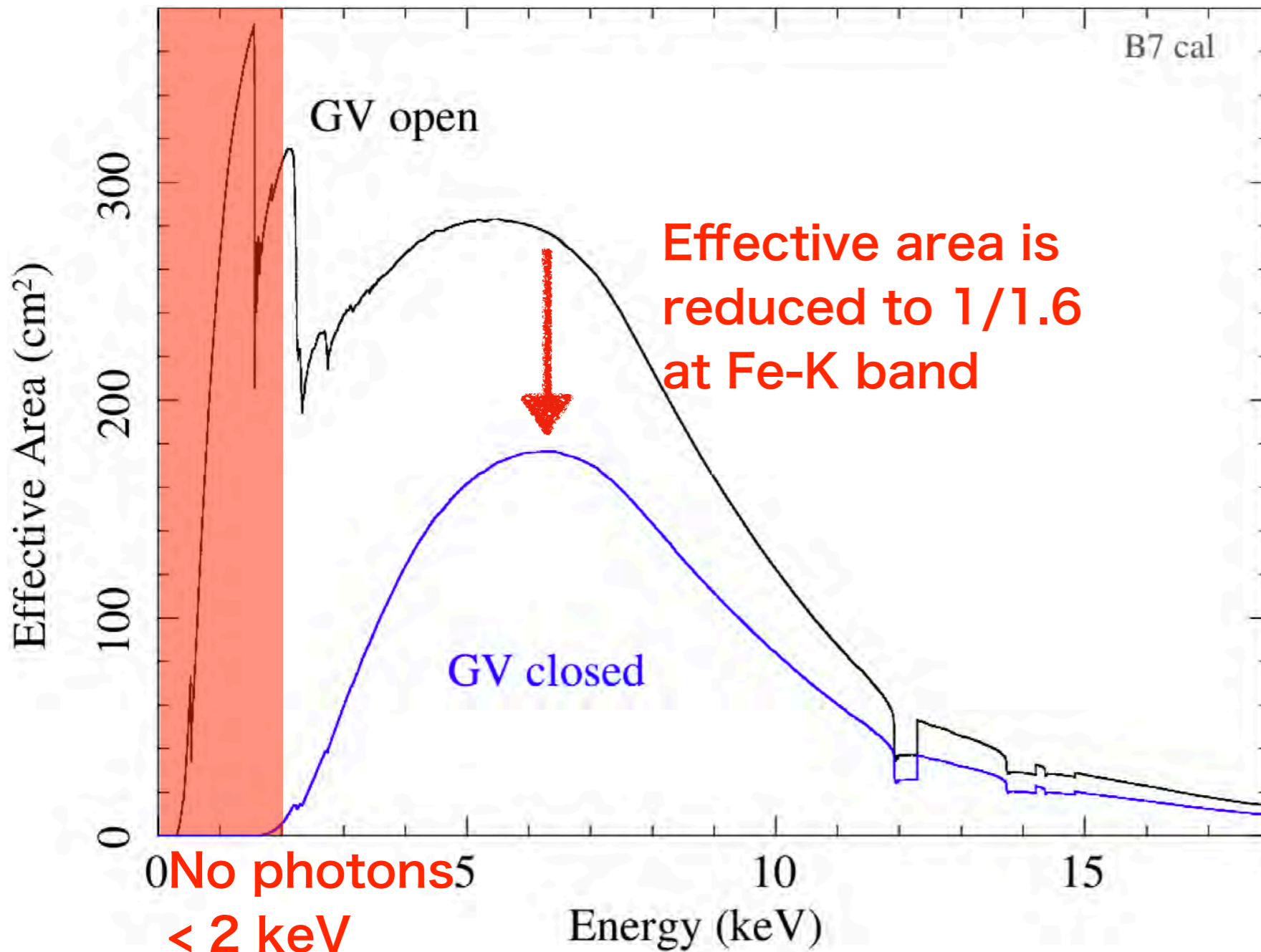


- Spectral resolution of Resolve: **< 5 eV @5.9 keV**, corresponding to  **$v \sim 200$  km/s** at the Fe-K band
- Groundbreaking performance, especially in the Fe-K band, providing completely new insights into X-ray astrophysics

# Gate Valve issue



- Resolve's aperture door (gate valve; GV) is not opened



- GV is a 250- $\mu\text{m}$  thick Be filter to protect the detector from the outgas
- Since 2023.11, we tried to open it 3 times, but it still closed
- The XRISM team decided to proceed with preparations for the 4th trial after the GO1 observations

# PV targets



## Galactic compact

- ▶ 4U 1916-053
- ▶ 4U 1624-490
- ▶ GX 13+1
- ▶ Cyg X-1
- ▶ SS 433
- ▶ Cyg X-3
- ▶ Cen X-3
- ▶ Eta Carinae
- ▶ V834 Cen
- ▶ GT Mus
- ▶ SS Cygni
- ▶ T CrB
- ▶ Cir X-1
- ▶ Vela X-1

## Galactic diffuse

- ▶ SN1987A
- ▶ Tycho's SNR
- ▶ W49B
- ▶ Cas A
- ▶ Galactic Center
- ▶ Kepler's SNR
- ▶ 3C397
- ▶ N132D
- ▶ Sgr A East

## Extragal. compact

- ▶ Centaurus A
- ▶ Circinus Galaxy
- ▶ MCG-6-30-15
- ▶ NGC 1365
- ▶ NGC 3783
- ▶ NGC 4151
- ▶ PDS 456
- ▶ IRASF05189
- ▶ Mkn 766
- ▶ M81

## Extragal. diffuse

- ▶ M82
- ▶ Perseus Cluster
- ▶ Virgo Cluster
- ▶ Coma Cluster
- ▶ Centaurus Cluster
- ▶ Abell 2029

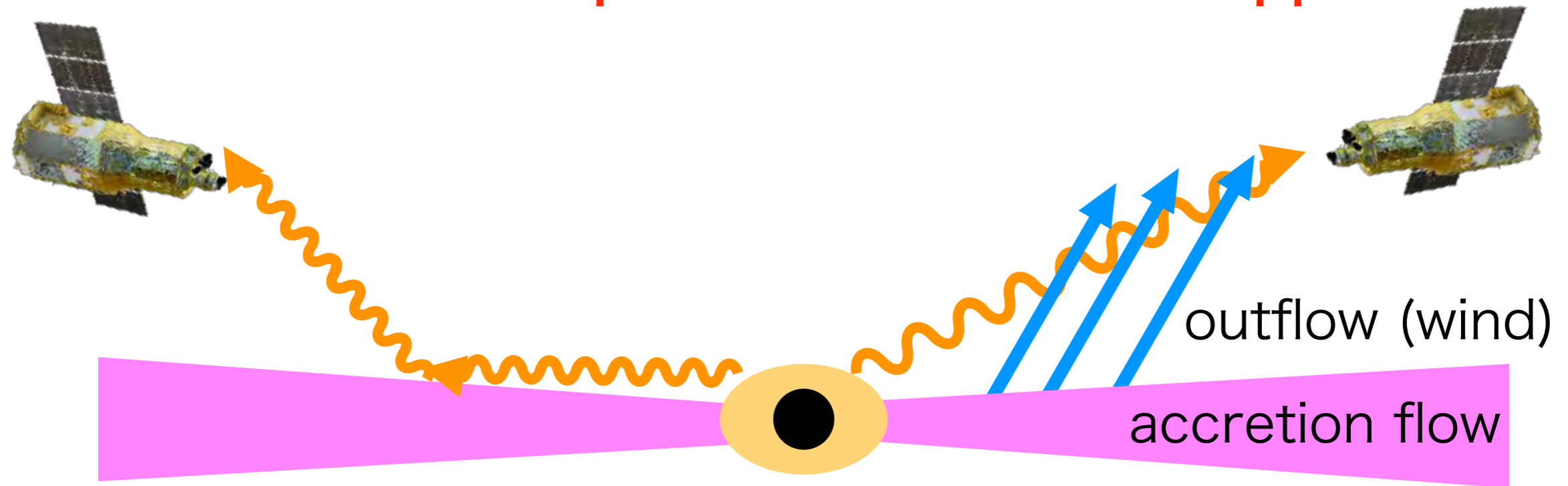
- ✓ Six papers have already been published (N132D, NGC4151, Cyg X-3, Sgr A\* East, Cen X-3, V4641 Sgr)
- ✓ Many papers have been or will be submitted to Nature/Science



# AGN Science with XRISM



✓ XRISM is the best probe to detect the Doppler effect



## ◆ Emission line

- Doppler broadening by the Keplerian motion:

$$v_K = \sqrt{GM/r}$$

- Emission line width  
➔ **location of emitter**

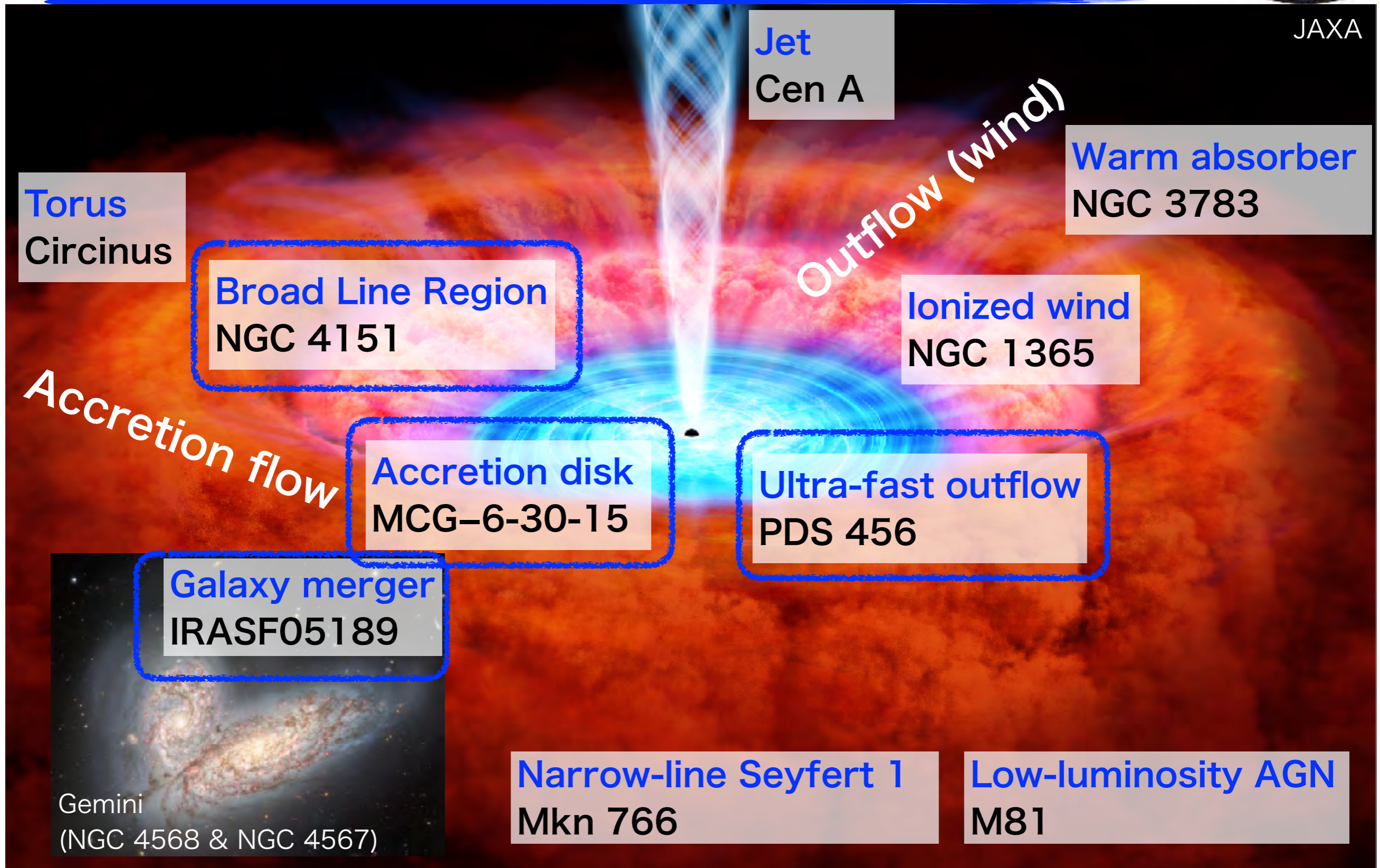
## ◆ Absorption line

- Doppler shift by the outflowing velocity of the wind along our line of sight
- Absorption line energy/profile  
➔ **wind velocity/structure**

# AGNs observed in PV phase



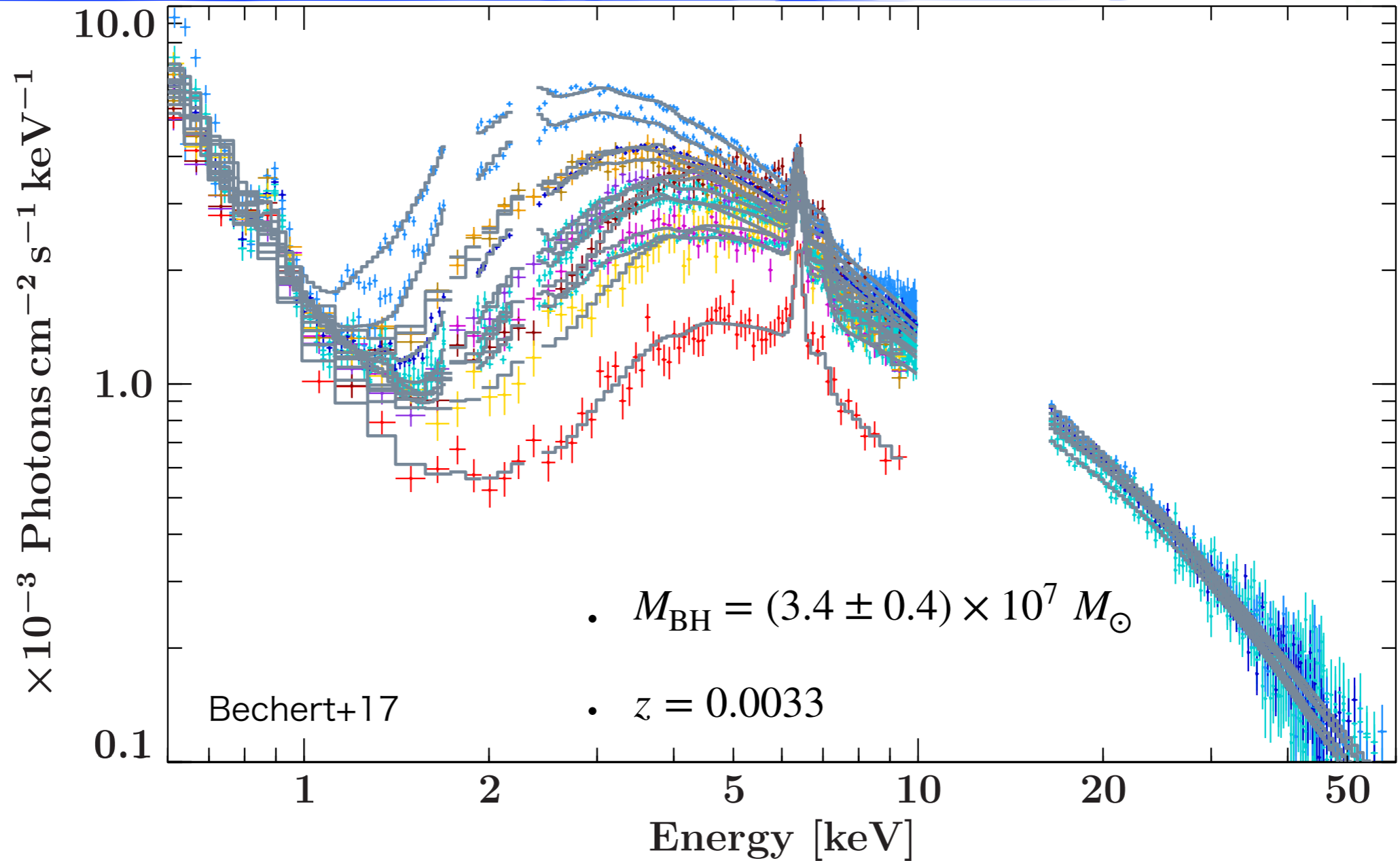
JAXA



# Nuclear structures in NGC 4151

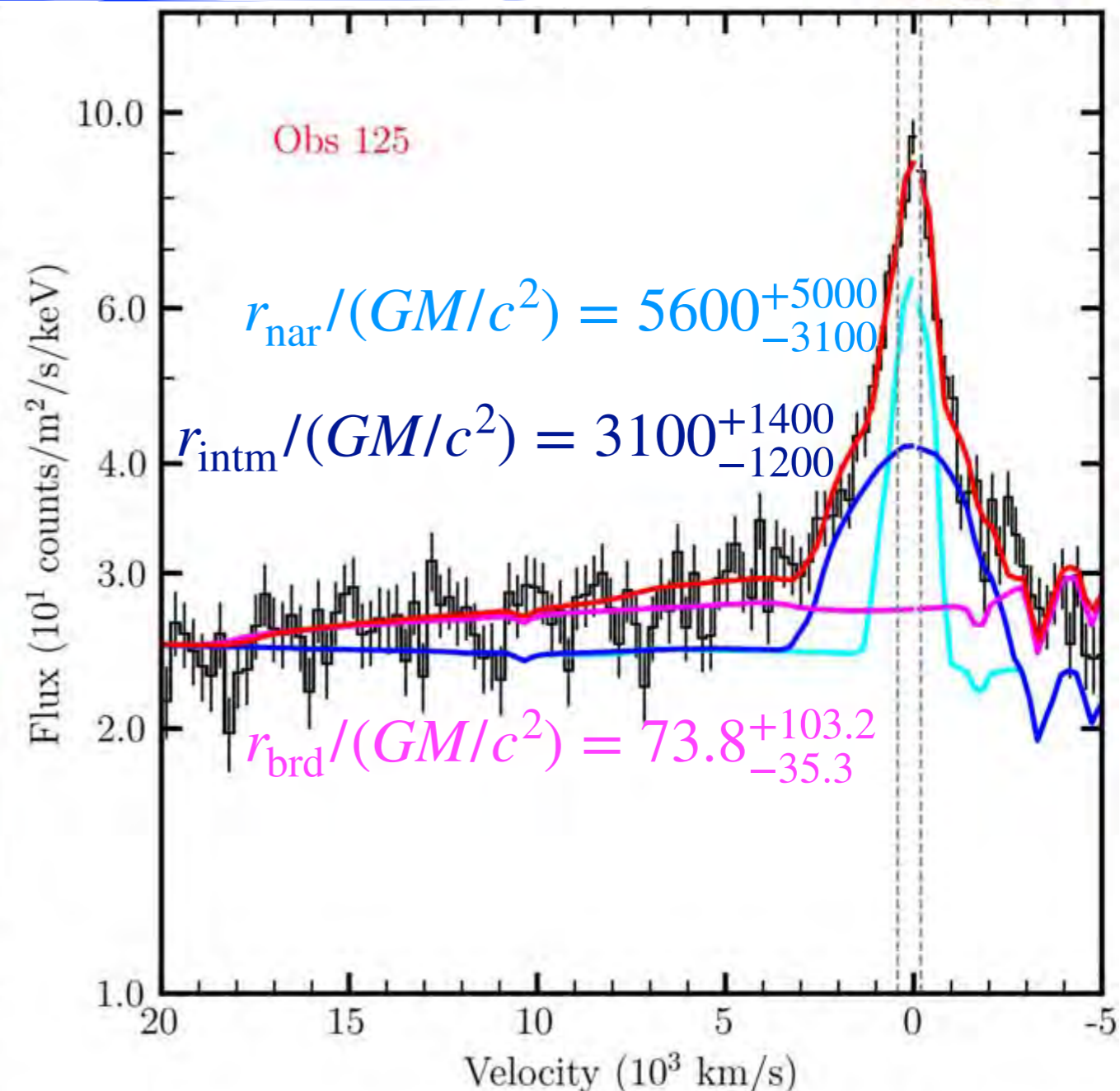
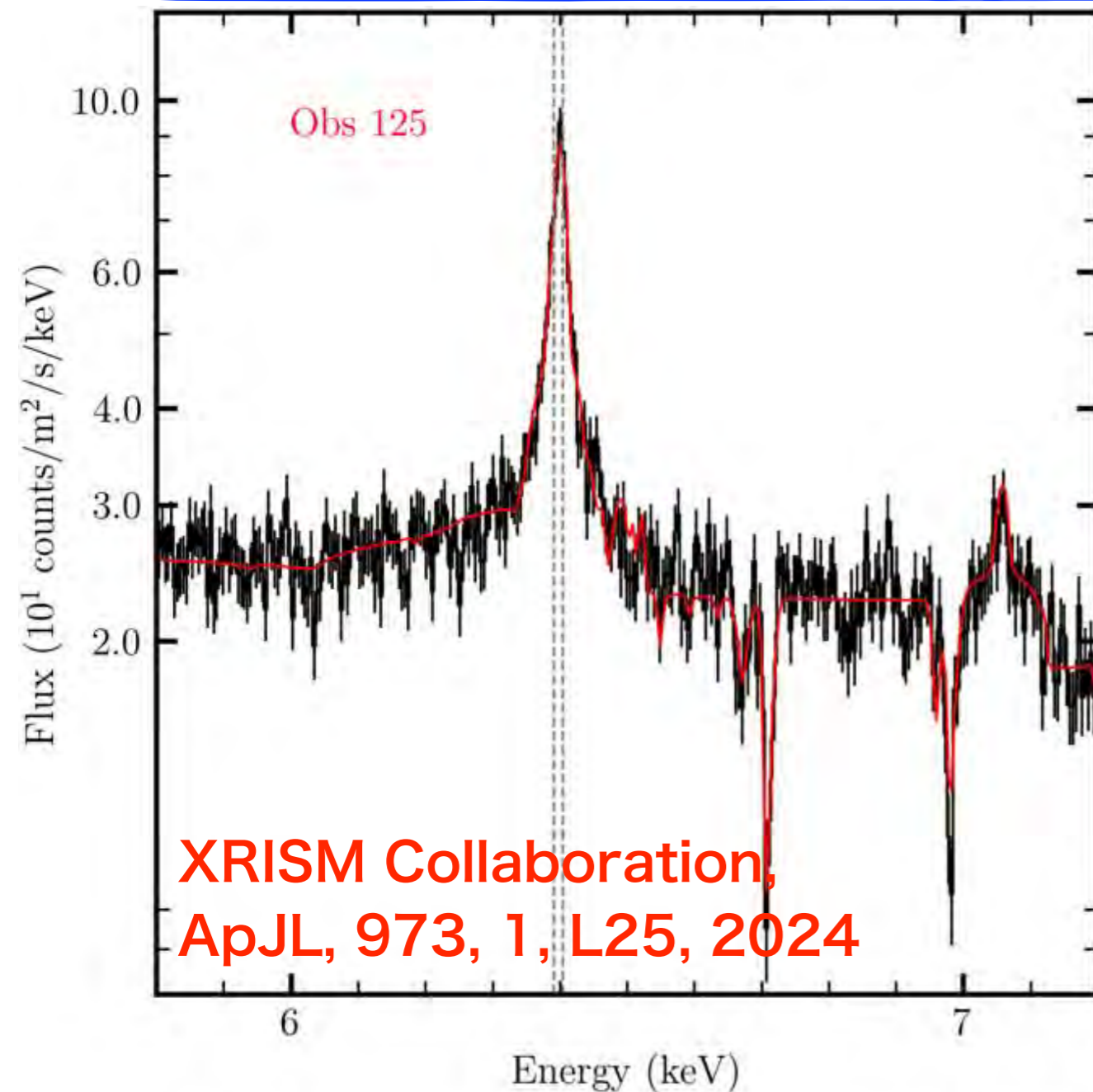
(already published in ApJL)

# Seyfert 1 galaxy NGC 4151



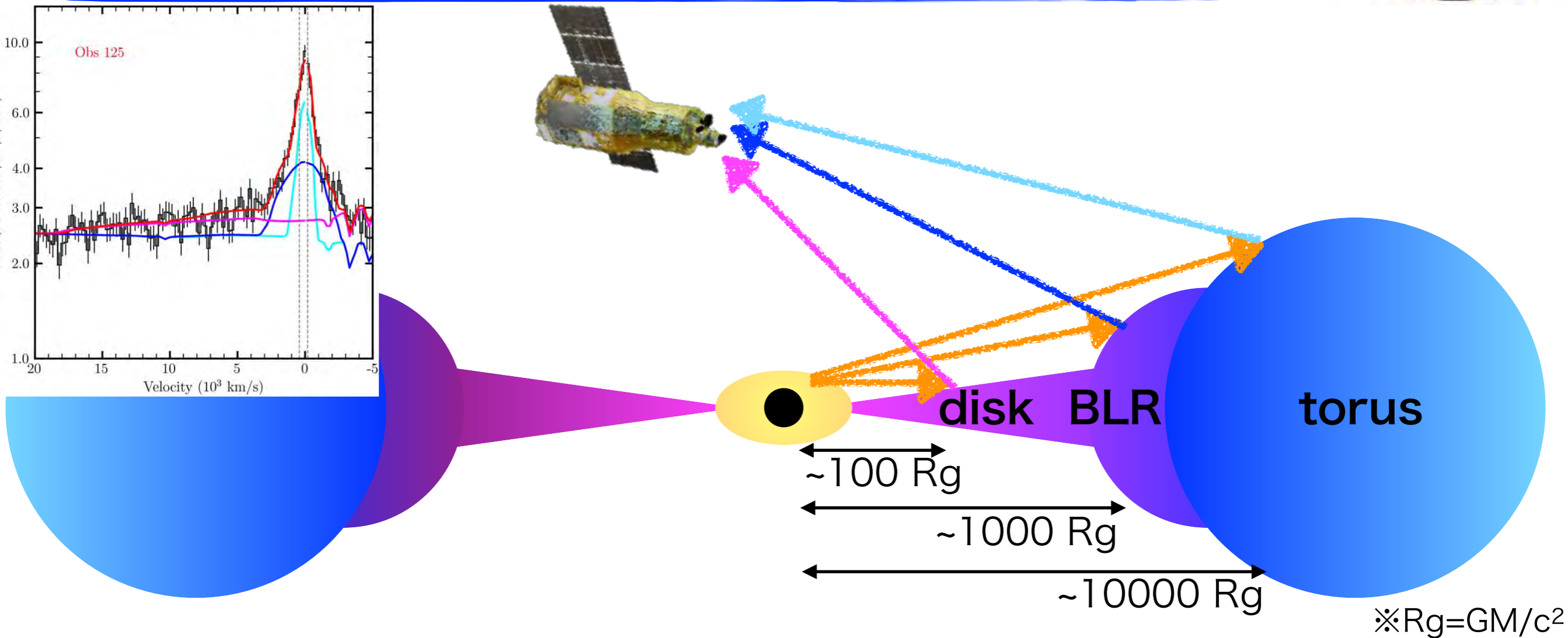
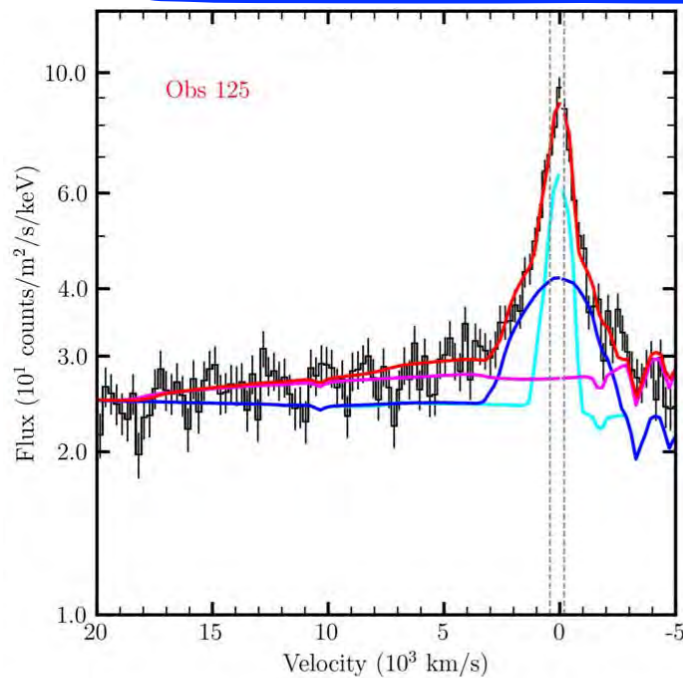
- Brightest Seyfert 1 galaxy in X-ray band with strong Fe-K emission line
- One of the most studied Seyfert 1

# XRISM spectrum of NGC 4151



- XRISM decomposed the Fe-K emission line into **3 components with different velocity widths (=radii)**

# Structures revealed by XRISM



- XRISM enabled to probe the **circumnuclear structures at multiple scales of 100–10000 R<sub>g</sub>**, almost independent from the material states (plasma, gas, dust, etc.)
- With XRISM, we can now investigate **the difference in the geometry** among different types of AGNs (Compton-thick, Radio-loud, etc.)

# No photos or screenshots

Preliminary & unpublished results  
will be presented hereafter



# Summary



- **The X-Ray Imaging and Spectroscopy Mission (XRISM)** was successfully launched in 2023.09 and now performing **Guest Observation (GO) cycle 1**.
- As the **Performance Verification (PV) observations**, **~40 targets** are observed, and many papers are getting to be published.
- In the **AGN science**, XRISM's unprecedentedly high spectral resolution of **< 5 eV (FWHM)** at the Fe-K band enables us to probe:
  - ✓ **circumnuclear structures** from the very vicinity to **~10000 GM/c<sup>2</sup>** from supermassive black holes
  - ✓ **internal structures** of the powerful accretion disk **winds**