

Scientific Highlights from the X-Ray Imaging and Spectroscopy Mission (XRISM)

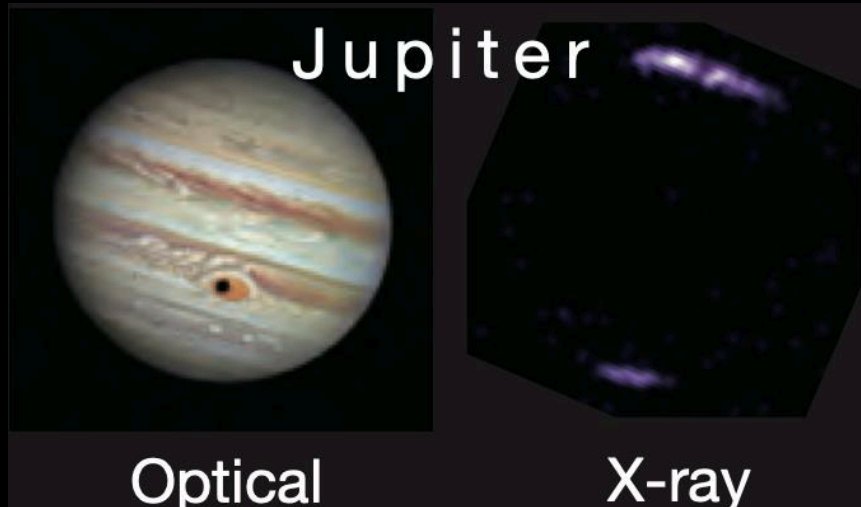
2025 September 10

Tohoku University, Japan

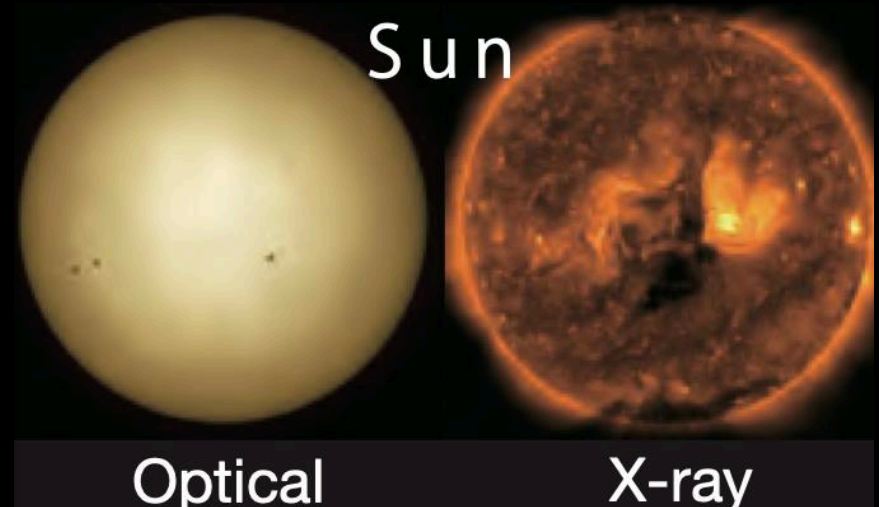
Hirofumi Noda



X-ray Emission from Various Celestial Objects

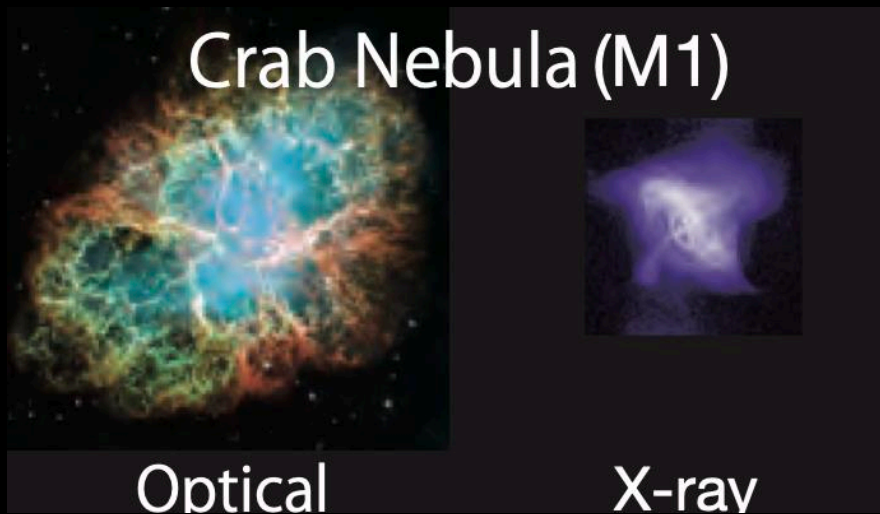


NASA, ESA and A. Simon (GSFC/NASA/CXC/SwRI/R.Gladstone et al.)



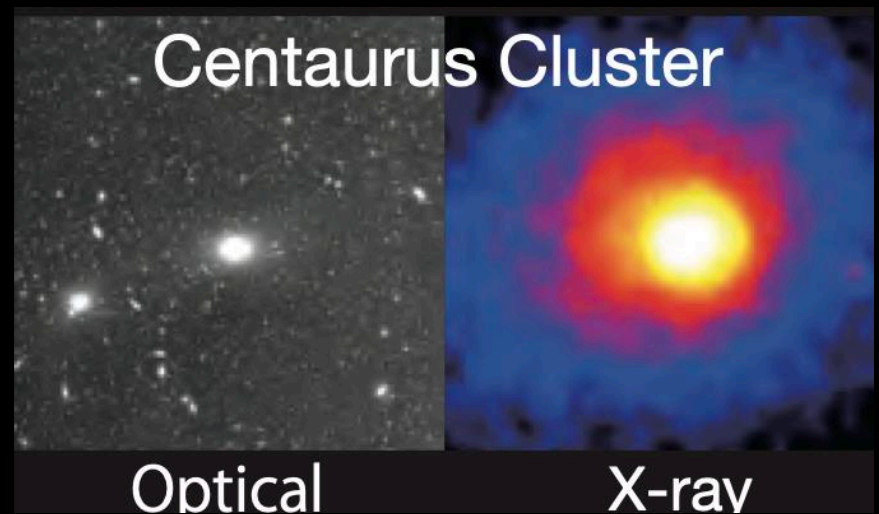
NAOJ

JAXA/NAOJ



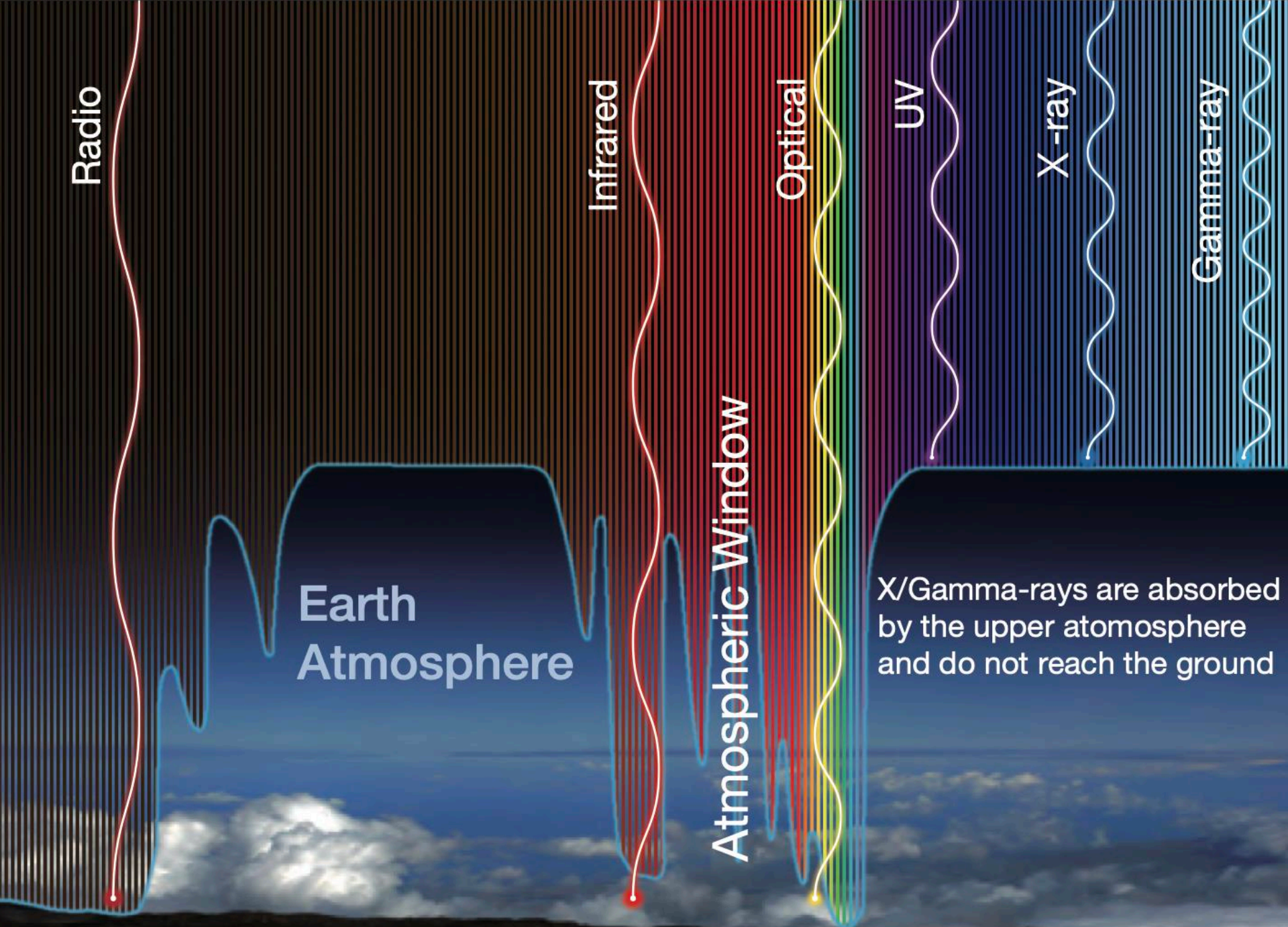
Palomar Obs.

NASA/CXC/SAO



NASA SkyView

JAXA/U. Tokyo



Radio

Infrared

Optical

UV

X-ray

Gamma-ray

Earth
Atmosphere

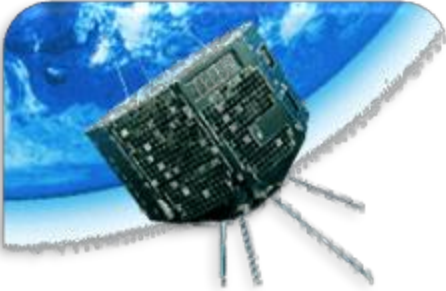
Atmospheric Window

X/Gamma-rays are absorbed
by the upper atmosphere
and do not reach the ground

X-ray Astronomical Satellites Led by Japan (JAXA)

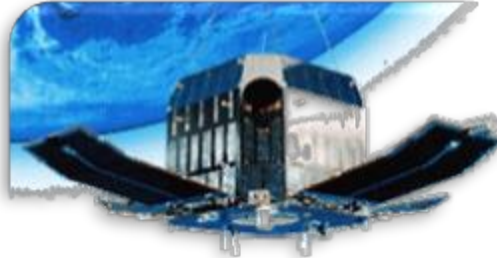
1979-81

Hakucho (96kg)



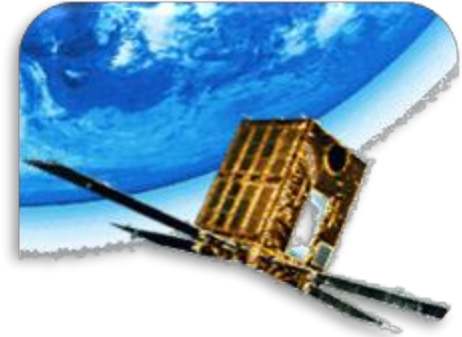
1983-85

Tenma (216 kg)



1987-91

Ginga (420 kg)



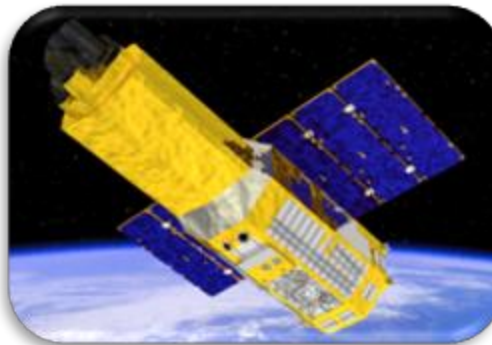
1993-00

ASCA (420kg)



2005-2015

Suzaku (1700kg)



2016

Hitomi (2700kg)



(credit) JAXA

The operation of Hitomi was terminated about a month after its launch...

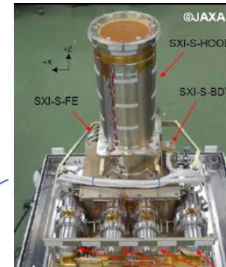
X-Ray Imaging and Spectroscopy Mission (XRISM)

A recovery mission of Hitomi (ASTRO-H), launched in 2016 Feb 17 and abandoned after a month

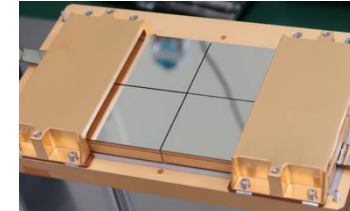
X-ray Mirror Assembly (XMA)



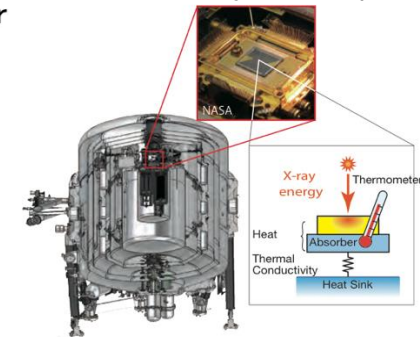
Xtend-Soft X-ray Imager



Noda et al. (2025)



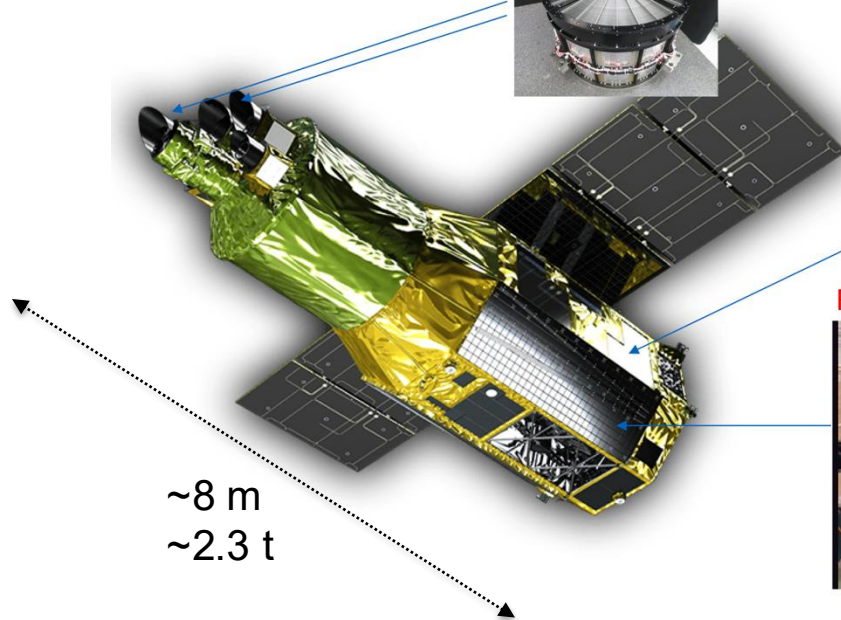
Kelley et al. (2025)



Resolve-Soft X-ray Spectrometer



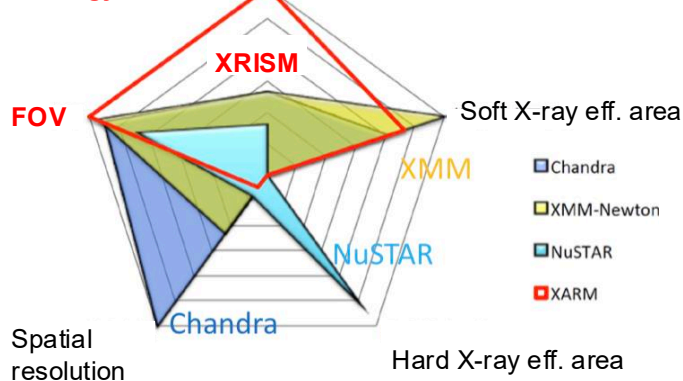
XRISM quick reference



~8 m

~2.3 t

Energy resolution



Instrument	FOV/pix	ΔE (FWHM at 6 keV)	E band
Resolve (X-ray mirror assembly + X-ray microcalorimeter)	2.9' $\square$ / 6×6 pix	7 eV (goal 5 eV)	0.3–12 keV
Xtend (X-ray mirror assembly + X-ray CCD camera)	38' $\square$ / 1280×1280 pix	< 200 eV (BOL)	0.4–13 keV



宇宙航空研究開発機構



美国航空宇宙局



欧洲宇宙機関



首都大学東京



金沢大学



大阪大学



宮崎大学



埼玉大学



SRON(Netherlands
Institute for Space
Research)



University of Geneva



Canadian Space
Agency



Gravitation
AstroParticle Physics
Amsterdam



Canadian Light Source
Inc.



University of Chicago



中央大学



University of Durham



愛媛大学



European Sauther
Observatory



藤田医科大学



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University of Waterloo

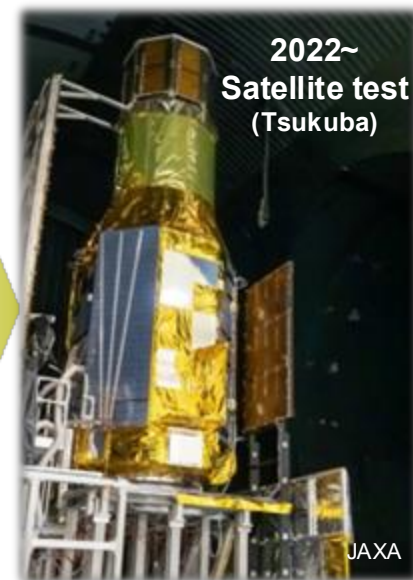


University of
Wisconsin



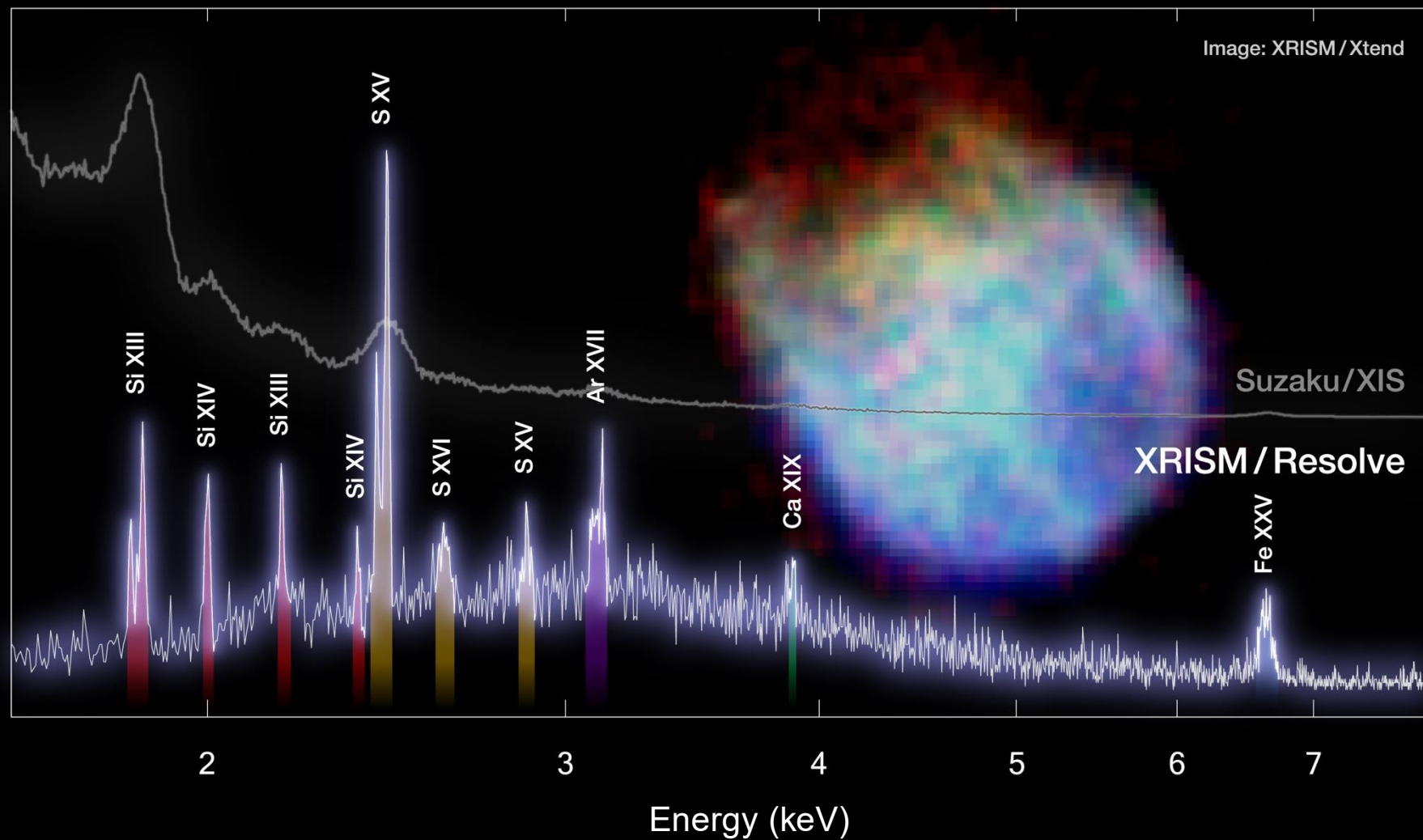
Yale University

Our Development of XRISM Instruments



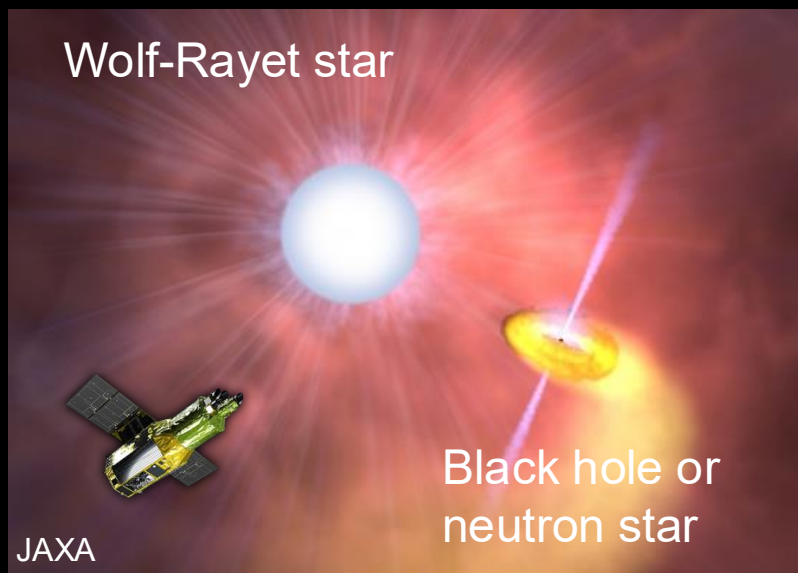


*X-ray Spectrum of Supernova Remnant N132D Measured by **XRISM Resolve***



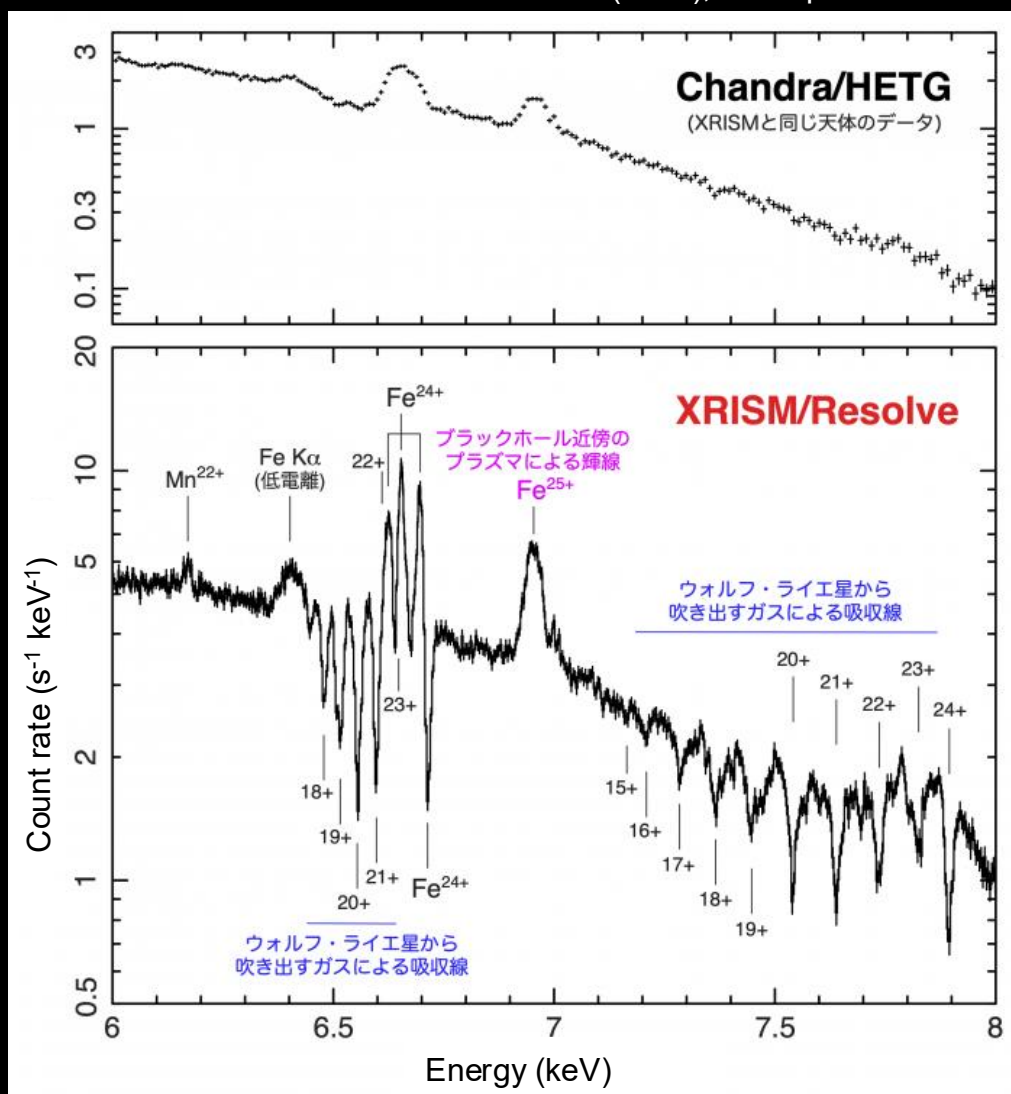
X-ray Binary Cygnus X-3

XRISM collaboration (2024), JAXA press release

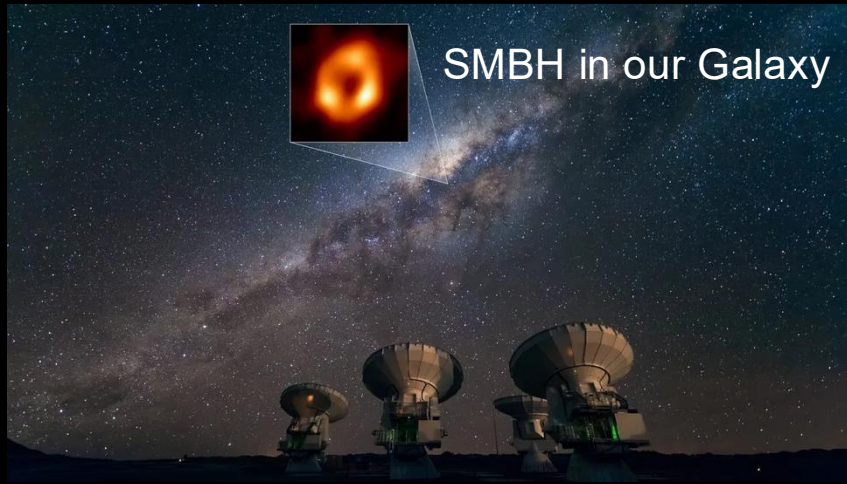


Enabling comprehensive detection of X-ray spectral lines from the vicinity of a black hole/neutron star

→ Detailed physical conditions and motions of hot plasmas near compact objects



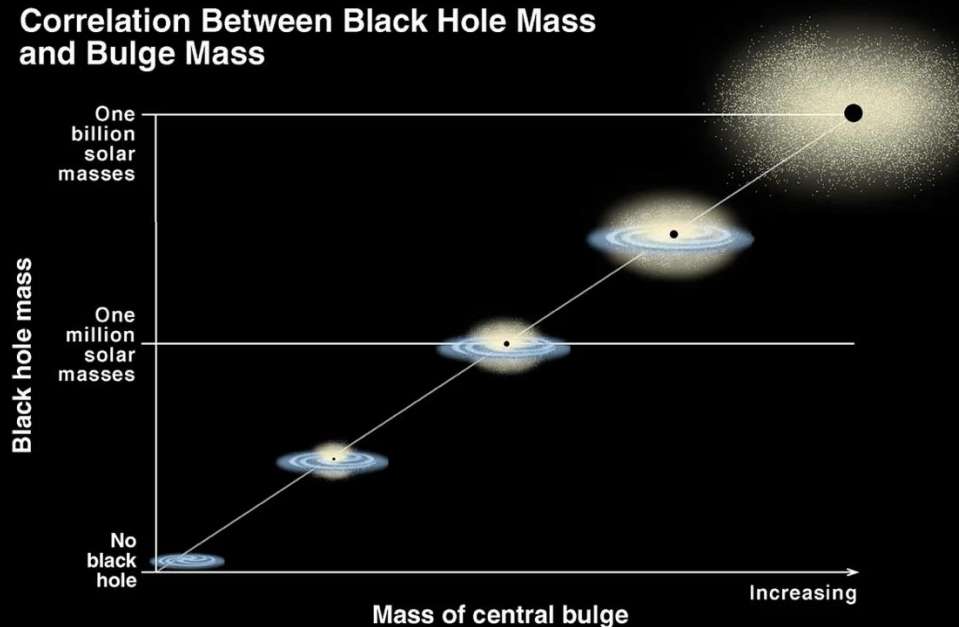
Key Science of Supermassive Black Hole



ESO/José Francisco Salgado, EHT Collaboration

- ☆ Galaxies are the fundamental elements of the universe, consisting of $\sim 10^{11}$ stars.
- ☆ A Super-Massive Black Hole (SMBH) with a mass of 10^5 – 10^{10} times that of the Sun exists at the center of almost all galaxies.

Correlation Between Black Hole Mass and Bulge Mass



Credit: K. Cordes, S. Brown (STScI)

- ☆ SMBHs co-evolve with galaxies and play a crucial role in the evolution of the Universe.
- ☆ It is one of the most important questions in astronomy, how SMBHs and their host galaxies interact with each other

Powerful Gas Bullets from Accreting SMBH PDS 456

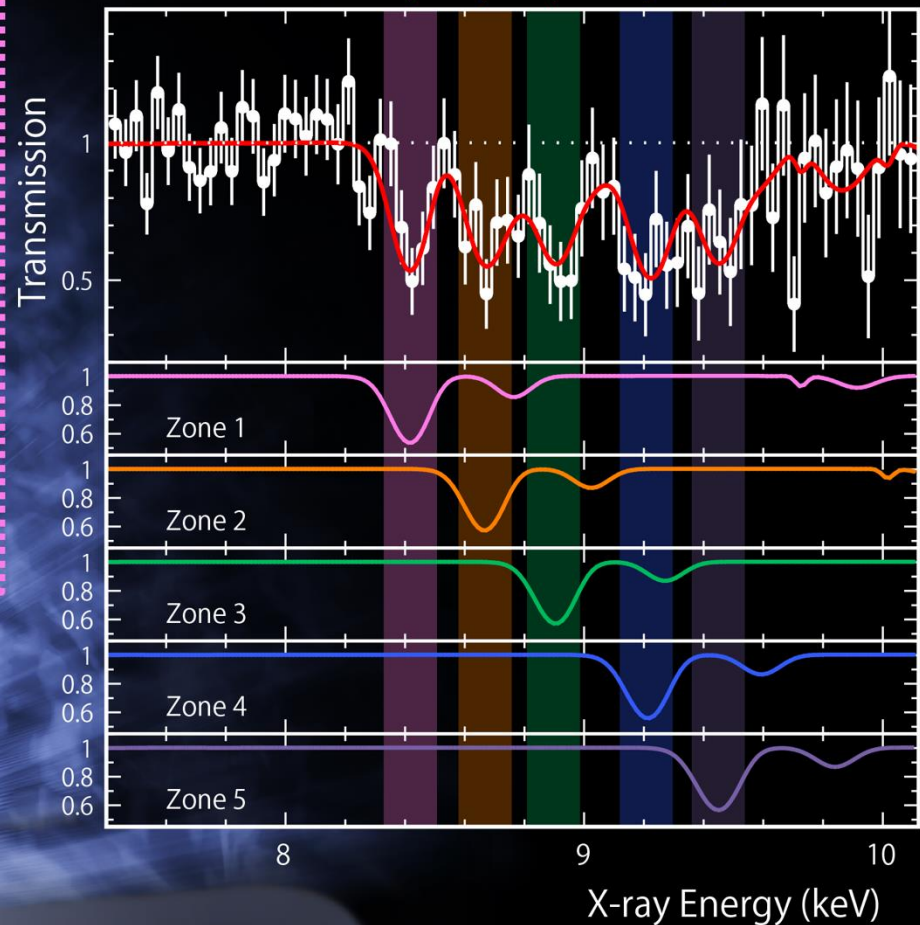
XRISM discovered gas bullets with enormous amounts of matter and energy

→ Important step to reveal the influence on their host galaxies

$v \sim 60,000$ km/s

SMBH

Accretion disk



Summary



- ☆ **X-ray astronomy is the field of studying high-energy phenomena in celestial objects through observations with scientific satellites.**
- ☆ **XRISM was successfully launched on September 7, 2023, achieving unprecedented X-ray spectroscopy on various objects.**
- ☆ **We hope for fruitful cooperation between Czechia and Japan in coordinated X-ray observations and space activities in the future.**