

X-ray Astronomy Recovery Mission

XARM

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on behalf of XARM pre-project preparation team
at the X-ray Universe 2017
on June 8, 2017 @ Rome

ASTRO-H “*Hitomi*”

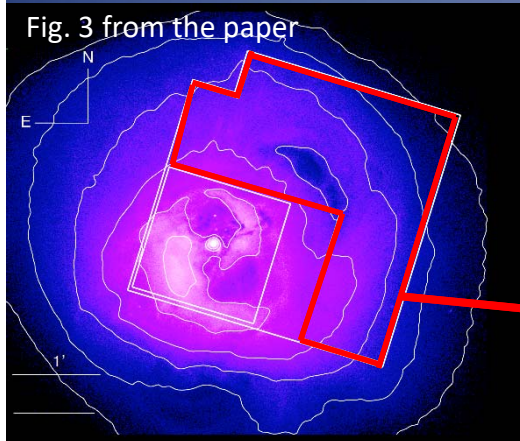
Launched on 17 Feb. 2016



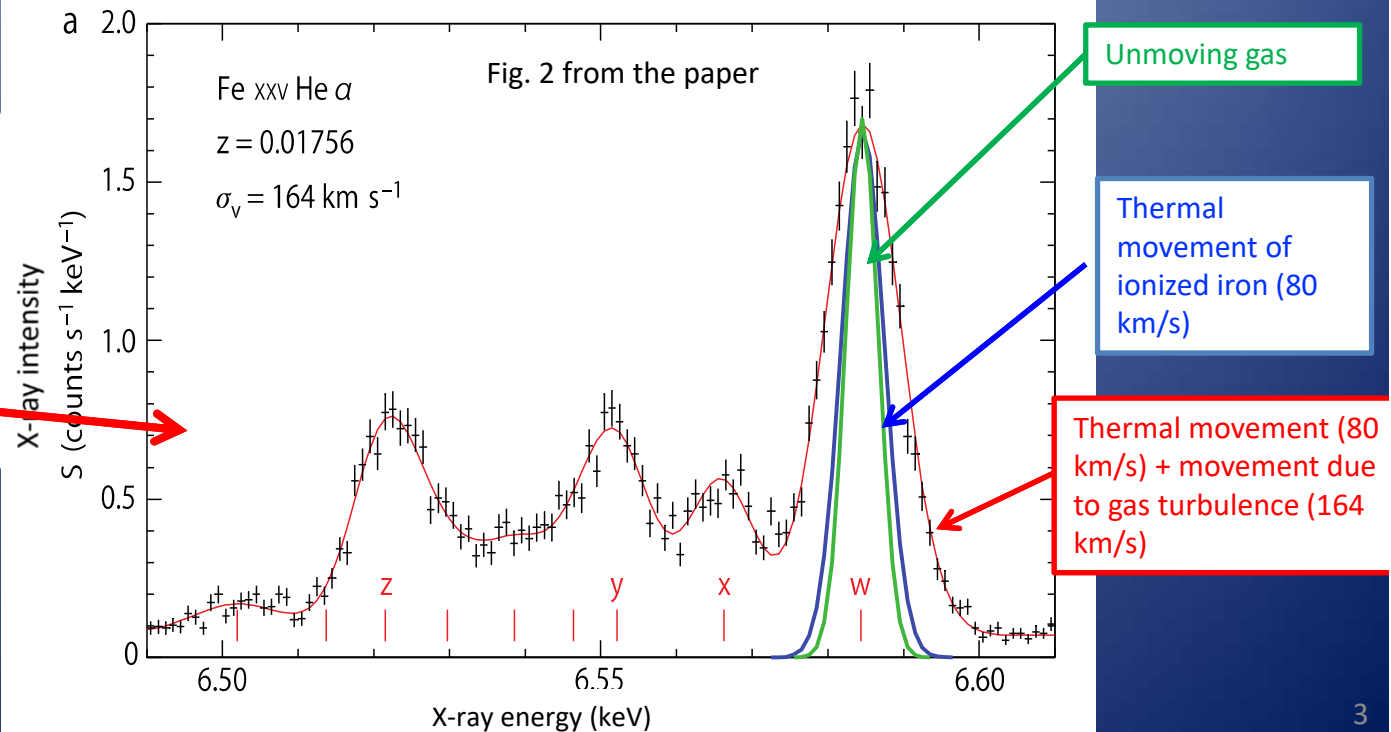
- The Soft X-ray Spectrometer (SXS) aboard Hitomi provided spectrometry performance far exceeding requirements.
- X-ray micro-calorimeter is a powerful tool to measure plasma velocity fields, as well as to observe fine structures of lines.

See papers in this symposium by:
Noda, Ohashi, Gu, Sato, Nakashima,
Ichinohe

Hitomi collaboration, 2016, Nature, 535, 117



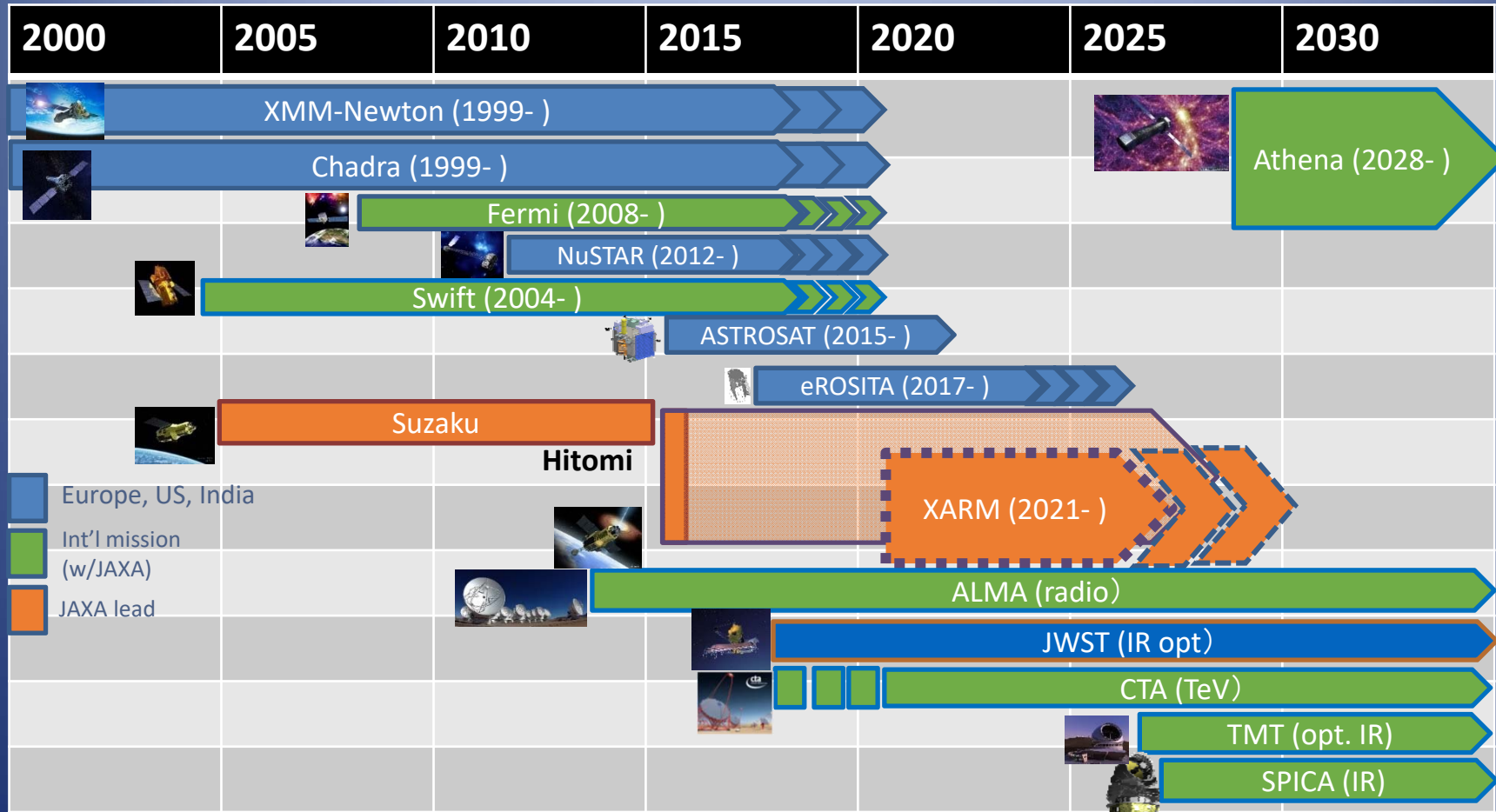
Chandra satellite image and the detector field of view



(ASTRO-E XRS → Suzaku XRS → ASTRO-H SXS/XARM Resolve → Athena X-IFU)

	ASTRO-E XRS*	Suzaku XRS	A-H/XARM SXS/Resolve	Athena X-IFU	ASTRO-H SXI (CCD)
Launch year	2000*	2005	2016/2021	2028	2016
Energy resolution (FWHM at 6 keV)	12 eV*	7 eV	5 eV/<7 eV	2.5 eV TES	150 eV
Energy range	0.4-10 keV	0.3-12 keV	0.3-12 keV	0.2-12 keV	0.4 — 13 keV
Pixel format	2 x 16	6 x 6	6 x 6	3840	1280 x 1280
Cooling system	ADR/ L-He/ S-Ne ADR+cryogen		ADR/ L-He/ JT/ 2ST mech. coolers	ADR/JT/ PT/2ST cryogen free	1ST
Spatial resolution	2 arcmin		1.5 arcmin	5 arcsec	1.5 arcmin

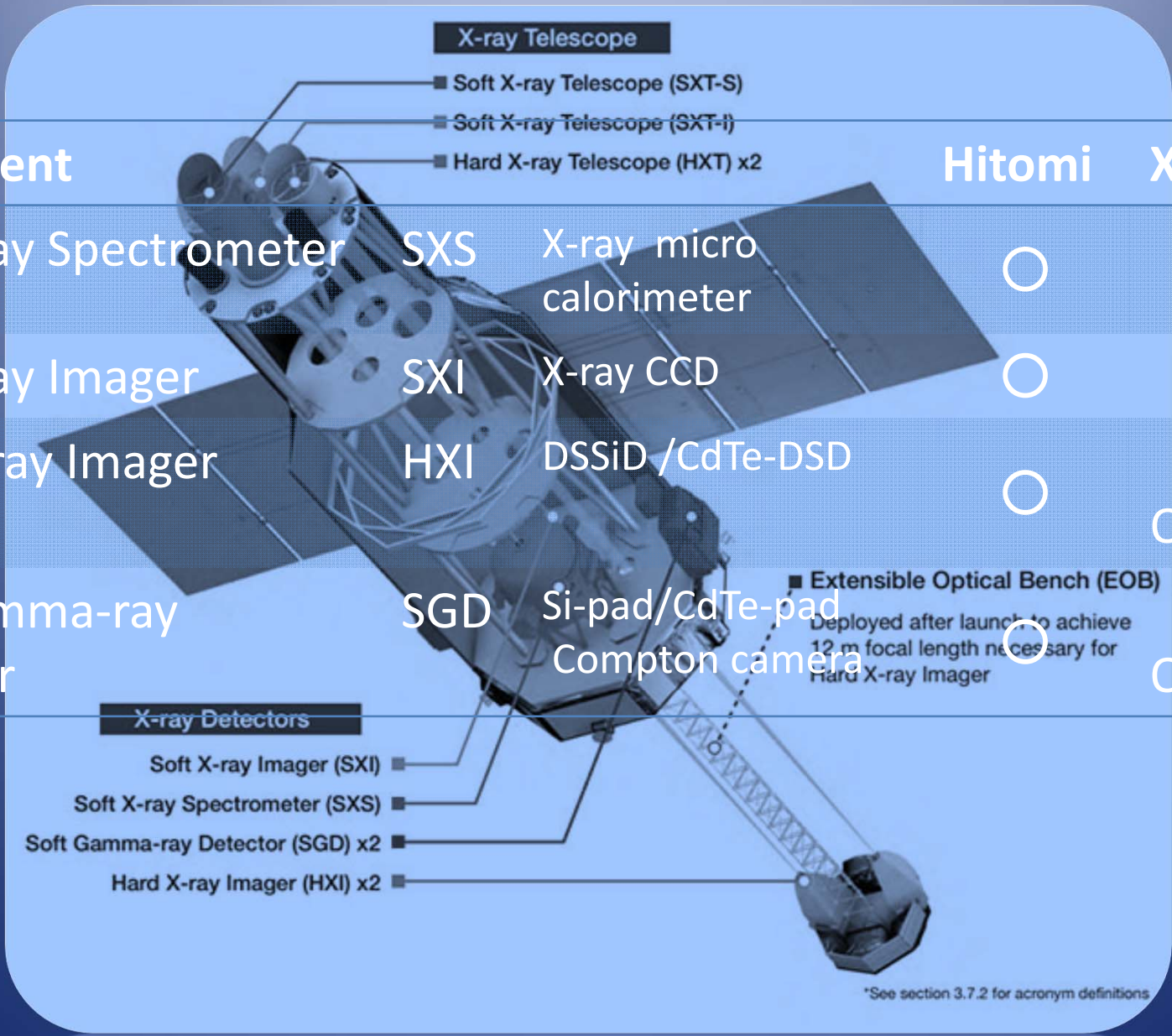
* Only prelaunch data, due to the launching vehicle failure,



X-ray observatory: XMM-Newton, Chandra, Suzaku, Hitomi, XARM, Athena
 Swift: GRB/H-X survey Fermi:GeV gamma-ray, NuSTAR:Hard X-ray imaging, eROSITA:soft X-ray survey

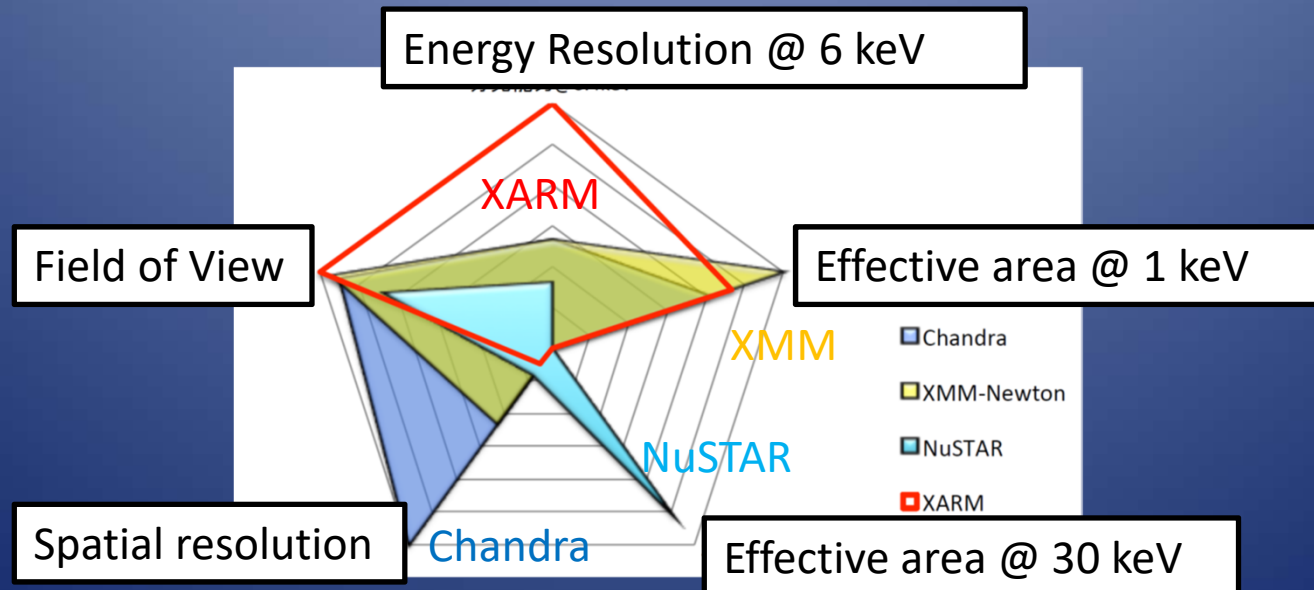
After the mishap of Hitomi...

- Root causes of the Hitomi mishap were investigated.
- JAXA makes **revision** for the science mission management
- To resume the X-ray Astrophysics that should be achieved by Hitomi, especially with the **high energy-resolution spectroscopy of $E/\Delta E \sim 1200$ ($\Delta E \sim 5\text{eV}$ @ 6keV).**
- in the decade that No such large-scale X-ray fine spectroscopy mission is planned.
- with strong support for consideration by NASA, European institutes.



Instrument			Hitomi	XARM
Soft X-ray Spectrometer	SXS	X-ray micro calorimeter	○	○
Soft X-ray Imager	SXI	X-ray CCD	○	○
Hard X-ray Imager	HXI	DSSiD /CdTe-DSD	○	Not Onboard
Soft Gamma-ray Detector	SGD	Si-pad/CdTe-pad Compton camera	○	Not Onboard

Instrument	FOV/pix	ΔE (FWHM @6 keV)	Energy band
Resolve (XMA + X-ray microcalorimeter)	2.9' \square / 6 x 6 pix	7 eV (goal 5 eV)	0.3 – 12 keV
Soft X-ray Imager (TBD) (XMA + X-ray CCD)	38' \square / 1280 x 1280 pix	< 250 eV at EOL (< 200 eV at BOL)	0.4 – 13 keV



- How does the large structure formed?
 - What forms and sustain the clusters of galaxies structure against gravity ?
 - Gas pressure, **turbulence**, and their spatial distribution
- How was the elements and energy produced and distributed in the universe ?
 - **Metallicity** of SNs and their remnants
 - Dissipation of the material
 - **Velocity** of elements of SNR metals
and **Accretion** and **outflow (winds)** of AGNs, galaxies
- New astrophysics with X-ray micro-calorimeter

- ❑ To **continue the science of the Hitomi** SXS, the XARM mission was proposed and approved by both Japanese and the US governments.
- ❑ European participation is now considered on basis of the Hitomi case.
- ❑ ISAS **Program Review** (MDR + (top level) SRR) were **successfully finished** in April.
- ❑ Preliminary schedule of the launch in JFY 2020 from Tanegashima SC (incl. 31 deg, alt. 550 km)
- ❑ GOs will be started soon after the commission, calibration, and performance verification.