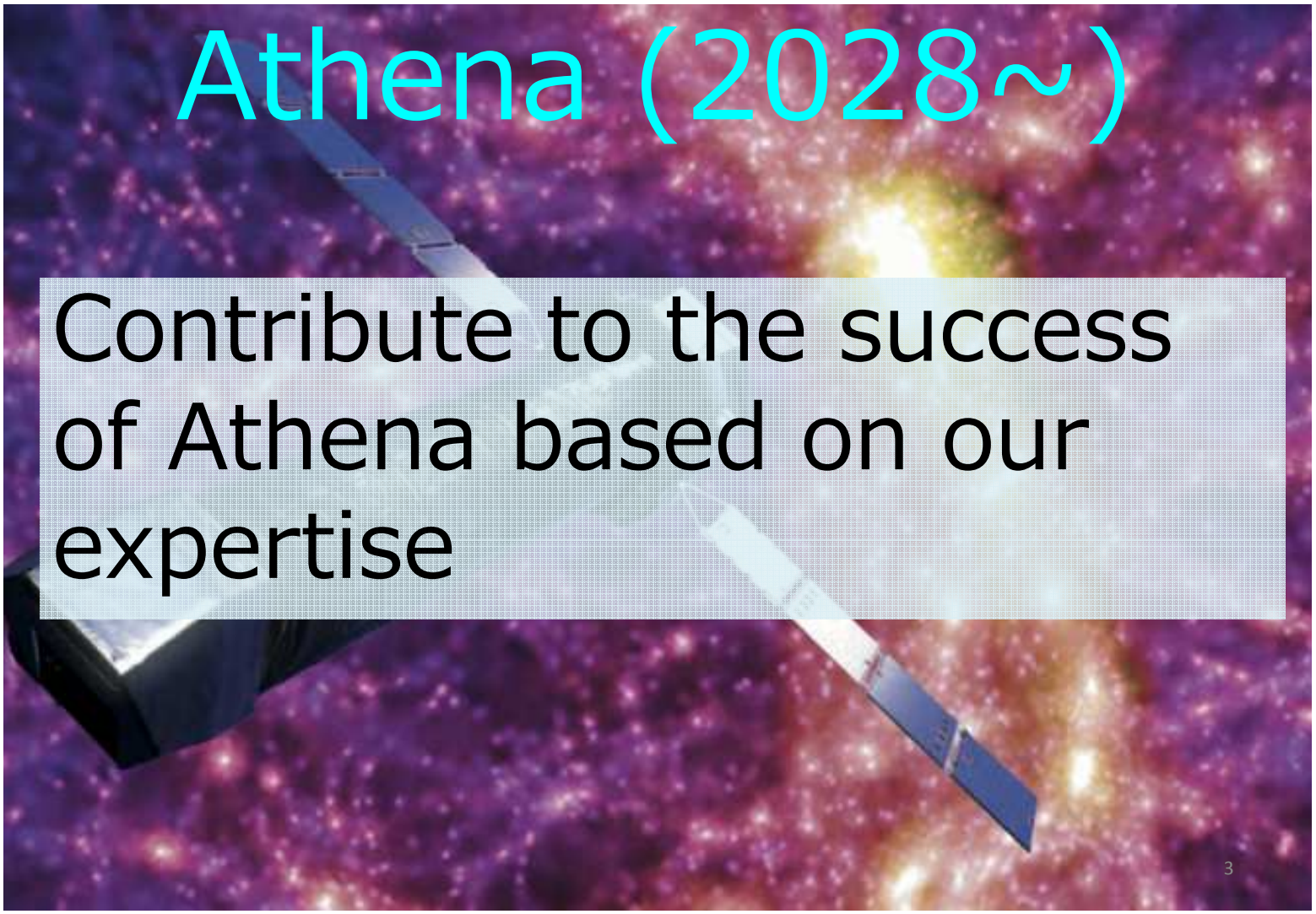
Athena & Future plans of X-ray astronomy in Japan

Hiro Matsumoto
(Nagoya U.)

Outline

- Japanese contributions to Athena
- Future Japanese projects



ISAS/JAXA next 10-20years

Strategic L-class mission (L class)

H-IIA, 3/10 years (ASTRO-H class)

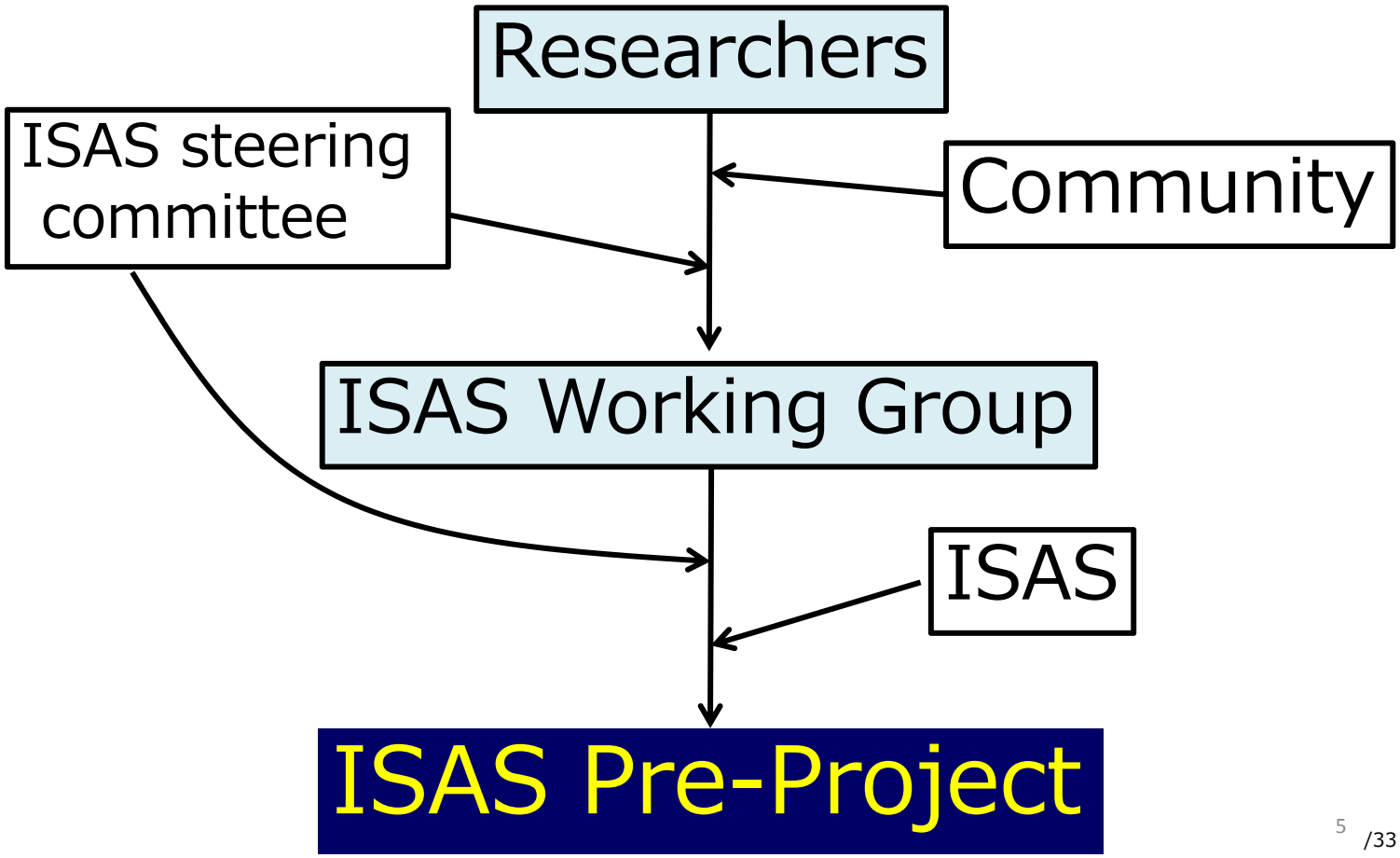
Competitively-chosen medium-sized focused mission (M class)

Epsilon, 1/2 years, ~70MEuro (w/o rocket)

Mission of Opportunity (S class)

foreign agency-led missions, ISS, sounding rocket, etc. Total~10MEuro/year.

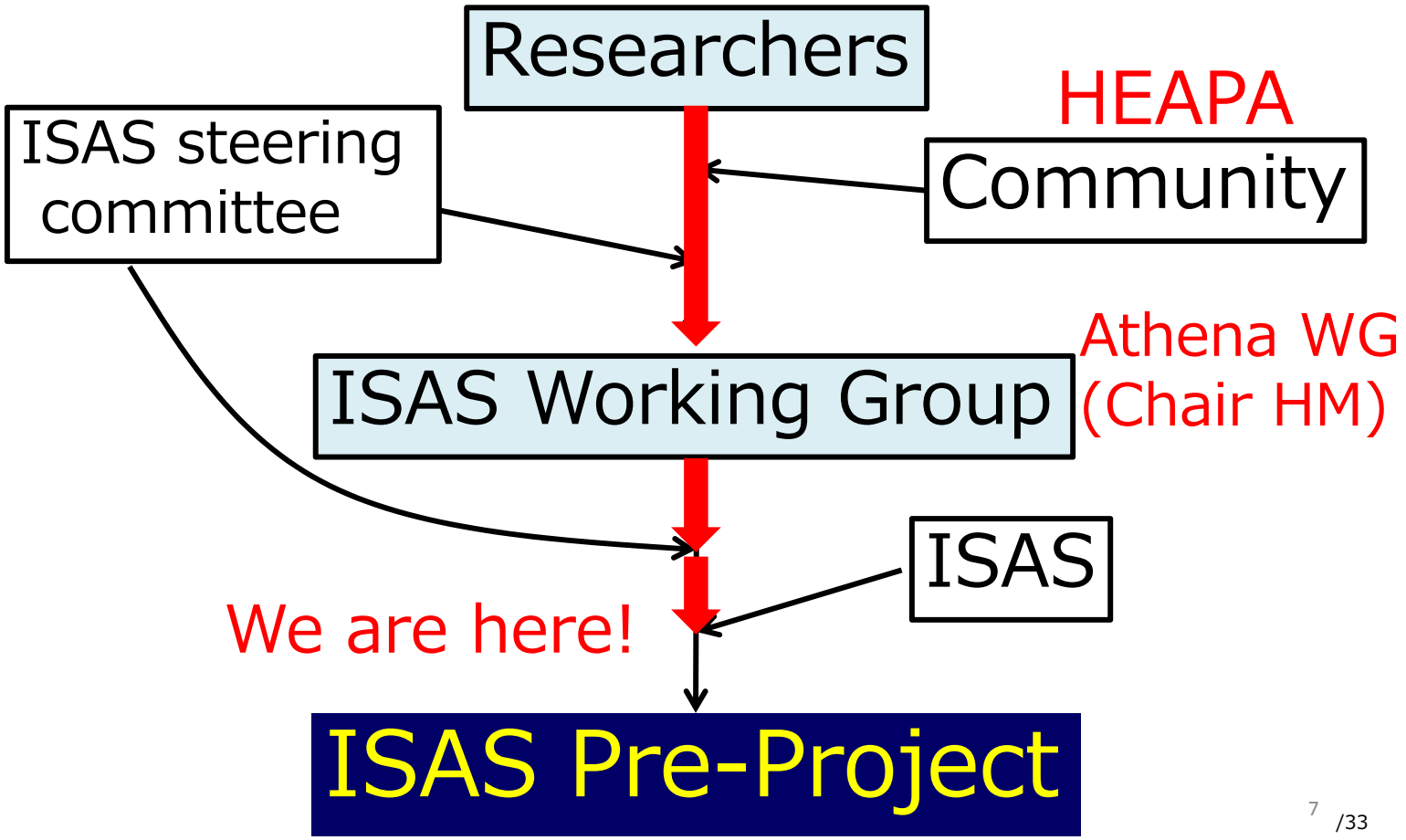
ISAS space mission selection



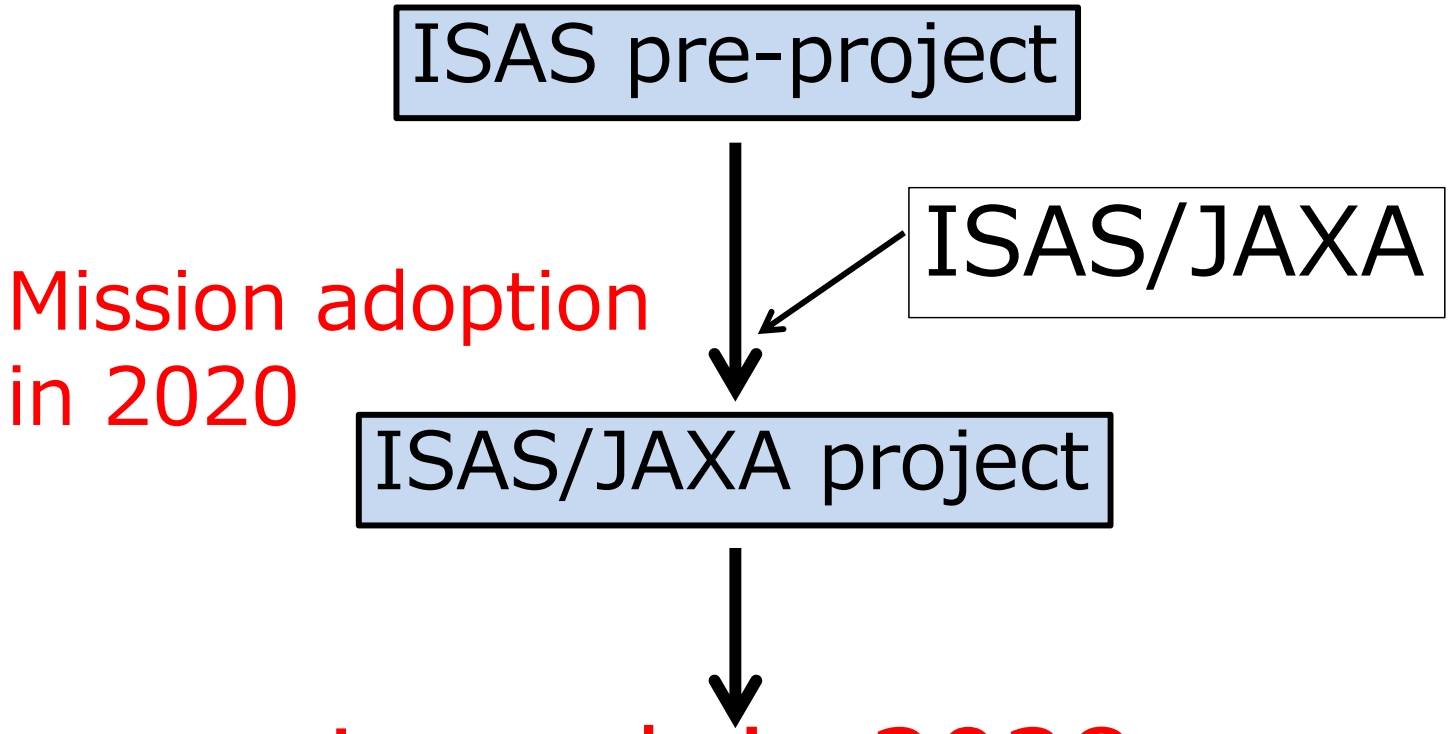
What is “ISAS pre-project”?

- ISAS officially supports Athena.
- Up to the mission adoption in ~2020.

Athena case



Future



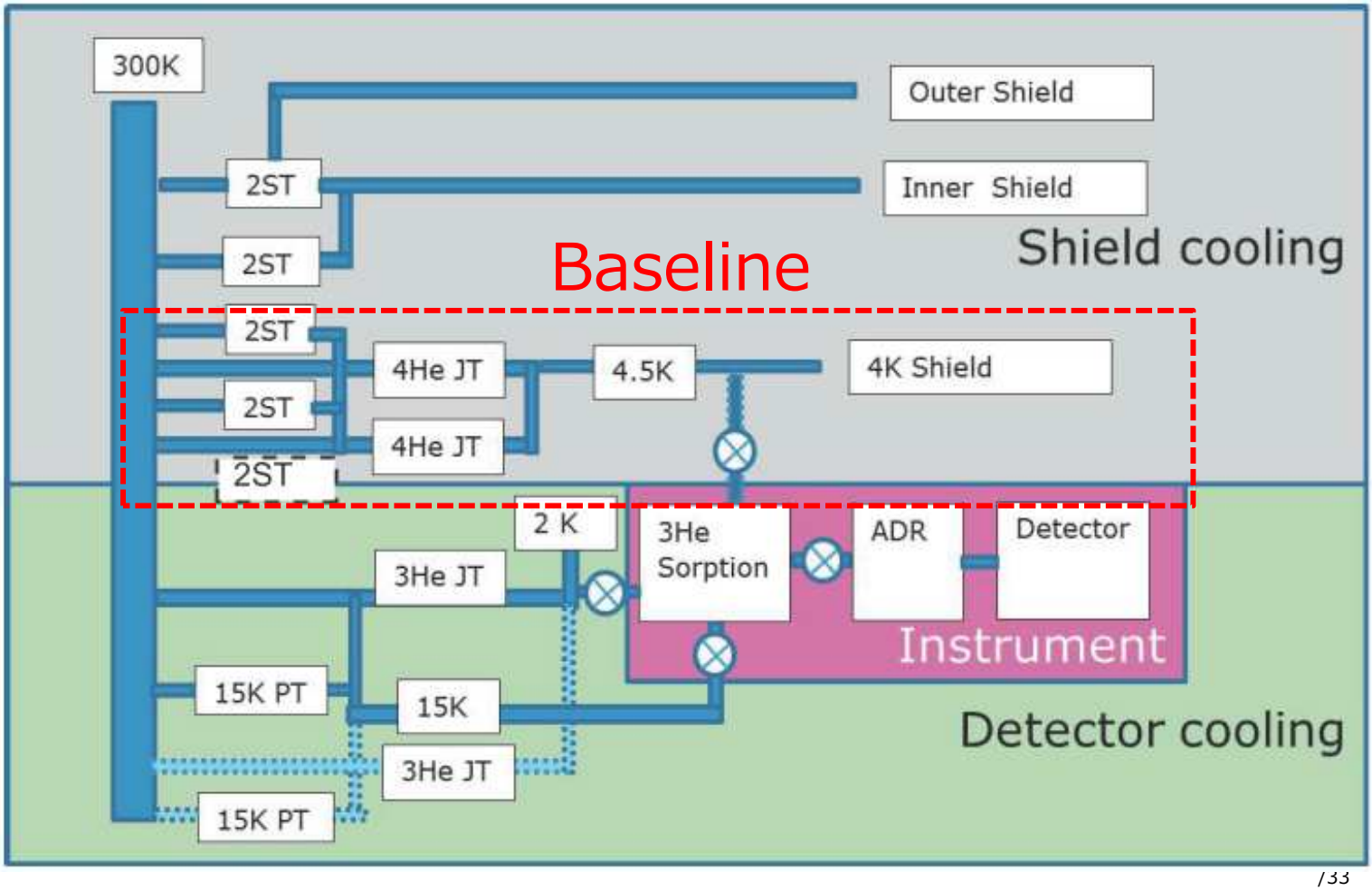
Contribution to X-IFU

X-IFU proto-consortium

K. Mitsuda (ISAS)
N. Yamasaki (ISAS)
H. M. (Nagoya U)

X-IFU scientist

Y. Fukazawa (Hiroshima U.)



SWG

Chairs (6)

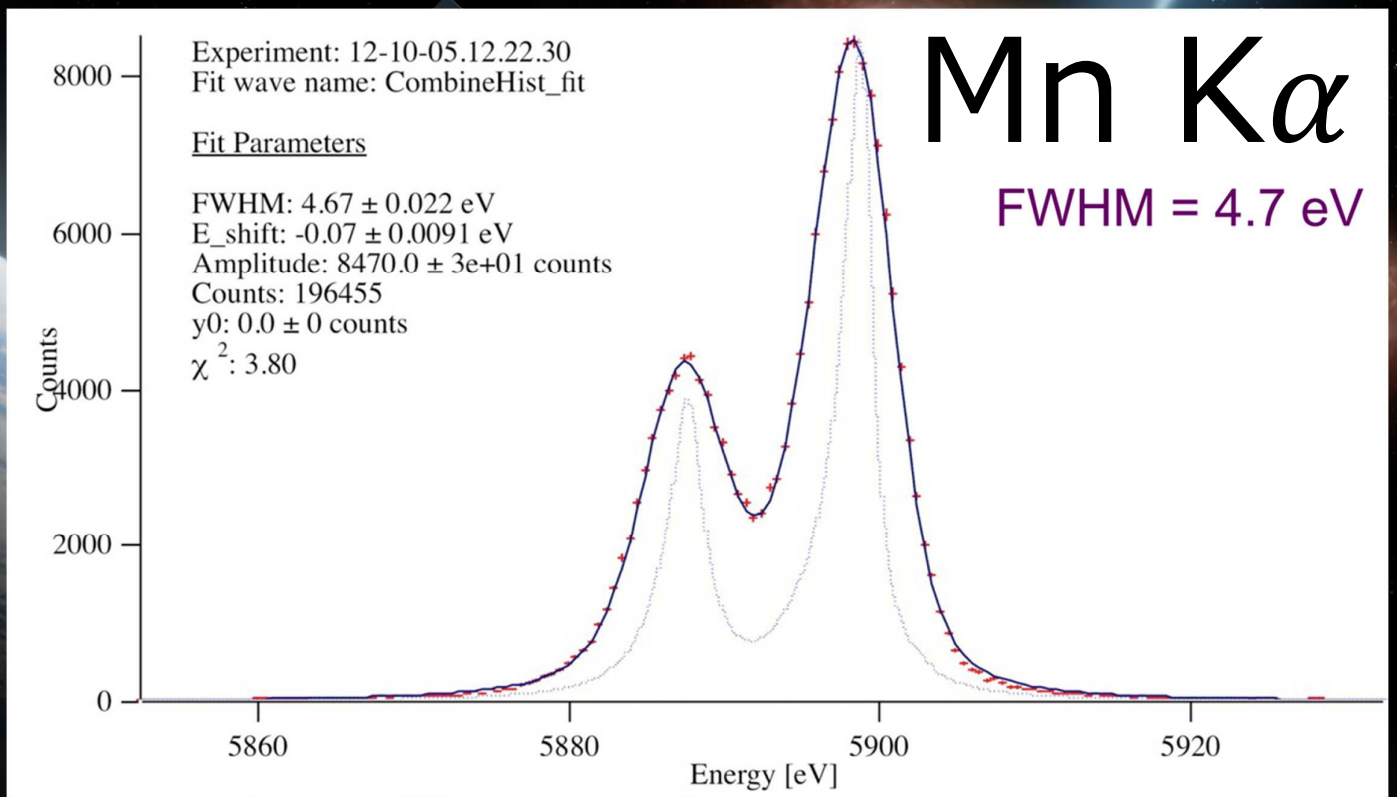
SWG1 T. Ohashi
SWG 1.1 N. Ota
SWG 2.2 Y. Ueda
SWG 2.3 T. Tsuru (→Terashima)
SWG 3 H.M.
SWG 3.4 A. Bamba

+ 20 members

- Possiblities
  - WFI
  - TOO ground stations
  - Calibrations
  - etc.

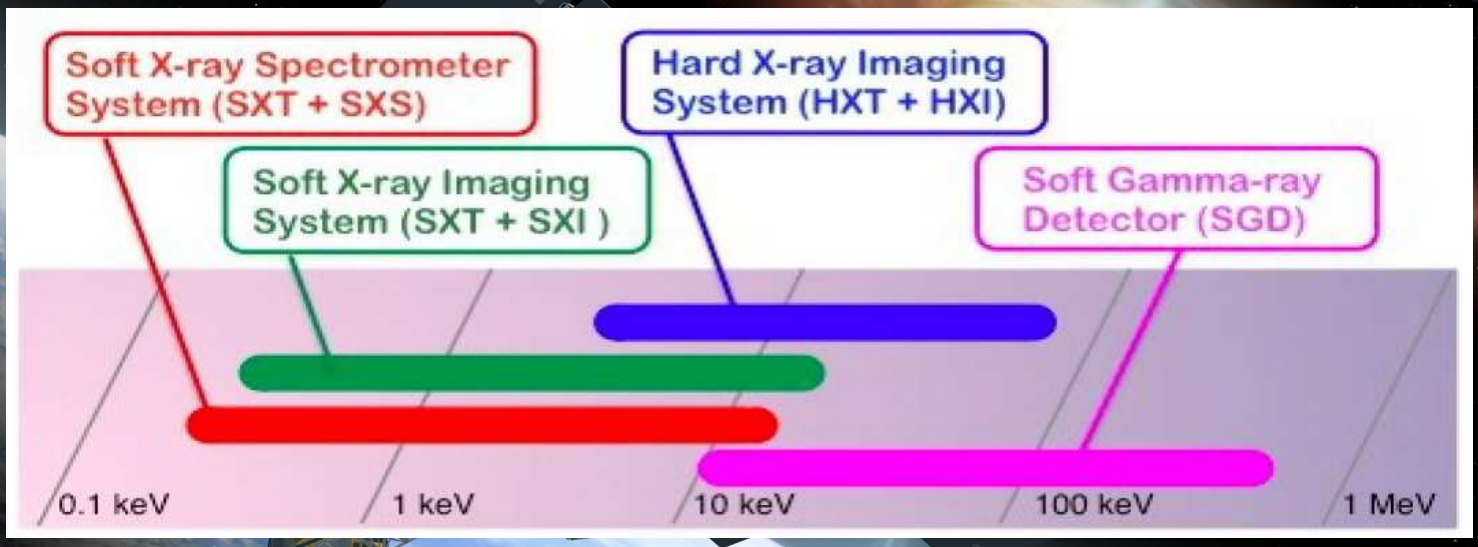
ASTRO-H

ASTRO-H

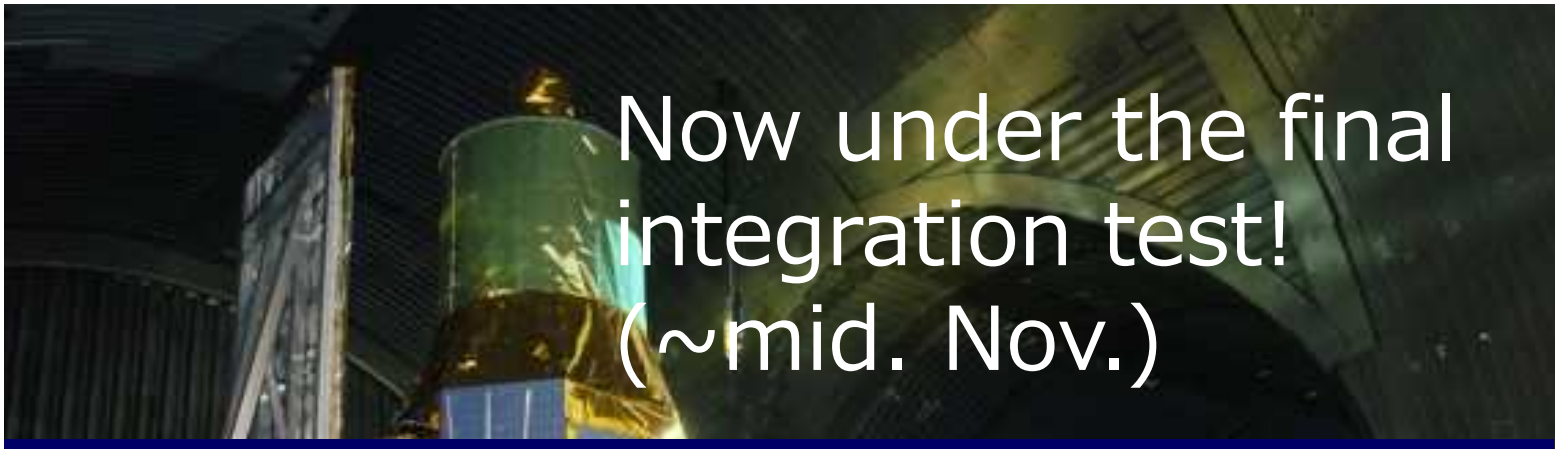


First calorimeter mission

ASTRO-H



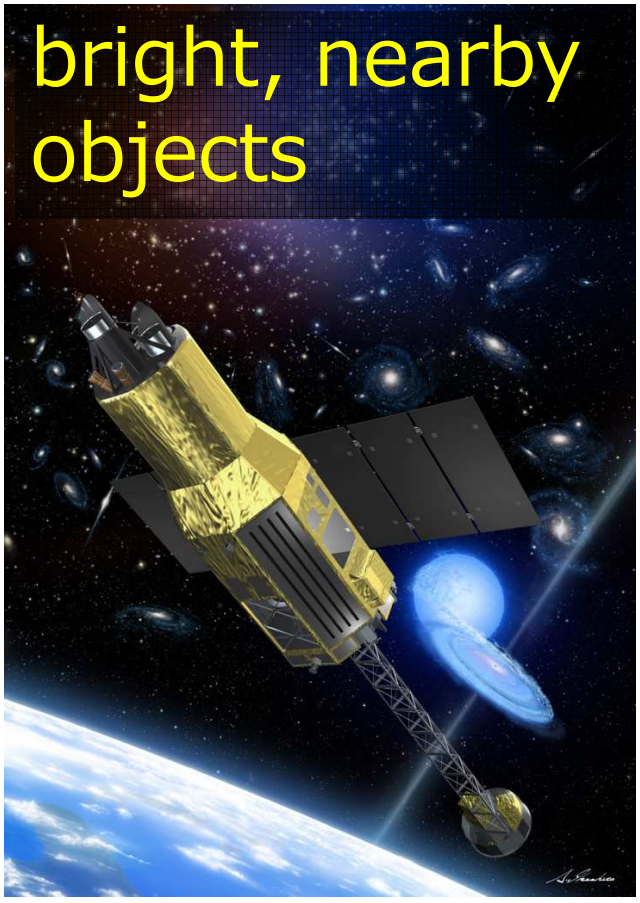
Wide band (0.3—600keV)



Now under the final integration test! (~mid. Nov.)

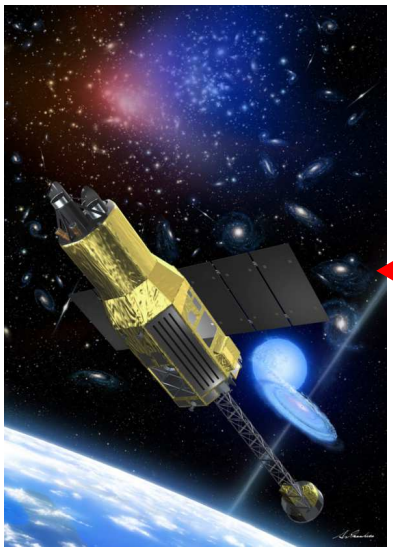
To be launched in early 2016
Stay tuned!

2016~



2028~

2016~



2028~

What should we do?

ISAS/JAXA next 10-20years

Strategic L-class mission (L class)

H-IIA, 3/10 years (ASTRO-H class)

Competitively-chosen medium-sized focused mission (M class)

Epsilon, 1/2 years, ~70M Euro (w/o rocket)

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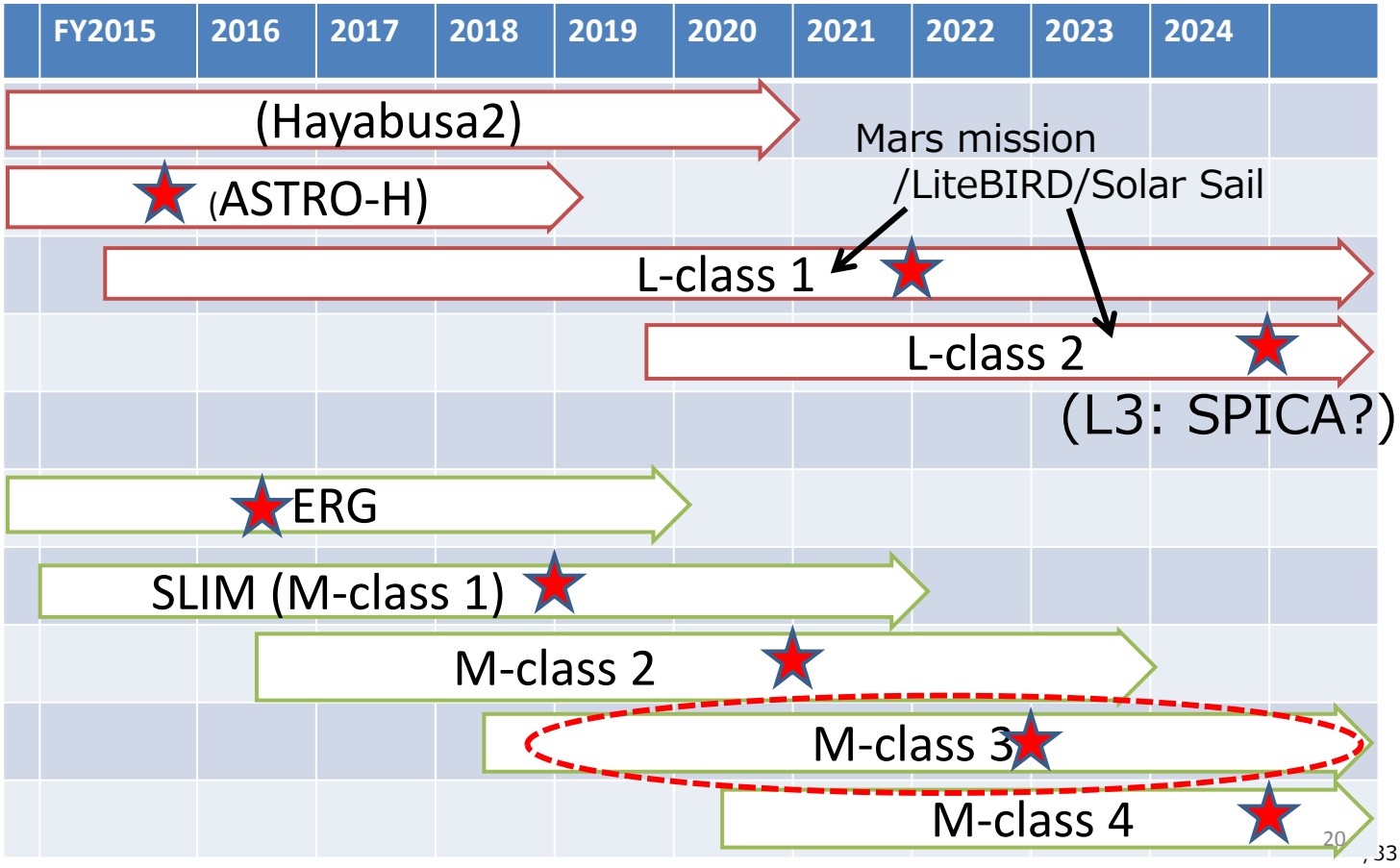
Athena

Basic timeline

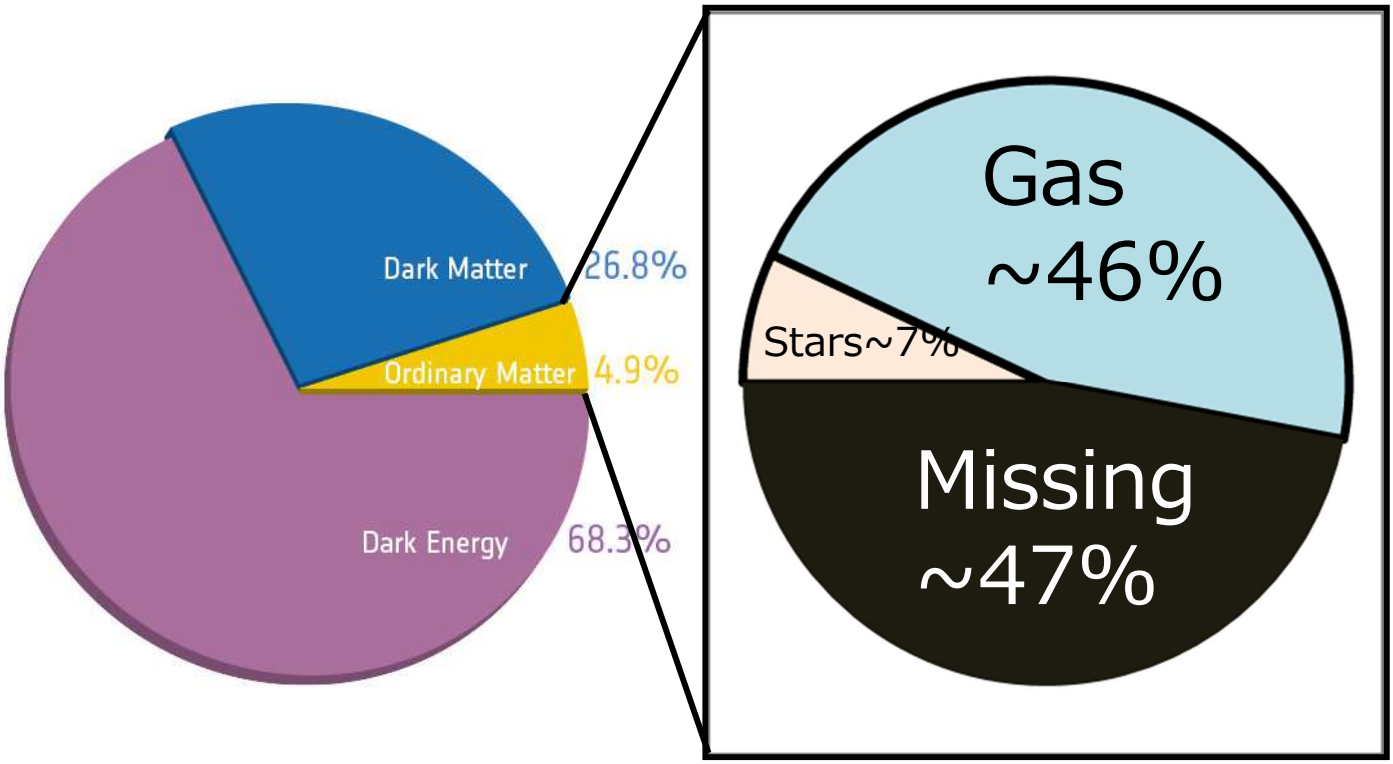
★ launch



Beyond AH and Athena

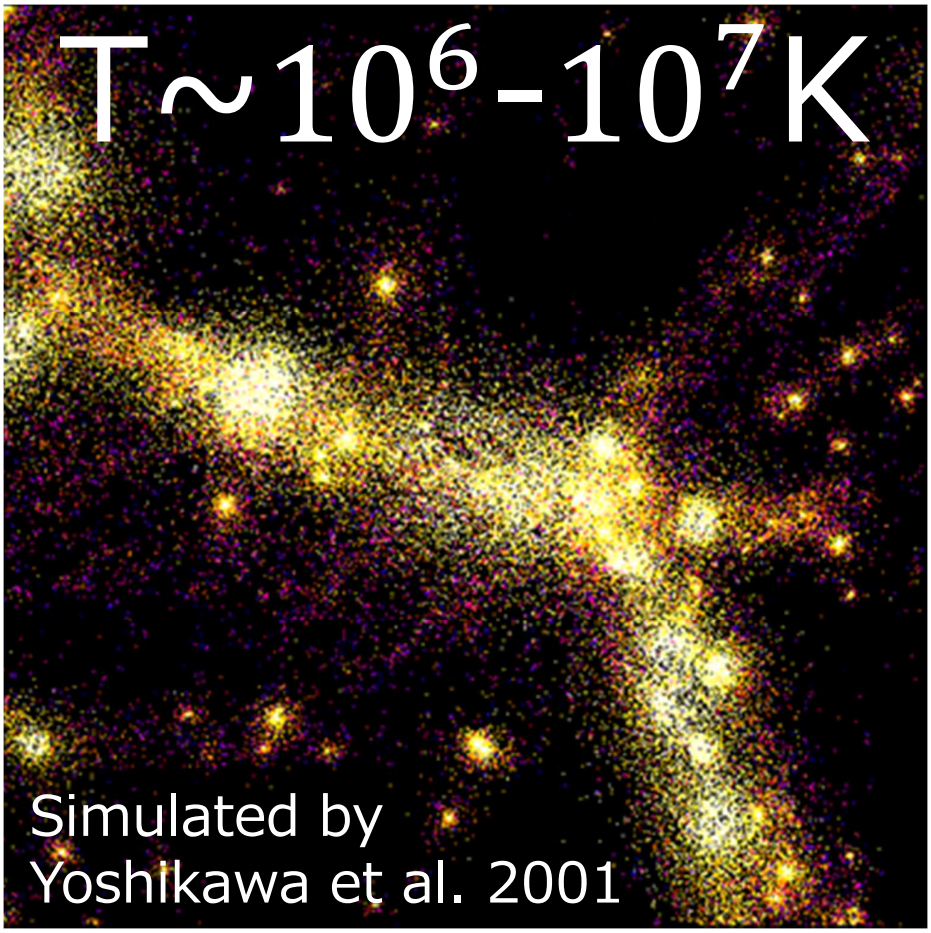
Dim & Diffuse X-rays

If Cosmology is correct

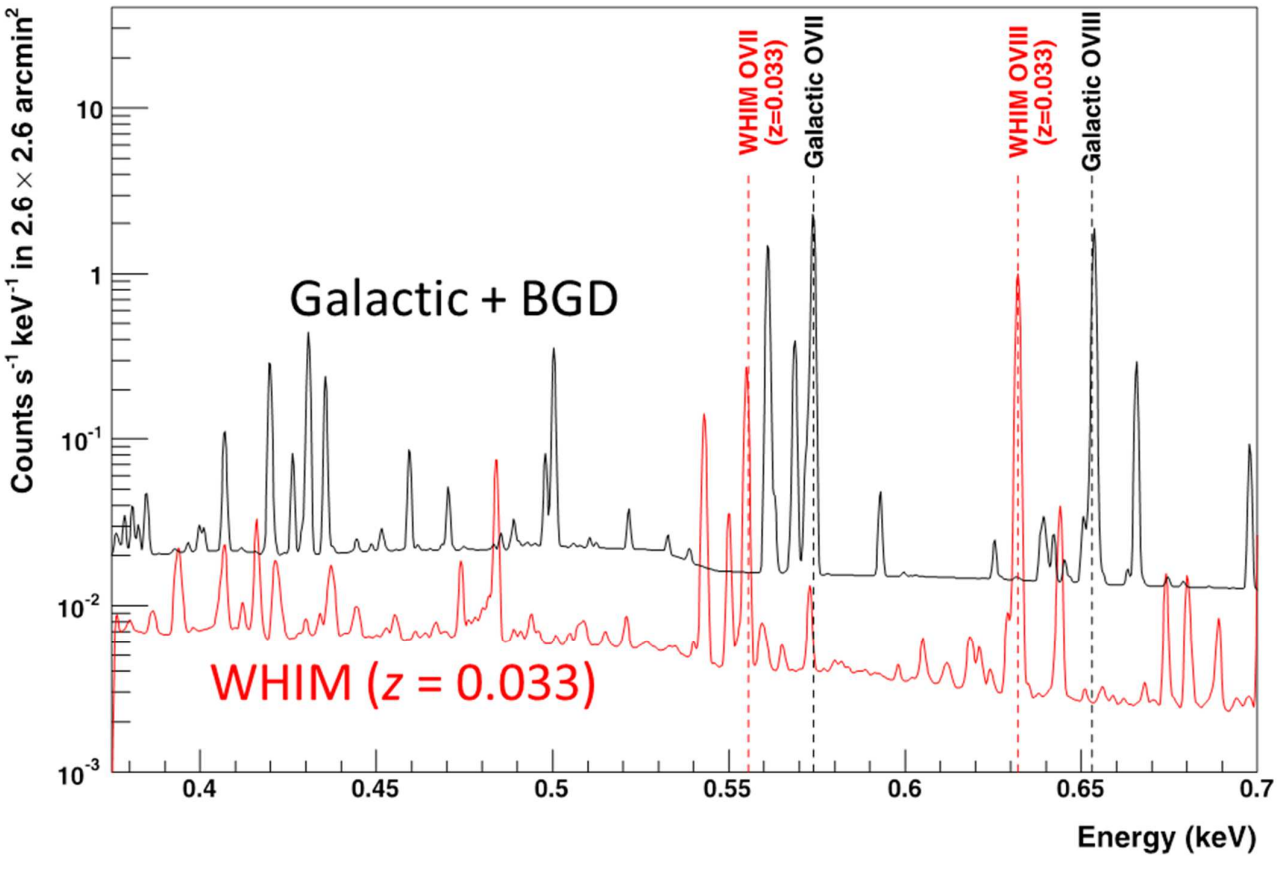


Where are missing baryons?

Warm Hot Intergalactic Medium (WHIM)



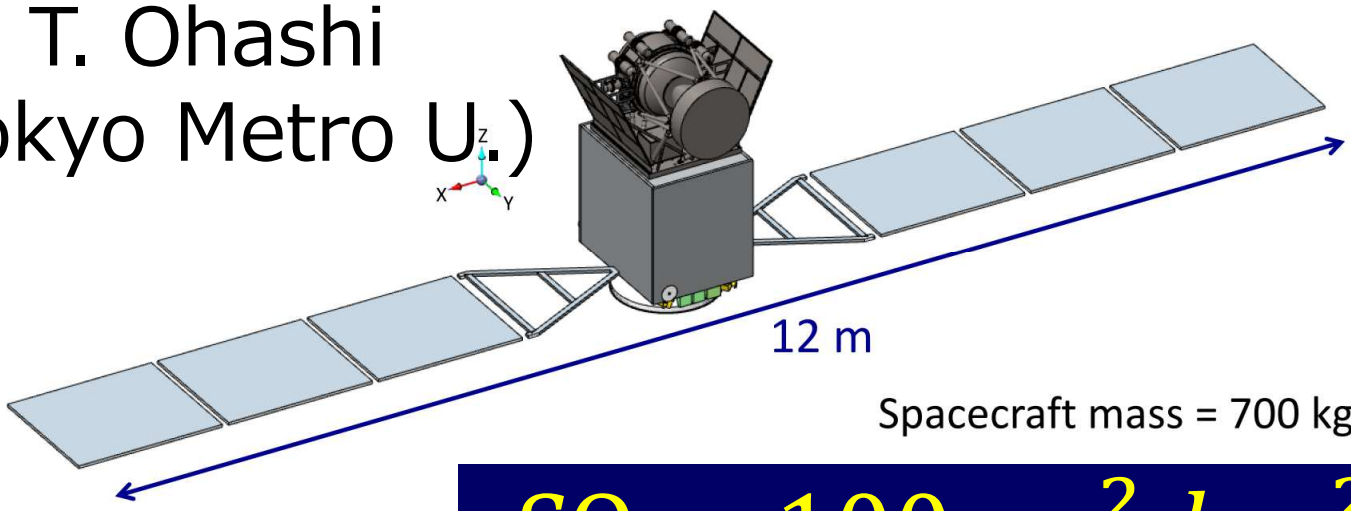
Characteristic X-rays from Oxygen



DIOS

--Diffuse Intergalactic Oxygen Surveyor --

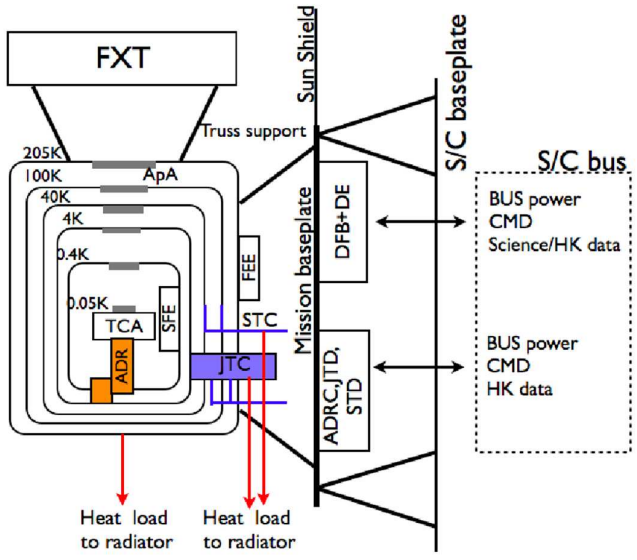
PI: T. Ohashi
(Tokyo Metro U.)

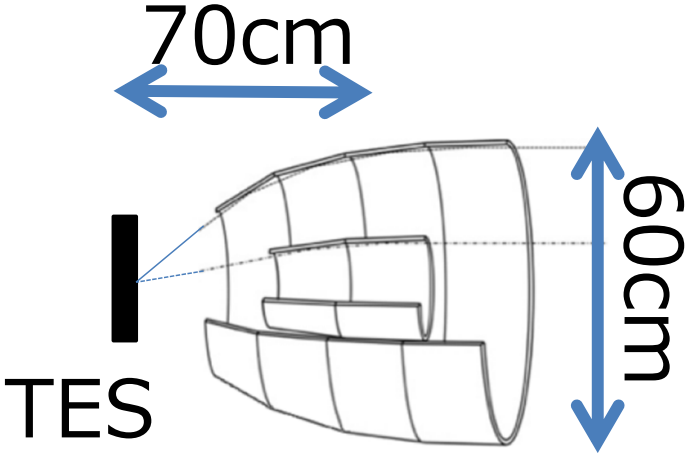


Spacecraft mass = 700 kg

$$S\Omega \sim 100 cm^2 deg^2$$
$$\Delta E < 5eV$$

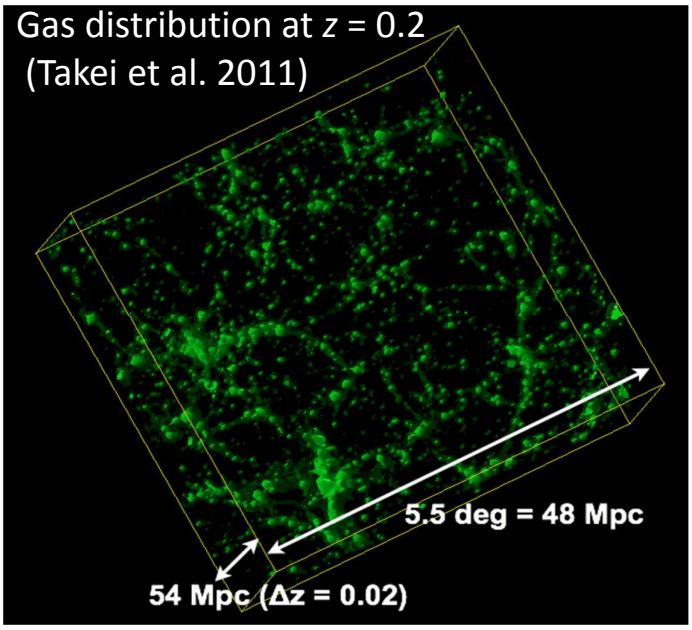
TES + 4 stage XRT

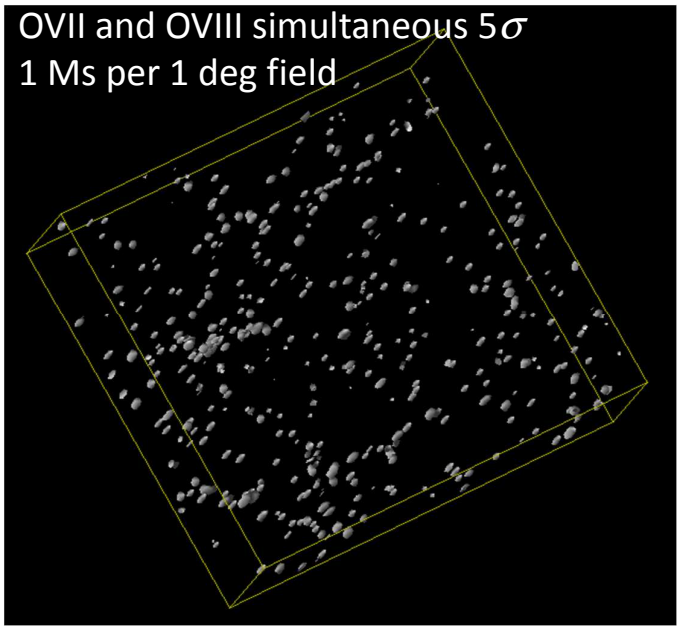




$$\Delta E < 5eV,\ E = 0.1 - 1.5\ \mathrm{keV}$$
$$FOV \sim 50',\ S\Omega \sim 100\mathrm{cm}^2\mathrm{deg}^2$$

Expected 3D map at $z = 0.2$



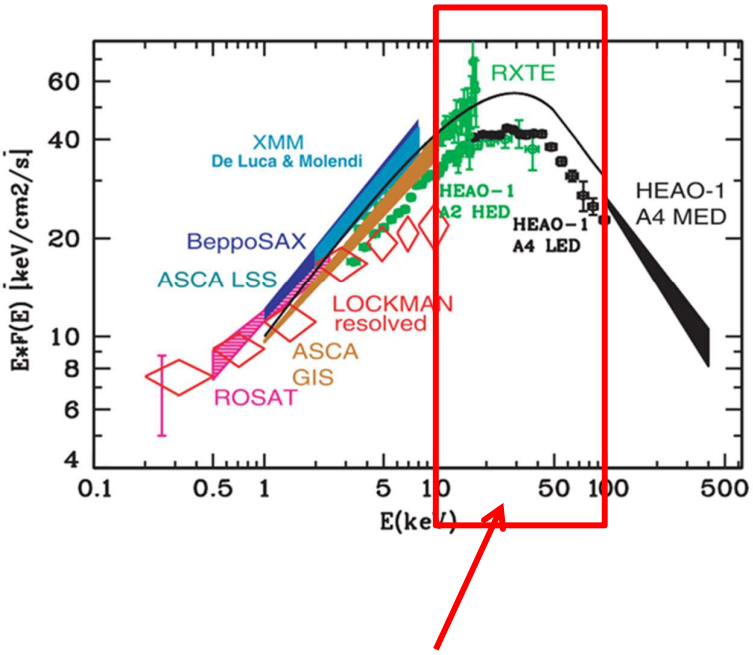


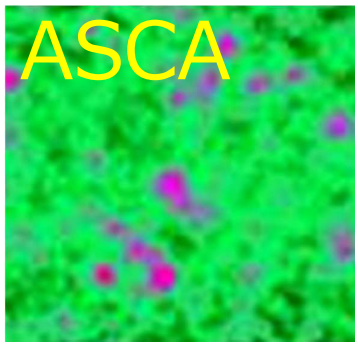
0.5 – 1 Msec pointing per position. About 30 points mapped.
DIOS can pick up filaments and faint galaxy groups.
Overdensity $\rho/\langle\rho\rangle$ ~ 30 is explored, revealing about 30% of baryons.

Beyond AH and Athena

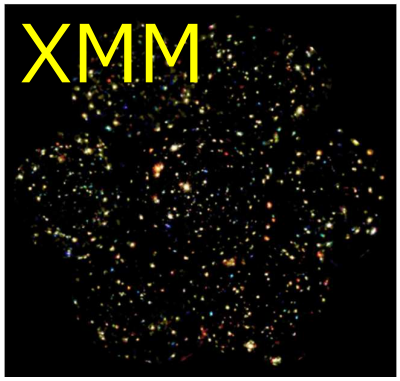
Hard X-ray Imaging

Resolve the peak of CXB!





NuSTAR
ASTRO-H

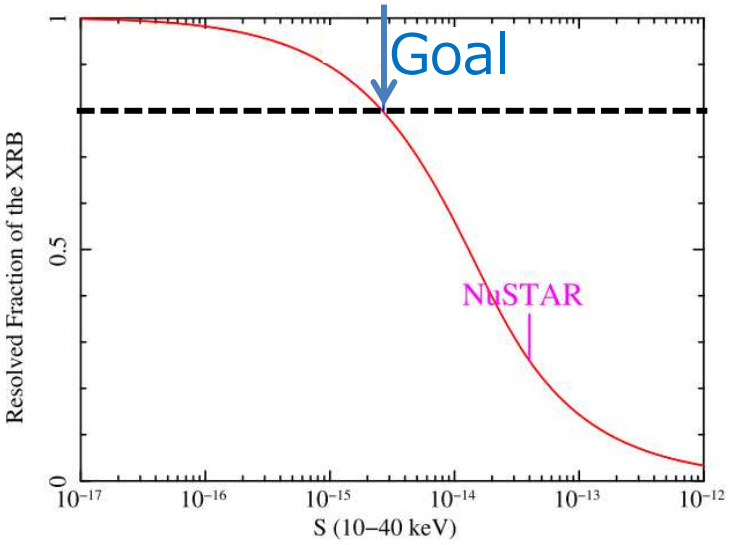


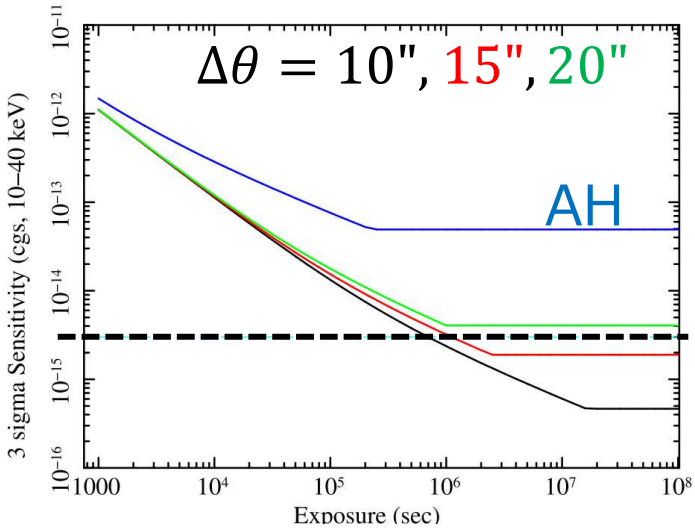
Goal!

Key to clarify the evolution of SMBHs.

Resolve 80% of CXB in 10-40 keV

$S = 3 \times 10^{-15}$





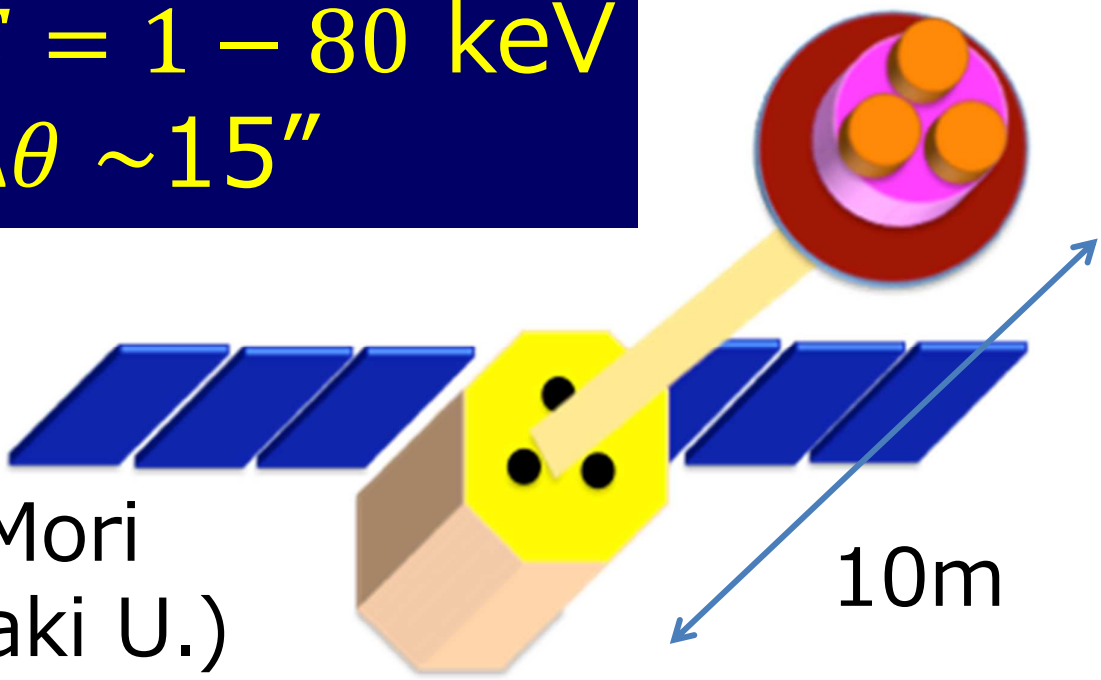
Based on a CXB model constructed below 10keV

$\Delta\theta < 15"$

NGHXT

Next Generation Hard X-ray Telescope

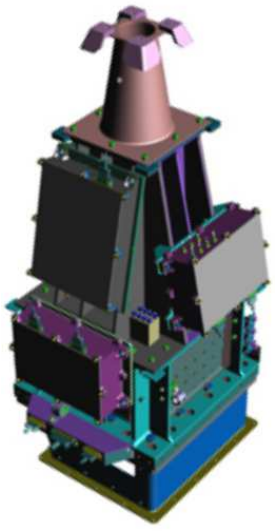
$E = 1 - 80$ keV
$\Delta\theta \sim 15''$

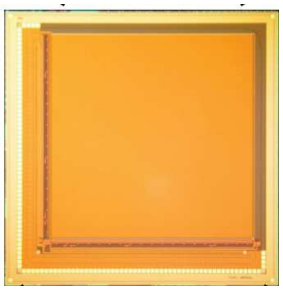


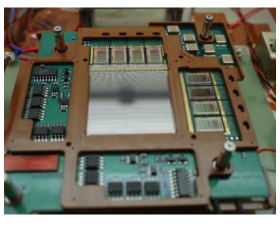
PI: K. Mori
(Miyazaki U.)

Detector

Active shield
+ Si SOI & CdTe



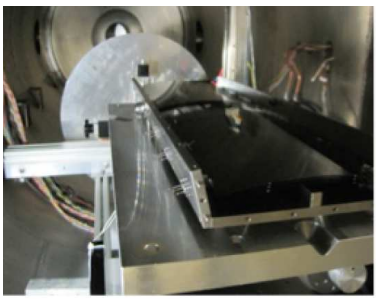


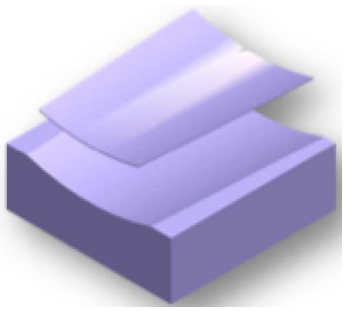


AH successor

Mirror

Glass or Si foils
etc.
+ multi-layer





Possible
collaboration with
NASA/GSFC

Summary

- Athena
- ASTRO-H
- M3 in 2022
  - DIOS, NGHXT