Probing the Hot and Energetic Universe:

X-rays and Astrophysics

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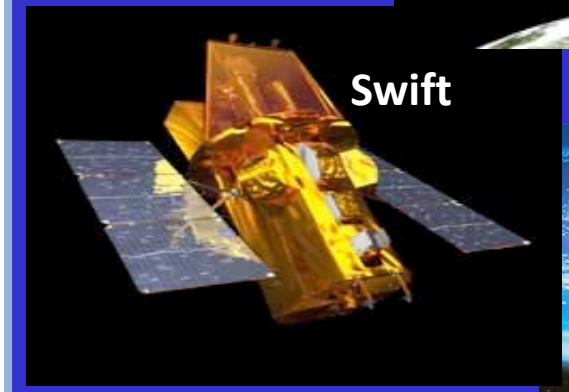
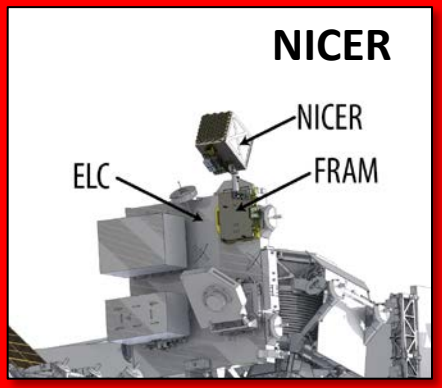
Smithsonian Astrophysical Observatory

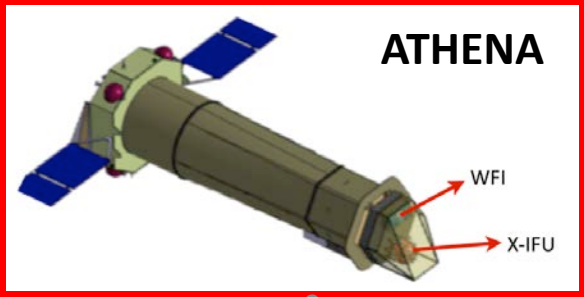
High Energy Missions

TODAY



THE FUTURE





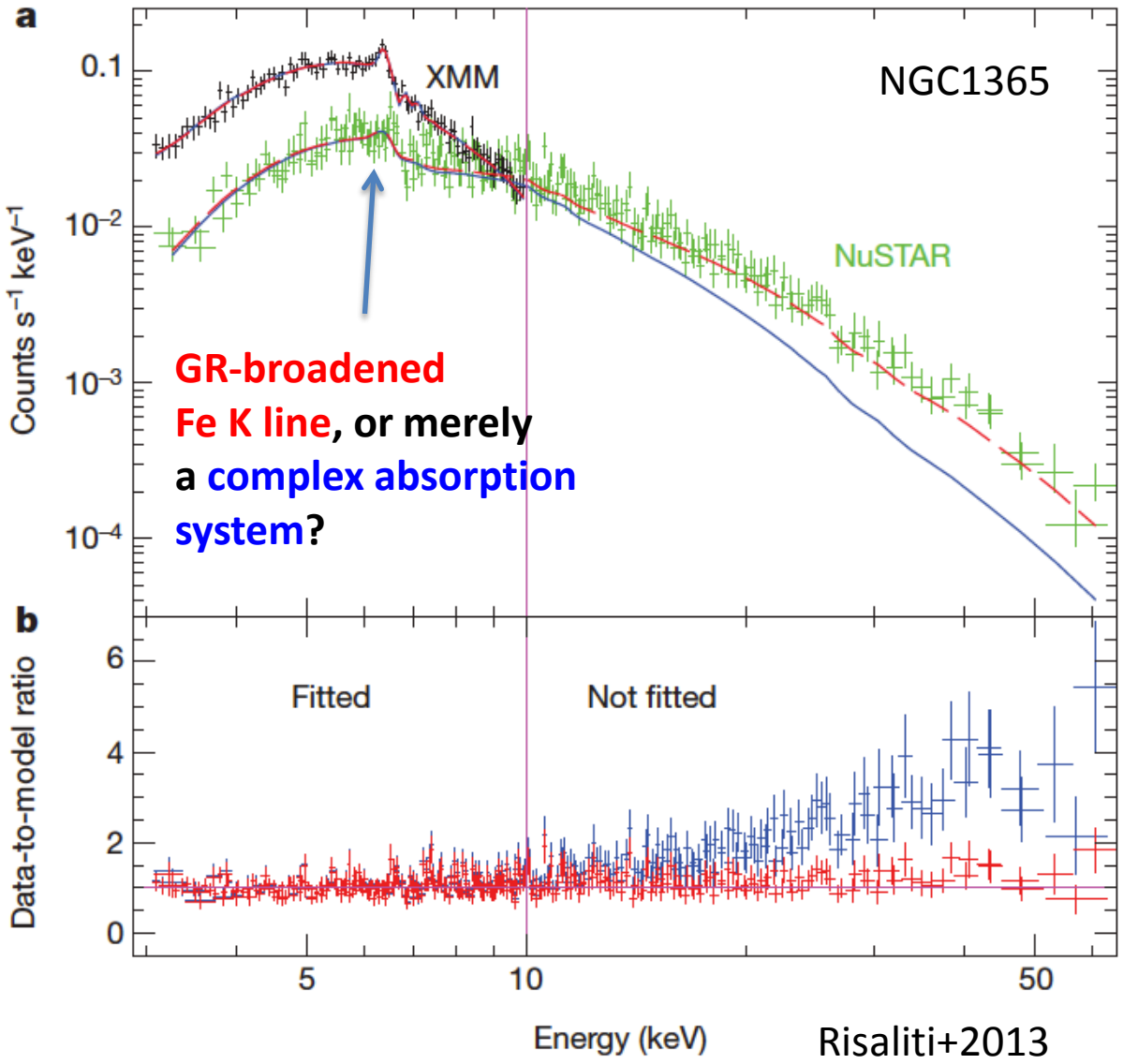
Proof of Dark Matter

The "Bullet Cluster"

Two galaxy clusters colliding in the plane of the sky.

The total mass shown in blue from gravitational lensing measurements combined with X-ray emission in red shows visually that the X-ray emitting plasma (containing most of the baryons) interacts differently than the bulk of the mass in this collision.

Measuring Black Hole Properties

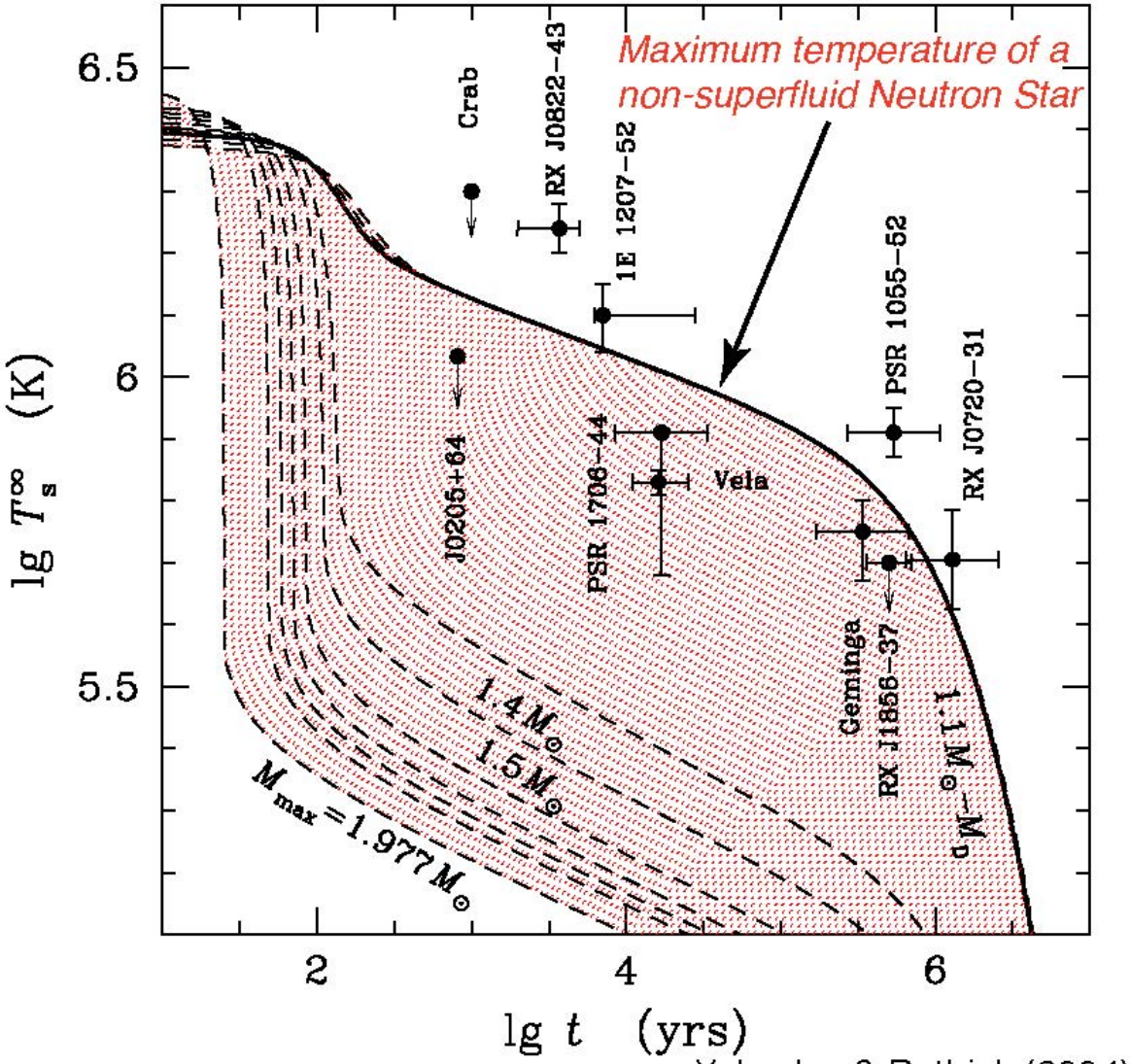


Risaliti+2013

After NuSTAR extended the bandpass, we know that this black hole is nearly maximally rotating.

Neutron Star Interiors

Theoretically predicted, X-ray observations show that NS interiors must be superfluid; with more data, the EOS itself can be measured.



Yakovlev & Pethick (2004)

ASTRO-H: Soft X-Ray Spectrometer

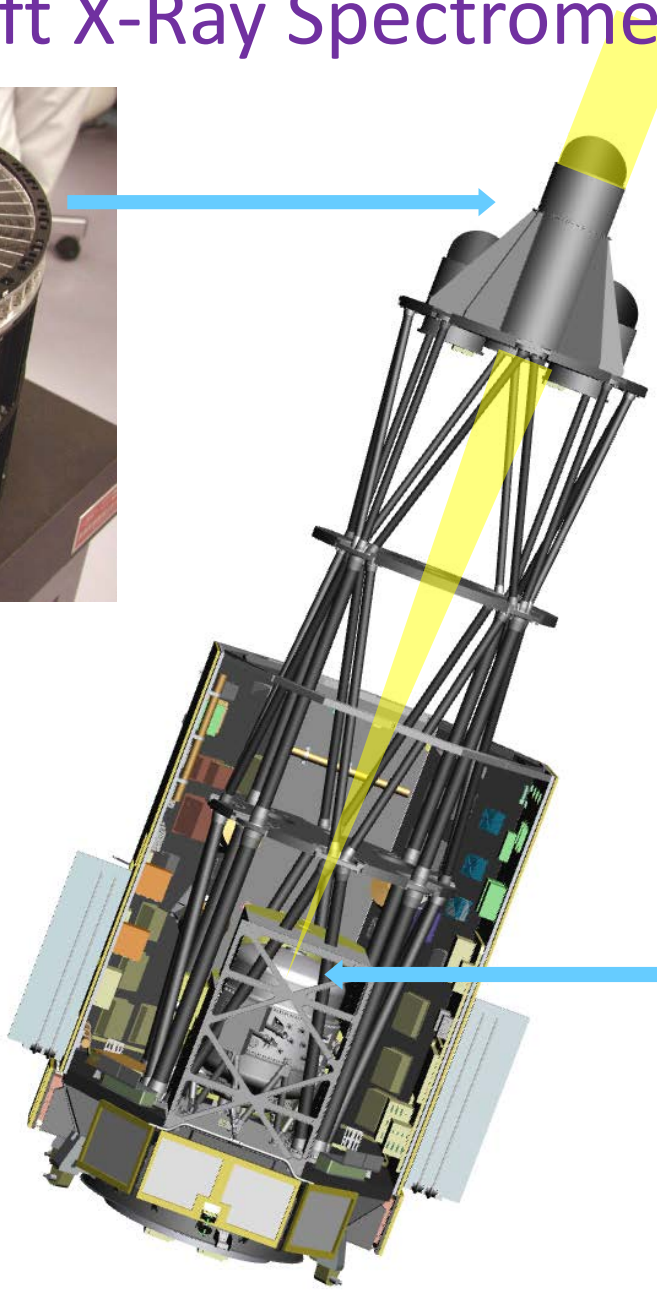
Soft X-Ray Telescope

5.6 m focal length

203 concentric shells (1624 individual reflectors)

Outer Diameter: 45 cm
Mass: CBE = 46 kg.

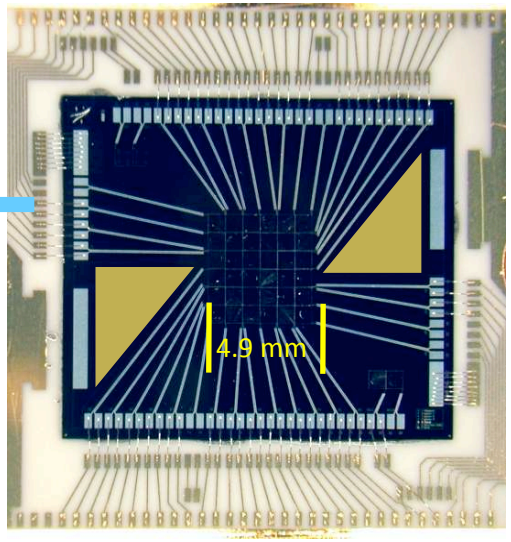
HPD ~1.2 arcmin



X-ray Calorimeter Spectrometer

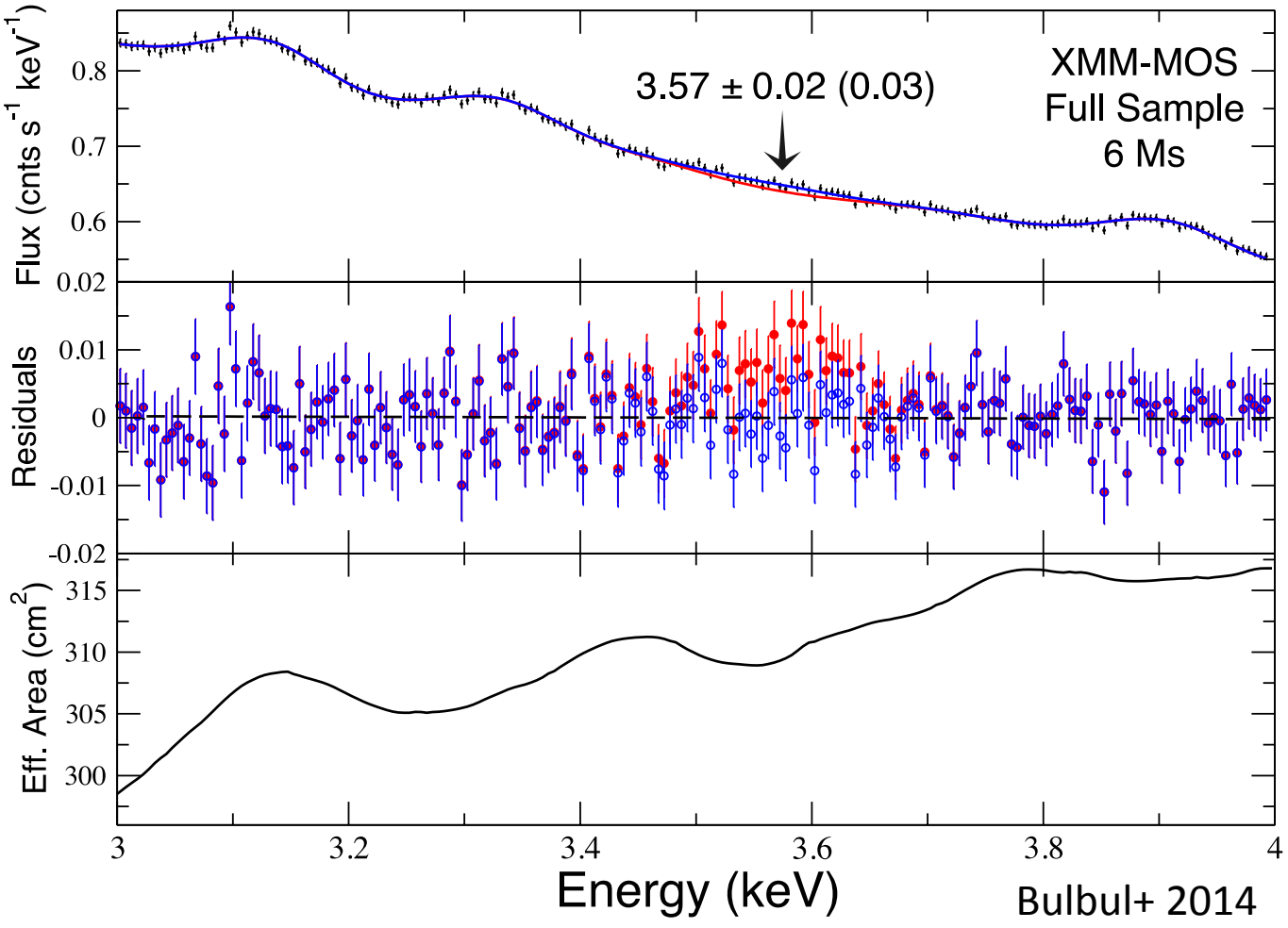
SXS – energy resolution better than 7 eV at system level

6 x 6 array of 30” x 30” pixels (3 arcmin field of view)



Recent Excitement

The "Detection of An Unidentified Emission Line in the Stacked X-ray spectrum of Galaxy Clusters" – possible signature of new physics?



Confirmation to come!

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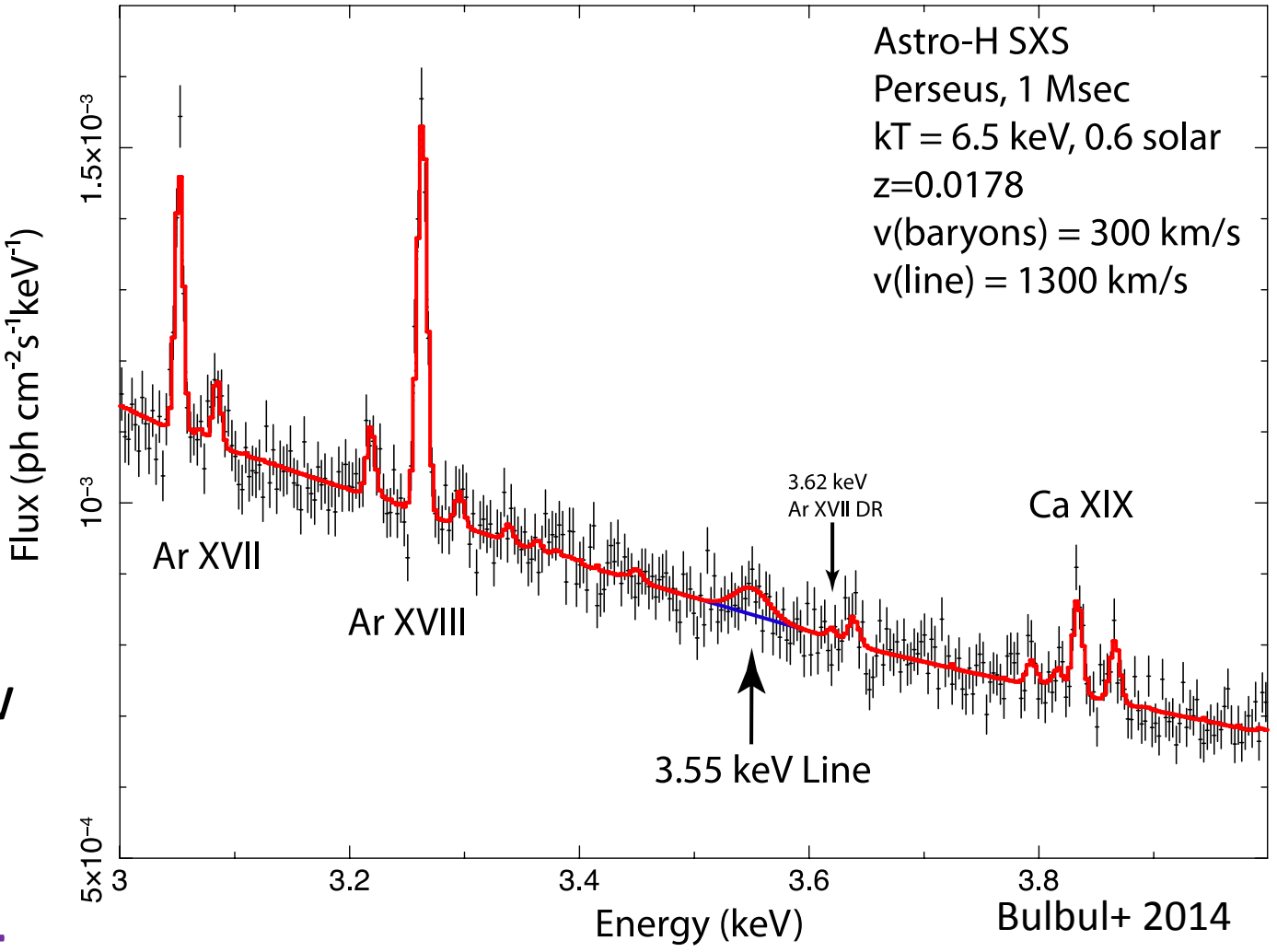
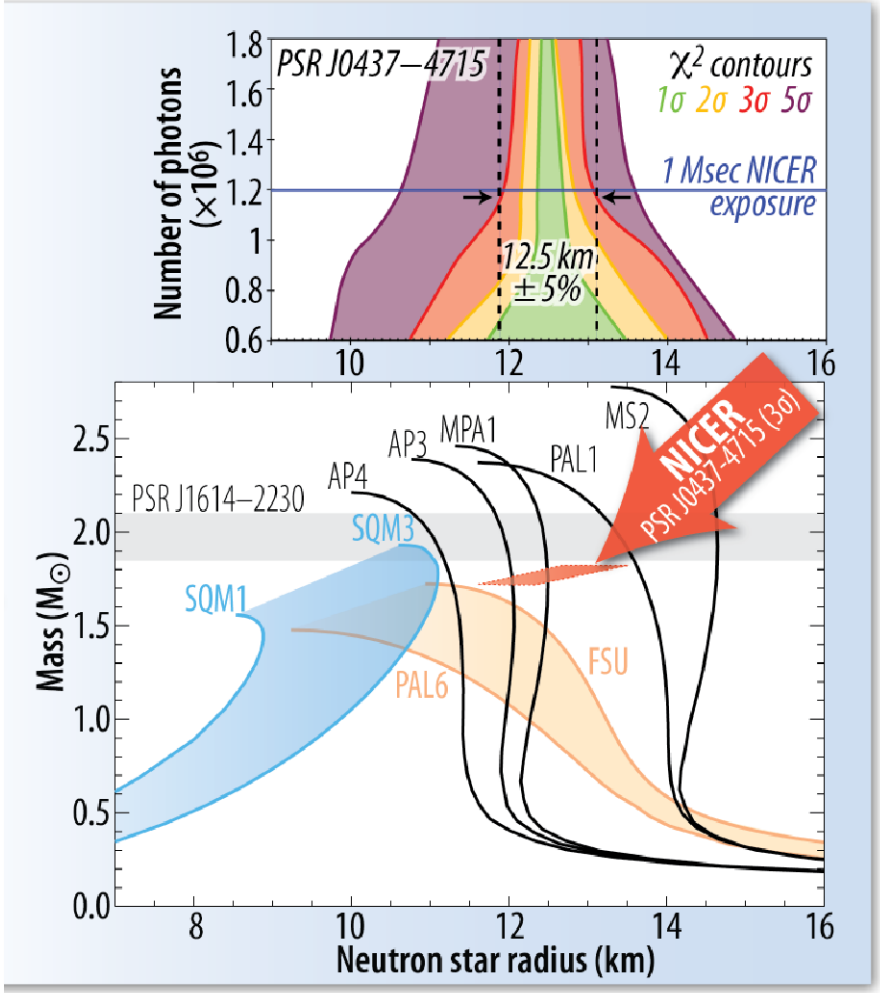


If so, we’ll see it with Astro-H

NICER: Neutron Star Interiors on the ISS

- Sufficiency of the collected data (e.g., 10^{5-6} photons for thermal lightcurves of MSPs) is demonstrated through a comprehensive set of simulations performed by the NICER science team using NICER responses !

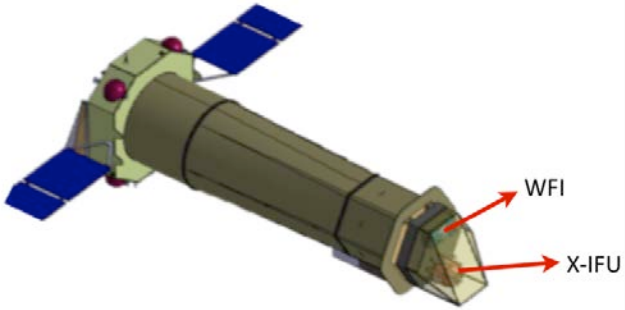


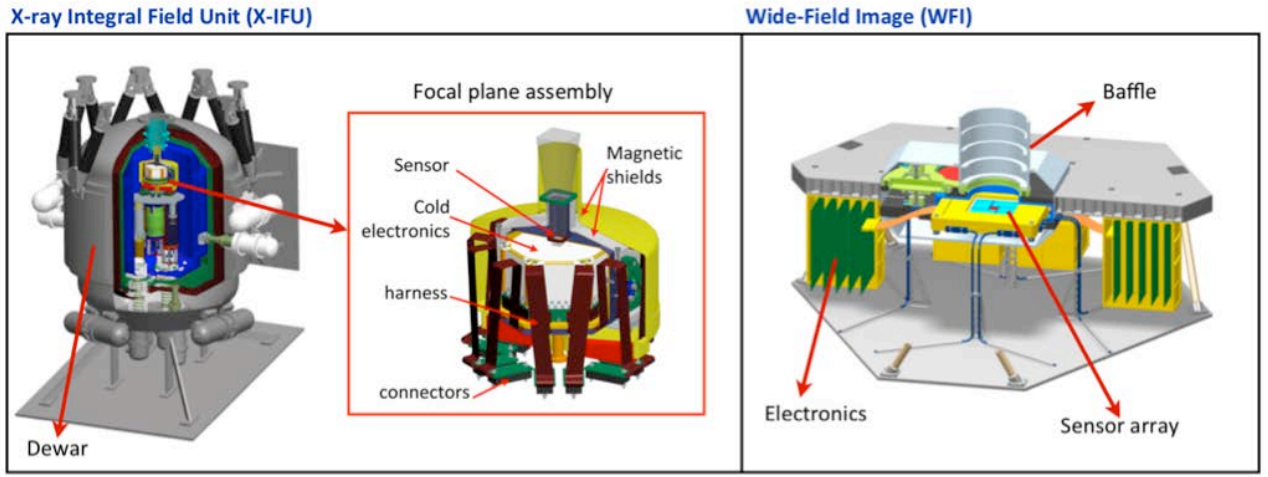
Simulations show the assumed radius is recovered to ±5% with ~10^6 photons

ATHENA

ESA's L2 Mission for 2028

Single telescope, 12m fl, using ESA Silicon Pore Optics, 5" resolution





X-IFU (X-ray Integral Field Unit)

TES calorimeter
Cooled to 50 mK

High spectral resolution spatially resolved spectroscopy, limited FoV

WFI (Wide Field Imager)

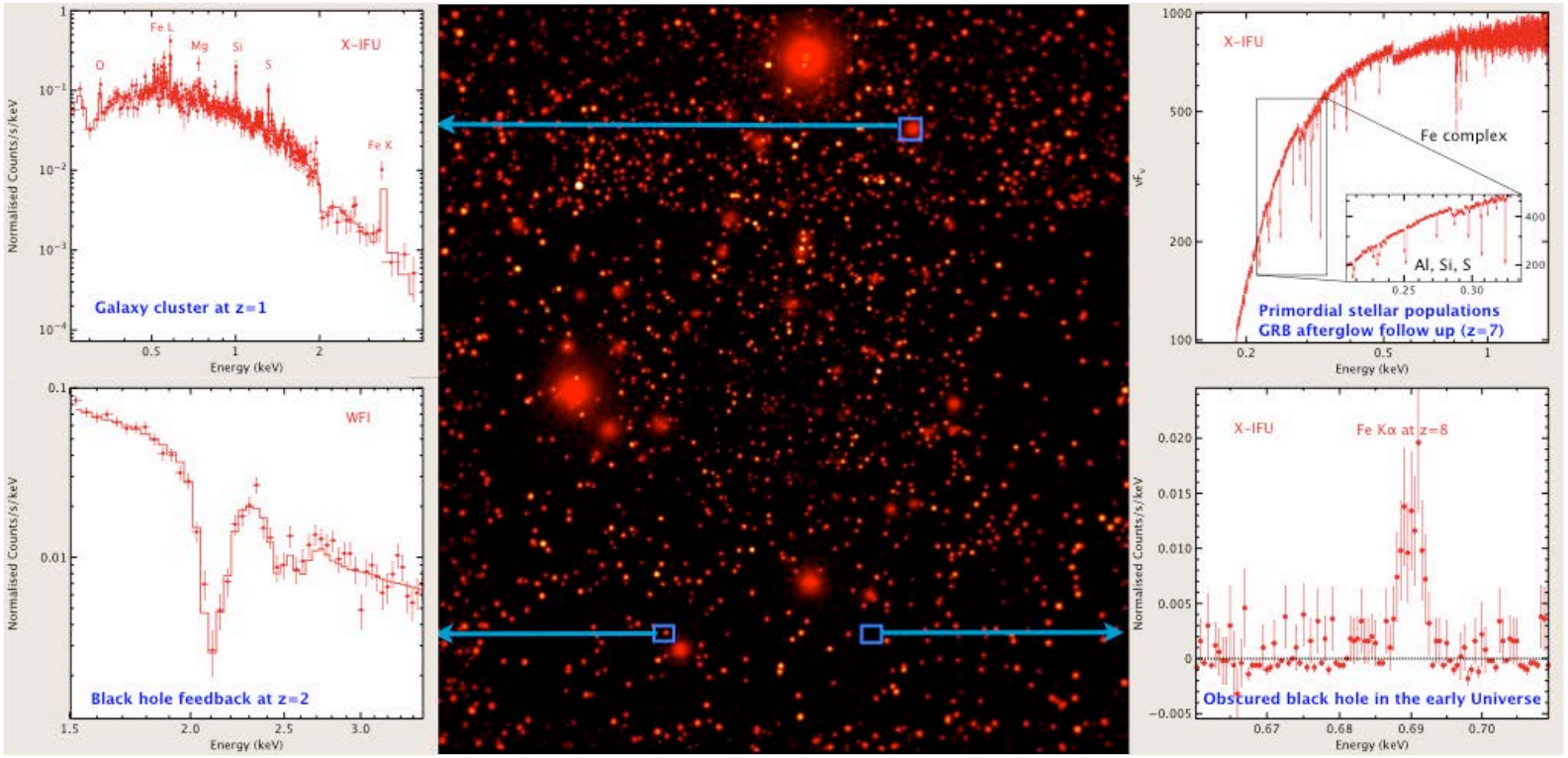
Si-based DEPFET

Low spectral resolution, spatially resolved spectroscopy on wide FoV and high count-rate capability

ATHENA Observations in a nutshell

Cluster at z=1

GRB afterglow at z=7



QSO feedback z=2

Early AGN at z=9

Future XR-SIG Activities

- Small, informal planning meeting will be held at the Boston AAS (June) as a prelude/planning to the HEAD meeting.
- Full **XRSIG meeting at the HEAD meeting** (Chicago, August 17 -21). status recent technology developments; identify technology gaps, and have an open discussion of strategies for future X-ray missions given the ATHENA selection.
- Provide HQ with inputs, if requested, in terms of community views of NASA progress in fulfilling the 2010 Decadal objectives as part of the mid-decadal review process.
- SIG Co-Chair Contact Information:

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  mwb@space.mit.edu – Mark Bautz
- SIG Website

  http://pcos.gsfc.nasa.gov/sigs/xrsig.php