

X-ray Astronomy: Current Status and Future Plans

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Recent Results from Current Missions

Chandra



Direct detection of cluster feedback

XMM-Newton



Detection of intermediate mass black hole

Suzaku



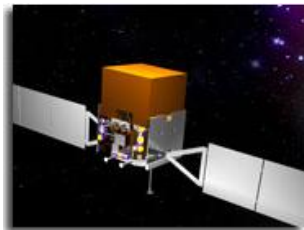
First view of infalling gas into of galaxy clusters

Swift



Discovered origin of 'short-hard' gamma-ray bursts.

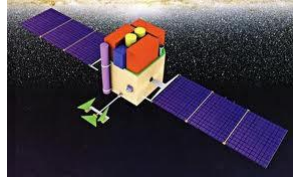
Fermi



Discovery of gamma-ray pulsars

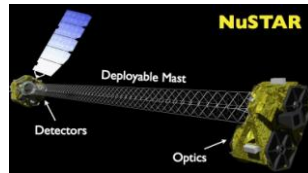
Approved Future Missions

ASTROSAT



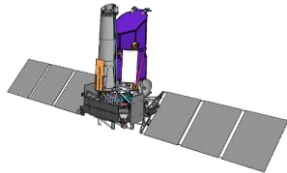
Large-area PC; soft XT, CZT coded mask; SSM; Launch in 2011

NuSTAR



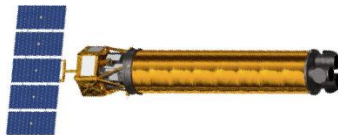
Imaging hard X-ray satellite; Launch in 2012

SXG/eROSITA



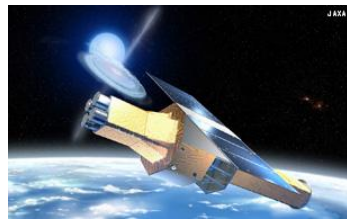
All-sky survey with CCDs; Launch in 2013

GEMS



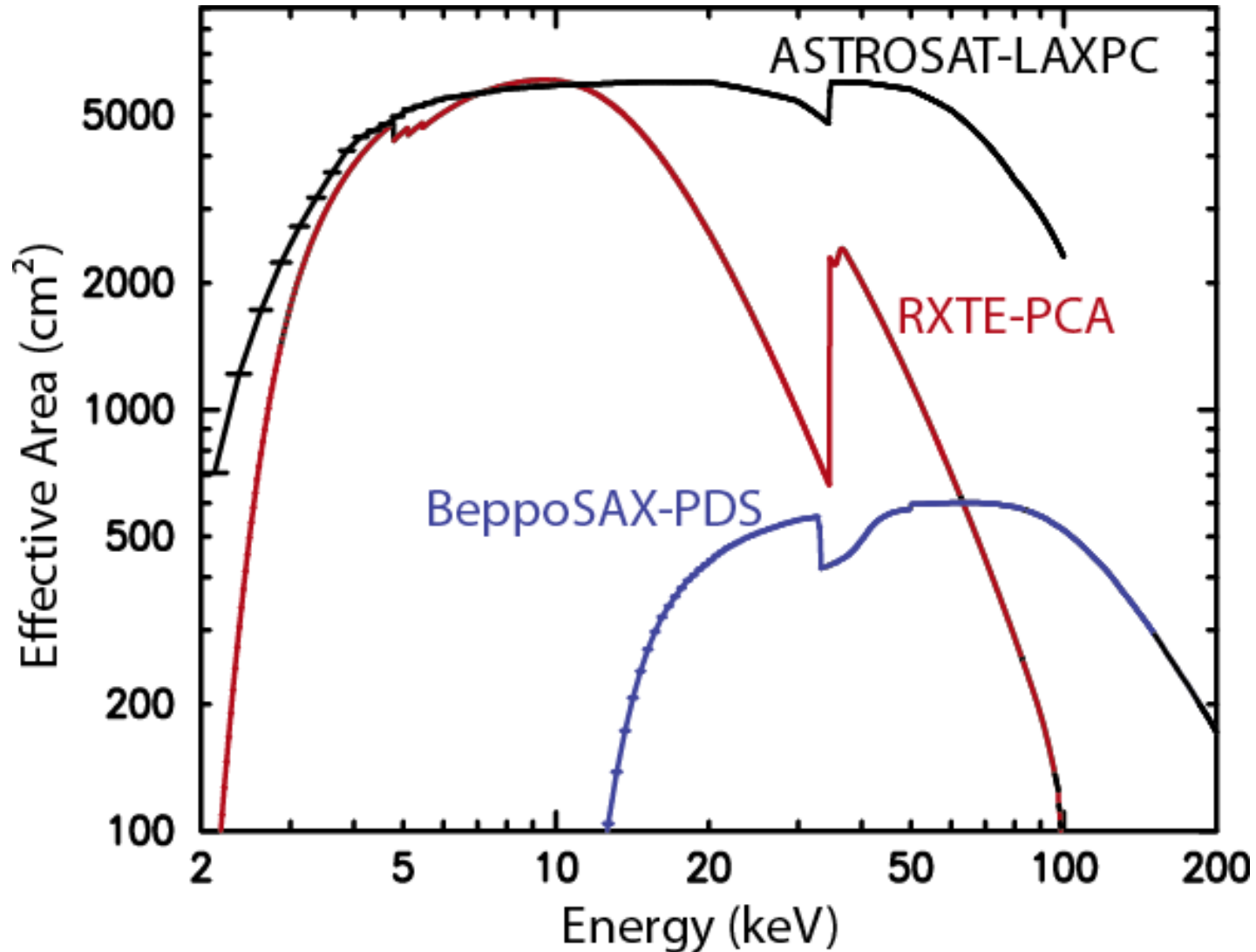
Efficient X-ray polarimetry; Launch in 2013

Astro-H

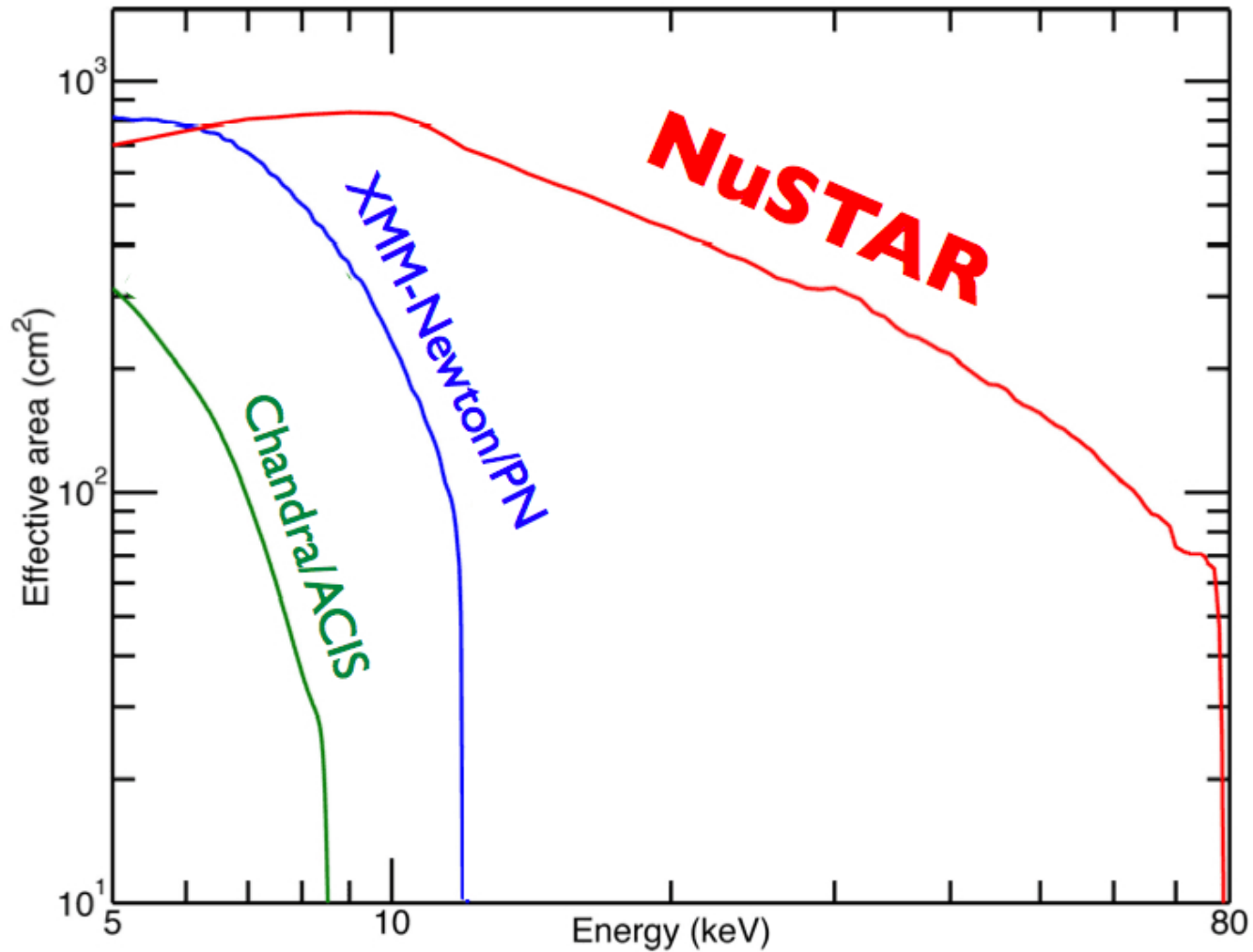


High-res. non-dispersive spectroscopy; HXT; Launch in 2014

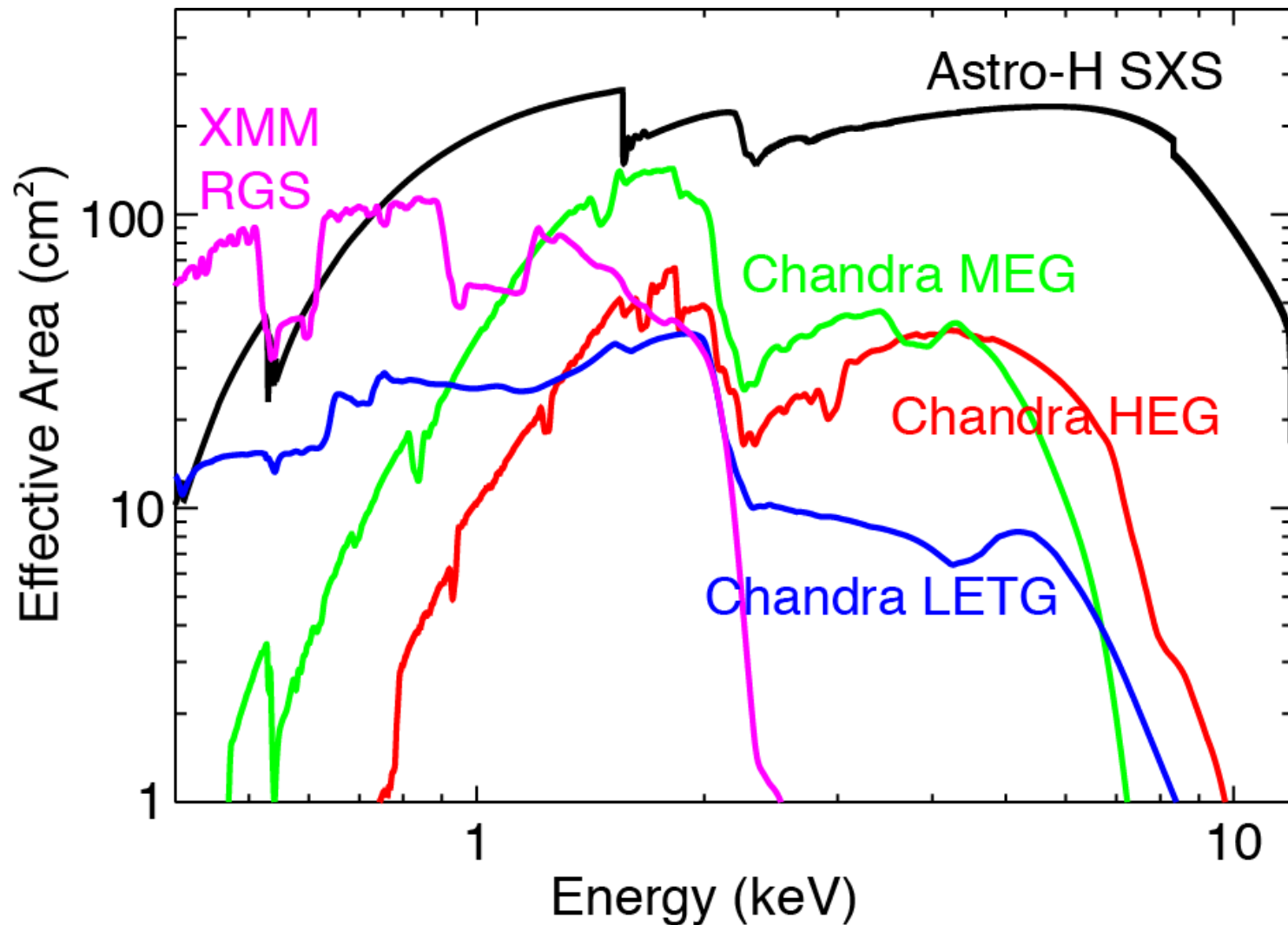
Effective Area for Hard X-ray Timing



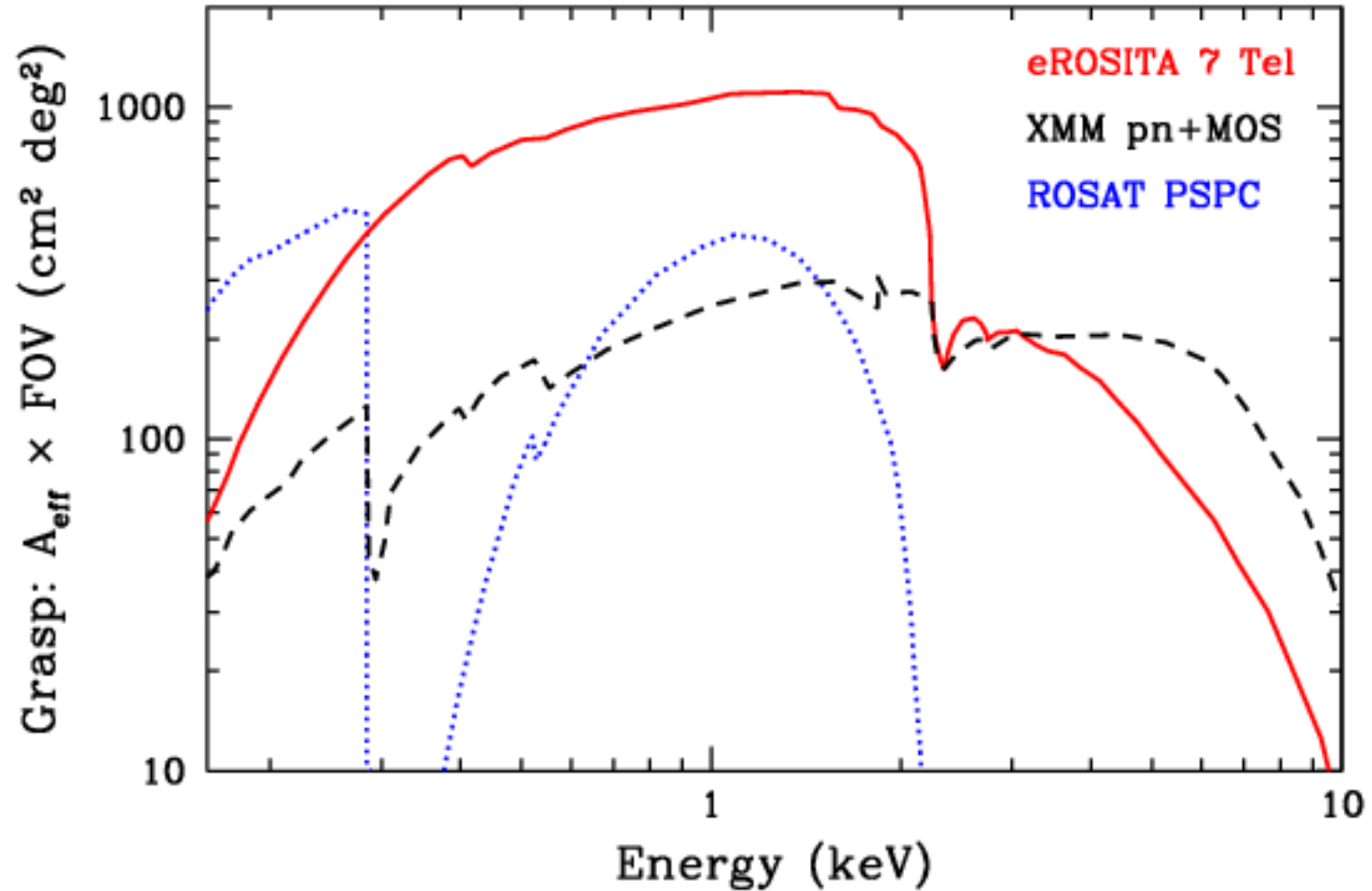
Effective Area for Imaging Hard X-rays



Effective Area for High-Resolution Spectroscopy



Grasp for Large Area Surveys



Future Science Arenas I

- High Spectral Resolution
 - Enables:
 - Probes of AGN feedback mechanisms / regulation of galaxy growth
 - Studies of metal formation/evolution over cosmic time
 - Probes of cosmology (DE and DM) via cluster evolution studies
 - Finding the ‘missing’ baryons
 - Requires:
 - Large effective areas with:
 - Transition Edge Sensor Microcalorimeters
 - Off-Plane *or* Critical Angle Transmission Gratings

Future Science Arenas II

- Very High Spatial Resolution
 - Enables:
 - Probes of the high-z universe – e.g., black hole evolution, constraints on accretion luminosity of the universe.
 - Surveys of SNR, XRB populations in galaxies
 - Probes/identification of obscured AGN
 - Trace the evolution of structure, black holes, and galaxies and the elements they produce
 - Probe the behavior of matter in extreme environments
 - Requires:
 - Piezoelectric-Adjusted Thin Mirrors

Future Science Arenas III

- High Timing Resolution

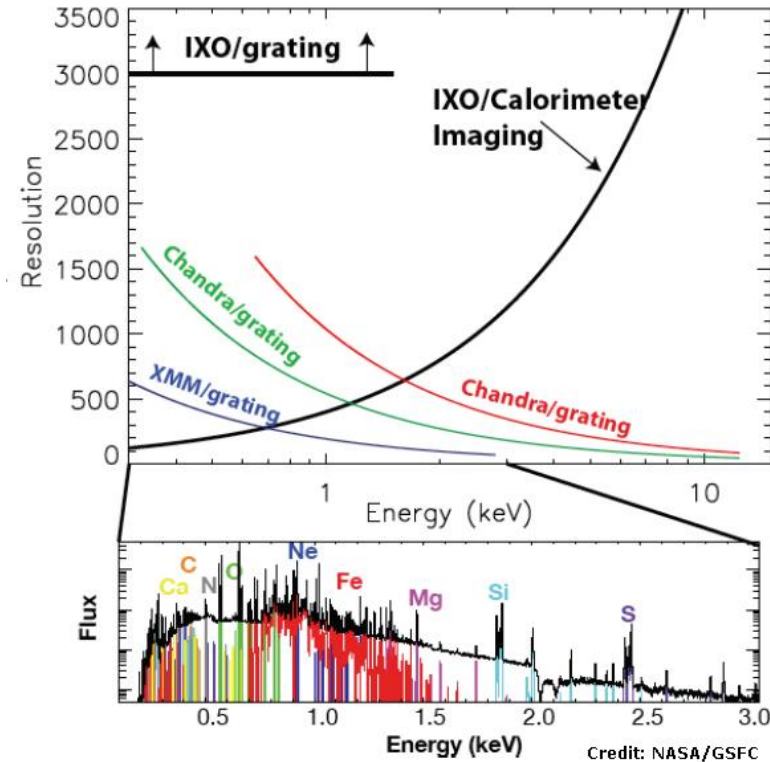
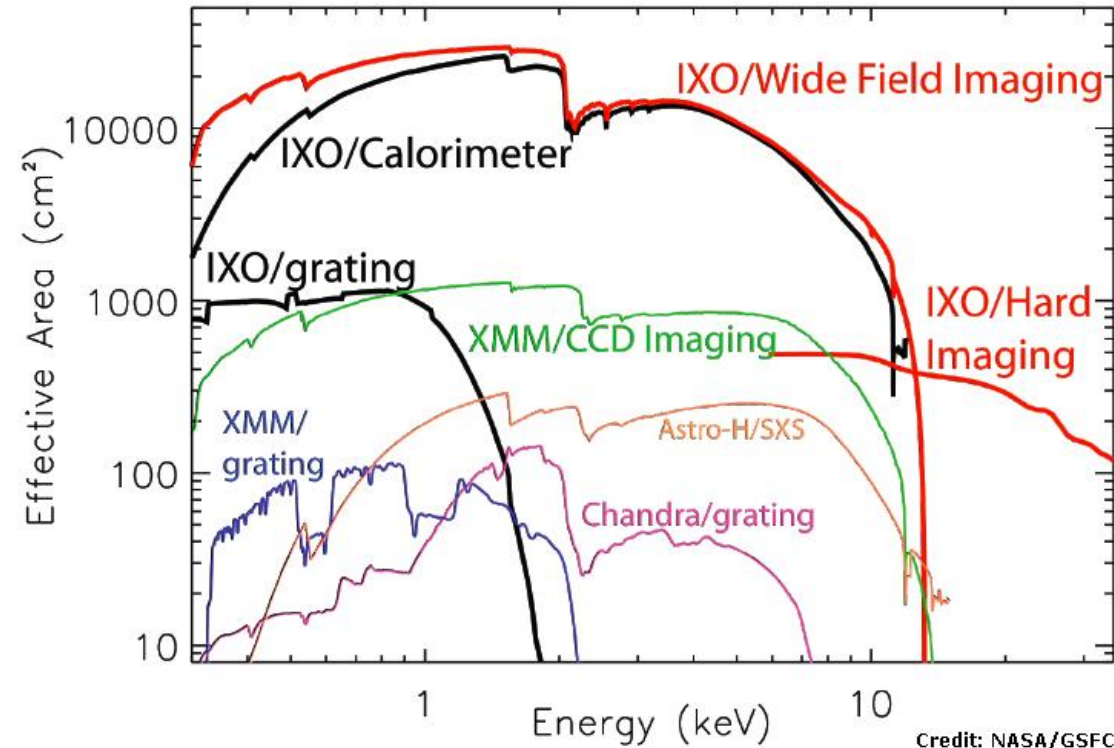
- Enables:

- Probes of physics of ultra-dense matter via studies of neutron star surfaces
 - Probes of accretion over all mass scales
 - Probes of strongly curved spacetime through studies of black hole event horizons
 - Probes of intense magnetic fields

- Requires:

- Large effective areas with
 - Active Pixel Sensors
 - Silicon Drift Diodes

IXO Capabilities



- Recommended in NWNH, but not 1st priority
- ESA deferring L-Class selection; lower-cost options (e.g. Athena) being investigated.

Summary and Status

- The current picture for X-ray astronomy is good. Powerful tools are in place, breaking new ground and complementing telescopes at other wavelengths
- Near-term advances in key areas are on the horizon with hard X-ray imaging, high-resolution spectroscopy, polarimetry, and surveys
- The future is less certain, particularly for large missions. Clear definition of science needs, and creative plans for meeting goals with missions of different scales, are crucial for establishing the required science and technology roadmap.