Science Summary: WFXT Reviewed by CST and Support Team

Overview/General Notes:

WFXT is a $800M survey mission in a high-earth orbit, combining a wide (1 sq deg) field of view with a uniform 5 arcsec PSF and a large (0.7m^2 @ 1 keV, 0.2m^2 @ 4 keV) effective area. It will use large-format silicon detectors with moderate energy resolution, similar to existing X-ray CCDs. Technical challenges include manufacturing the individual mirror shells to the required figure and surface smoothness. The five-year nominal mission includes three years of survey that will cover both narrow, deep (100 deg^2, 400 ksec) and broad, shallow (3000 deg^2, 13 ksec) fields. The remaining two years will be used for guest observations. WFXT has scientific heritage and strategy from ROSAT and eROSITA. The key survey metric (FOVxEA/PSF^2) is 1-2 orders of magnitude larger than Chandra, its nearest competitor for surveys.

1) What happens close to a Black Hole?

Concept	*Measurement*
Stellar tidal disruption events may show strong gravity effects (speculative)	*Detect and study tidal disruption events*

While not explicitly mentioned in the RFI response, the authors do mention time-domain studies of AGN that will uncover rare events – *e.g.* stellar tidal disruptions, absorption variation events, and accretion disk instabilities. It is possible that GR models will have an impact on some of these, especially events such as stellar tidal disruptions. However, this is speculative, and it is unclear how studying such phenomena relate to the IXO science objective of testing GR in the strong field limit.

2) When and how did super massive Black Holes grow?

Concept	*Measurement*
Distribution of spins determines whether black holes grow primarily via accretion or mergers.	*Measure the spin in (small number of?) supermassive black holes from broad Fe K line, CCD resolution*

Concept	*Measurement*
Number counts and spectra at moderate to high z can probe growth of SMBH	*Surveys will detect numerous AGN from 1<z<2, and some at z=6, many with good CCD spectra*

The WFXT surveys will discover 5x10^6 AGN, 1/10th of these with good spectra, including 10^4 heavily obscured AGN and hundreds of Compton-thick AGN at z>1. Depending on the evolution model assumed, WFXT will find 10^3-10^4 AGN at z>6. This survey will define the luminosity function as a function of redshift. This will assist in addressing 'when' AGN grew both as a function of cosmic time and as a function of AGN type; it is not clear if this information will also address 'how' the AGN grew. The CCD resolution will measure redshifts directly for sources with good spectra. For a small fraction of these (exact numbers unknown), the spin of the AGN could be measured via the broad Fe K line, and masses measured via reverberation methods or estimated using correlations with the X-ray spectrum.

3) How does large-scale structure evolve?

Concept	*Measurement*
Detect the growth of cosmic structure and the evolution of the elements	*Measure the mass and composition of a survey of clusters of galaxies at redshift < 2*

The WFXT surveys will find $2\text{x}10^5$ clusters out to z~2, with good mass measurements (via spectroscopic proxies after removing cluster cores) for 5000 clusters, including ~2000 at z>1. Redshifts will be measured from the Fe Lyα line. This dataset will provide strong constraints on both standard and non-standard cosmologies, such as distinguishing between LCDM and DGP cosmologies. WFXT will not measure WHIM filaments in emission or absorption, however.

4) What is the connection between supermassive black hole formation and evolution of large-scale structure (i.e., cosmic feedback)?

Concept	*Measurement*
Resolve cluster bubbles and cavities and AGN jets where energy from AGN is deposited	*Map the metallicity and temperature of hot gas in galaxies and clusters, but not turbulence (CCD resolution)*

The WFXT survey of clusters out to z~1 and beyond will reveal hundreds of clusters with sufficient counts to make entropy, temperature, and metallicity maps that will show how entropy was injected and metals were distributed into the ICM as a function of redshift. The spectral resolution will be similar to existing data; the key advance is in measurements of many clusters at a range of redshifts. Combining these results with the AGN survey will help show how the emergence of clusters connects to era of peak star formation. WFXT will not be able to measure turbulence or velocities in individual cluster cavities to show how individual AGN connect to their host clusters.

5) How does matter behave at very high density?

It does not appear that WFXT can address this science.