Questions for AXTAR:

Can AXTAR address "What happens close to a black hole" using Fe-L line measurements?

(*We are answering the question assuming the Fe-K line is what was intended*)
The iron line is an important diagnostic of the structure of the accretion disk around a black hole. One technique is to study the shape of the iron line and compare it to models of the expected reflection spectrum from the inner accretion disk, which under certain assumptions can produce a measurement of the spin of the black hole. With twice the spectral resolution of RXTE, AXTAR can make some progress using that approach. And, with some investment in silicon drift detector technology, an additional factor of two in spectral resolution is available (<300 eV FWHM).

We remind the panel that the proposed strength of AXTAR is the ability to combine any spin inferences from Fe line measurements with simultaneous results from HFQPOs and continuum fitting, using many observations of black hole binaries, to build a coherent and robust program to probe strong gravity via BH spin. It is only through a combination of methods that the degeneracy between system parameters (mass and spin) and alternative theories of gravity can be broken (see Johannsen & Psaltis 2011, ApJ, 726,11).

In addition, with its large area, AXTAR can also use the iron line in other ways by doing fast spectral-timing. This may include detection of disk precession due to relativistic frame dragging using Fe line variations in low frequency BH QPOs (work of Ingram and Done 2010, 2011). In this model, the Fe line should have phase lag of 90° w.r.t QPO continuum — a prediction that is testable with AXTAR. In addition, reverberation mapping in Galactic BH systems can potentially provide a mass-independent constraints on the inner radius for the disk.

Given the MSFC ACO detailed studies, what is to be gained by a GSFC MDL run?

The MSFC study was based on the RXTE-style collimator design. We are now becoming confident that the micromachined tantalum collimator will be the preferred option. This greatly reduces the instrument mass (by a factor of 5) and volume, requiring a re-design of the spacecraft and should produce a lighter and less expensive mission. This significant change in mass necessitates an updated spacecraft study, which can also incorporate a high fidelity instrument design that we are working on. An independent cost analysis would also be a benefit of an MDL run.