A MIDEX Mission to Spectrally Analyse the Diffuse X-ray and Ultraviolet Background

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University of Wisconsin - Madison | Maryland Space Grant Consortium | ... from all across America

ABSTRACT

BEST (Baryonic Extragalactic Structure Tracer) is a proposed Medium-class Explorer (MIDEX) that is focused on mapping diffuse hot intergalactic and interstellar gas with high spectral resolution. We describe the four spectrographs and an imager that can over a three-year mission map the entire sky and conduct deep pointed observations of selected regions to profoundly extend, and possibly to fundamentally change, our understanding of hot mattter in the Universe. This tremendously versatile suite of instruments addresses a wide range of scientific issues. We highlight areas where we believe BEST will have greatest scientific impact:

- Detect and characterize the "missing baryons" in the current epoch, which are primarily in moderately overdense intergalactic regions and are predicted to account for 10 - 20 % of the soft X-ray background;
- Measure accurately the extragalactic diffuse ultraviolet background, probably produced by the ensemble of intergalactic gas and galaxies over cosmological space;
- Determine properties of the hot Galactic halo and the hot Galactic gas, crucial to understanding the evolution and dynamics of the ISM; *and*
- Map H_2, a fundamental constituent of the ISM, over the entire sky.

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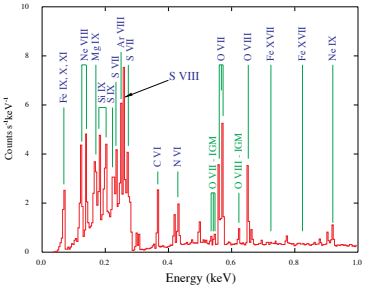

BEST X-ray Calorimeter (XRC) simulated deep X-ray Spectroscopic Observation. Exposure of 10^5s on a powerlaw AGN plus a thermal Local Bubble at kT = 0.09 keV plus TWO thermal components at kT = 0.2 keV, one galactic, and one WHIM (warm/hot intergalactic medium) at a redshift of $z = 0.047$. Depleted elemental abundances are assumed for all thermal components. Local line labels are blue, IGM lines green.

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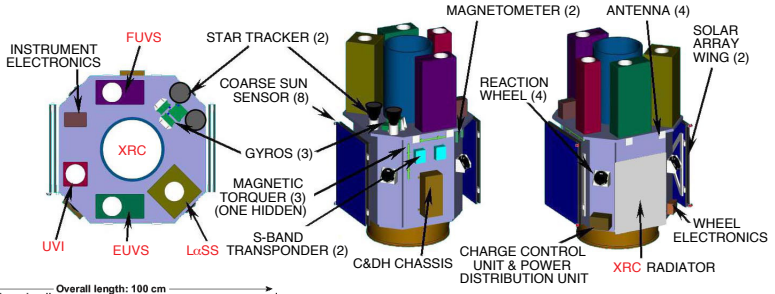
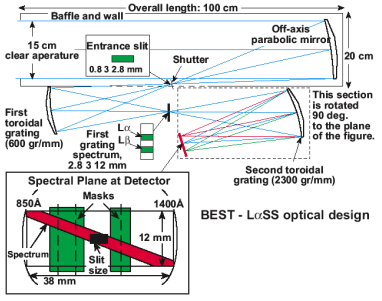
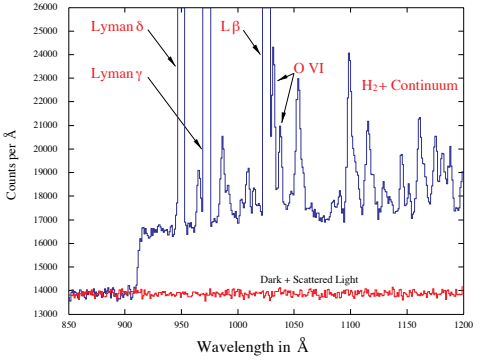
BEST Observatory - Stowed Configuration

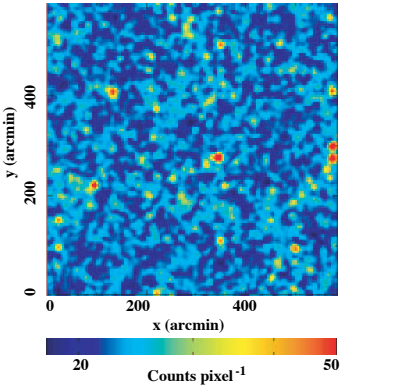




The BEST payload includes an X-ray Imaging Spectrometer called XRC, plus four ultraviolet instruments. This figure shows the optical design of the most interesting Ultraviolet Spectrometer, Lyman Alpha Straddle Spectrometer, which is a double-pass design by Keith Peacock allowing elimination of terrestrial and solar-system Lyman α radiation. This permits us to see if the cosmic background has a step at Lyman α corresponding to detection of Lyman α recombination radiation from the intergalactic medium.



Simulation of a 3Å -resolution one-week observation using the BEST EUVS (Extreme Ultraviolet Spectrometer). Many important emission lines from the universe are seen, including O VI and H_2. Omitted in this simulation: higher solar-system Lyman lines. Continuum is dust-scattered starlight.



Smoothed simulation, by R. A. Croft, of what the BEST XRC could see (0.5 - 0.8 keV) by using 10^6 seconds to map a 9.8° x 9.8° field (in 500 2000-second pointings). The X-ray spectrum used was the same as is shown in another poster figure. AGNs and the Galactic emission provide ~ 80% of the flux, but the angular features seen trace the structure of the warm/hot intergalactic medium (WHIM).

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