DXL: A SOUNDING ROCKET MISSION TO MEASURE SOLAR WIND CHARGE EXCHANGE

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THE DXL INSTRUMENT

- Sounding rocket mission for the study of the Local Hot Bubble and SWCX
- 4 co-aligned X-ray proportional counters
- >1,000 cm² effective area, 7.5 deg FOV
- C, B, and Be filters
- High response from 40 eV to 10 keV
- 1-D images generated by rolling the payload
- Launched from WSMR, NM on 12/12/2012 and 12/6/2015, from PFFF, AK on 1/16/2018, and from WFF, VA on 1/9/2022
- First Demonstration in Space of Lobster-eye Optics
XMM-Newton has a grasp about 150 times smaller at $\frac{3}{4}$ keV requiring 40,000 s
Suzaku about 2,000 times smaller, requiring 600,000 s of observing time
At lower energy the situation is much worse, in the $\frac{1}{4}$ keV band their effective area
drops well below 100 cm$^2$, making any science there essentially impossible
DXL STRATEGY (FLIGHTS #1 & 2)

- DXL should measure an excess emission due to SWCX from the He focusing cone

Slow scan region
Galactic plane: 36%±5% (±5% systematic error)
Averaged over the whole sky: 27%±4% (±5% systematic error)
Local Hot Bubble the major contributor to 1/4 keV emission
SWCX less than 40% in the 1/4 keV band
THE LOCAL HOT BUBBLE

Fairly constant temperature of the Local Hot Bubble
~0.083keV (9.63E5 K)

THE LOCAL HOT BUBBLE

3D model of LHB

Data From Lallement et al. 2014

FLIGHTS # 3 & 4 SCIENCE GOAL

Measuring the compound cross section with H using the spatial signature of the Cusp
FLIGHTS # 3 & 4 STRATEGY

Payload View

Perpendicular View

WFF ~ 37° N
DXL FLIGHT #4 RESULTS
DXL FLIGHT #4 RESULTS

Count rate vs. Altitude for 4 scans in the lowest energy band

Count rate vs. Altitude for scan #2 for three energy bands

Count rate vs. Altitude for 4 scans in the lowest energy band
The red lines are the field lines defining the exterior surface of the cusp.
THE LOBSTER-EYE X-RAY TELESCOPE (LXT)

Micropore Optics coupled to large area CCD detectors

- Broad energy range 0.1-10 keV
- Large FoV (7.5°×7.5° per telescope)
- Good energy resolution (~100 eV FWHM)
- Moderate Angular Resolution (~ 8 arcmin FWHM)
- Moderate effective area (tens of cm²)
- Compact design with low MOI for rapid repointing (50 cm focal length)

Applications:

- Multi-messenger science
- Transient searches
- Low brightness diffuse objects
Thanks to LXT very large field of view it is possible to observe the whole loop with a single pointing, thus removing cross-calibration issues and minimizing the effect of time varying background.
“That's all Folks!”