

Exploring the Hard X-Ray Universe: NuSTAR Observations of the NDWFS Bootes Field at 6-80 keV

D. Stern and the NuSTAR Science Team



2004 June 2
AAS - Denver

NuSTAR:

Nuclear Spectroscopic Telescope Array

- 1 of 5 SMEX proposals under competitive phase A review
 - proposals due June 18th
 - downselect November 2004
 - launch 2007/2008
-
- **the first focusing mission above 10 keV**

Science Team:

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Finn Christensen (DSRI)
Lynn Cominsky (Sonoma State)
Walter Cook (Caltech)
William Craig (LLNL; PS)
Charles Hailey (Columbia)

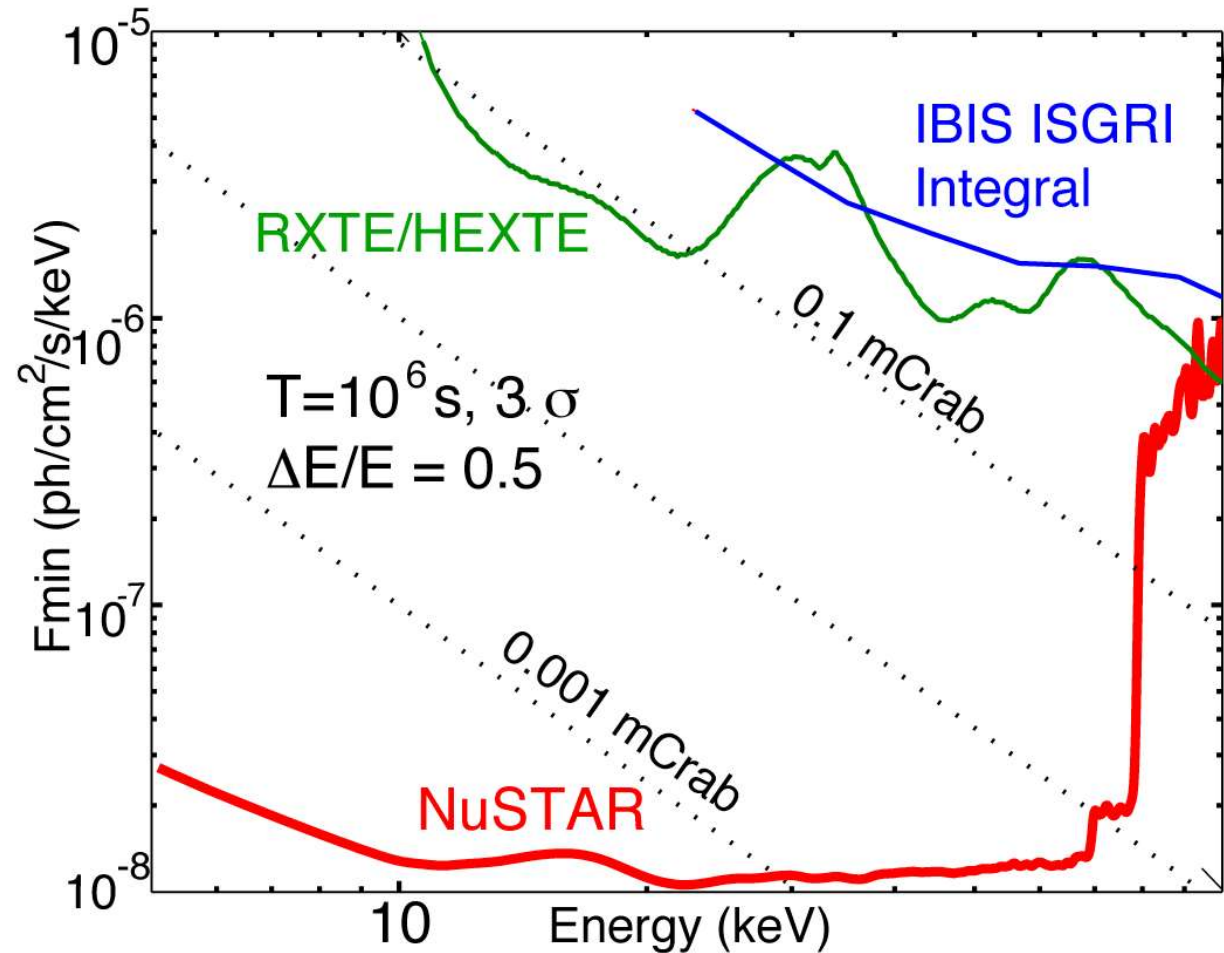
Greg Madejski (SLAC)
Dave Meier (JPL)
Daniel Stern (JPL)
Steven Thorsett (UCSC)
David Windt (Columbia)
Stan Woosley (UCSC)



first focusing mission above 10 keV

brings unparalleled:

- sensitivity
- angular resolution
(20 arcmin \rightarrow 40 arcsec)
- spectral resolution
($R \sim 6 \rightarrow R \sim 60$)

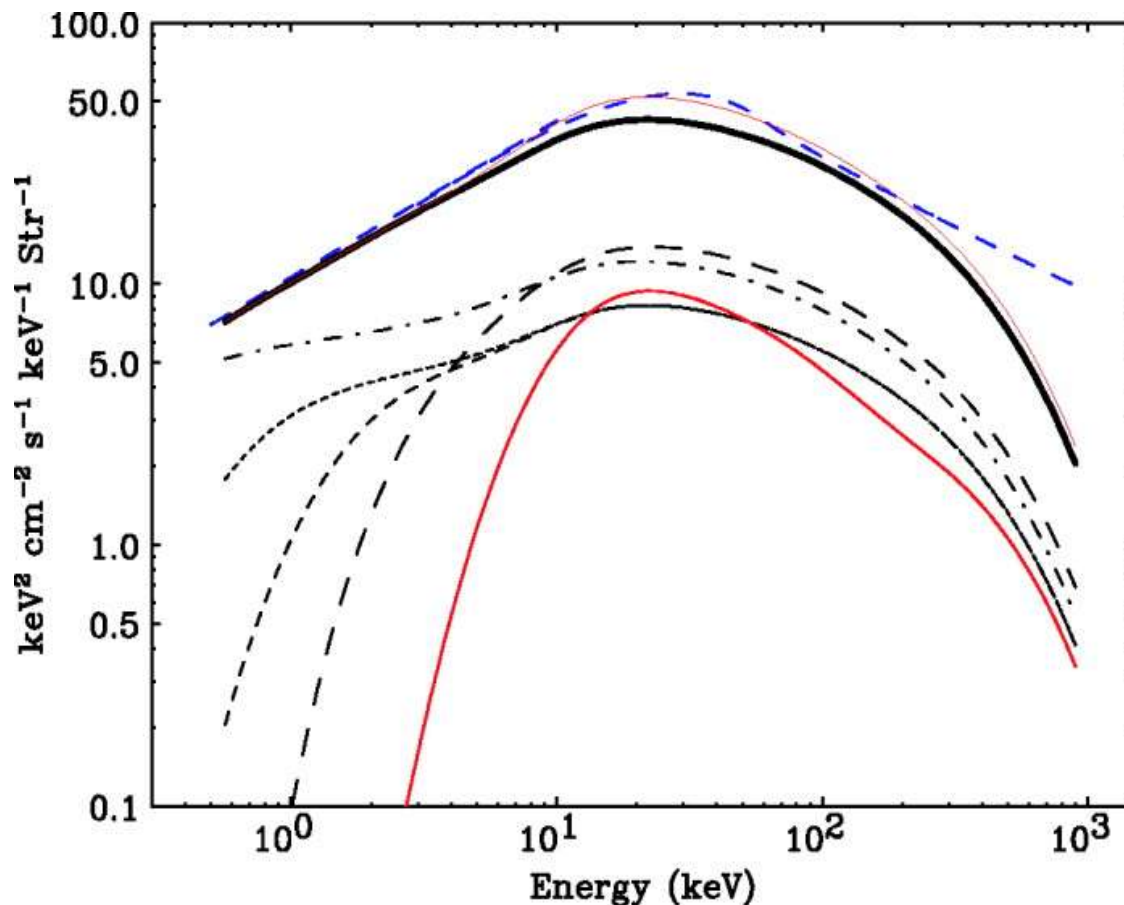


- opens up a new window in the electromagnetic spectrum
- gains are comparable to what Einstein did for the soft X-ray and what Spitzer is doing for the near-/mid-infrared

Expected Performance:

Energy range	6-80 keV
Angular resolution	40 arcsec
FOV (20 keV)	10 arcmin
Strong/weak src positioning	4/12 arcsec
Spectral resolution	1 keV @ 60 keV
Timing resolution	1 ms
Mission Lifetime	3 years
Orbit	Near earth equatorial
ToO response	<24 hours
Solar angle constraint	none

Motivation: Cosmic X-Ray Background

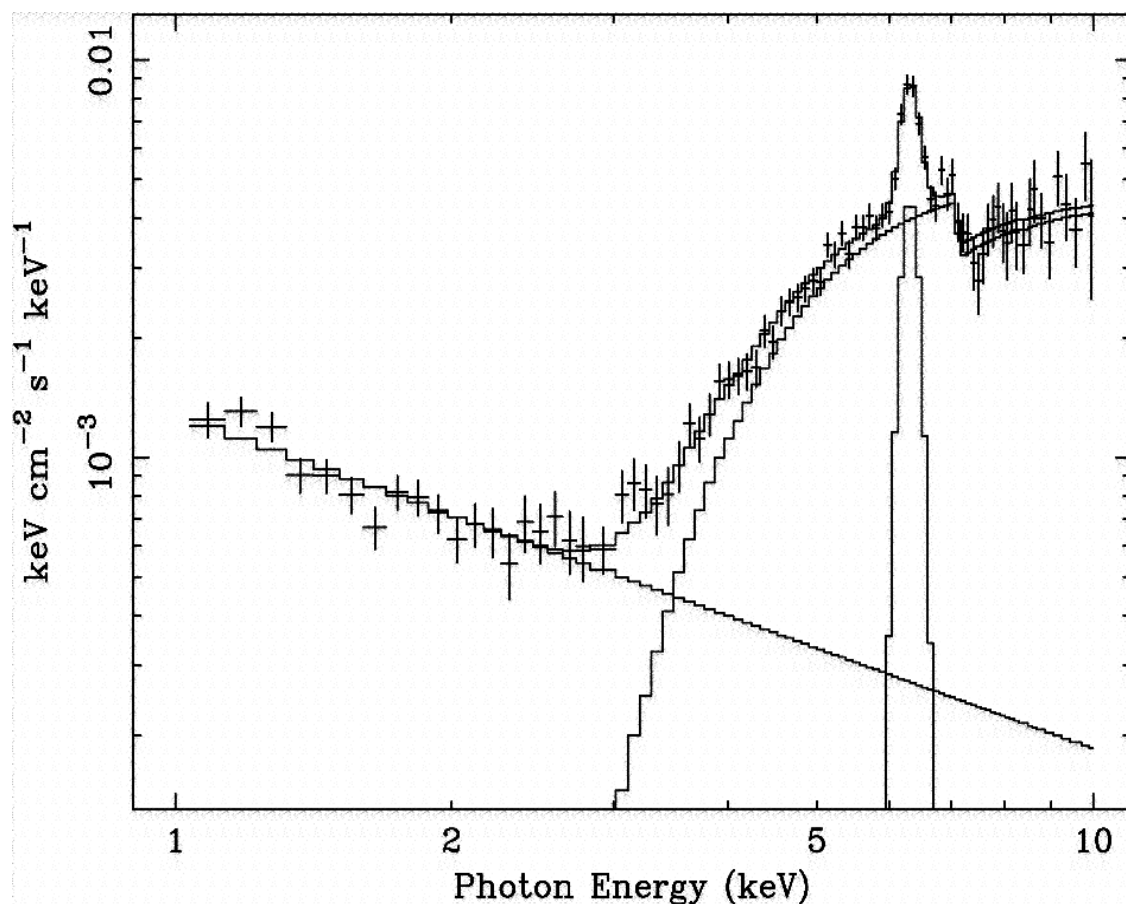


Peaks at ~ 30 keV

Constrains the accretion history of the universe, e.g. the formation history of supermassive black holes

Requires population of heavily obscured AGN

Motivation: Cosmic X-Ray Background



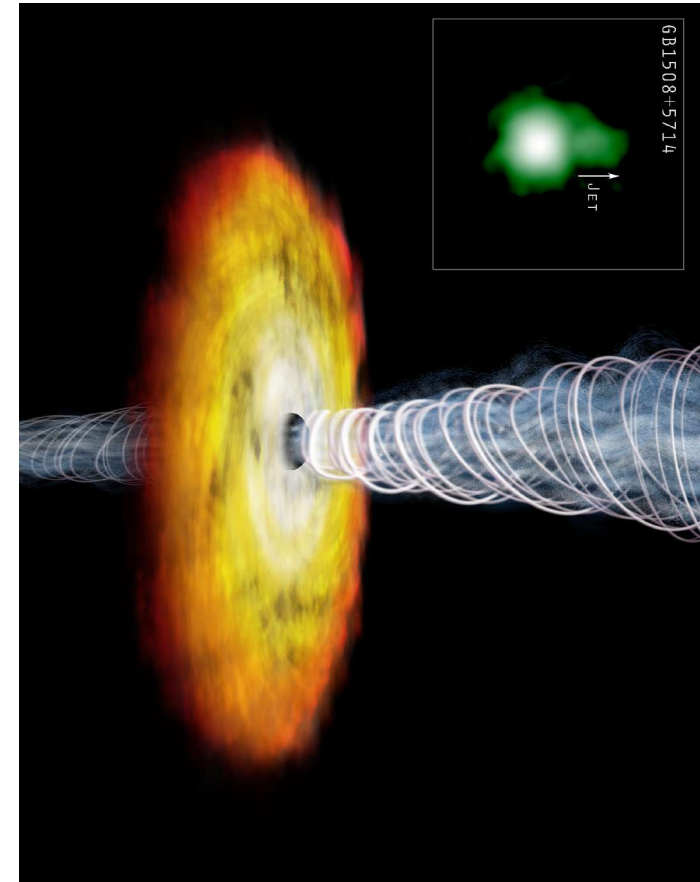
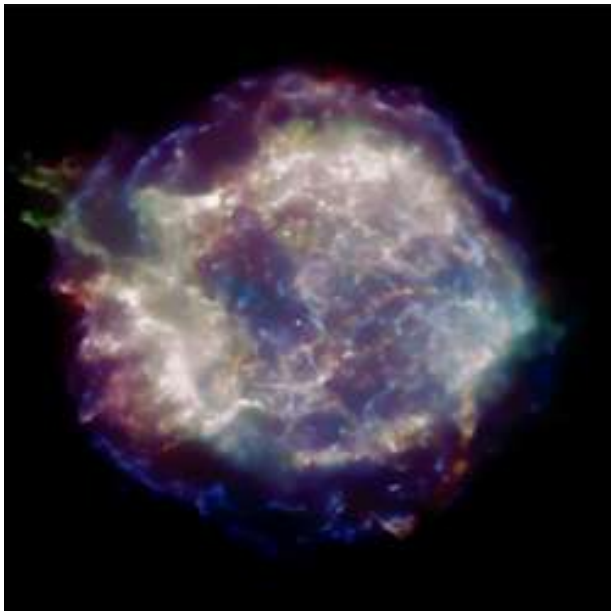
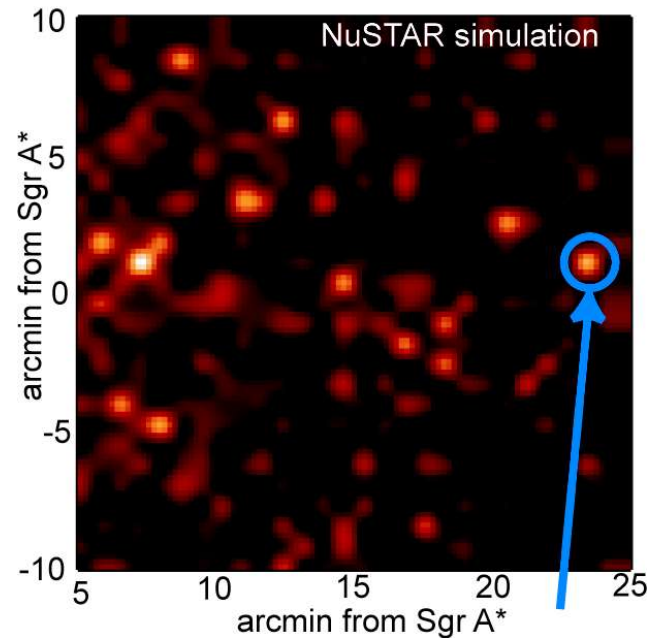
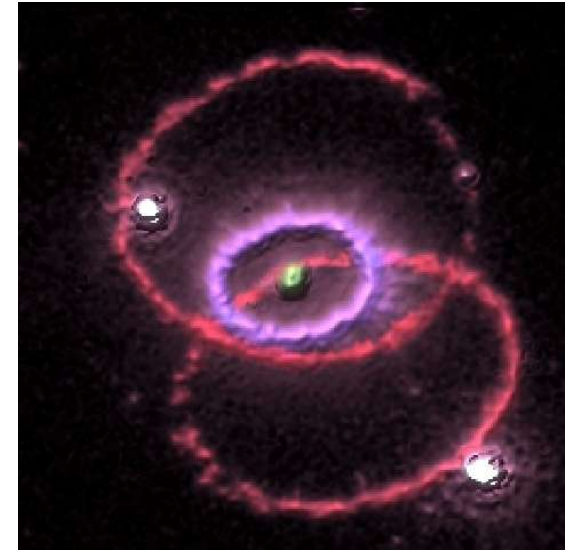
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Baseline mission: 3 years

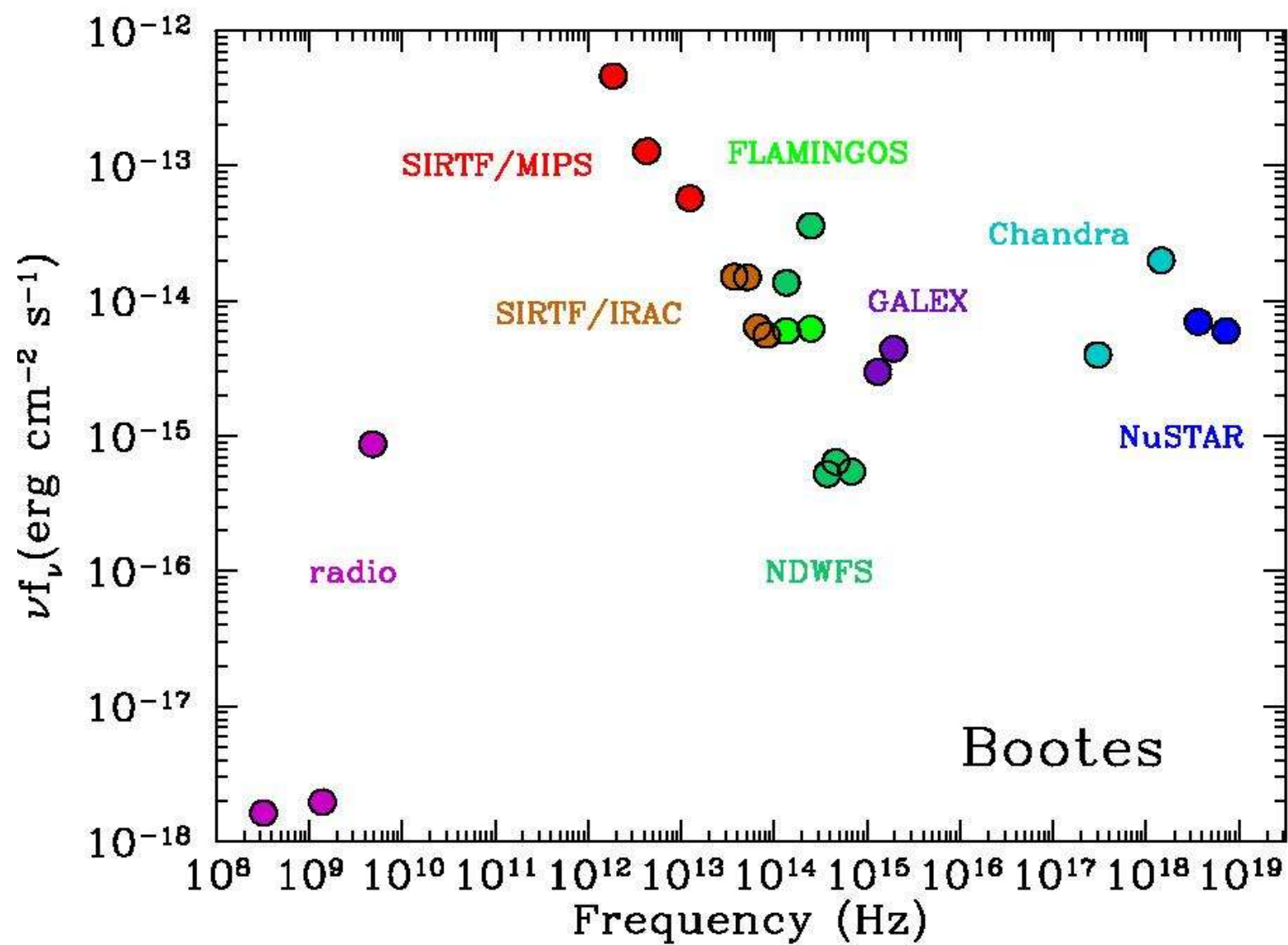
- 2 months: checkout (Crab, Her X-1)
- 15 months: Bootes, GOODS, Galactic center
- 6 months: study supernova remnants
- 3 months: study blazars
- 6 months: other (e.g. ToO, SNIa)
- 4 months: science reserve



Bootes: NuSTAR observations

- Proposal calls for 6 months of observations, to map entire 9 sq. degrees of Bootes field to 40 ks depth
- 5-sigma depths:
 - 10-20 keV : $7e-15$ erg/cm²/s
 - 20-40 keV : $6e-15$ erg/cm²/s
- Expect to detect >150 AGN at 10-40 keV which would be missed from lower energy surveys (i.e., Chandra, XMM)





Science Goals of NuSTAR Bootes Observations:

- Unbiased census of black holes
- Study high-energy properties of known AGN; study spectral energy distribution, intrinsic power-law slope, obscuration
- Open new discovery space (in a wide-area survey field with comprehensive and impressive multi-wavelength data)



THE END

