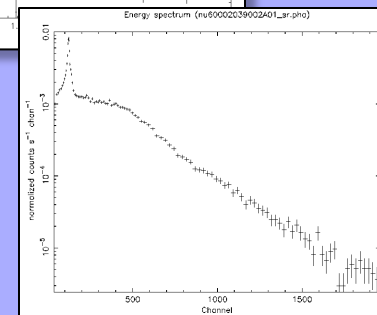
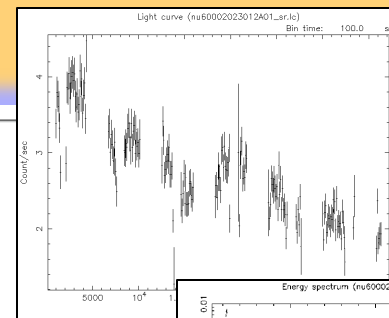
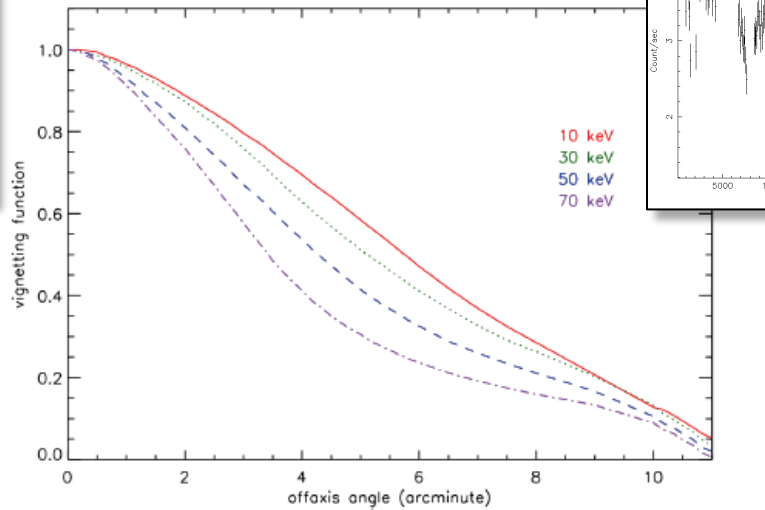
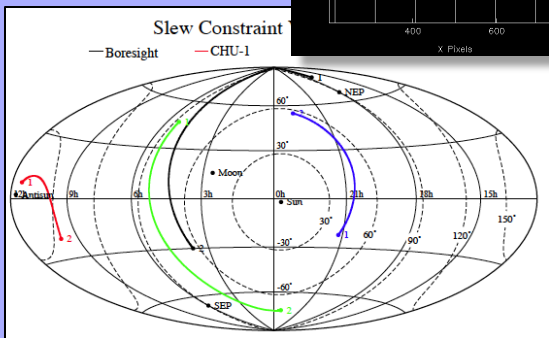
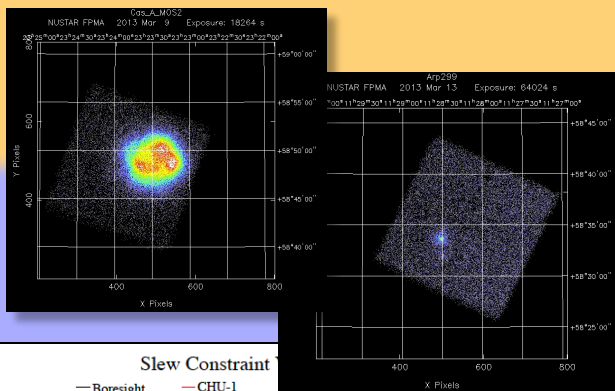




NuSTAR Status

Karl Forster
NuSTAR SOC, Caltech

IACHEC
March 25, 2013





NuSTAR mission summary

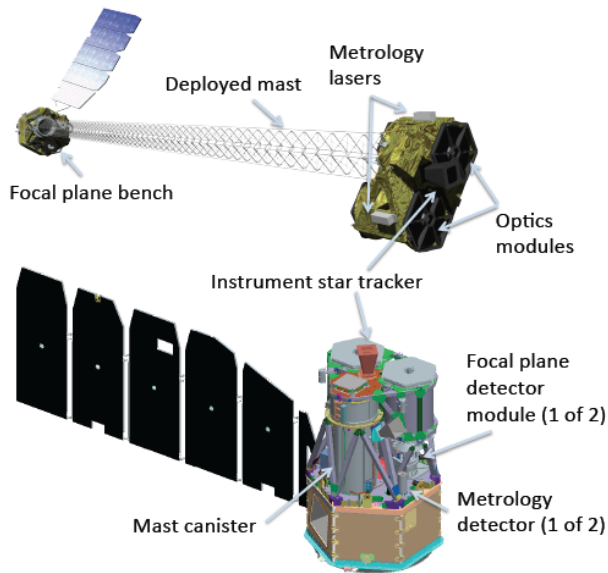


- Launched June 13th 2013, mast deployment June 21st
 - NASA small explorer \$160M, PI Fiona Harrison (Caltech)
- NuSTAR is performing well on orbit and meeting mission specifications
 - Observation efficiency > 58% (50% requirement), slew rate 0.06 deg/s
- Transitioned to the nominal science operations on 2012-08-01
 - Calibration observations began on 2012-07-01
- NuSTARDAS / CALDB development nearly complete
 - Public data and code release at HEASARC – June 2013
 - Steady release of data every month – 60 day verification period

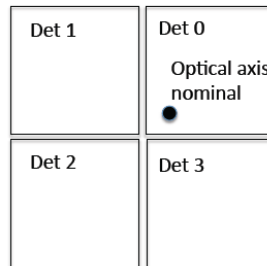
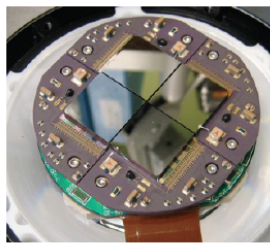
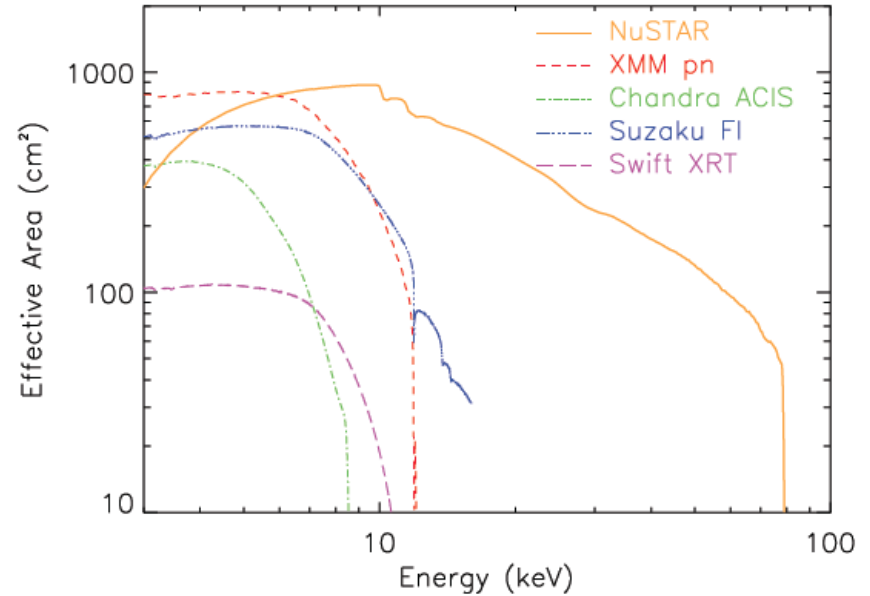
2014 Feb	NASA senior review – Extended mission proposal
2014 July	NASA senior review recommendations
2014 August	End of primary mission
Late 2014	AO GI program, proposal deadline
2015 Spring	GI cycle 1 observations begin



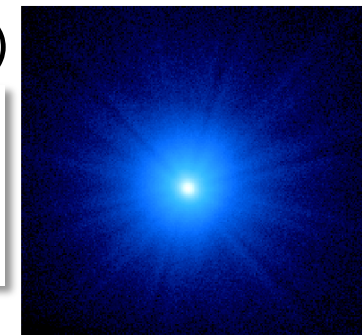
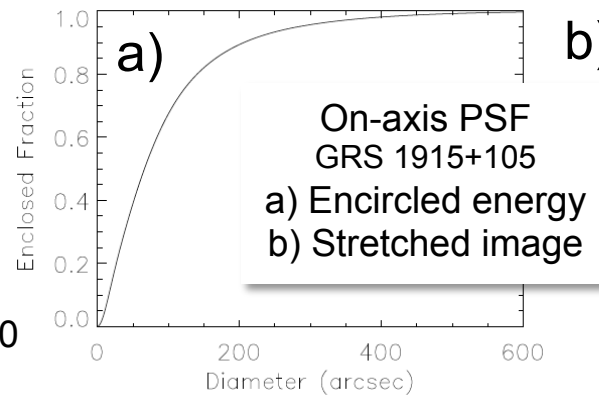
NuSTAR Observatory



Effective collecting area – 3 to 78.4 keV



- 2x2 array of CdZnTe pixel detectors
- Each has 32x32 pixels 0.6mm = 12"
- Nominal optical axis location on DET0
 - 1' from chip gaps





Observatory performance



KEY OBSERVATORY PERFORMANCE PARAMETERS.

Parameter	Value
Energy range	3 – 78.4 keV
Angular resolution (HPD)	58''
Angular resolution (FWHM)	18''
FoV (50% resp.) at 10 keV	10'
FoV (50% resp.) at 68 keV	6'
Sensitivity (6 – 10 keV) [10^6 s, 3σ , $\Delta E/E = 0.5$]	2×10^{-15} erg cm ⁻² s ⁻¹
Sensitivity (10 – 30 keV) [10^6 s, 3σ , $\Delta E/E = 0.5$]	1×10^{-14} erg cm ⁻² s ⁻¹
Background in HPD (10 – 30 keV)	1.1×10^{-3} cts s ⁻¹
Background in HPD (30 – 60 keV)	8.4×10^{-4} cts s ⁻¹
Spectral resolution (FWHM)	400 eV at 10 keV, 900 eV at 68 keV
Strong source ($> 10\sigma$) positioning	1.5'' (1σ)
Temporal resolution	2 μ s
Target of opportunity response	< 24 hr
Slew rate	0.06° s ⁻¹
Settling time	200 s (typ)



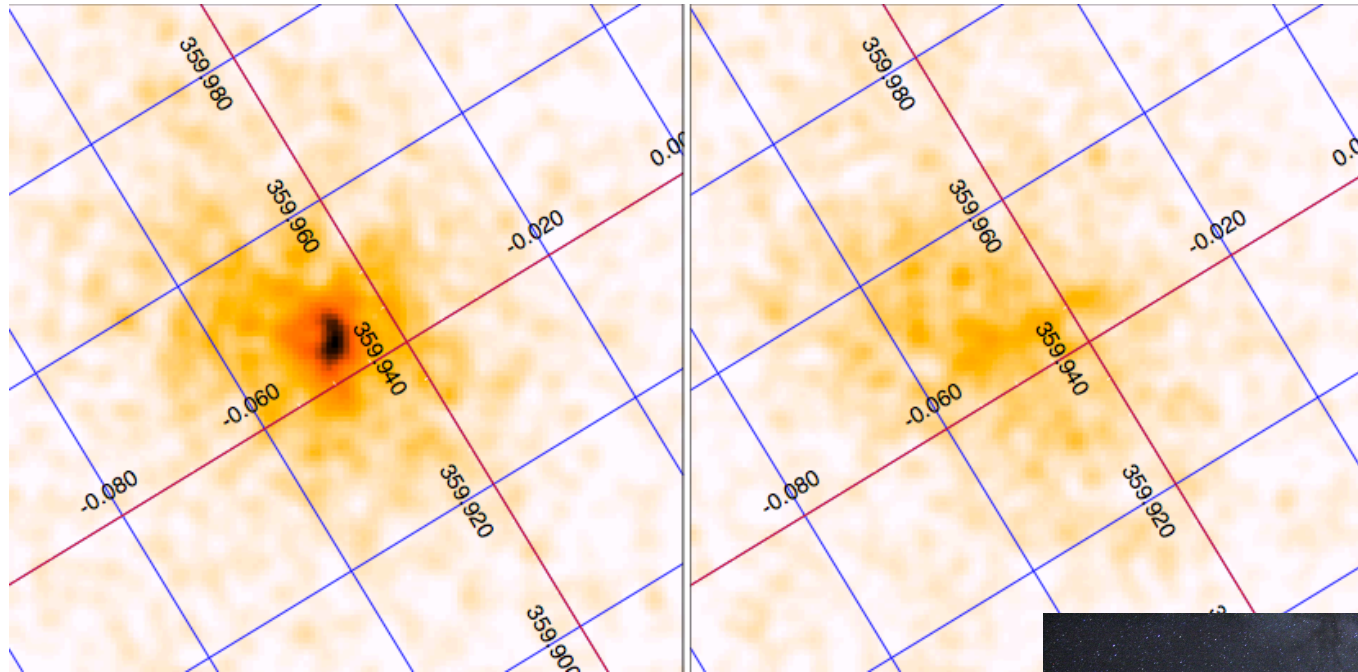
First papers



- The Nuclear Spectroscopic Telescope Array (NuSTAR) high energy X-ray mission
 - Harrison *et al.* 2013 ApJ accepted
 - Primary mission reference, on astro-ph
 - <http://uk.arxiv.org/pdf/1301.7307>
- A rapidly spinning supermassive black hole at the centre of NGC 1365 (NuSTAR & XMM)
 - Risaliti *et al.* 2013 Nature 494, 449
- NuSTAR and Chandra observations of X-ray flares in Sgr A*
 - Science, (nearly submitted)
- NuSTAR and Chandra insight into the nature of the 2-30 keV nuclear emission in NGC 253
 - Lehmer *et al.* 2013 ApJ Submitted
- 22 more papers close to submission



NuSTAR images of Sgr A* July flare



3-79 keV, 2800s in each panel

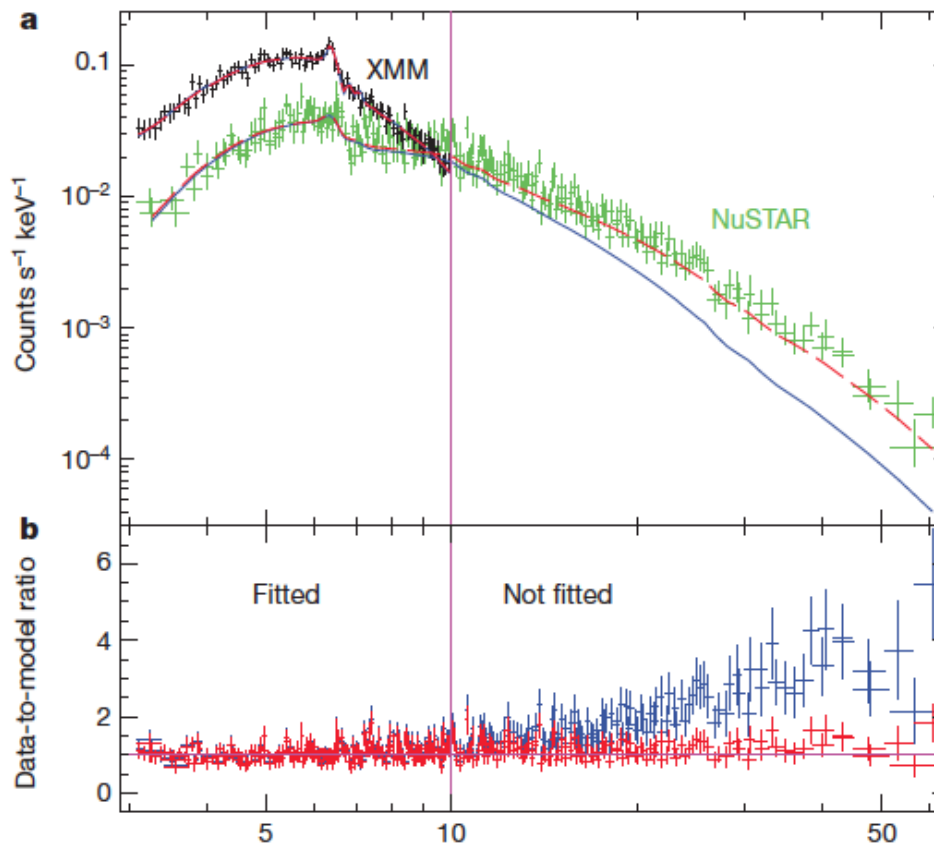
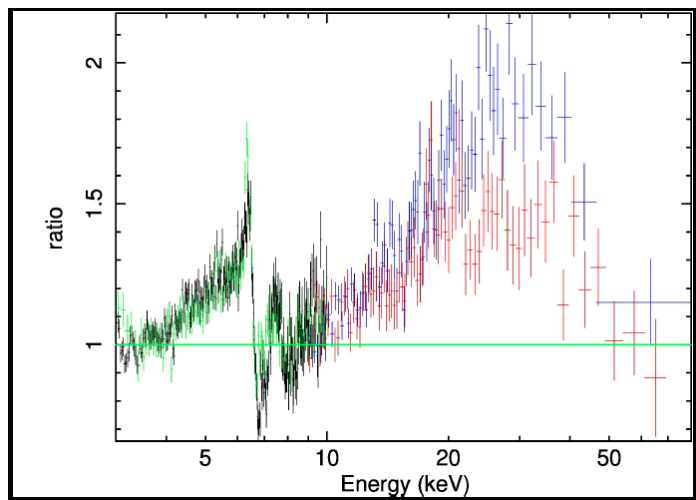
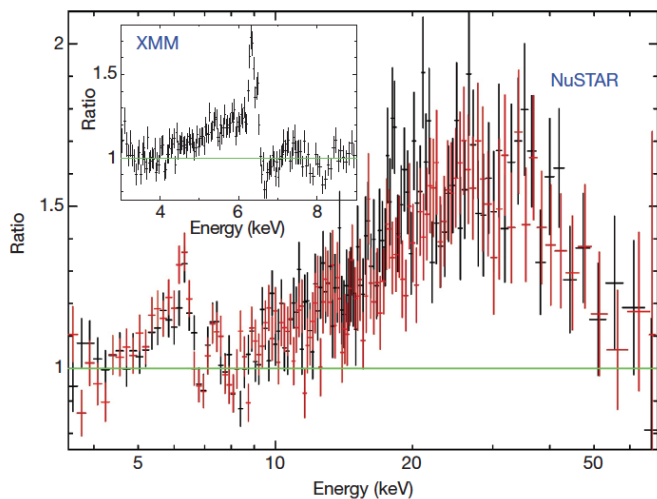
- Coordinated with Chandra and Keck NIR
- Monitoring campaign detects multiple flare events





NGC 1365

Relativistic reflection not absorption



Above 10 keV
Blue – partial covering model
Red – relativistic reflection



Coordinated Calibration



	Date(s)	XMM	Chandra	Suzaku	Swift	INTEGRAL
3C 273	2012-07-14 to 19	X	X	X	X	X
IC 4329A	2012-08-12			X	X	
Her X-1	2013-09-19			X	X	
Crab	2012-10-25			X		X
Cyg X-1	2012-10-31			X	X	X
PKS 2155-304	2013-04-23	X	X	X	?	

- Additional calibration targets from archival data:
 - SNR: G21.5-0.9
 - Galaxy clusters: Bullet, Abell 2256
- **Big THANKS!** to all teams for enthusiastic support
- More presentations in session VII (Wednesday)
- Observation schedules, as-flown timelines, available on SOC website
 - http://www.srl.caltech.edu/NuSTAR_Public/NuSTAROperationSite/Home.php