NuSTAR Analysis Goal:
Check high energy N132D standard model

• Use two epochs of NuSTAR data (~150-ks total)

• Use background models fit for each epoch

• Use optimal binning and check v2.14 IACHEC model with:
  • 1.14 keV norm = 3.97e-2 (source:52)
  • 5.47 keV norm = 9.6e-4 (source:56)
  • Fe XXV norm = 3.21e-6 (source:434)

• Use latest NuSTAR CALDB release
  • Includes effective area / vignetting / RMF updates
v2.14 model with consensus update
3.2 – 8 keV, no fitting → cstat/dof = 479.1 / 78

Model over-predicts continuum level <5 keV
Some Fe line residuals
Reasonable fit >8 keV

~10% difference in continuum strength

Mismatch in Fe line
Modifications
(or, How do we capture offsets between current soft X-ray effective areas and NuSTAR?)

• **Option 1: Allow overall normalization to float**
  - $cstat / dof = 173 / 78$
  - thaw source:1 $\rightarrow$ 0.88(1)

• **Option 2: Allow both 1.14 keV norm and 5.47 keV norm to vary**
  - $cstat / dof = 136 / 75$
  - 1.14 keV norm $\rightarrow$ 3.0(1)e-2 (was $\sim$4, range was 3.4 tp 4.2)
  - 5.47 keV norm $\rightarrow$ 1.2(1)e-3 (was 0.96e-3, but range was 0.8 to 1.1)
  - Fe XXV norm $\rightarrow$ 2.6(2)e-6 (was 3.2e-6, range was 2.9 – 3.6)
Take Aways

• One large spectral shape discrepancy between NuSTAR and other missions
  • “Neutral Fe line” excess has been seen in other observatories (and in science papers)
  • Also need to allow redshift of lines → known shift ~10s of eV, so not enough to explain Fe line red tail.
  • More analysis need to firm up consensus on Fe region
Take Aways

• Overall continuum normalization difference between NuSTAR and soft-Xray consensus model “in family” with expectations for difference between observatories (12%)
  • *for an “achromatic” correction
Take Aways

• However, main difference between NuSTAR/others is the relative strength of the 5.47 keV and 1.14 keV continuum components
  • NuSTAR wants 1.14 keV flux to be lower, 5.47 keV higher
  • NB: Actual shape of 5.47 keV component unknown, but difficult to constrain parameters
    • Has to be “hot” and can’t contribute much at low energies (so probably thermal?). But have work to do to figure out if this is 4, 5, 10 keV...

• Did sims for NuSTAR Cycle 07, estimated ~1 Ms additional time probably required to constrain hot component (is it worth it?)
Backups
data and folded model

Counts s^{-1}, keV^{-1}

Energy (keV)

Ratio

CXB
Overview

• Reprocessed N132D with latest CALDB (gain, no effect for these)

• Used latest NuSTAR CALDB (VIGN update)

• No significant change vs base model (as expected)