# Thermal SNR Working Group: Summary Report

*Paul Plucinsky on behalf of the IACHEC Thermal SNR Working Group*

# Thermal SNR Working Group

***One of the "Standard candle" working groups.***

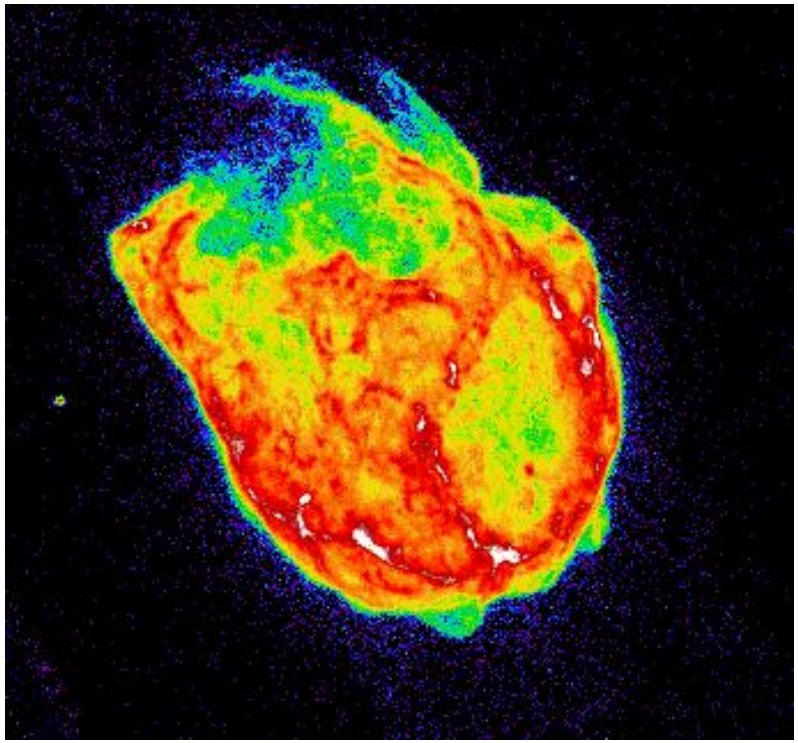
***This presentation is a summary report of this group's work:***

| | |
|---|---|
| XMM-Newton | Andy Pollock & Matteo Guainazzi (ESAC) |
| Chandra HETG | Dan Dewey (MIT) |
| XMM-Newton MOS | Steve Sembay (Leicester) |
| XMM-Newton pn | Frank Haberl (MPE) |
| Chandra ACIS | Jenny Posson-Brown, Joe DePasquale, & Paul Plucinsky (SAO) |
| Suzaku XIS | Eric Miller (MIT) |
| Swift XRT | Andrew Beardmore (Leicester) |
| Models | Adam Foster & Randall Smith (SAO) |

# Chandra X-Ray Observatory

CXC

N132D: X-ray brightest in the LMC
1.7X2.3 arcmin, 25x33.5 pc
t ~ 3,000 yr (Morse et al. 1996)
$L_X$(0.3-10.0 kev) = $1.0 \times 10^{38}$ ergs $s^{-1}$
no compact object
"O-rich" core-collapse SNR



ACIS 0.35-8.0 keV

E0102: X-ray brightest in the SMC
0.77X0.77 arcmin, 13X13 pc
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$L_X$(0.3-10.0 kev) = $2.5 \times 10^{37}$ ergs $s^{-1}$
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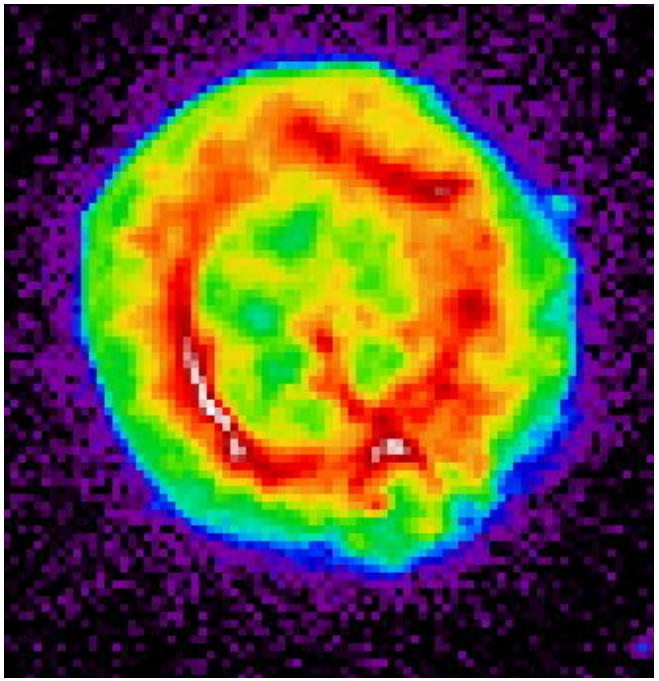

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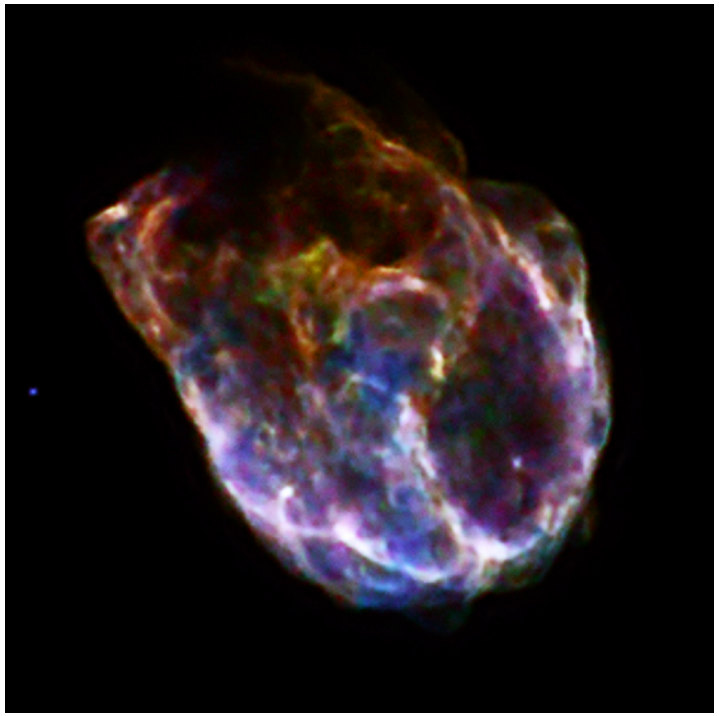

Red (0.3-0.5 keV), Green (0.5-0.75 keV)
Blue (0.75 – 7.0 keV)

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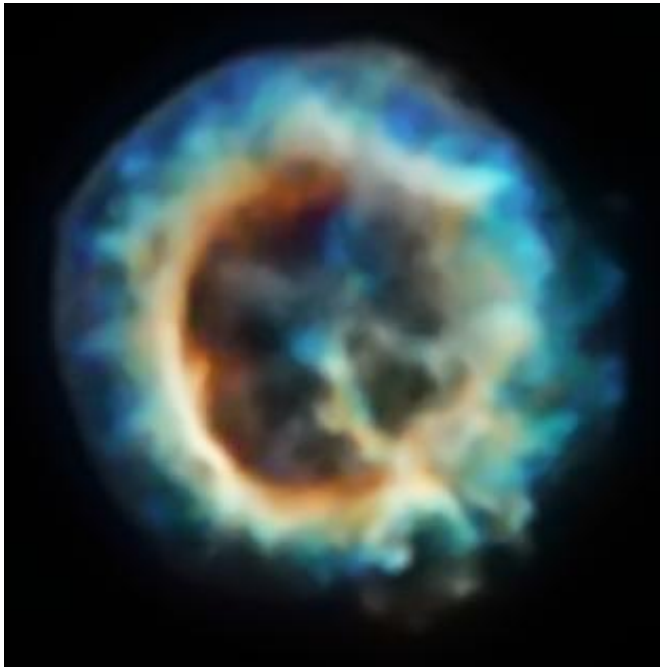
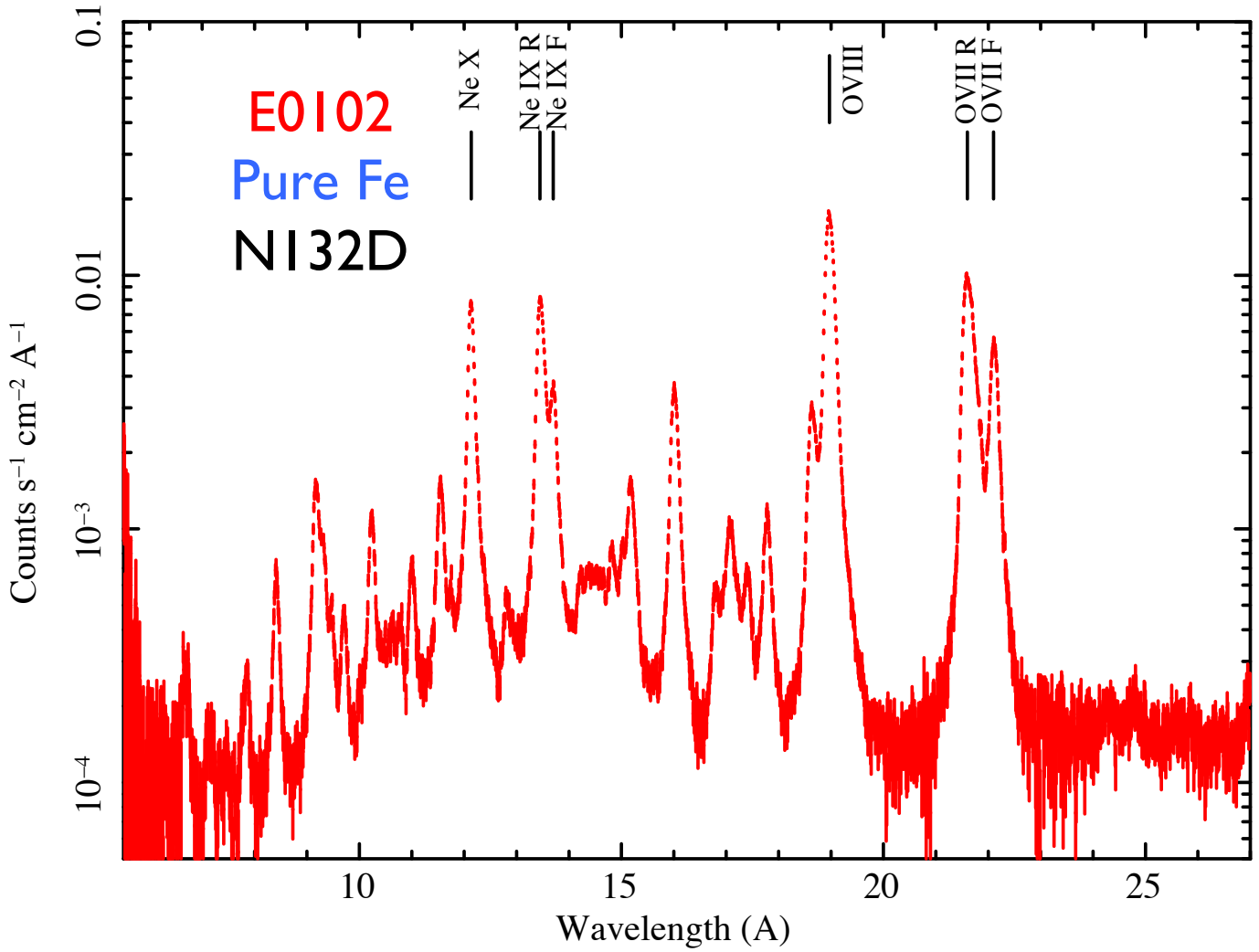


Red (0.3-0.75 keV), Green (0.8-1.1 keV),
Blue (1.1 – 2.0 keV)

# RGS Spectra of E0102 & N132D

*XMM RGS Courtesy A. Pollock (ESAC)*



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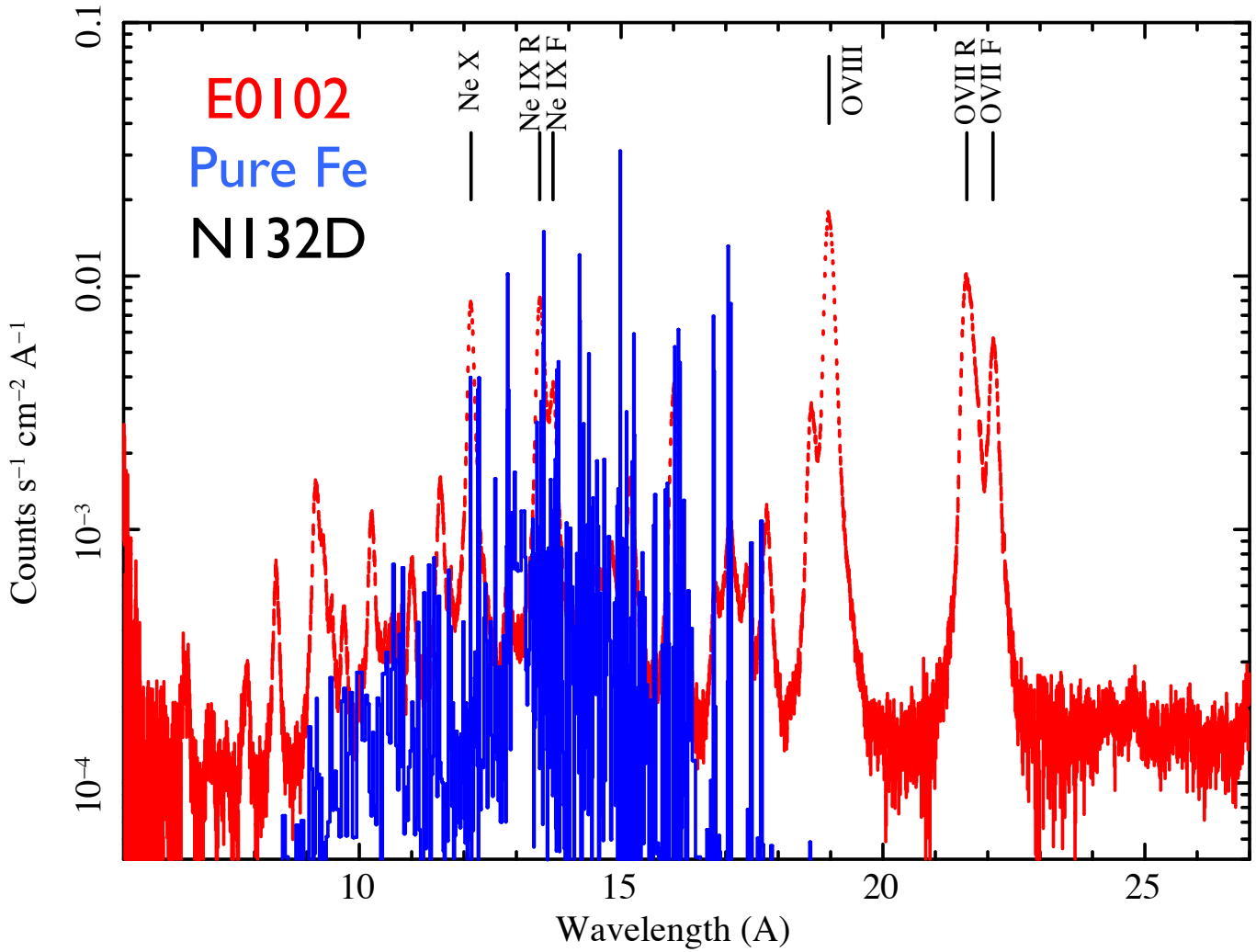
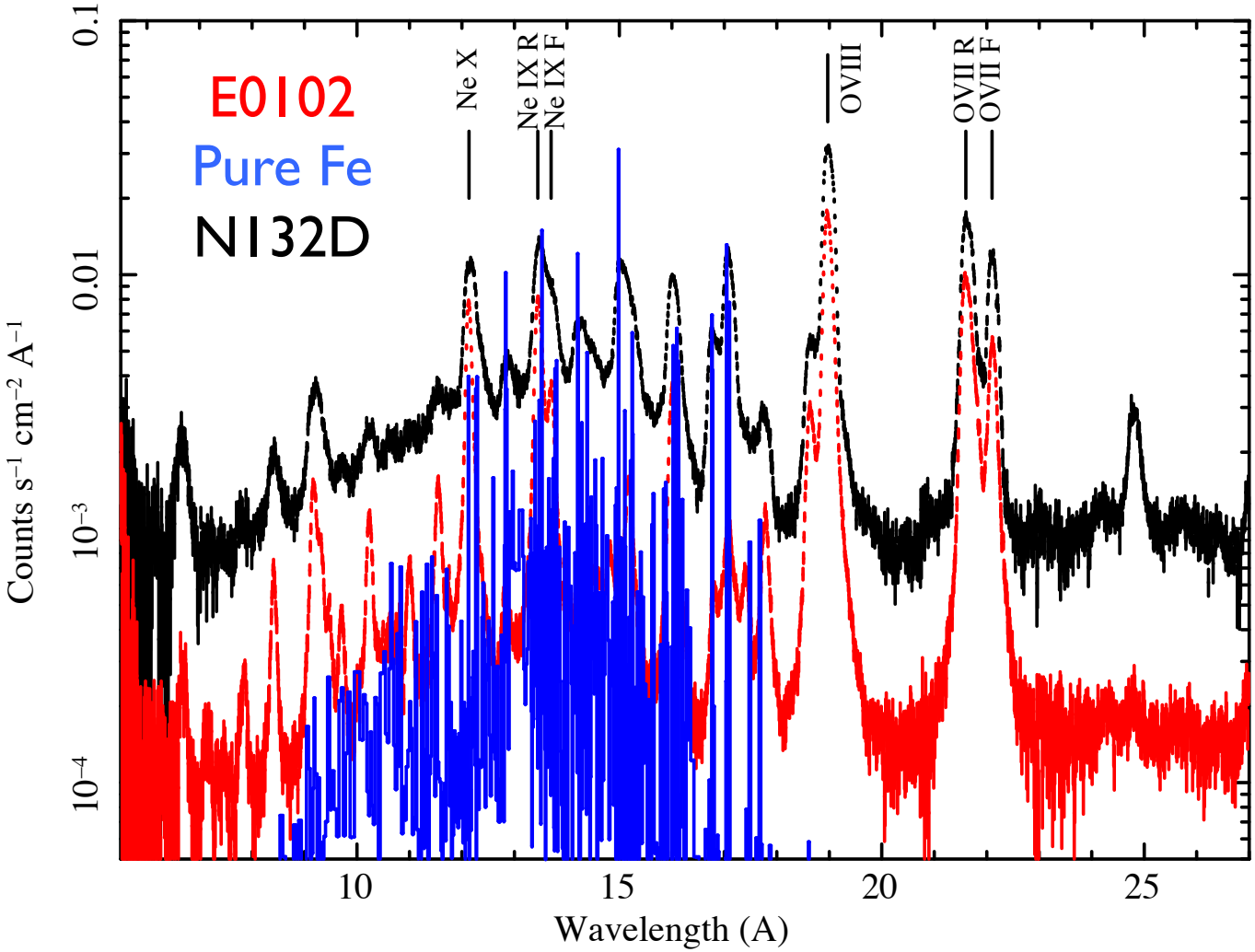


# RGS Spectra of E0102 & N132D

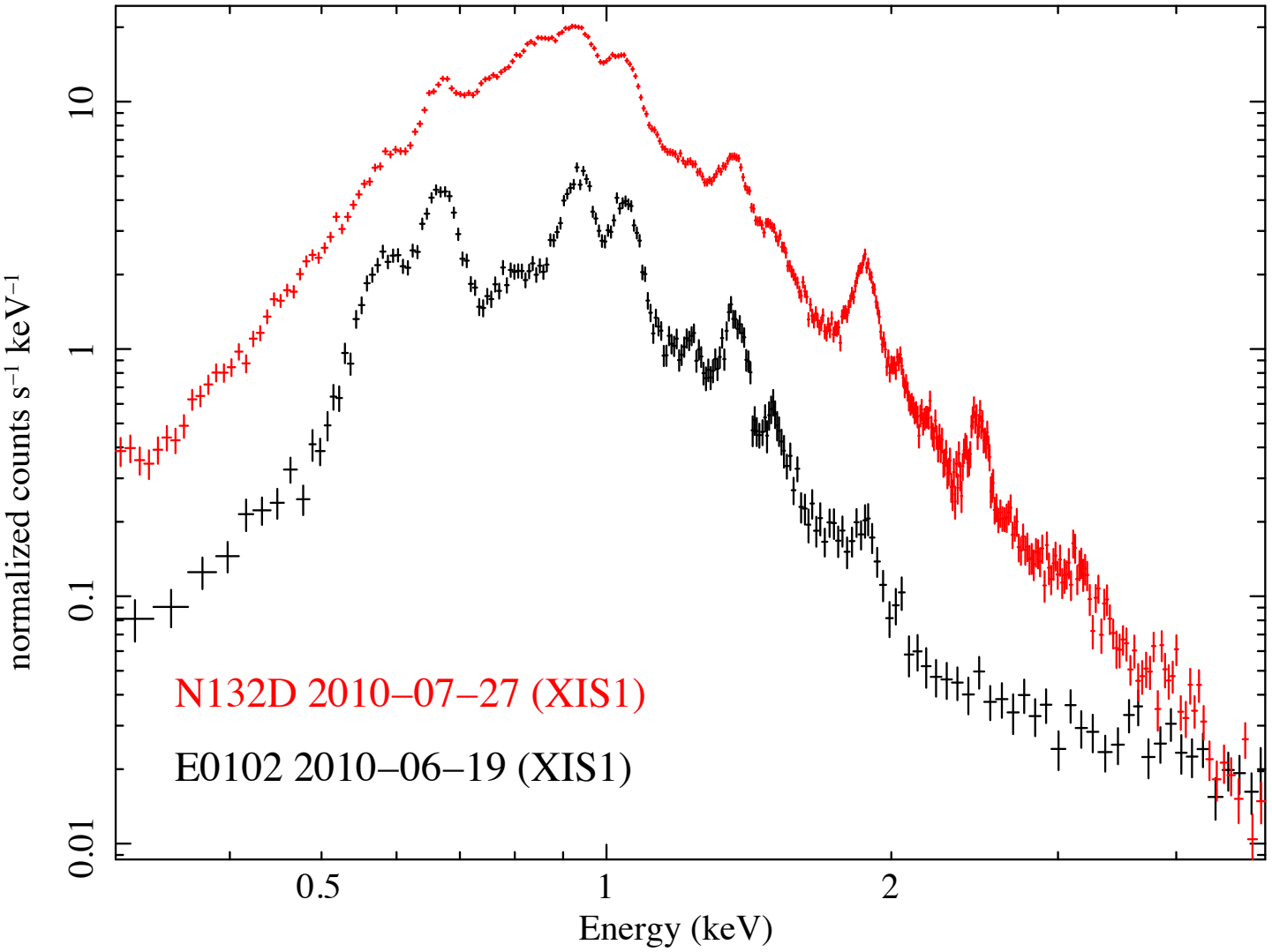
*XMM RGS Courtesy A. Pollock (ESAC)*

*Significant Fe in N132D's spectrum. Very little or no Fe in E0102's spectrum.*

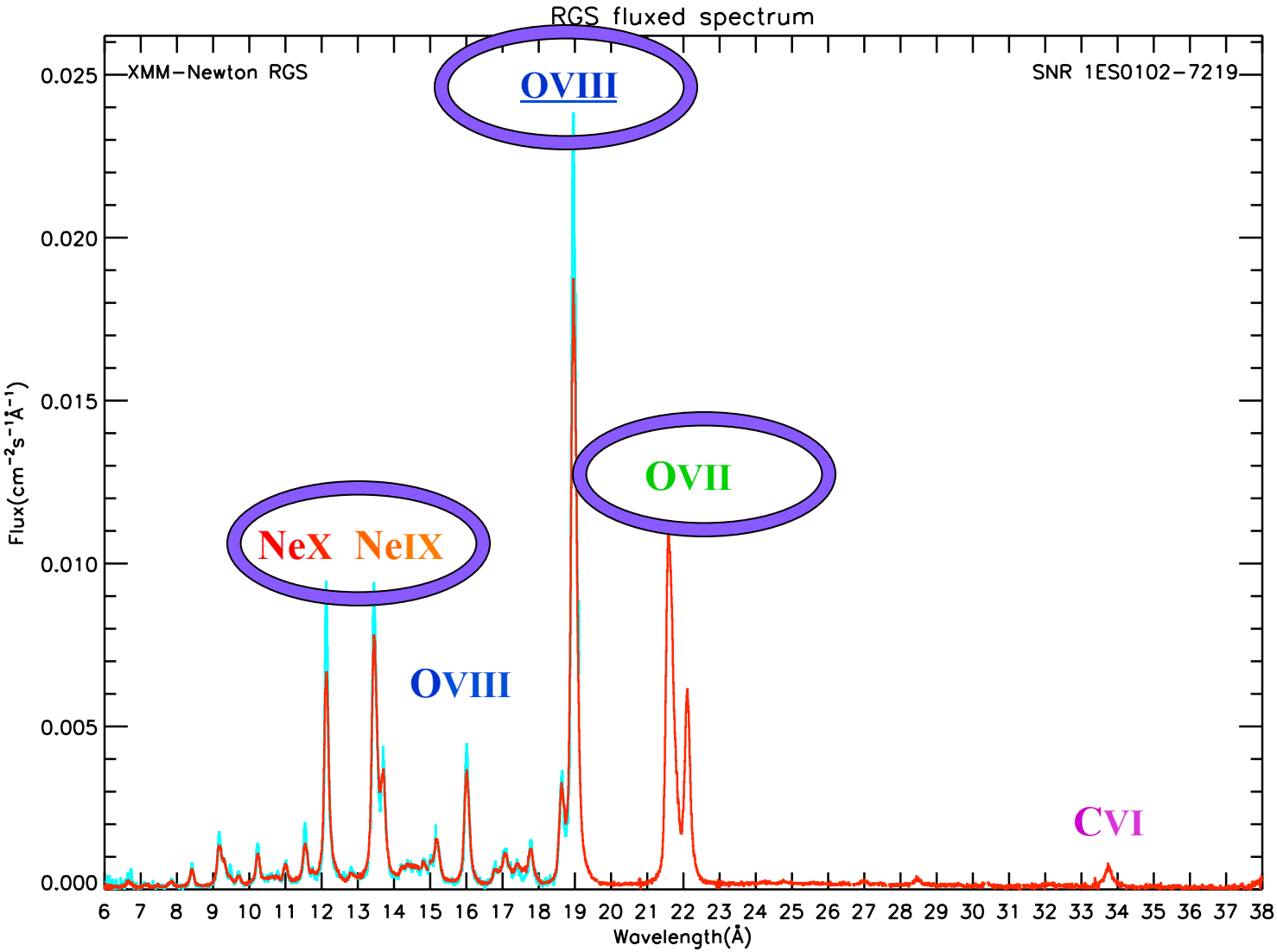


## Suzaku Specturm of E0102 & N132D

*Miller(MIT)*



# XMM-Newton RGS Spectrum of E0102: *Pollock (ESAC)*




IACHEC E0102 model Plucinsky et al. 2012, SPIE Plucinsky et al., 2008 SPIE

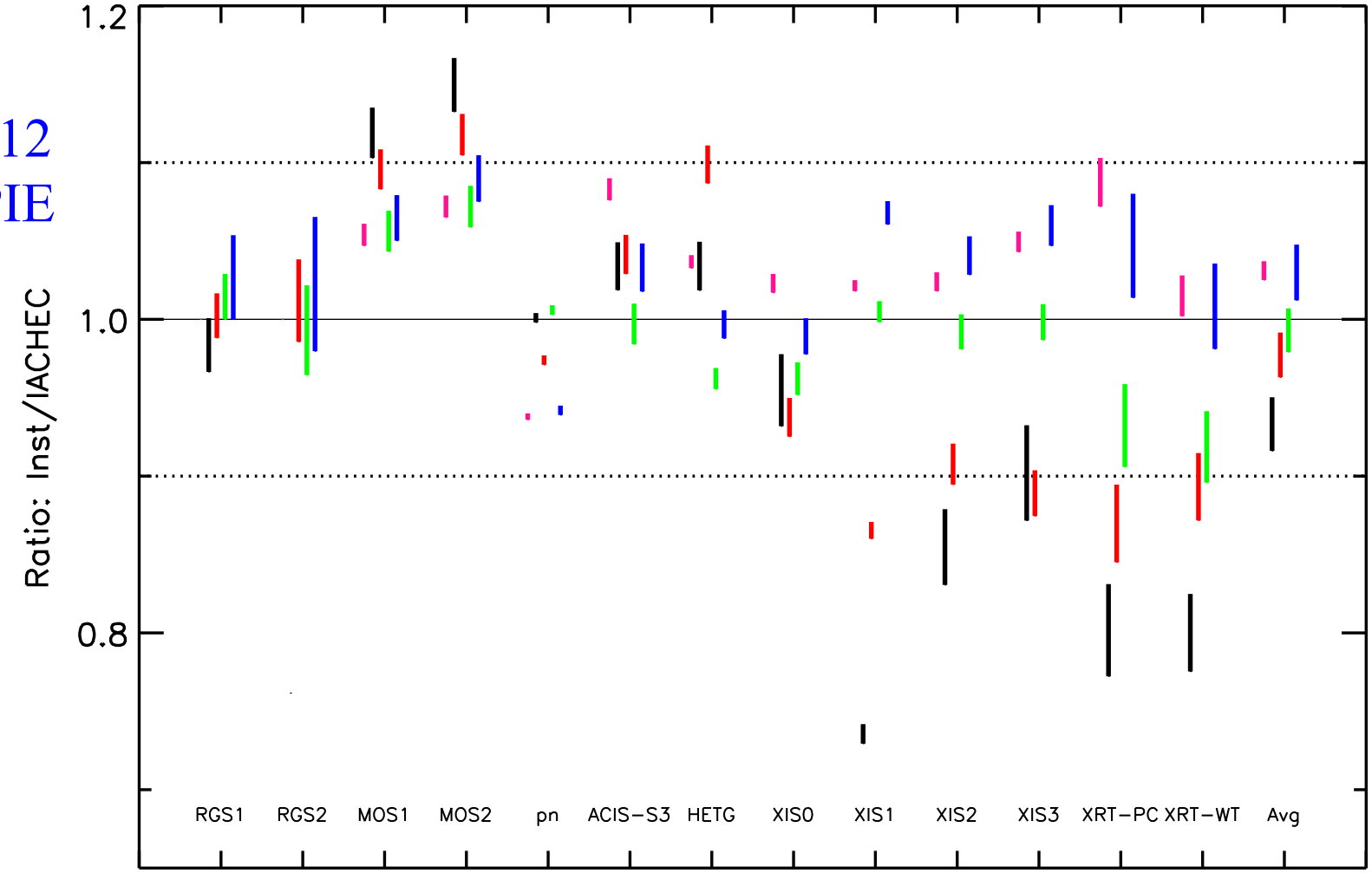
Relatively simple spectrum dominated by O & Ne, little or no Fe emission.

In most applications, line energies & widths are frozen, only 4 normalizations are allowed to vary OVII, OVIII, NeIX, & NeX

# Comparison of Fluxes for Bright Line Complexes:

• Only 5 or 7 free parameters, normalizations for the OVII triplet (560-574 eV), the OVIII Ly-a (654 eV), the NeIX triplet (905-922 eV), and the NeX Ly-alpha line (1022 eV) and gain for some instruments

2012 SPIE



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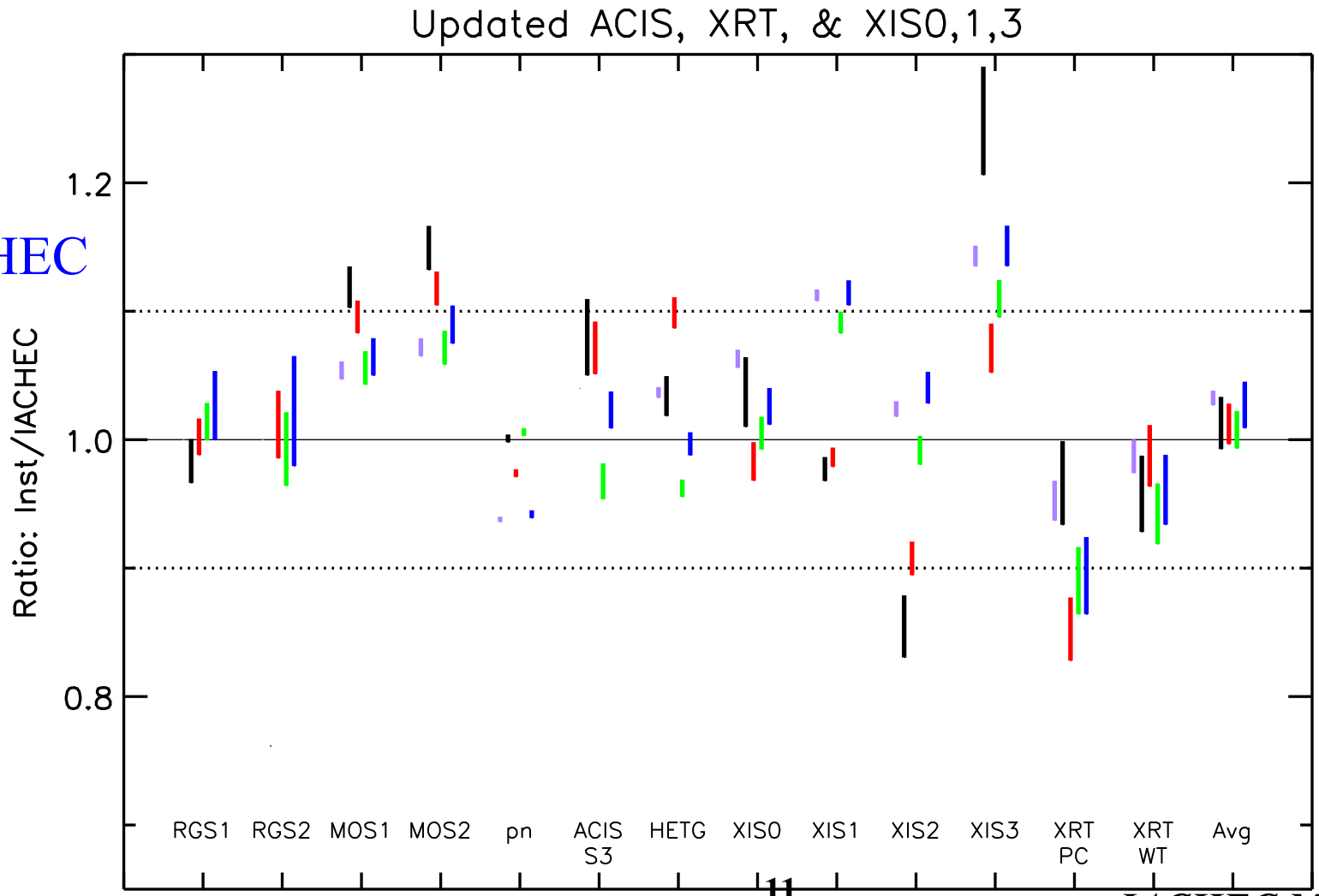
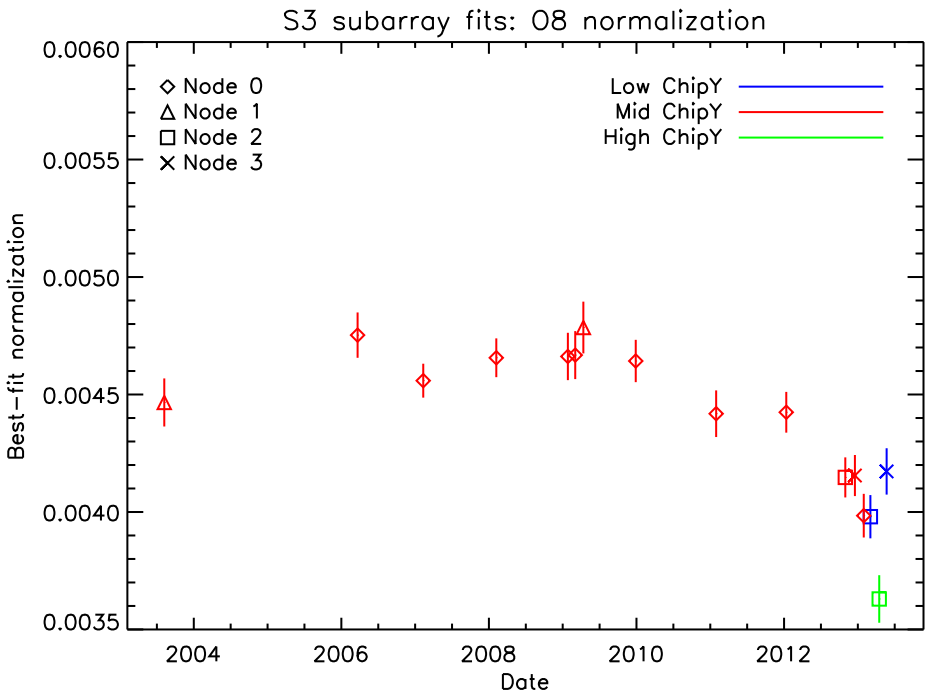
2013
IACHEC

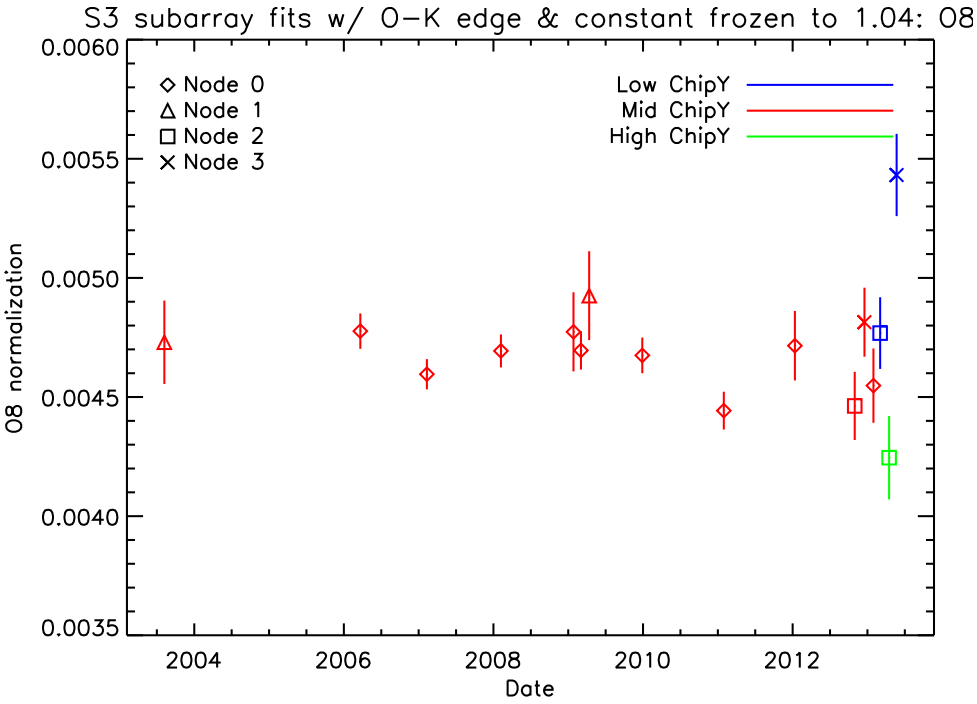


## Use of the IACHEC E0102 Model: ACIS Contamination vs. Time

***Posson-Brown(SAO)***

Time-variable extra O edge



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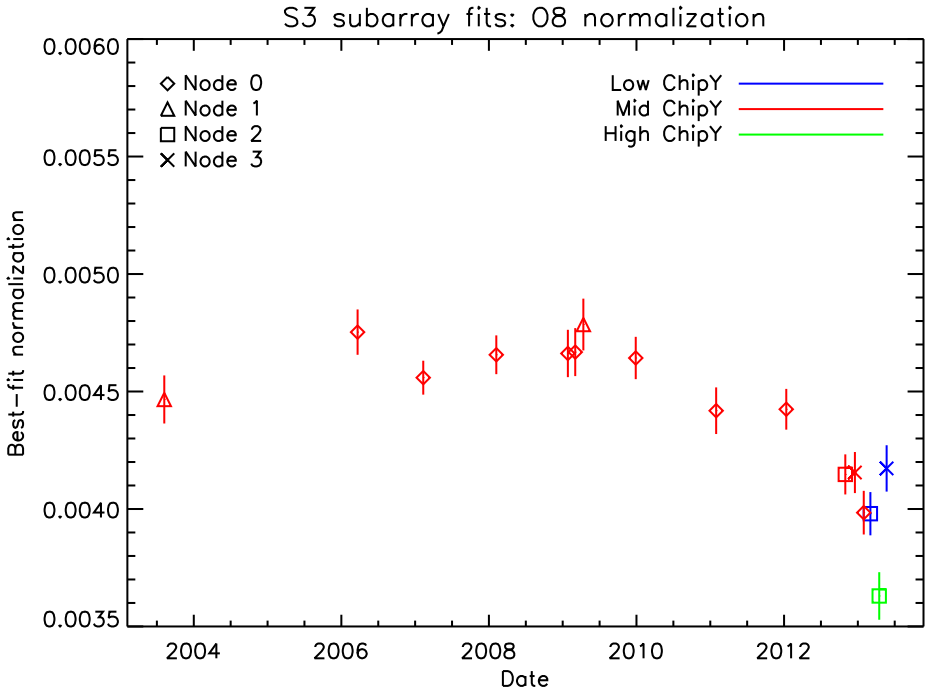
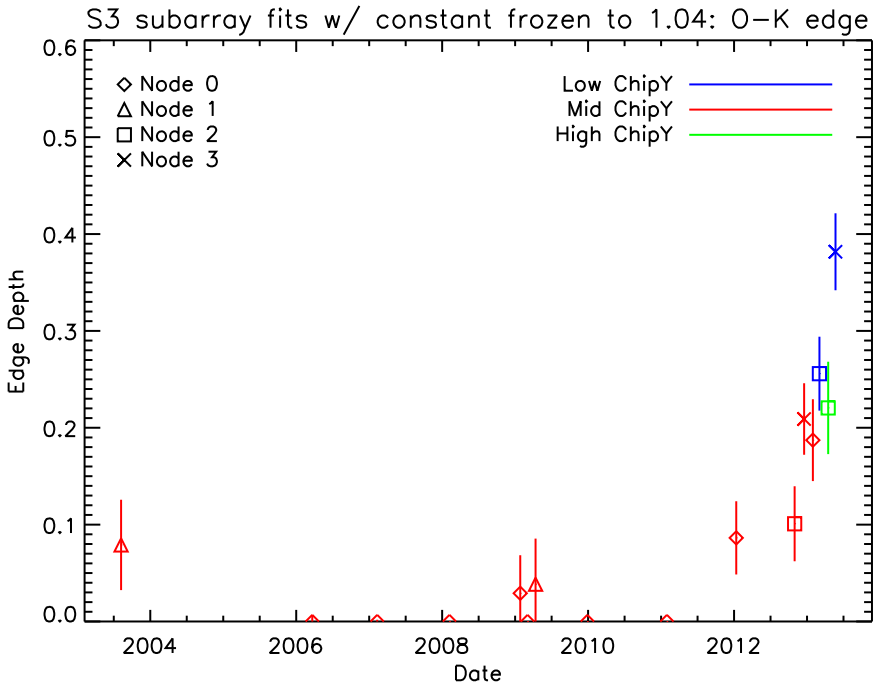
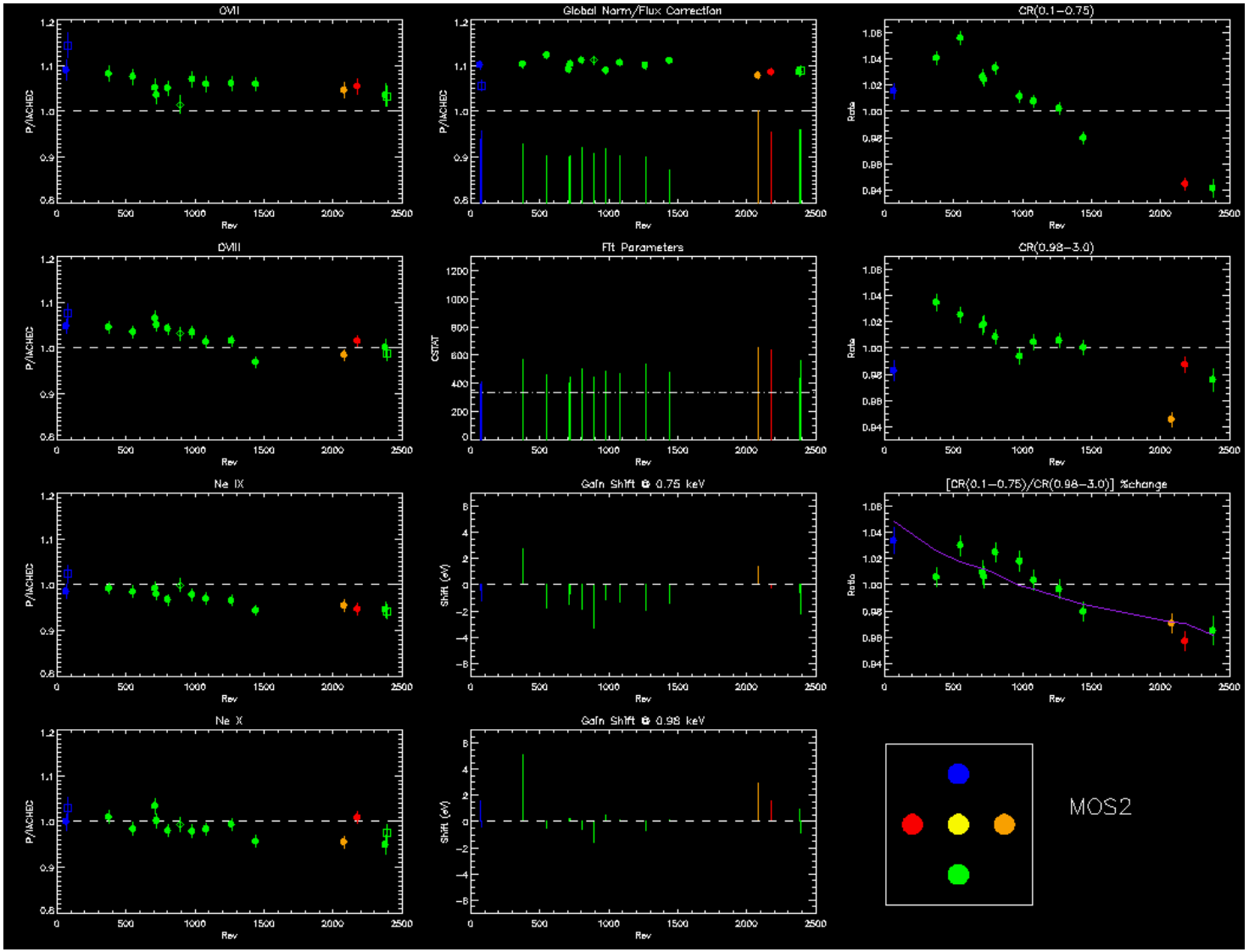


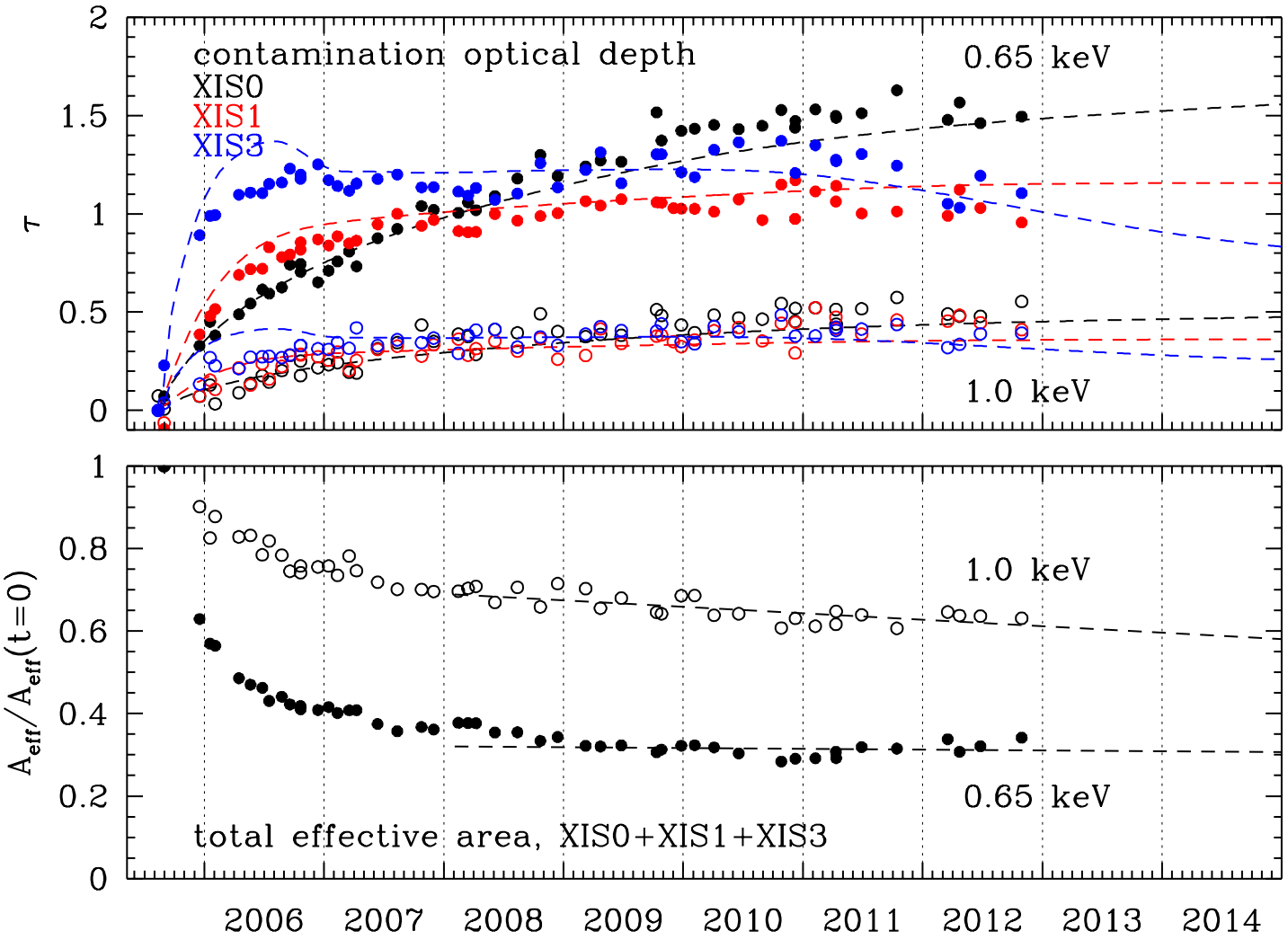



# Use of the IACHEC E0102 Model: MOS Time Dependent Response




MOS2 time-dependent response, Sembay (Leicester)

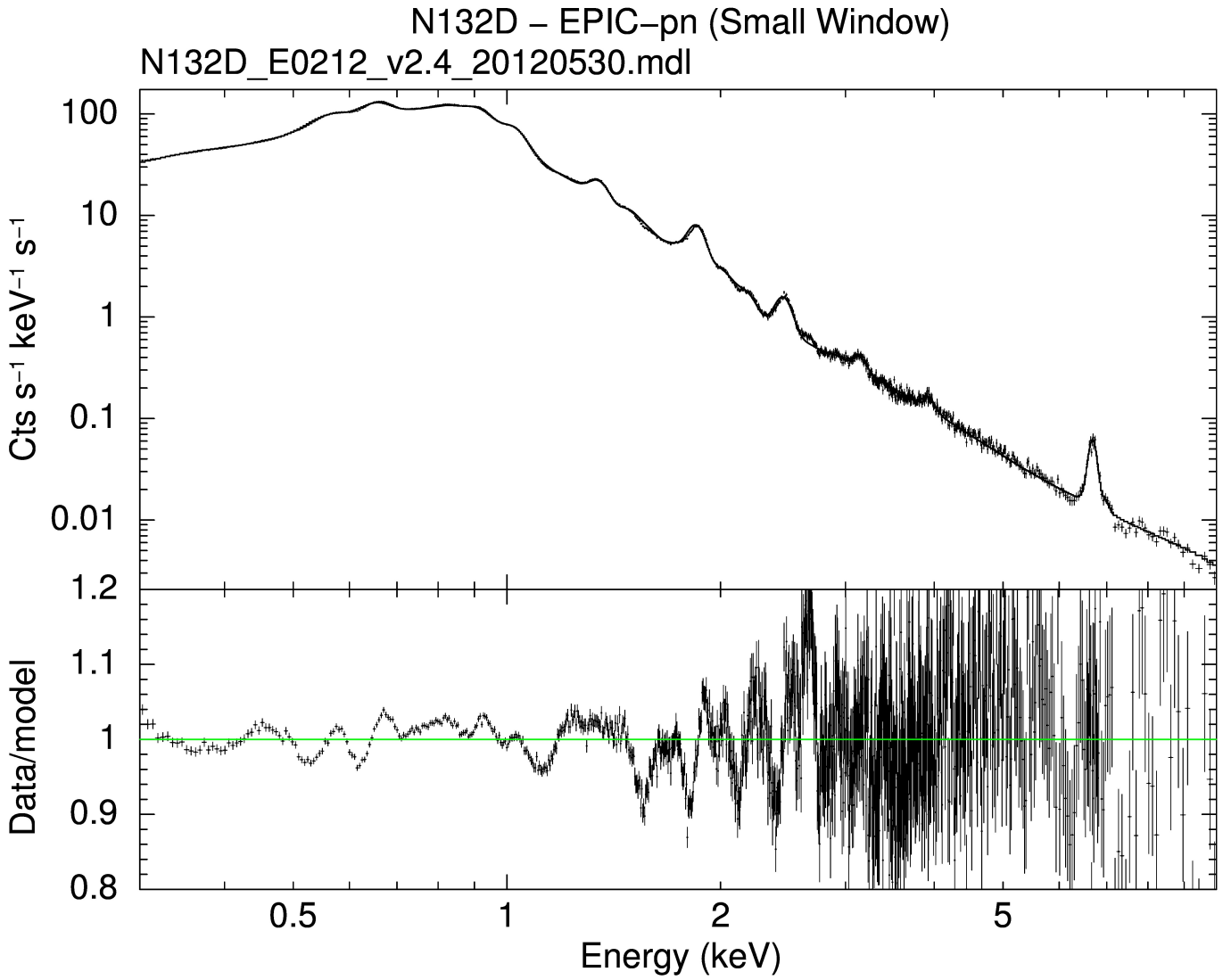
## Use of the IACHEC E0102 Model: Suzaku XIS Contamination




Miller (MIT)

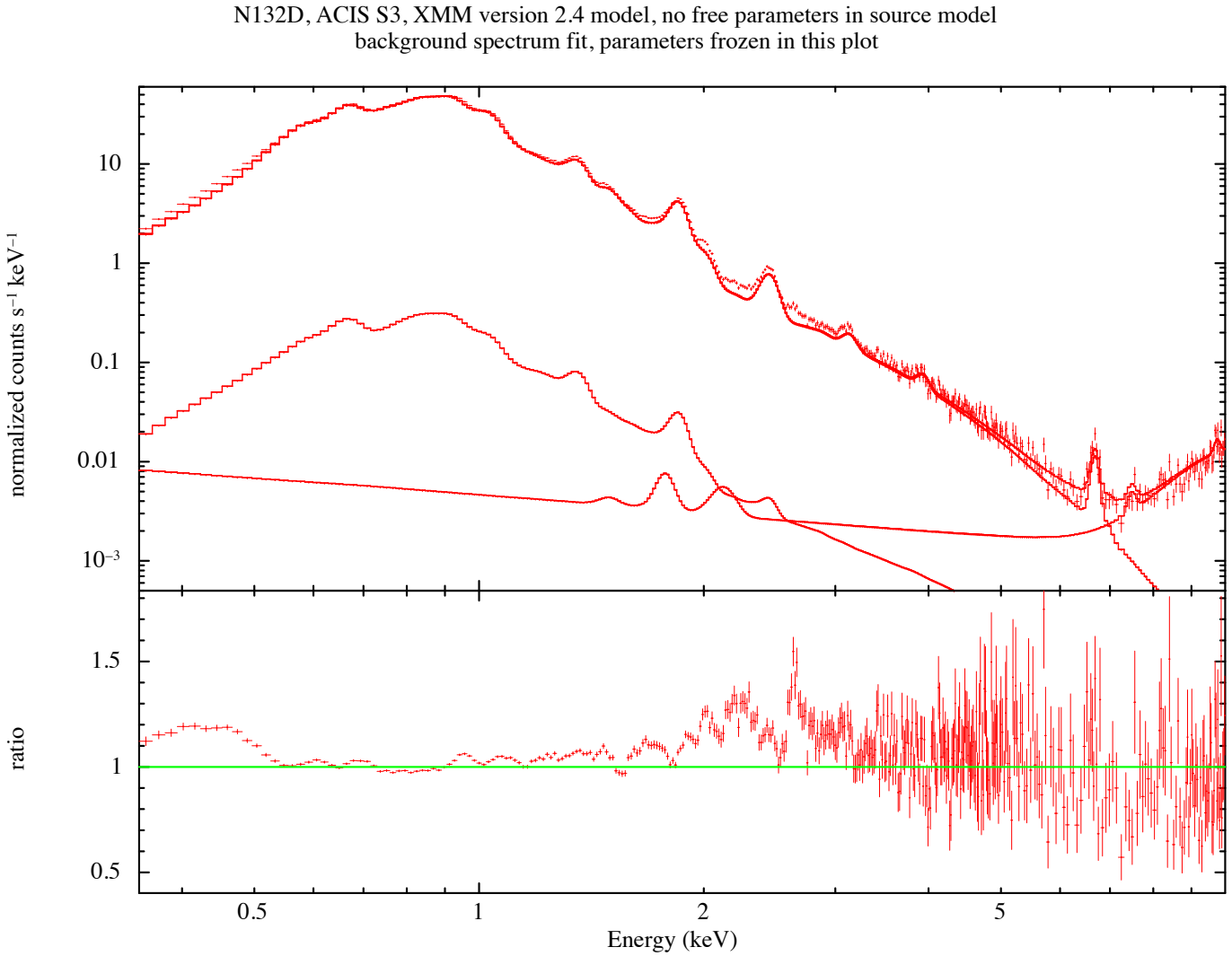
from E0102

## N132D Model based on XMM RGS and PN data:

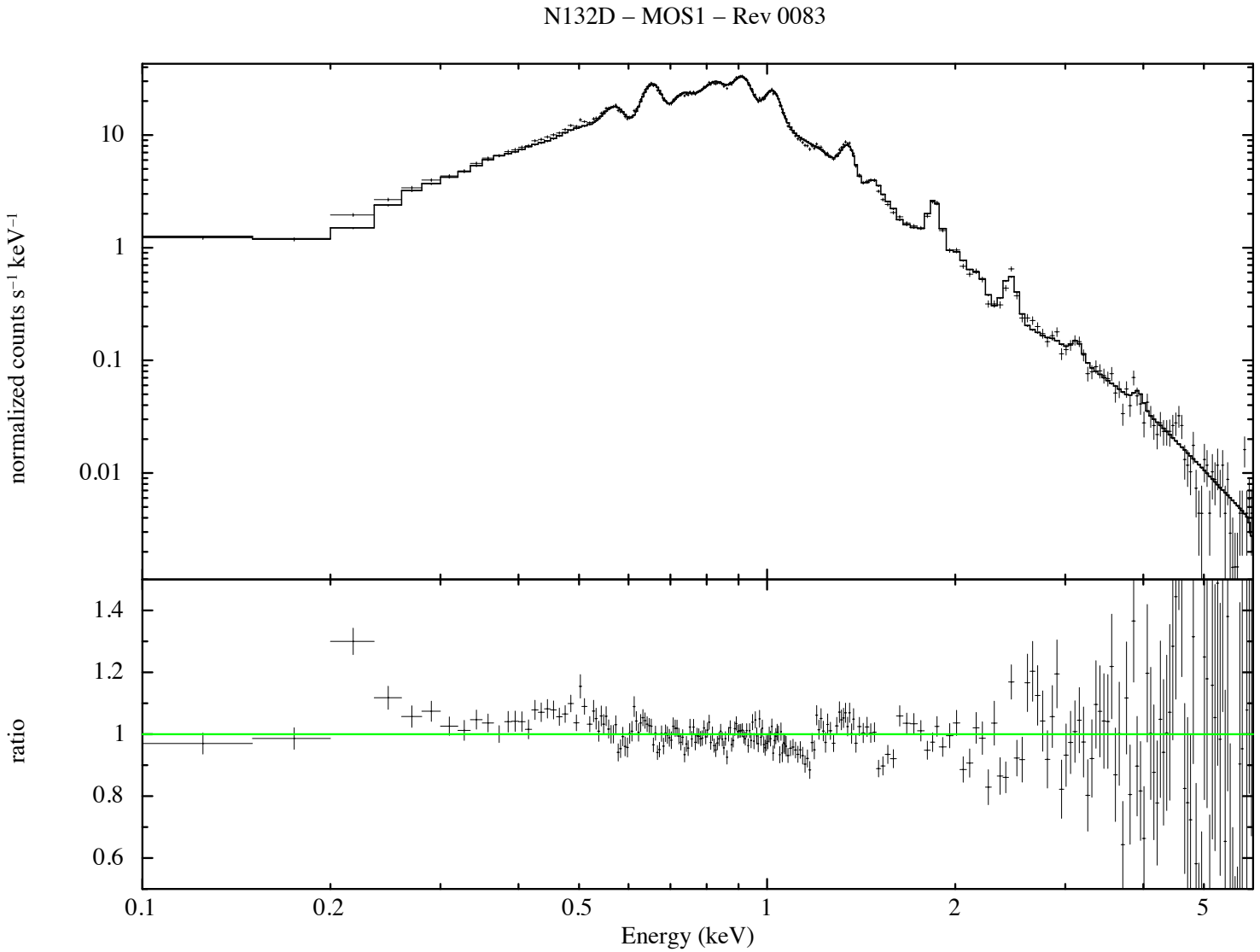



*Guainazzi, Stuhlinger, & Pollock (ESAC) v2.4*

## N132D v2.4 Model compared to ACIS Data:

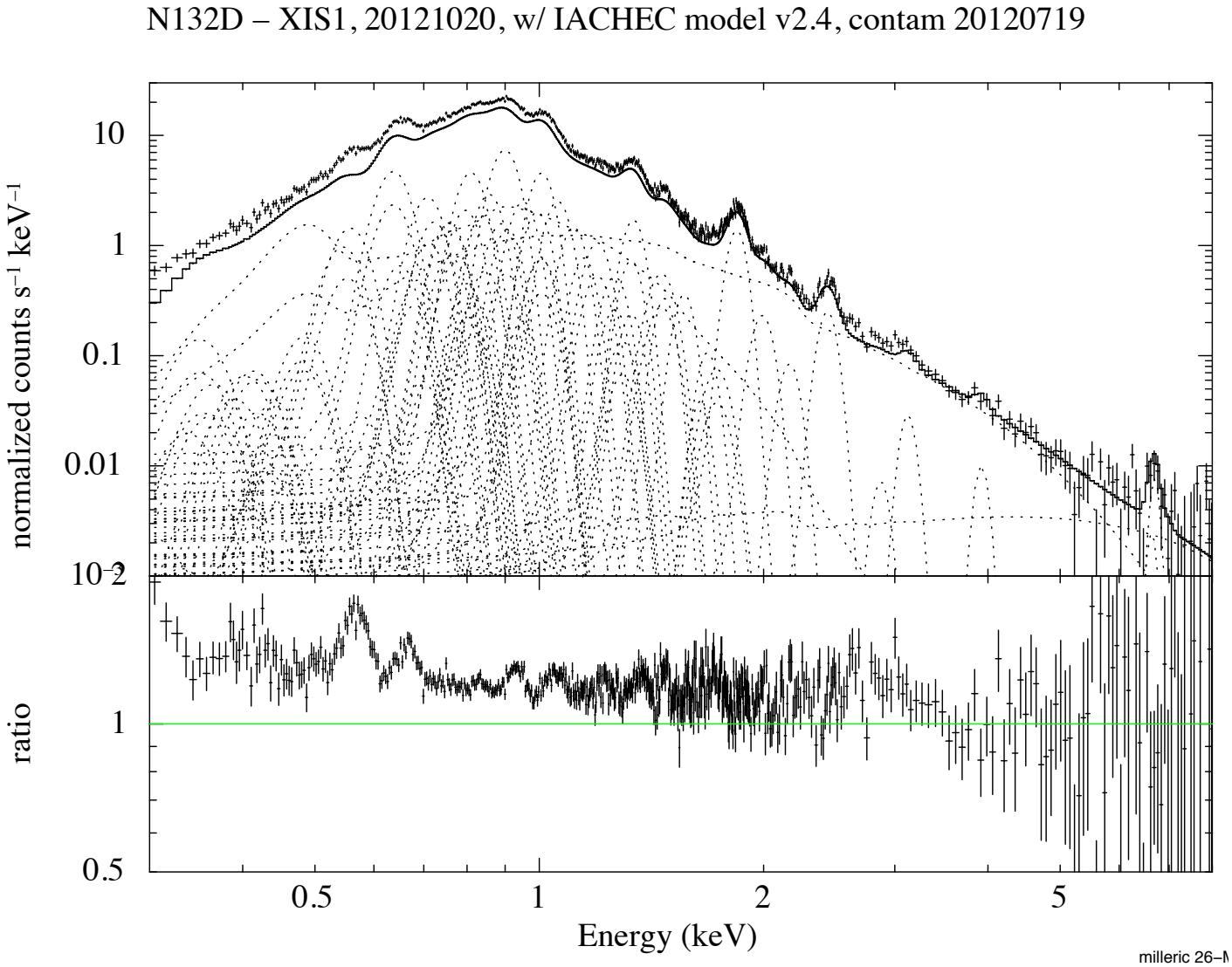


## N132D v2.4 Model compared to MOS Data:




Sembay (Leicester)

## N132D v2.4 Model compared to Suzaku XIS Data:




Miller (MIT)

# Summary

## 1 E0102-7219:

- The IACHEC standard model has become a valuable tool for some of the teams to understand the changes in their instruments with time. This is a clear success of the IACHEC.
- SPIE papers are not good enough, we need to decide what we want to in an A&A paper to give the model more visibility.

## N132D:

- A standard IACHEC model of N132D is under development
- We need to decide how we will use such a model to help our calibrations