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

E0102: X-ray brightest in the SMC
0.77X0.77 arcmin, 13X13 pc
t ~ 1,000 yr (Hughes et al. 2001)
$L_X(0.3-10.0 \text{ kev}) = 2.5 \times 10^{37} \text{ ergs s}^{-1}$
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Chandra X-Ray Observatory

RGS Spectra of E0102 & N132D

XMM RGS
Courtesy
A. Pollock
(ESAC)

E0102
Pure Fe
N132D

Counts s$^{-1}$ cm$^{-2}$ Å$^{-1}$
RGS Spectra of E0102 & N132D

- E0102
- Pure Fe
- N132D

Wavelength (Å)

Counts s⁻¹ cm⁻² Å⁻¹

XMM RGS
Courtesy
A. Pollock
(ESAC)
**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.

**E0102**  
Pure Fe

**N132D**
Suzaku Spectrum of E0102 & N132D

N132D 2010–07–27 (XIS1)
E0102 2010–06–19 (XIS1)
XMM-Newton RGS Spectrum of E0102:  

Pollock (ESAC)

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

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

![Graph showing comparison of fluxes for bright line complexes.](image-url)
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Use of the IACHEC E0102 Model: ACIS Contamination vs. Time

Posson-Brown (SAO)

Time-variable extra O edge

S3 subarray fits: O8 normalization

S3 subarray fits w/ O–K edge & constant frozen to 1.04: O8

Paul Plucinsky

IACHEC March 2013
Use of the IACHEC E0102 Model: ACIS Contamination vs. Time

**Posson-Brown (SAO)**

Time-variable extra O edge

![Graphs showing ACIS contamination over time](image-url)
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

Paul Plucinsky
N132D Model based on XMM RGS and PN data:

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

EPIC-pn residuals against IACHEC model v2.4
N132D v2.4 Model compared to ACIS Data:

N132D, ACIS S3, XMM version 2.4 model, no free parameters in source model
background spectrum fit, parameters frozen in this plot
N132D v2.4 Model compared to MOS Data:

N132D – MOS1 – Rev 0083

Sembay (Leicester)
N132D v2.4 Model compared to Suzaku XIS Data:

N132D – XIS1, 20121020, w/ IACHEC model v2.4, contam 20120719
**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