Thermal SNR Working Group: Report from this IACHEC

Paul Plucinsky on behalf of the IACHEC Thermal SNR Working Group
Chandra X-Ray Observatory

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)
The major challenge over the last few years has been characterizing the time-dependent performance of the various instruments. How do we perform a meaningful comparison??
E0102: How to Compare the Instruments?

Steve Sembay had the brilliant suggestion:

Don’t Do It !!!

Organization of an A&A Paper on E0102:

① Compare line normalizations/effective areas for the early mission data sets used in the 2008 SPIE paper with the calibration available today.
② Each instrument will write its own section on its time dependence.
Comparison of Fluxes for Bright Line Complexes:

- 2008 SPIE results updated in 2010

O VII black  O VIII red  Ne IX green  Ne X blue

DePasquale (SAO)  Posson-Brown (SAO)

Preliminary
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
N132D: Brightest SNR in the LMC

Guainazzi, Stuhlinger, & Pollock (ESAC)
• Fit the EPIC-pn spectrum in the 2-10 keV band
  ◆ Continuum+$\sum$unresolved Gaussian lines+power-law (high-energy background)
• Freeze all the parameters in #1, and fit the RGS spectrum
  ◆ Another continuum+photoelectric absorption+$\sum$unresolved Gaussian lines
  ◆ We try to add full “atomic series” of lines (e.g.: OVIII, NeIX, FeXX …) rather then being simply driven by the statistics.
  ◆ Lines are identified and their energy frozen to the value in ATOMDB (via the XSPEC identify command)
  ◆ Once the lines are identified, a fit cycle is run on the whole model to determine the best-fit line width for each series. The width of each line in each series is calculated rescaling linearly with energy the width of its first line
  ◆ This is: N132D_E0212_v2.3_20120324_RGS.mdl
  ◆ This model does not necessarily work well above 2 keV
• Freeze the energy and the width of the Gaussian components in the RGS energy bandpass in #2. and fit the EPIC-pn spectrum again
  ◆ This is: N132D_E0212_v2.3_20120324_PN.mdl
• Free the energy, the widths and the normalizations of the Gaussian components in the RGS energy bandpass in #2, and fit the EPIC-pn spectrum again
  ◆ This is: N132D_E0212_v2.3_20120324_PN_RGSLinesFrozen.mdl
N132D: Comparison of IACHEC model to pn data

N132 – EPIC–pn (Large Window)

N132D_E0212_v2.3.4_20120324_PN_RGSLinesFrozen.mdl
N132D: Comparison of IACHEC model to ACIS data

N132D, ACIS S3 spectrum 89 ks, XMM RGS+pn ver 2.3.3 model
Cstat=6382.8, 643 DOF
N132D: Comparison of IACHEC model to ACIS data

N132D, ACIS S3 spectrum 89 ks, XMM RGS+pn ver 2.3.3 model
Cstat=6382.8, 643 DOF
N132D: Comparison of IACHEC model to MOS data

Sembay (Leicester)
N132D: Comparison of IACHEC model to MOS data

Sembay (Leicester)

Global model renormalized

![Graph showing the comparison of N132D and MOS1 data](image)
N132D: Comparison of IACHEC model to XIS data

Miller
(MIT)

black = XIS1
red = XIS0
green = XIS3
Summary

1 E0102-7219:

- We need to decide what we want to publish (if anything) on the multiple measurements over the course of the mission

N132D:

- We want to develop a standard IACHEC model of N132D that we can use for calibration purposes

Fitting Methodology:

- We want adopt the approach of using unbinned spectra, modeling the background, & using the C statistic
- We believe the IACHEC should take the lead in encouraging the User community to adopt this approach