Understanding and Correcting for the ACIS Contaminant

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C−K edge

C−K EXAFS

0.285   0.290
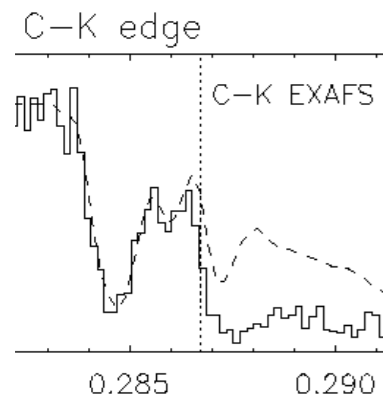
Overview

- Grating and external cal source (ECS) data disagree at 10% level, reconciled by adding fluffium

- Correcting for the ACIS contaminant is good to <3%

- The contaminant is still being monitored

- No new observations are planned to test models of the contaminant

ECS Results Summary (from Alexey Vikhlinin)

- Optical depth uncertainties $\tau \sim 0.03$

- 2002-4: $d\tau/dt \sim 0.06 \pm 0.025$ per year

- Significant spatial variations up to 50%

- Correcting for contaminant is good to ~3%

  - Set $\tau(t)$ at 700 eV using ECS
  - Set $\tau(E)$ using grating fits & fluffium
  - Correction above 600 eV is robust
  - Below 600 eV, correction is less certain

LETG/ACIS Analysis Summary

- Twenty observations analyzed over 5 years fit to double PL spectra

  - τ(C-K) is good to about 0.07 (mostly systematic error)

  - ACIS QE systematics are corrected

  - Pileup, Ir-M edge are corrected

  - Residual systematics across spectrum are < 5%

- Composition: > 70% C and ~5-10% O & F

- $d\tau_{C\text{-}K}$ = 0.45 ± 0.03 per year

- τ(700 eV) varies < 5% with model

Time Dependence

- Fix contaminant composition, giving 1-parameter fits
- Absorption model gives estimate of 700 eV optical depth
- Comparison to ECS still shows discrepancy — fluffium needed
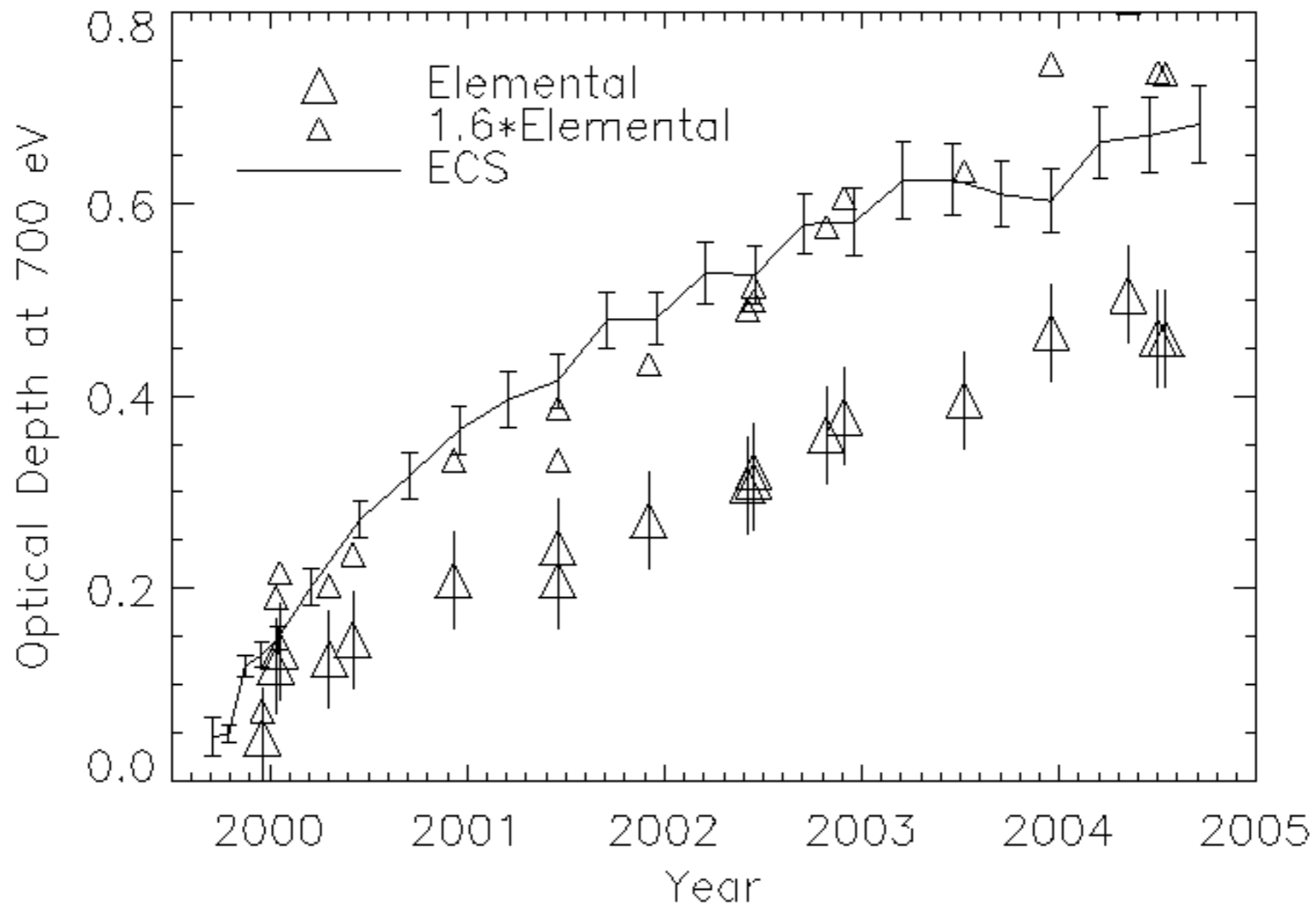
Reconciling ECS and ACIS/LETG Spectra

- Multiple optical depth (fluffy) material can have different edge depth dependences on thickness

- Model allows larger o.d. at high E, without affecting C-K

- Approximate model with "element" fluffium, a fake spectral component

- Time dependence is pegged to ECS results

- CIAO decontamination scripts use fluffium calibration files in caldb

- A.P. Hitchcock (McMaster U.): thickness variations should not be expected — model is unphysical

Spatial Variation

- Dithering around row 35 near readout samples various optical depths
- Compute optical depth gradients vs. energy
- Gradients are larger than expected but within uncertainties from ECS
- Gradients change with time as contaminant pattern varies
- Gradient is not responsible for varying optical depth of "fluffium"
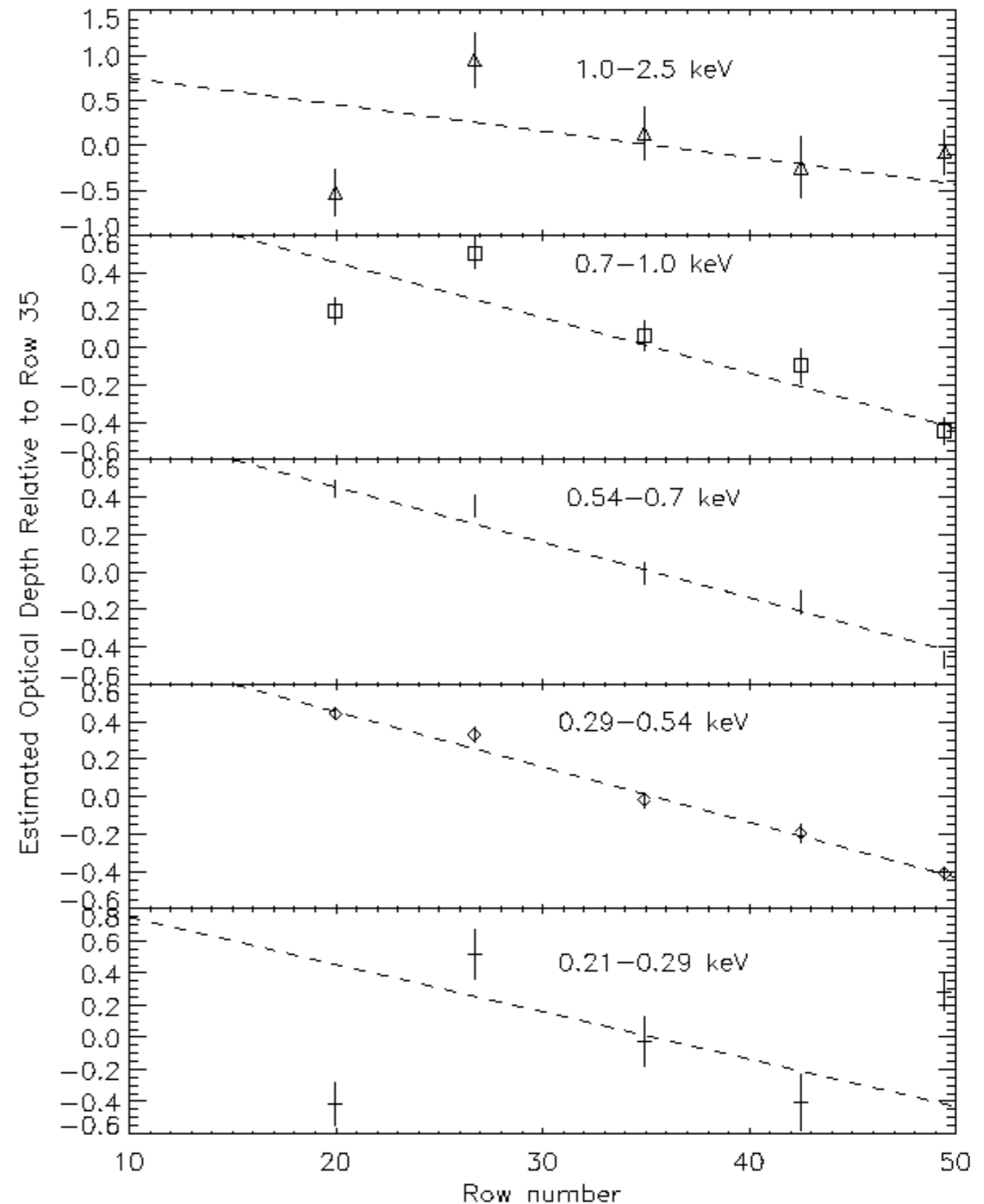
Plans to Improve Contaminant Modeling

- Refit all LETG/ACIS data with released fluffium model

- Determine gradients for other observations to refine the spatial nonuniformity model

- Quantify limits to spatial and temporal composition variations

- Compare global fits to LETG/HRC and XMM-Newton fits

- Track C-K and O-K edge structure
  - 510 eV O I feature should be distinguishable from ISM
  - 285 eV C=C feature is now evident in contaminant
  - Features may track a second component of contaminant