An Introduction to XSLIDE

X-Ray Spectral Line IDentifier and Explorer

NASA/GSFC XRISM SDC
Outline

- Scientific Methodology of Plotting X-Ray Spectra
- Overview of XSLIDE Software
- XSLIDE Walkthrough
- Software Development
Scientific Methodology of Plotting X-Ray Spectra
An X-Ray spectrometer obtains photon counts, from which we seek to determine the source spectrum via the equation:

\[ C(I) = T \int R_{\text{RMF}}(I, E) R_{\text{ARF}}(E) S(E) dE \]

- **Problem**: This equation cannot be analytically solved for \( S(E) \)
- **Rigorous Solution**: Forward fitting, by positing a model for \( S(E) \), minimizing the error by varying the model parameters, and revising the model as necessary
Choosing the right model is not always easy, and doing so takes time.
XSLIDE’s solution

\[ C(I) = T \int R_{\text{RMF}}(I, E)R_{\text{ARF}}(E)S(E)dE \]

- Assume RMF is a diagonal matrix providing an ideal one-to-one mapping between incident photon energy and detector channel
- Assume ARF is slowly varying such that it is approximately constant between neighboring instrument channels
- Allows for \( S(E) \) to be solved directly as:

\[
S(E) = \frac{C(I)}{R_{\text{ARF}}(E)T\Delta E}
\]
Benefit of XSLIDE’s Solution
Validity of XSLIDE’s Solution

Overview of XSLIDE Software
How to Access XSLIDE

- Both desktop and web versions are available, with very similar user interfaces
Language Localisation

- Available in Japanese on both desktop and web

Thanks to Chris Baluta and Megumi Shidatsu for their work on these translations!
XSLIDE is designed to be simple and easy to use. The user is guided through ordered steps and substeps:

1. Load and Modify Spectrum
2. Detect Lines
3. Identify Lines
4. Perform Diagnostics
5. Export Results
XSLIDE Walkthrough
Exploring Hitomi’s Perseus Data
Brief Demonstration of Web Version
Software Development
Model-View-Control Software Architecture

**View**
Defines the display shown
- Qt: most of the widgets
- PyQtGraph: interactive graph

**View**
Defines the display shown
- HTML/CSS
- Bokeh: interactive graph and most other widgets

**Model**
Directly stores and updates the application’s underlying data
- Python
- Astropy: performs common astrophysical functions
- PyVO: retrieves spectra from HEASARC archive

**Controller**
Responds to user events
- Qt for Python (PySide6)

**Controller**
Responds to user events
- JavaScript
- Bokeh: backend server
Testing

- Unit testing for Python-based Model
- Functional testing for GUIs
  - Squish for desktop
  - Selenium for web
Summary

- XSLIDE is a simple and user-friendly application that allows for the interactive plotting of spectra from XRISM’s Resolve instrument without forward-fitting.
- XSLIDE performs many common tasks involved in X-ray spectrum analysis:
  - Rebinning
  - Continuum fitting
  - Automatically detecting lines
  - Assigning detected lines to known atomic transitions
  - Spectral diagnostics
- XSLIDE will help XRISM’s scientific investigators to rapidly examine many spectra to find those that contain spectral lines of particular interest.
- XSLIDE will also allow astronomers from outside the field of X-ray spectroscopy to easily interact with XRISM data.
Thank You!

Questions?

For follow-up questions, or to request access to the beta version of XSLIDE, please contact xrism-sdc-help@lists.nasa.gov