

# SIMPOT - A FILE FORMAT FOR SIMULATION INPUT

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## Abstract

With *SIMPOT* we present a standard format for source input files to be used in simulations of astronomical observations. Each source file contains a catalog with one or multiple sources which are described by specific properties such as position, brightness, energy spectrum, as well as optional characteristics such as time variability, polarization and spatial extent. The *SIMPOT* file format defines a common basis to exchange data between different software packages and scientific groups. It was developed in particular for the simulation of X-ray telescopes and is already used in several projects such as, e.g., eROSITA. However, *SIMPOT* can also be utilized in different wavelength domains.

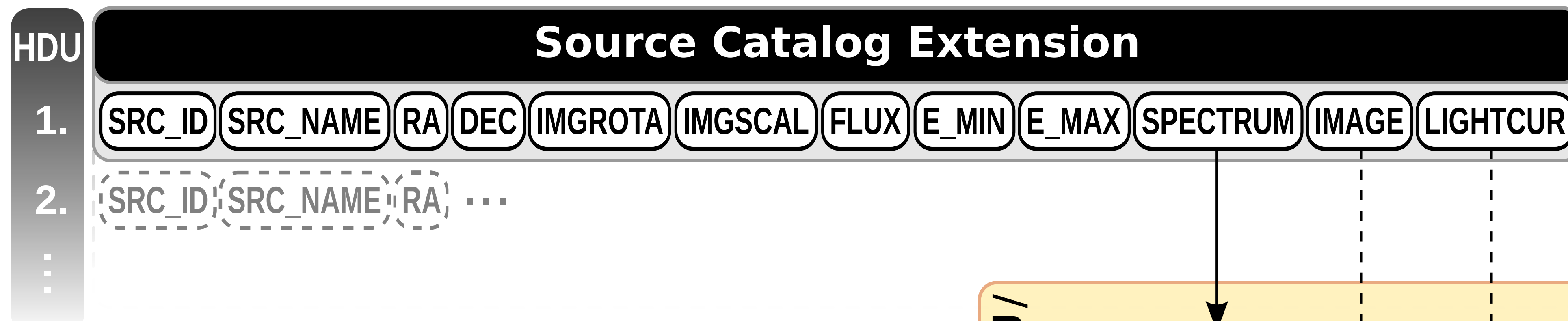
## Overview

*SIMPOT* is a common input data format for simulations of astronomical X-ray telescopes based on the *Flexible Image Transport System (FITS)* by Hanisch et al. (2001) and Pence et al. (2010). This turns catalogs which were created in *SIMPOT* format into very versatile databases and allows to reuse data which was generated for one particular simulation in other software packages.

The *SIMPOT* format supports modeling of, e.g.,

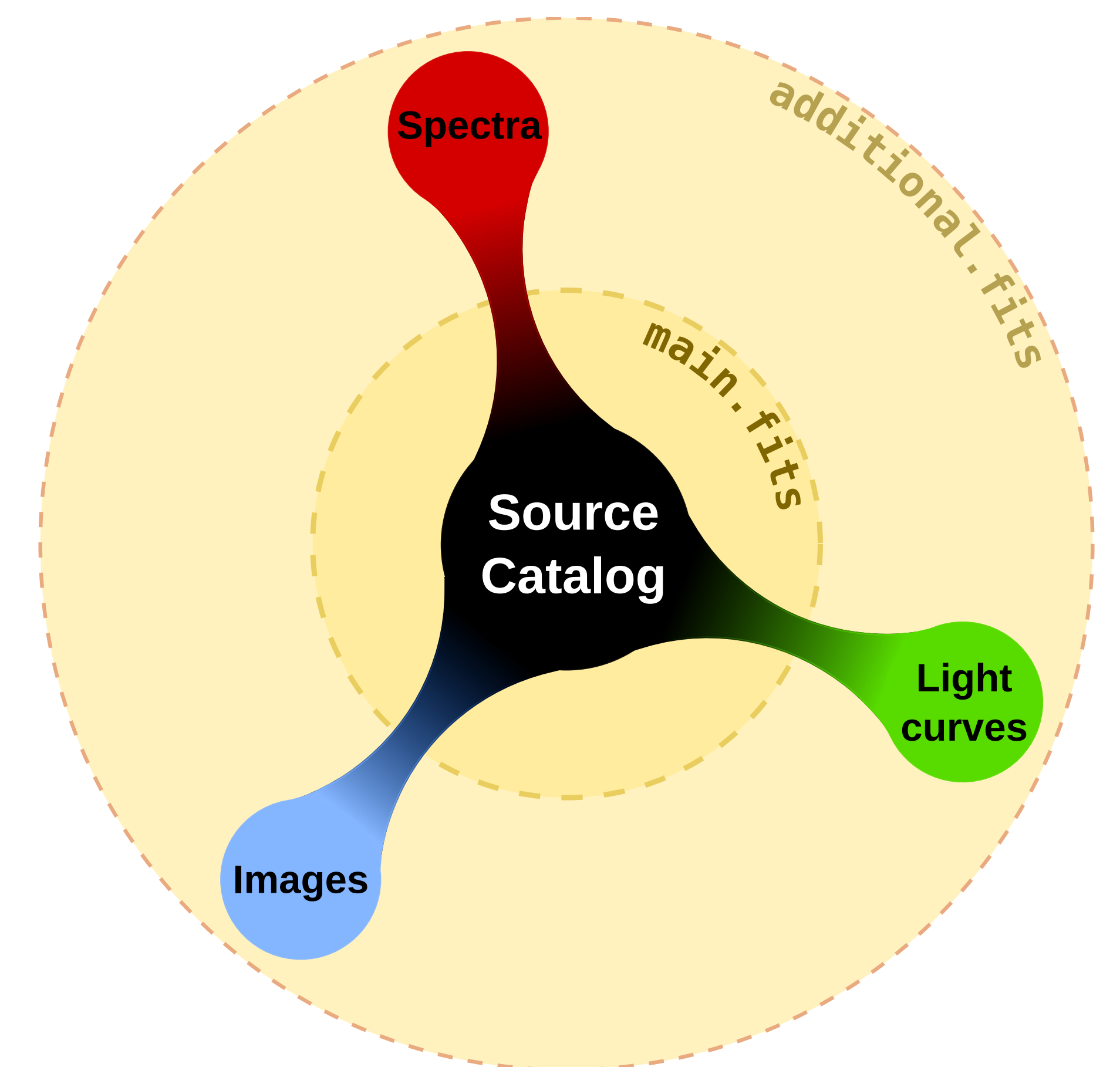
- source positions
- spatial shapes for extended sources
- energy spectra
- polarization of emitted radiation
- time-variable features

## Source Catalog

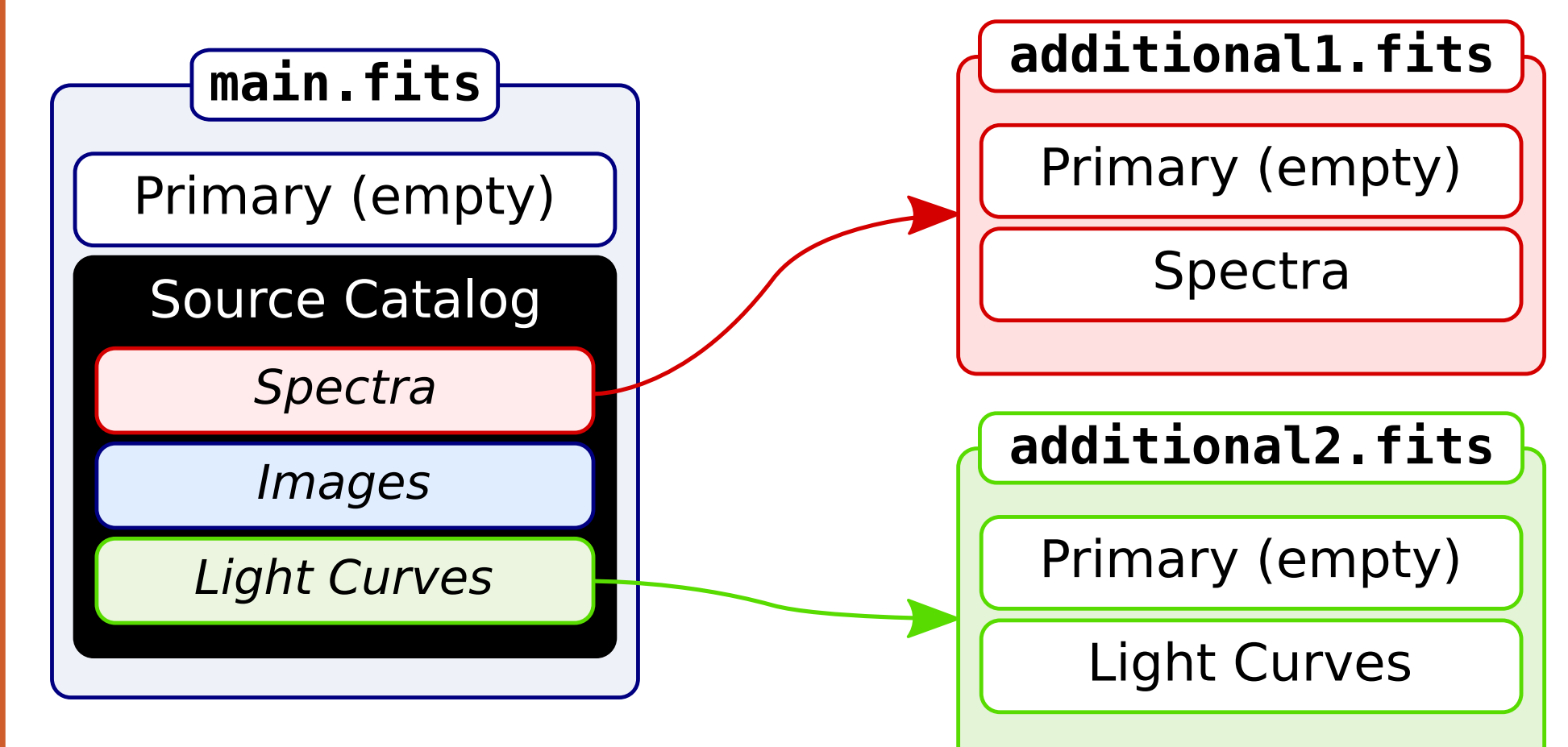


The structure of the mandatory source catalog extension is shown in the figure above. Basic properties of at least one source (such as position, energy flux density...) as well as a reference to a spectrum extension must be provided. In contrast, references to a source image and a light curve or PSD are optional.

## File Structure

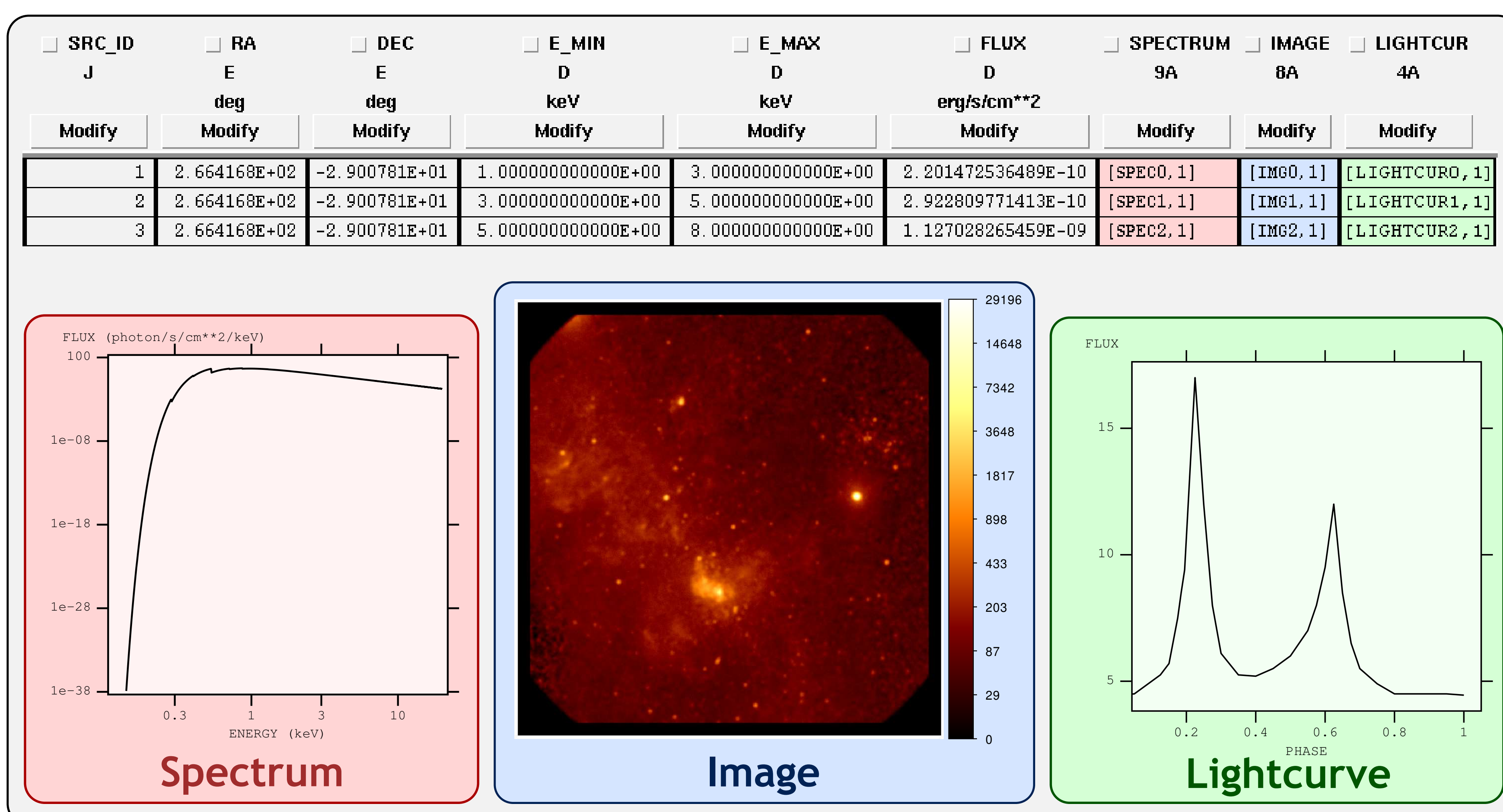


The *SIMPOT* file structure consists of at least one *FITS* file which contains a catalog of all sources and optionally additional information (spectra, lightcurves, images...). However, these can also be stored in dedicated external *FITS* files with a corresponding reference in the main file.



References to additional data must be provided in the form of the *FITS* extended filename syntax (see example). The Primary extension in the main *FITS* file and every additional file may either contain source image data or should be empty.

## Example



This source catalog contains three sources, each of them providing additional image and lightcurve data. These data are referenced by using the *FITS* extended filename syntax which leads to additional HDUs in the main file in this case. If, e.g., lightcurve data were stored in an external file, the link must have the form `external_lc.fits[LIGHTCURn, 1]` (with *n* being the number of the corresponding HDU).

The example plots and the image are just for presentation purposes and don't correspond to the original file.

## Conclusion

Due to reasons of simplicity, only a small overview on the *SIMPOT* data format could be presented. Its capabilities reach much further and satisfy even elaborate requirements (such as, e.g., modeling of highly variable sources with different polarized emission regions and oscillations between spectral states).

Due to its versatility and portable design, *SIMPOT* can be useful not only for X-ray astronomers but also in other domains. This could provide a valuable advantage for data archival and exchange in multi-wavelength astronomy.

## References and Acknowledgements

Schmid C., Smith R., Wilms J., et al., 2011, "SIMPOT - A File Format for Simulation Input"  
 Hanisch R.J., Farris A., Greisen E.W., et al., 2001, *Astronomy and Astrophysics* 376, 359  
 Pence W.D., Chiappetti L., Page C.G., et al., 2010, *Astronomy and Astrophysics* 524, A42  
 This research was funded by the BMWi under DLR grant numbers 50 QR 0903, 504 OR 0801