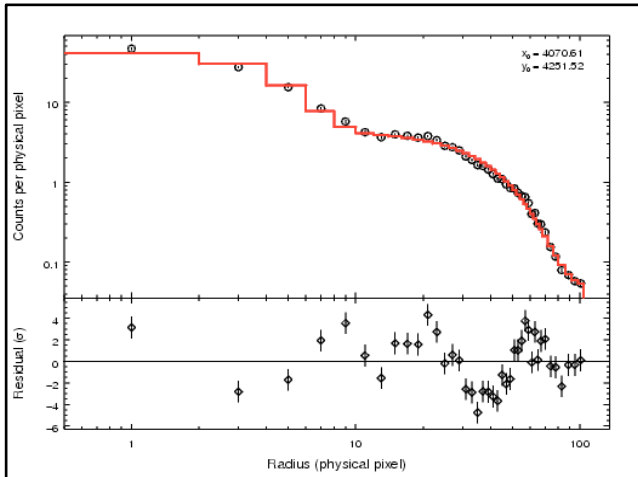




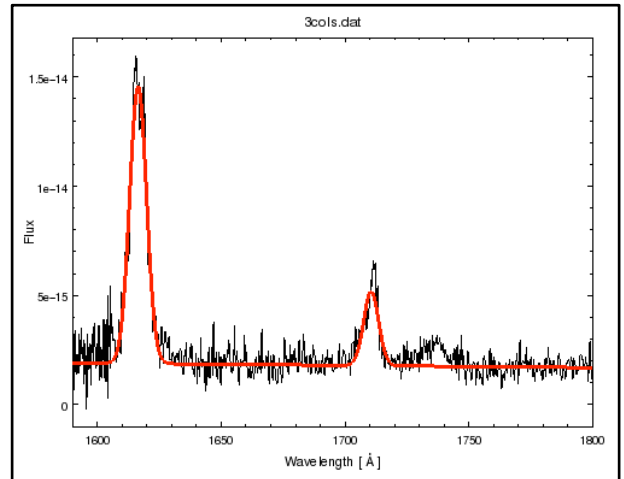
## The Chandra Modeling and Fitting Package

Sherpa enables the user to construct complex models from simple definitions and fit those models to data; optimization methods and fit statistics are used to characterize the results.

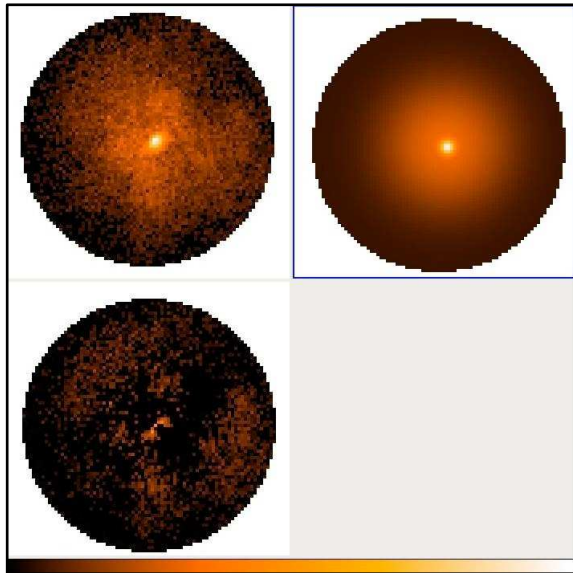
Sherpa can be run from the command line or imported as a Python module. Both options allow users to write their own analysis scripts in Python.



*Surface brightness: model fit and residuals*



*Fitting an optical spectrum*



*Image of the data, model, and residuals*

### What you can do with Sherpa:

- fit 1D data: spectra, surface brightness profiles, light curves, general ASCII arrays
- fit 2D images/surfaces in the Poisson/Gaussian regime
- fit data iteratively with the Primini and sigma-rejection methods
- access the internal data arrays
- build complex models with convolved and unconvolved components
- define XSpec-style additive and multiplicative table models
- select appropriate statistics for modeling Poisson or Gaussian data
- visualize a parameter space with simulations or by using 1D/2D cuts of the parameter space
- calculate confidence levels on the best-fit model parameters
- choose a robust optimization method for the fit: Levenberg-Marquardt, Nelder-Mead Simplex or Monte Carlo/Differential Evolution

A full list of features in Sherpa 4.5 is available online: <http://cxc.harvard.edu/sherpa/updates.html>

<http://cxc.harvard.edu/sherpa/>

# Sherpa Command Reference

**add\_model** Add a user-defined model class  
**add\_user\_pars** Add parameters to a user-defined model  
**calc\_chisqr** The chi squared statistic contribution  
**calc\_data\_sum(2d)** Calculate the observed data counts  
**calc\_energy\_flux** Calculate the unconvolved energy flux  
**calc\_kcorr** Calculate the k correction  
**calc\_model\_sum(2d)** Calculate the sum of convolved model amplitudes  
**calc\_photon\_flux** Calculate the unconvolved photon flux  
**calc\_source\_sum(2d)** Calculate the sum of unconvolved model amplitudes  
**calc\_stat** Return the statistic value  
**calc\_stat\_info** Returns goodness-of-fit statistics for a dataset  
**clean** Erase data and model settings in a session  
**conf** Estimate confidence intervals based on method  
**contour** Plot a contour of the data  
**contour\_data** Create a contour plot of the data  
**contour\_fit** Create a contour plot of the fit  
**contour\_fit\_resid** Create a contour plot of the fit and residuals  
**contour\_kernel** Create a contour plot of a PSF kernel  
**contour\_model** Create a contour plot of the model  
**contour\_psf** Create a contour plot of a PSF  
**contour\_ratio** Create a contour plot of the ratio (data/model)  
**contour\_resid** Create a contour plot of the residuals  
**contour\_source** Create a contour plot of the source  
**copy\_data** Copy a dataset to a new data id  
**covar** Estimate confidence intervals  
**create\_model\_component** Create a new model component  
**dataspace1d/2d** Create a blank 1D or 2D dataset  
**delete\_bkg\_model** Remove a background model  
**delete\_data** Delete a dataset  
**delete\_model** Delete a model  
**delete\_model\_component** Delete a model component  
**delete\_psf** Delete a PSF model  
**eqwidth** Compute the equivalent width of a line  
**fake\_pha** Fake PHA counts using Poisson noise  
**fit** Perform a fit  
**fit\_bkg** Perform a fit to background data  
**freeze** Freeze model parameters  
**get\_bkg\_scal** Returns the complete background scaling factor  
**get\_draws** Run pyBLoCXS MCMC-based algorithm  
**get\_response** Return the instrument response model  
**get\_stat\_info** Parses the output of `calc_stat_info()`  
**group/group\_adapt/group\_adapt\_snr/group\_counts/group\_snr/group\_bins/**  
**group\_width** Specify the grouping settings of spectral data  
**guess** Estimate initial parameter values and ranges  
**ignore/\_id** Ignore 1D data with an interval filter  
**ignore2d/\_id** Ignore 2D data with a region filter  
**ignore\_bad** Ignore bins according to quality flags  
**image\_close** Close the imaging window  
**image\_data** Send image of the data to the imager  
**image\_deleteframes** Delete all frames in the imager  
**image\_fit** Send image of the fit\_results to the imager  
**image\_getregion** Returns a region description from the imager  
**image\_kernel** Send a PSF kernel image to the imager  
**image\_model** Send image of the model to the imager  
**image\_model\_component** Images convolved model component  
**image\_open** Open an imager window  
**image\_psf** Image the PSF  
**image\_ratio** Image the ratio (data/model)  
**image\_resid** Image the residuals (data - model)  
**image\_source** Image the source  
**image\_source\_component** Images unconvolved model component  
**image\_setregion** Send a region description to the imager  
**image\_xpaset** Retrieve data from ds9 using XPA  
**image\_xpaset** Send data to ds9 using XPA  
**int\_proj** Confidence plot of fit statistic vs. parameter value  
**int\_unc** Confidence plot of fit statistic vs. parameter value

**link** Link model parameters  
**list\_bkg\_ids** List the available background ids  
**list\_data\_ids** List the available data ids  
**list\_functions** List all available Sherpa functions  
**list\_methods** List the available optimization methods  
**list\_model\_components** List the components of active models  
**list\_model\_ids** List the available model ids  
**list\_models** List the available models  
**list\_priors** List thawed parameters with associated priors  
**list\_response\_ids** List the available response ids  
**list\_samplers** List all pyBLoCXS samplers  
**list\_stats** List available statistics  
**load\_arf** Load source ARF data  
**load\_arrays** Load numerical arrays into a dataset  
**load\_ascii** Load ASCII/text data from a file  
**load\_bkg** Load background data  
**load\_bkg\_arf** Load background ARF data  
**load\_bkg\_rmf** Load background RMF data  
**load\_data** Load a data file  
**load\_image** Load FITS image data  
**load\_multi\_arfs** Load multiple ARF files  
**load\_multi\_rmf** Load multiple RMF files  
**load\_pha** Load PHA data  
**load\_psf** Load a PSF model  
**load\_rmf** Load RMF data  
**load\_table** Load data  
**load\_table\_model** Load data into a table model  
**load\_template\_model** Load a set of template models  
**load\_user\_model** Load a user-defined model  
**notice/\_id** Notice 1D data with an interval filter  
**notice2d/\_id** Notice 2D data with a region filter  
**pack\_image** Pack up image data from a dataset  
**pack\_pha** Pack up PHA data from a dataset  
**pack\_table** Pack up tabular data from a dataset  
**plot** Plot multiple Sherpa components (data, model, etc)  
**plot\_arf** Plot ARF data  
**plot\_bkg** Plot background data  
**plot\_chisqr** Plot the chi-squared  
**plot\_data** Plot the data  
**plot\_delchi** Plot the delta chi  
**plot\_fit** Plot the fit  
**plot\_fit\_delchi** Plot the fit and delta chi  
**plot\_fit\_resid** Plot the fit and residuals  
**plot\_kernel** Plot the PSF kernel  
**plot\_model** Plot the model  
**plot\_model\_component** Plots unconvolved model components  
**plot\_order** Plot the convolved source model by order  
**plot\_psf** Plot the PSF  
**plot\_ratio** Plot the ratio of data/model  
**plot\_resid** Plot the residuals (data - model)  
**plot\_source** Plot the unconvolved source model  
**plot\_source\_component** Plots convolved model components  
**proj** Estimate confidence intervals  
**reg\_proj** Confidence region contour plot using projection  
**reg\_unc** Confidence contour of fit statistic vs. two params  
**reset** Reset model parameter values to defaults  
**restore** Restore a previous Sherpa session  
**sample\_flux** Sample model parameters to get unabsorbed fluxes  
**save** Save the current Sherpa session  
**save\_all** Save all the information about the current session  
**save\_data/image/error/arrays/delchi/filter/grouping/model/quality/resid/**  
**source** Write data, models, and settings to a file  
**save\_pha** Write PHA data to a file  
**save\_table** Write tabular data to a file  
**script** Record all commands in a Sherpa session  
**set\_analysis** Set the units for spectral analysis

**set\_areascal** Set the fractional area  
**set\_arf** Set an ARF dataset  
**set\_backscal** Set the extraction region area  
**set\_bkg** Set a background PHA dataset  
**set\_bkg\_model** Set a background model  
**set\_coord** Set the coordinate system  
**set\_counts** Set the dependent variable (e.g. counts) of a dataset  
**set\_covar\_opt** Set the options for covariance  
**set\_data** Set a dataset by Id  
**set\_default\_id** Set the default Sherpa data id  
**set\_exposure** Set the exposure time  
**set\_full\_model/set\_bkg\_full\_model** Manually define full convolved model expression  
**set\_grouping** Apply user-defined grouping flags  
**set\_iter\_method** Fit with Primini or sigma-rej iterative method  
**set\_method** Set the Sherpa optimization method by name  
**set\_method\_opt** Set the options of the optimization method  
**set\_model** Set the model expression.  
**set\_model\_autoassign\_func** Set a user-defined function pointer  
**set\_par** Set initial values for a model parameter  
**set\_pileup\_model** Set a jdpileup model  
**set\_prior** Define a prior function for a model parameter  
**set\_proj\_opt** Set the options for projection  
**set\_psf** Convolve the PSF model with the source model  
**set\_rmf** Set an RMF dataset  
**set\_sampler/\_opt** Set pyBLoCXS sample and options  
**set\_source** Set the source model expression  
**set\_stat** Set the current Sherpa statistic by name  
**set\_staterror** Set the statistical errors  
**set\_syserror** Set the systematic errors  
**set\_xlinear/set\_ylinear** Changes the plot axes to a linear scale  
**set\_xlog/set\_ylog** Changes the plot axes to a log scale  
**set\_xsxset** Set environment variables for XSPEC models  
**show\_all** Reports the current state of the Sherpa session  
**show\_bkg/show\_bkg\_source/show\_bkg\_model** Show PHA background data and model information  
**show\_covar** Show all current covariance results  
**show\_data** Show all current datasets  
**show\_filter** Show the filters applied to a dataset  
**show\_fit** Show the current fit.  
**show\_kernel** Show the PSF kernel  
**show\_method** Show the current optimization method.  
**show\_model** Show the convolved source model  
**show\_proj** Show current projection results  
**show\_psf** Show the PSF model  
**show\_source** Show the unconvolved source model  
**show\_stat** Show the fit statistic  
**subtract** Perform background subtraction  
**thaw** Thaw a list of parameters  
**ungroup** Turn grouping off for a PHA dataset  
**unlink** Unlink model parameters  
**unpack\_arf** Read ARF data into a dataset  
**unpack\_arrays** Read numerical arrays into a dataset  
**unpack\_ascii** Read ASCII data into a dataset  
**unpack\_bkg** Read background data into a dataset  
**unpack\_data** Read spectrum, table, or ASCII data into a dataset  
**unpack\_image** Read image data into a dataset  
**unpack\_pha** Read PHA data into a dataset  
**unpack\_rmf** Read RMF data into a dataset  
**unpack\_table** Read data into a dataset  
**unsubtract** Undo background subtraction

Type '`ahelp <command>`' within CIAO to see complete details or view the online version:

<http://cxc.harvard.edu/sherpa/ahelp/>

*Note: most "get" commands were omitted from this list for space.*