Hands-on session

Simulation of energy spectrum using ISIS code ‘***astrosat.sl***’

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Installation of ISIS and startup script

ISIS Installation Guide

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For more information about isis, see: http://space.mit.edu/cxc/isis/

Send bug reports, comments and suggestions to: isis-users@space.mit.edu

Overview

The easiest way to set up a new isis installation is to run an installation script that will automatically download and install isis and a few commonly used modules. This installation method is documented in Part I, Scripted Installation.

For those who prefer greater control and customization, full details of the isis installation process are documented in Part II, Manual Installation.

Once isis is installed, a number of optional components are available to support a variety of specialized tasks. For details, see Part III, Optional Components.

Download the ISIS Startup Files and Example Data

Here is a gzipped, tar file that contains the following files:

```
./.isisrc
./.isisrc_conf
./.isisrc_data
./.isisrc_fitfun
./.isisrc_flux
./.isisrc_plots
```

These files are meant to be unpacked in your main directory. In the main `.isisrc` file, there is a `path` variable that needs to be edited to point to your main directory, so that the other `.isisrc_*` files will be loaded as well. *Important Note:* These files contain on only my own custom `s-lang` routines. You still need to download and install ISIS separately!

The data shown and analyzed on these pages is found here.

The script used to perform these analyses is found here.

A brief description of the custom ISIS functions found in the above `.isisrc` files is found here.

For links to more web pages with other useful ISIS modules and scripts, take a look at the ISIS Power Tools page.

Walkthrough: simulation of the energy spectrum of black hole GX 339-4

- **Edit astrosat.sl: give path of response files**
- **invoke isis**
- isis> .load astrosat.sl
- isis> fit_fun("tbabs*(diskbb+gaussian+power law)");
- isis> list_par;
- **change parameter values using set_par(); and edit_par();**
- **We should have already prior knowledge of parameters with other satellite like RXTE, XMM-Newton**
- isis> set_par(1,0.5);
- final value is
- isis> list_par;
- **simulate energy spectrum for laxpc2 for a particular exposure**
- isis> astrosat_laxpc2_simulate_spec(80000.0);
- isis>fit;

- **Plotting:**
- open_plot();
- xlog;
- ylog;
- rplot_counts;
- rebin_data(1,20);
- rplot_counts;
- close_plot();

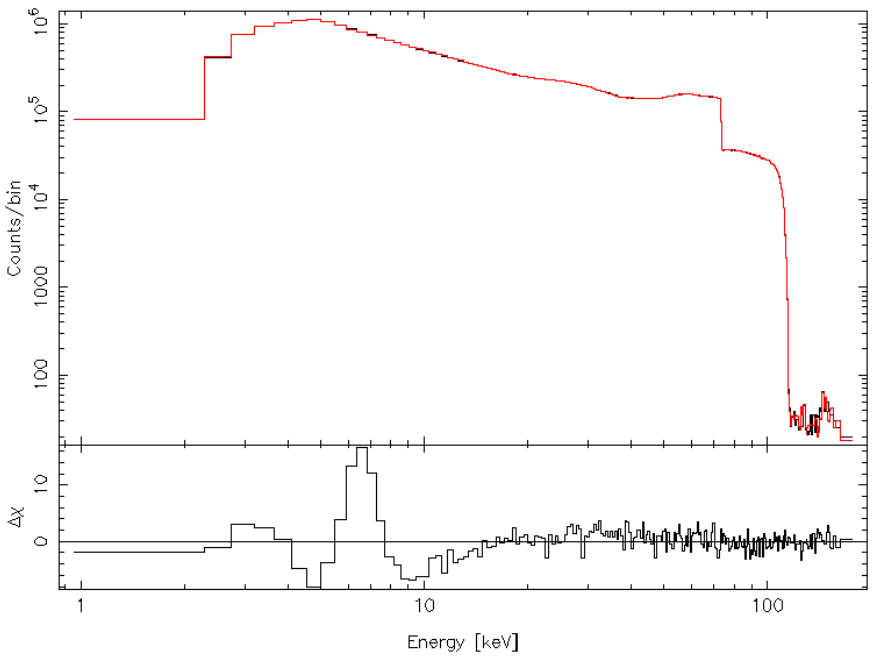
- **error calculation**
- conf_loop search in manual at page no 188
- (pmin, pmax) = conf_loop ([2,3,4,5,6,7,8] ; save,prefix="error");
- fit;
- **calculate flux for 3.0-80.0 keV.**
- model_flux(1,3.0,80.0);
- 4.566269066439905e-09
- 0.1827672111992542

To see iron line residual : remove gaussian model and plot.

isis> fit_fun("tbabs*(diskbb+powerlaw)");

isis> fit;

isis> rplot_counts;



Minimum exposure time estimation

Exposure time 1000 sec

isis> fit_fun("tbabs*(diskbb+gaussian+powerlaw)");

fit;

delete_data(1);

astrosat_laxpc2_simulate_spec(1000.0)

`eval_counts();`

`renorm_counts();`

`fit_counts();`

(pmin, pmax) = conf_loop ([1,2,3,4,5,6,7,8] ; save,prefix="error_exposure_1000.");

Fit;

Now see the uncertainties of all parameters.

Now take another exposure like 10000 sec

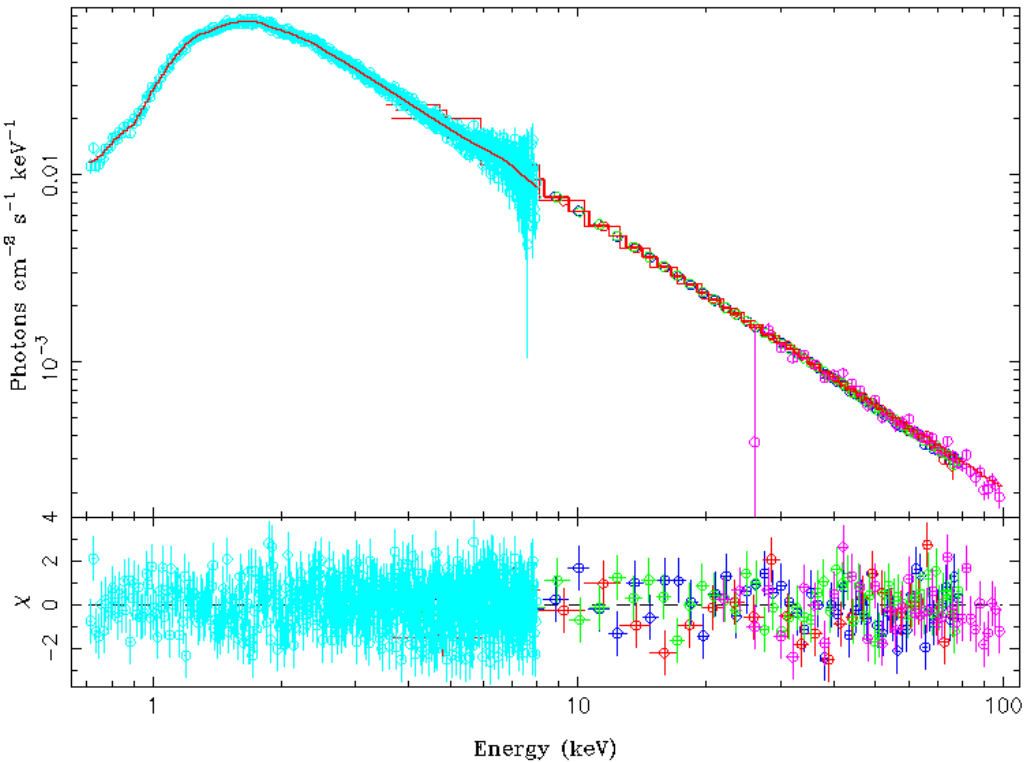
And again check uncertainties of all parameters.

Uncertainty of parameters decreases as we increase exposure. In this way we can find optimum value of exposure.

Simultaneous plot of SXT, LAXPC, and CZTI

```
 .load astrosat.sl
fit_fun("tbabs*(diskbb+gaussian+powerlaw)");
load_par("param_tb_db_ga_after_err.txt");
astrosat_xray_simulate_spec(50000.0);
fit;
ignore_en(1,0.0,3.0);
ignore_en(1,80.0,200.0);
ignore_en(2,0.0,3.0);
ignore_en(2,80.0,200.0);
```

```
ignore_en(3,0.0,3.0);
ignore_en(3,80.0,200.0);
ignore_en(4,0.0,0.7);
ignore_en(4,8.0,12.0);
ignore_en(5,0.0,20.0);
ignore_en(5,100.0,200.0);
eval_counts;
renorm_counts;
fit_counts;
 xlog;
Ylog;
plot_unfold({1,2,3,4,5};dcol={4,2,3,5,6},res=1);
```



UVIT simulation using astrosat.sl

```
isis
 .load astrosat.sl
fit_fun("tbabs*(diskbb+gaussian+powerlaw)");
load_par("param_tb_db_ga_after_err.txt");
isis> astrosat_uvit_fuv_baf2_sim(80000.0);
```

The End