URL: http://cxc.harvard.edu/ciao3.4/xsxion.html
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*AHELP for CIAO 3.4*

# xsxion

Context: sherpa

***Jump to:*** Description Bugs See Also

## Synopsis

Reflected spectra of a photo−ionized accretion disk or ring. XSpec model.

## Description

This model describes the reflected spectra of a photo−ionized accretion disk or a ring if one so chooses. The approach is similar to the one used for tables with stellar spectra. Namely, a large number of models are computed for a range of values of the spectral index, the incident X−ray flux, disk gravity, the thermal disk flux and iron abundance. Each model's output is an un−smeared reflected spectrum for 5 different inclination angles ranging from nearly pole−on to nearly face on, stored in a look−up table. The default geometry is that of a lamppost, with free parameters of the model being the height of the X−ray source above the disk, h_X; the dimensionless accretion rate through the disk, m−dot; the luminosity of the X−ray source, L_X; the inner and outer disk radii, and the spectral index. This defines the gravity parameter, the ratio of X−ray to thermal fluxes, etc., for each radius, which allows the use of a look−up table to approximate the reflected spectrum. This procedure is repeated for about 30 different radii. The total disk spectrum is then obtained by integrating over the disk surface, including relativistic smearing of the spectrum for a non−rotating black hole (e.g., Fabian 1989).

In addition, the geometry of a central sphere (with power law optically thin emissivity inside it) plus an outer cold disk (Geometry=2), and the geometry of magnetic flares (Geometry=3) are available. One can also turn off relativistic smearing to see what the local disk spectrum looks like (Relsmear=2 in this case, otherwise leave it at 4). In addition, Reftype=1 produces reflected plus direct spectrum/direct; Reftype=2 produces (incident + reflected)/incident [note that normalization of incident and direct are different because of solid angles covered by the disk; 2 should be used for magnetic flare model]; and Reftype=3 produces reflected/incident. Abundance is controlled by Feabun and varies between 1 and 4 at the present. A much more complete description of the model is available from Nayakshin et al. (2001, ApJ 546, 406).

### xsxion Parameters

| Number | Name | Description |
|---|---|---|
| 1 | height | height of the source above the disk (in Schwarzschild radii) |
| 2 | lx/ld | ratio of the X−ray source luminosity to that of the disk |
| 3 | rate | accretion rate (in Eddington units) |
| 4 | cosAng | cos i; the inclination angle (1 = face−on) |
| 5 | inner | inner radius of the disk (in Schwarzschild radii) |
| 6 | outer | outer radius of the disk (in Schwarzschild radii) |
| 7 | index | photon index of the source |

| | | |
|---|---|---|
| 8 | redshift | redshift, z |
| 9 | Feabun | Fe abundance relative to Solar (which is defined as 3.16e−5 by number relative to H) |
| 10 | Ecut | exponential high energy cut−off energy for the source |
| 11 | Reftype | 1 = (reflected+direct)/direct; 2 = (reflected+incident)/incident; 3 = reflected/incident |
| 12 | Relsmear | 2 = no relativistic smearing; 4 = relativistic smearing |
| 13 | Geometry | 1 = lamppost; 2 = central hot sphere with outer cold disk; 3 = magnetic flares above a cold disk. Note that setting Geometry to 2.y gives a central hot sphere with luminosity law dL/dR = 4pi R^2 R^(−10y). The inner radius of the sphere is 3 Schwarzschild radii and the outer radius is equal to height (par1). Only the case with inner >= height has been tested so far. |

This information is taken from the XSpec User's Guide. Version 11.3.1 of the XSpec models is supplied with CIAO 3.2.

## Bugs

For a list of known bugs and issues with the XSPEC models, please visit the XSPEC bugs page.

## See Also

*sherpa*
: atten, bbody, bbodyfreq, beta1d, beta2d, box1d, box2d, bpl1d, const1d, const2d, cos, delta1d, delta2d, dered, devaucouleurs, edge, erf, erfc, farf, farf2d, fpsf, fpsf1d, frmf, gauss1d, gauss2d, gridmodel, hubble, jdpileup, linebroad, lorentz1d, lorentz2d, models, nbeta, ngauss1d, poisson, polynom1d, polynom2d, powlaw1d, ptsrc1d, ptsrc2d, rsp, rsp2d, schechter, shexp, shexp10, shlog10, shloge, sin, sqrt, stephi1d, steplo1d, tan, tpsf, tpsf1d, usermodel, xs, xsabsori, xsacisabs, xsapec, xsbapec, xsbbody, xsbbodyrad, xsbexrav, xsbexriv, xsbknpower, xsbmc, xsbremss, xsbvapec, xsc6mekl, xsc6pmekl, xsc6pvmkl, xsc6vmekl, xscabs, xscemekl, xscevmkl, xscflow, xscompbb, xscompls, xscompst, xscomptt, xsconstant, xscutoffpl, xscyclabs, xsdisk, xsdiskbb, xsdiskline, xsdiskm, xsdisko, xsdiskpn, xsdust, xsedge, xsequil, xsexpabs, xsexpdec, xsexpfac, xsgabs, xsgaussian, xsgnei, xsgrad, xsgrbm, xshighecut, xshrefl, xslaor, xslorentz, xsmeka, xsmekal, xsmkcflow, xsnei, xsnotch, xsnpshock, xsnsa, xsnteea, xspcfabs, xspegpwrlw, xspexrav, xspexriv, xsphabs, xsplabs, xsplcabs, xsposm, xspowerlaw, xspshock, xspwab, xsraymond, xsredden, xsredge, xsrefsch, xssedov, xssmedge, xsspline, xssrcut, xssresc, xsssice, xsstep, xstbabs, xstbgrain, xstbvarabs, xsuvred, xsvapec, xsvarabs, xsvbremss, xsvequil, xsvgnei, xsvmcflow, xsvmeka, xsvmekal, xsvnei, xsvnpshock, xsvphabs, xsvpshock, xsvraymond, xsvsedov, xswabs, xswndabs, xszbbody, xszbremss, xszedge, xszgauss, xszhighect, xszpcfabs, xszphabs, xszpowerlw, xsztbabs, xszvarabs, xszvfeabs, xszvphabs, xszwabs, xszwndabs

*slang*
: usermodel

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