Chandra X-ray Center

AHELP for CIAO 3.4 **jdpileup** Context: sherpa

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Synopsis

A CCD pileup model developed by John Davis of MIT.

Description

The 1D pileup model can be applied to model the 1D Chandra spectrum obtained in the imaging mode. It should not be used for Chandra grating or 2D image data. This model is used for fitting energy spectra only.

Subsequent use of Powell and Simplex optimization methods is desirable when fitting data with pileup model.

Several model parameters describe pileup:

n, f and g0: The values of n, f and g0 should remain frozen; The full discussion of these parameters is presented in Davis (2001).

alpha: The value of the parameter alpha should be allowed to vary. alpha parameterizes "grade migration" in the detector, and represents the probability, per photon count greater than one, that the piled event is not rejected by the spacecraft software as a "bad event". Specifically, if n photons are piled together in a single frame, the probability of them being retained (as a single photon event with their summed energy) is given by alpha(n−1). In reality, the alpha parameter should be a photon−energy−dependent and detector−chip−dependent matrix; for simplicity, the jdpileup model assumes a constant value.

ftime: The ftime and parameter should be set to the value given in the header keyword EXPTIME of the event file. (Note that EXPTIME is used instead of TIMEDEL because the latter includes the transfer time, which ftime should not.)

fracexp: The fracexp parameter should be set to the value given in the header keyword FRACEXPO of the ARF file:

JDPILEUP Parameters

Number	Name	Description
1	alpha	grade migration; probability of a good grade when two photons pile together
2	g0	probability of grade 0 assignment

3	f	fraction of flux falling into the pileup region
4	n	number of detection cells
5	ftime	frame time [seconds] (keyword EXPTIME in the event file)
6	fracexp	fractional exposure that the point source experienced while dithering on the chip (keyword FRACPROB in the ARF file)

The pileup model does not work for pileup in dispersed grating spectra. The model was designed for imaging pileup, including pileup by the gratings in zeroth order.

For more information, see Event Pileup in Charge Coupled Devices by John E. Davis and the Sherpa thread on Using a Pileup Model.

See "ahelp integrate" for further information about source model integration.

Example 1

This example illustrate the setting of the pileup model.

```
sherpa> DATA spectrum.pi
sherpa> INSTRUMENT = RSP[myinst]("source.rmf", "source.arf")
sherpa> POW[p]
sherpa> SOURCE = p
sherpa> JDPILEUP[jdp]
sherpa> PILEUP = jdp
sherpa> show jdp
jdpileup[jdp]  (integrate: off)
    Param   Type      Value        Min         Max               Units
    -----   ----      -----        ---         ---               -----
 1  alpha thawed       0.5          0           1
 2     g0 frozen         1       1e-120          1
 3      f thawed      0.95         0.9           1
 4      n frozen         1       1e-120         100
 5  ftime frozen     3.241       1e-120          5               sec
 6fracexp frozen     0.987          0            1
sherpa> fit
```

In this example, data is input and a power–law model component is established and then defined as the source model for fitting. The command JDPILEUP[jdp] establishes the JDPILEUP model component and assigns it the name jdp. The command PILEUP = jdp then defines this pileup model for use in fitting.

Example 2

After fitting, display the pileup fractions with SHOW PILEUP:

```
sherpa> SHOW PILEUP
   1: 0.224696   0.541445
   2: 0.263513   0.304025
   3: 0.206024   0.113808
   4: 0.120808   0.031952
   5: 0.0566711  0.00717652
   6: 0.0221538  0.00134322
   7: 0.00742312 0.000215494
   8: 0.00217637 3.02503e-05
   9: 0.000567189 3.77462e-06
```

Example 1

```
  10: 0.000133035  4.23895e-07
  *** pileup fraction: 0.458555
```

Each row represents the number of photons per CCD frame. The maximum number of rows is 20; here, there were no more than 10 photons piled together per frame. The left column represents the percentage of frames with the stated number of photons: here, 22.47% of frames contained a single photon, 26.35% contained two photons piled together, etc. The right column indicates the percentage of observed counts with the stated number of photons: here, 54.14% of recorded counts were comprised of one photon, etc.. The total pileup fraction is the sum of the right column, excluding the first row: here, 45.85% of observed counts actually contain two or more photons piled together.

Bugs

See the Sherpa bug pages online for an up–to–date listing of known bugs.

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, 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, xssssice, xsstep, xstbabs, xstbgrain, xstbvarabs, xsuvred, xsvapec, xsvarabs, xsvbremss, xsvequil, xsvgnei, xsvmcflow, xsvmeka, xsvmekal, xsvnei, xsvnpshock, xsvphabs, xsvpshock, xsvraymond, xsvsedov, xswabs, xswndabs, xsxion, xszbbody, xszbremss, xszedge, xszgauss, xszhighect, xszpcfabs, xszphabs, xszpowerlw, xsztbabs, xszvarabs, xszvfeabs, xszvphabs, xszwabs, xszwndabs

slang

usermodel

URL:
http://cxc.harvard.edu/ciao3.4/jdpileup.html
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Bugs