

AKARI Helpdesk  
2007  
**Questions and answers**

## IRC Imaging

1. *What are the best methods for photometry?*

Do an aperture photometry with the same aperture size used in the flux calibration (standard aperture). There are no official corrections for the other aperture sizes, because of the changing of the PSF between the observations, mainly from the drift of the attitude of the satellite during a pointed observation. The recommendation is to calculate the correction for each observation, comparing the results of aperture photometry with both the standard size and your favourite size (e.g., Wada et al. PASJ, 59, S515-528, 2007. or arXiv: 0708.2530v1 [astro-ph]). The size of aperture, sky annulus and conversion factor (from ADU to Jy for the pipeline output) used in the standard photometry can be found in the IDUM. The radius of the aperture can be found in the last paragraph of section 4.6.1 "Observed standards and data processing", and is 10.0 pixels for NIR, and 7.5 pixels for MIRS and MIRL. The inner radius of the sky annulus is the same as that of the aperture, and the width is 5 pixels. The conversion factors (from ADU to Jy) are in Table 4.6.7. These are in units of Jy/ADU and should be used on the pipeline output.

2. *During the coadd process, in the median sky subtraction, can the size of the median kernel be changed?*

Following the instructions below, it is possible, using epar adjust\_sky x\_box y\_box

```
ecl> irc
irc,> epar adjust_sky
.....
(x_box = 20) If submedsky=yes, x box car size
(y_box = 20) If submedsky=yes, y box car size
```

3. *What kinds of problems are associated with the Earthshine?*

Data taken in May, June and July may suffer from the Earthshine problem. The followings are possible walk arounds

- a) Check the drift of the background level during a pointing and comment out any "high background MIR-L frames" from "irclog" and run the pipeline again.  
Note, if you want to use CoaddUsingS, the frames which have the same frame number must be also commented out. E.g., if you comment out F0000001\_L002, you must also comment out F0000001\_S002...)
- b) Use rej\_sky=yes option not to use "bad" frames.  
c1> pipeline rej\_sky=yes
- c) Use submedsky option. This will remove diffuse background  
c1> pipeline submedsky=yes # use for point sources only...
- d) Adjust the median kernel size in the "submedsky" option. Smaller values will remove diffuse background better, but wash out diffuse target objects as well!!

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```
bluebox> epar adjust_sky
(x_box =          20) If submedsky=yes, x box car size
(y_box =          20) If submedsky=yes, y box car size
```

4. *In the putwcs process of the pipeline, the pipeline fails with the error message Matching failed . Previous runs of the pipeline were successful so what has changed ?*

Note that this is not an intrinsic pipeline error and it is the 2MASS database format itself that has changed. When the 2MASS format changes we will always update the pipeline or provide a patch. Please check the observers page or alternatively check <http://www.ir.isas.jaxa.jp/AKARI/Observation/> --->Software ----> IRC

## IRC spectroscopy

5. *When recalling the IDL save file, by issuing restore, "12345678\_some\_more\_information.sav" the IDL says 'syntax error', but there seems to be no syntax errors in this simple command. What is wrong?*

*When running the IRC\_SPECRED, by issuing irc\_specred,"12345678\_some\_more\_information.tbl",'SG1.lst','SG2.lst','S9W\_SG1' the IDL says 'syntax error', but there seems to be no syntax errors in this simple command. What is wrong?*

Use ' (single quotation mark), rather than " (double quotation mark).

To know more, try issuing

```
help,"12345678_some_more_information.sav"
help,'12345678_some_more_information.sav'
```

and you will find the difference. For more, check the IDL manual (search 'quotation').

To avoid any confusion arising from IDL-language specific features, we suggest to use ' (single quotation mark) anytime when you work with the IRC\_SPECRED toolkit.

6. *When I issue the following command, the toolkit fails for some reason:*

```
irc_specred,' ','SG1.lst','SG2.lst','S9W_SG1'
```

*Why??*

Do not use ' ', but use " (null string, no spaces between single quotation marks). If ' ', the toolkit tries to find the source table whose name is ' ' (blank space), and it fails. The error message of the toolkit seems not so appropriate in the older version. Sorry.

7. *I set environment parameters for the toolkit in my '.cshrc' file, but the toolkit won't work. (I see some mysterious error messages, or the IDL say that some procedures/functions are undefined.) Probably something is wrong in the setting. How can I find it?*

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Check '.cshrc' even more carefully. If the problems persist, after launching the IDL, issue 'print,!path' on the IDL command line. This command shows all the paths for the IDL to search these libraries. See if all the TOOLKIT directories are included in '!path'.

8. *I want to see the toolkit results I made previously, and I recalled the IDL save file. But I cannot remember the source id of my favorite target. How can I find it??*

After recalling the save file, issue `show_aperture_on_ds9, <image>, source_table, (/imag)` as instructed on IDUM around P99-102. This launches a DS9 and displays image and region marks on it. Do not forget to include 'source\_table' after <image>, that was missed in the IDUM version 1.3.

9. *I want to run more than two toolkit processes on a single computer as a single user at a same time, for speeding up my job. It seems that more than two toolkit processes share some same DS9 windows, and it is not convenient for me. What should I do??*

Sorry, there are no good ways to run more than two pipeline processes at a same time. Please use other computers or other user account.

10. *According to the IDL log, some FITS files are removed due to satellite manoeuvre. Why?*

As you see in the observation manual, IRC repeats exposure cycles. It takes several exposures during a single pointing operation, and it continues taking exposures even after the satellite starts manoeuvring back to its survey mode. When the toolkit recognizes that the last exposure frame (cycle) was taken during this manoeuvring period, the frame is automatically removed from the stacking list.

Note that, although the observing manual says that 8 sub-frames will be taken for spectroscopy in AOT04 operation, it turned out that one additional frame (9th frame) can be often taken without suffering from satellite maneuvering.

11. *How can I reduce the pipeline products further, after processing with the IRC\_SPECRED toolkit?*

There are no good tools for this. This is beyond the purpose of the toolkit. Unfortunately, current FITS products of the processed images do not contain wavelength calibration information. Therefore, one needs to dump the spectra with an 'ASCII' option when plotting the spectra for further analyses.

12. *I performed more than two pointing observations for a single target. How can I coadd data taken over multiple pointings?*

There are no good tools to for this. This is beyond the purpose of the toolkit. The most simple way is to average/combine extracted 1D spectra after dumping the results on ASCII files, with an 'ASCII' option of the `plot_spec_with_image` commands. Then coadd them with users' own tool. Note that the wavelength for a given pixel is different from pointing to pointing, even if one observed the same target with same pointing coordinates, for slit-less spectroscopy data. One may need to rebin the spectra for a common grid for proper

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stacking.

*13. How to plot spectra for a given source taken with different dispersers at once?*

There are no good tools for this. One needs to dump the spectra with an 'ASCII' option when plotting the spectra, and then use your favourite plotting software for plotting multiple spectra once

*14. We found strange features in the 'NG' spectra taken at 'Np' aperture. What are they?*

There are several possibilities:

- a) The flat-field problem: Due to higher dispersion NG spectra, through narrower slit area (Np, Ns, Nh), at near infrared where natural background light is faintest, S/N of the NG slit flat image is rather poor, and this often limits the quality of the processed spectra. There is an option to disable the slit flat correction (put '/no\_slit\_flat' option at the end of the irc\_spectred toolkit command). We recommend processing the same data, with (default) and without (with the option) flat correction, for comparison. If one finds little noticeable differences in spectral features, (except for quality of the spectra), as we expect, one may accept the spectra processed without flat correction as a final calibrate data.
- b) Column pull-down problem: Even if one is interested in the slit area, any anonymous bright stars that are happened to be within the big aperture may cause the column pull-down effect of the array, damaging even the slit spectroscopy data. So far, correction of this effect is not implemented. To check this possibility, examine not only the 1D-extracted spectra but also the entire 2D-images, even outside of the slit area, so as to locate damaged row (since NIR images are rotated during the toolkit processing).

*15. We found strange features in the NP spectra at the big aperture (for Nc pointing). What are they?*

There are several possibilities. But probably the most frequently observed cause is that the error in wavelength calibration produces error in spectral response calibration, creating funny/fake spectral features. In this case, the features resemble the response curve (or more exactly, its change per pix along wavelength). Because of lowest spectral resolution and rather structured response-curve shape, this effect is most clearly seen in NP spectra. Note that even small wavelength offset (say, corresponding mere 0.5 pixel) would produce noticeable pseudo spectral features, especially around 2.4-3.5 um. We recommend checking the spectra of nearby field stars as well as your object to see if the funny features you found are common to these objects. If they look similar, the features are likely to be fake.

To see how the features change with wavelength offset, try the procedure 'checking for wavelength zero reference point ...' as described in 6.5.3 section of the IDUM. Although there are no zero-th order light images available for NP, the command 'change\_wave\_offset' works even for NP. One can observe how the spectral features change with the offset. Note that, for NP, there are no guidelines, such as zero-th order light, to find the best wavelength zero point in general. Therefore users should justify the amount of offset you entered with

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this command by themselves. Remember that nominal error of the wavelength zero-point calculation is 1.0 pixel or less.

16. *Sometimes I find jump in flux level in SG1 and SG2 spectra (or other pairs of adjacent wavelength) for a single source. What is wrong?*

First, check the aperture position (along X or space) to see if the aperture is really at the peak of the dispersed images. The toolkit tries to put it at just right position by tracking the telescope jittering motion, but it is not always perfect. Use 'space\_shift' option of the plotting tool along with '/with\_image' option to find the best position. Next, aperture correction is not always perfect because one needs to adopt rather narrow aperture (nsum=3 or so) for achieving the best S/N. If this is the case, even a small shift of the aperture position on sky (even at a scale of sub-pixel, although 'space\_shift' should be given in an integer pixel unit) gives rather large uncertainties in the flux aperture correction. Note that, for spectroscopy data, we just relies on 1D spatial PSF of the source, and pixel scale is not high enough to sample the PSF at good enough accuracy. So, with these limitations in mind, one needs to check the flux level, by changing the 'nsum' and/or 'space\_shift' parameters, for your own source and its brighter neighbors, to find the accuracy of the absolute flux calibration.

17. *I want to remove one or more sub-frame(s) before stacking, since they look severely damaged by cosmic rays (or by other causes). I deleted the frame on the ds9 window, but it seems not working properly (not removed, but is used in the stacking process). Why?*

The older version of the toolkit had a bug to remove one more sub-frames. Please update the toolkit.

Sometimes user 'deletes' the frames by mistake. Please make sure to 'hide' the frame.

18. *After running the pipeline several times successfully, it failed with some unknown reasons. Why?*

Try resetting the IDL sessions, by issuing '.reset' command at the IDL command line. This resets everything stored in the IDL memory, including IDL common and environmental valuables that are referred/updated during the toolkit session. Some old settings might cause the trouble. We recommend to do reset every time you restart the toolkit to avoid any confusion regarding used IDL valuables. Remember, however, that the '.reset' command will destroy even the main IDL memory contents that contain information for, e.g., plotting the spectra. Of course, users can restore the IDL save file contents back to the main IDL memory to resume the data analyses.

19. *I sometimes found unexpected narrow emission-line objects. What are they?*

That could be zero-th order light images of nearby brighter stars. See the DS9 window carefully since it shows expected location of such features.

20. *I have an extended bright source inside the 1 arc minute aperture. The spectrum of this object appears completely black and disappears with only a small component of the*

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*spectrum remaining around the edge. The observation of an enshrouded protostar and edge on flared disk, creating a bow-tie like structure with the central knot (containing the star) is observed in the point source aperture for AKARI spectroscopy. The knot could not automatically be assigned as a point source so the knot was assigned the zero source number manually (For slit and point source aperture photometry, there is only one source).*

To confirm.... NG at Np is in principle the same as slitless spectroscopy. The point source is isolated inside the aperture and slitless spectroscopy performed. It appears that the point source is indeed in the knot area (masked at the zero position), however, integrating the N3 image along the Y-axis in the Np aperture will result in the bright extended nebula dominating over the point source. In this scenario, it seems like a fraction of the exterior nebula emission is being included. By "becomes black and disappears" what is really meant is a relatively faint object spectra. A probability is that the bright area outside the aperture is causing a miscalculation in the sky subtraction superposing the faint spectrum of the point source on top of the bright emission of the extended emission.

Please try the following.

In ASTRO-F/IRC\_SPECRED/irc\_specred.pro (about half way down the code) there are 2 subroutines, do\_skysub\_n and do\_specflat

```
do_skysub_n,source_table,specimage_n,specimage_n_short,mask_specimage_n,specimage_n_bg,specimage_n_bg_short,$  
; was mask_specimage_n  
    fov_mask=fov_mask,$
```

```
noisemap_n=noisemap_n,noisemap_short_n=noisemap_short_n,noise_mask=noise_mask,objmask=objmask
```

```
; Do lambda_dependent flat_fielding
```

```
do_specflat,specimage_n_bg,specimage_n_bg_short,source_table,specimage_n_sff,specimage_n_sff_short
```

Here, in do\_specflat, change

```
specimage_n_bg  
specimage_n_bg_short
```

to

```
specimage_n  
specimage_n_short  
(i.e. delete the _bg)
```

After doing the above (and issuing a .reset command in IDL) please see the result (the result is to "skip" the do\_skysub\_n)

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If following the above changes the spectrum appears as expected then this may be added as a nominal option for `irc_specred` in the future so please report your findings.

You can check the result by using the `irc_specred /message_finish` option and typing;

```
atv,specimage_n_bg[*,*,0],/block  
and
```

```
atv,specimage_n[*,*,0],/block
```

at the IDL prompt to compare the two results with and without the sky subtraction.

21. *I have 2 spectral images that I would like to add together ? Is this possible and if so how can I do it?*

Practically, it is possible to do this. The most simplest method is to take the 2 spectra (.spc files) and add them. In this scenario, the wavelengths grids will differ so one must take care. In addition, the wavelength calibration becomes uncertain and may shift. These effects will need to be corrected. This is not really a normal process for the AKARI data so there does not exist any support tool for this job.

A more ideal method is to add the spectral images and then extract the spectra after this step in the processing. However, for this, the spectral wavelength direction can be correctly shifted and co-added. Unfortunately, at this time there is no publicly available tool to do this. AT present we are consulting with expert users but at present we have still to create a user friendly tool.

22. *I see a very noisy / bumpy spectrum over some range in my spectrum.*

For this, I recommend trying the `irc_specred /no_slit_flat_option`. Using this option omits the flat fielding but with the quality of the current flat data, especially for bright sources, this seems to produce better results. You should compare the results with and without setting this option and if there is a large difference (possibly an improvement in the S/N) then please continue with this option set.

Using this option, experts will analysis the results to see if they can ged rid of the bumpy effects.*ss\_run\_ss only searches for \*.fits.gz and not \*.fits files*

It is the specification of the software to find the TSD FITS file correctly (and not image FITS files). We will consider this for future releases. For the moment please do not un-gzip the TSD fits file (this also saves your disk space).