

# Instructions for obtaining GLAST blazar photometry

Written by Michelle Buxton

## 1. Goto latest images

- In an XGterm, go to /home/yalo/iraf/
- Login as 'yalo' (get password from Michelle) using command 'su yalo'

## 2. Get photometry of optical and IR images

- Login to IRAF (from /home/yalo/iraf directory) using the 'ncl' command
- Open ds9 (!ds9& in IRAF window)
- When in IRAF, cd to /net/glast/ccd (for optical images) or /net/glast/ir (for infrared images)
- Type:  
    glastphotop (for optical images)...or  
    glastphotir (for infrared images)

I usually start with the optical images.

In the case of OPTICAL IMAGES, this script will first ask you to find the photometry aperture radius via imexam (put cursor over a bright, isolated star and type 'r' then 'q' to quit). The 'r' command in imexam will display a graph; looking at this graph, choose the radius value as the x-value where the slope first becomes zero. **This number must be a whole number between 3 and 10 (e.g. use 8.00, NOT 8.35).** DO NOT use values displayed on the bottom of the radial plot window. I find in most cases that the aperture radius is around 8 or 9 (sometimes 7 in good seeing). Write your aperture radius value down for future reference in step 3. When done, hit "q" for quit.

Next, the script will have you perform aperture photometry using 'phot' in IRAF. Use the spacebar to choose the stars in a SPECIFIC ORDER. The order is as follows: always choose the blazar first, then the comparison stars from 1, 2, 3, and so on (as indicated on the finding chart – see our webpage). ***It is very important that you choose each star ONCE and once only.*** (Screwed up? See Troubleshooting below.) If you do not, it will mess up the collation of magnitudes into tables and, consequently, the calibration calculation. So TAKE YOUR TIME doing this step! When done, press 'q' to exit, then 'q' again to SAVE the magnitudes. This is necessary for the next step. See 'Troubleshooting' below for the cases when you don't see any/some stars.

In the case of INFRARED images, there is one extra step at the beginning – reduction of the images. The only thing you need to do here is to a) enter a number for the output file (this doesn't matter as it's not used– something that will be removed in future versions); and b) choose a star (place cursor over star and hit "a" then "q") in each image, for each object, so that the individual

images can be shifted and combined. Then you will be asked to find the radius for aperture photometry and perform photometry on the final images.

### 3. Calibrate photometry & create plots

- In an Xterm window (outside of IRAF), ensure you're in the working directory (/net/glast/ccd or /net/glast/ir) and that you are logged in as 'yalo'
- Type the following:  
./runphotcal  
This will add the latest magnitudes to our raw tables and calculate the true magnitudes for our blazars and some additional comparison stars (should there be more than one). This step needs to be done for both optical and IR images.
- Change directories to /net/glast/tables/.  
When there, type:  
./runcollate  
This will collate the true magnitudes of each blazar into one table, produce lightcurve plots, and copy the tables and plots over to the webserver, Oscar. You will need to enter the password for yalo three times at the end (when prompted). You only need to do this step ONCE.
- That's it – you're finished! Go to our GLAST blazars website and check that the tables and plots were updated. If you think there's a problem, notify Michelle along with any error messages that you may have encountered.

### Troubleshooting

1. **What if I don't see one of my stars?** Put your cursor over just outside of the image and hit the spacebar – this will bring up INDEF for magnitudes for that star and will be taken care of in subsequent parts of the script.
2. **What if I screwed up and chose a star more than once?** Continue glastphotop or glastphotir (whichever you were using at the time) until you get through all images. If you used glastphotir, then in a window outside of IRAF, ensure you're in the /net/glast/ir directory and type:  
./startover  
This will move all files back to the starting point. Then, in IRAF, type glastphotir to start the reduction/photometry again.  
If you used glastphotop notify Michelle – a script has not been written yet for optical startover.
3. **OOPS! I've accidentally deleted the data files!** To restore your data files do the following:
  - a. Create a temporary directory under /net/glast/ccd or ir (whichever is relevant);
  - b. Go to /data/yalo180/yalo/SMARTS13m. See if data directory for the date in question is there first (e.g. 20100105/ccd or 20100105/ir). If not, go to

subdirectory DUMPSTER and go to the data directory there. You'll see subdirectories 'ccd' and 'ir'. Go into whichever is relevant, then copy ALL FILES into your temporary directory under /net/glast/ccd or ir;

- c. In IRAF, go into your temporary directory and type:

```
hsl binir* $I 'owner=="YALE-08A-0001"' > in.lis
```

OR

```
hsl rccd* $I 'owner=="YALE-08A-0001"' > in.lis
```

- d. In same directory, type:

```
imcopy @in.lis ../
```

Now you should have your data files restored to the /net/glast/ccd or ir directory. Don't remove the temporary directory until you've finished the photometry, just in case you delete them again ☺