Lab 6
Signal Transmission, Resolution, Detectors

Log into your department Unix account and start X Windows using the "startx" command. Download the zipped tar file for this lab into the data subdirectory of your home directory. Unzip and untar the files:

```
cd ~/data
gunzip lecture6-data.tar.gz
tar xvf lecture6-data.tar
```

Start **ds9** and create a reasonably scaled RGB image with:

R representing the MIPS1 (24 μm) image
G representing the IRAC4 (8.0 μm) image
B representing the IRAC1 (3.6 μm) image

Annotate the image with a 30-arcsec scale bar, and save the image as a JPEG image (L673-7_RGB.jpg) and as a PostScript file (L673-7_RGB.ps) in your data directory. Print the image and hand it in at the end of lab.

In a second frame (not an RGB frame!) of ds9, load the IRAC1 image. Locate a moderately bright (non-saturated) source in the IRAC1 that: 1) at least by visual inspection, appears to be centered on a single pixel rather than centered across several pixels, and 2) is somewhat isolated with no comparably bright sources within 5 pixels of the center. You will find it critical to zoom in on sources and change the grayscale. Once you find such a source, use the "Pan" option (under the "Edit" menu) to center on the source and then zoom in on the source until you are displaying a region that is only about 20 pixels × 20 pixels. Record the (x,y) pixel position of the center of the source, where x and y are to the nearest integers, in Table 1 of the homework assignment. Also, record the (RA, Dec) position, estimate of the peak IRAC1 intensity of the source, and estimate of the background intensity. Using "Horizontal Graph" and "Vertical Graph" (under the "View" menu), estimate the FWHM of this source.

Now, in another terminal, change directories to the data subdirectory of your home directory, and then start and initialize **IDL**, and start **photvis**:

```
cd ~/data
idl

IDL> decompose, retain=2
IDL> window,0
IDL> astrolib
```

Load the IRAC1 image into photvis, and locate the moderately bright, isolated source that you found using ds9. **Note that the origin of the ds9 image is (1,1), while the origin of an image in IDL and photvis is (0,0).** Therefore, you should expect the pixel position to be offset horizontally and vertically by one pixel. Zoom in on the source and adjust the grayscale, as necessary. Verify your FWHM estimate.

Next, within IDL, load the IRAC1 image and extract a 15 pixel × 15 pixel subimage centered on the source:

```
IDL> image = readfits ( "L673-7_IRAC1.fits", hdr)
IDL> hextract, image, hdr, subimage, subhdr, x0-7, x0+7, y0-7, y0+7
```

where x0 and y0 are the IDL-pixel coordinates of the center of the source. Because of the offset before the IDL pixels and ds9 pixels, x0 and y0 are given by:

x0 = x(ds9) – 1
y0 = y(ds9) – 1

Save these arrays as FITS files in your data directory:

```
IDL> writefits, "L673-7_IRAC1_subimage_source1.fits", subimage, subhdr
```

Construct the horizontal and vertical profile of the IRAC1 intensity, and average them:

```
IDL>  pixels = findgen(15)
IDL>  xprofile = fltarr(15)
IDL>  yprofile = fltarr(15)
IDL>  xprofile(*) = subimage( *, 7)
IDL>  yprofile(*) = subimage( 7, *)
IDL>  profile = (xprofile + yprofile) / 2.
```

Using the standard IDL *plot* command, construct a plot of the average IRAC1 intensity profile (**profile** on the y-axis and **pixels** on the x-axis), with titles for the x- and y-axes. Then, using the standard IDL *gaussfit* command, fit a Gaussian profile to the average IRAC1 intensity profile:

```
IDL> result = gaussfit ( pixels, profile, coeffs, nterms = 4)
```

Print the fitted coefficients:

```
IDL>  print, coeffs
```

and record them in Table 1 of the homework assignment.