Lab 2
Optical / Infrared Databases and Catalogs

Log into your department unix account and start X Windows using the "startx" command. Open a **Terminal** and backup your current **.cshrc** file, located in your home directory:

```
cd ~
cp .cshrc .cshrc-original
```

Using a **Text Editor**, add the following lines to the **.cshrc** file:

```
#----------------------
#ASTROMAKE
alias astromake "source /n/astromake/astromake_start; unalias astromake"
astromake
astroload ds9
astroload lheasoft
#----------------------
```

In the **Terminal**, enter the command:

```
source ~/.cshrc
```

or exit the **Terminal**, and open a new one.

Open a browser and download the zipped and tarred data file ("lecture2-data.tar.gz") for this lab, found in the "Data" link under the "Materials" section on the course webpage. When you click on the "Data" link , the browser will prompt you for direction on how to download. Select the option to save to disk. It should save the file, by default, into your home directory. For this lab, each of you will be assigned data for a particular object.

In your home directory, create a new directory called "data":

```
cd ~
mkdir data
```

Move the downloaded data file into the "data" directory:

```
mv lecture2-data.tar.gz ~/data/.
```

Unzip and untar the data file:

```
cd ~/data
gunzip lecture2-data.tar.gz
tar xvf lecture2-data.tar
```

Open one of the FITS files for your object using **ds9**:

```
ds9 <filename> &
```

Begin familiarizing yourself with how this FITS viewer works. Before leaving lab today, you should be comfortable with the following tasks:

- opening a new file within the same ds9 window (without starting a new ds9)
- zooming in and out
- panning and centering on different regions of the image
- adjusting the color *scale*
- changing the color table
- properly aligning the image (north up, east to the left)
- annotating the image by overlaying circles, rectangles, and text
- determining approximate coordinates of some sources in the image
- opening a new *frame* with a different image; blinking between images
- creating an RGB color-composite image, and optimizing the RGB color scales
- properly "registering" (WCS-aligning) images in different frames
- saving an image

Create an RGB color-composite image of your object with:

R representing the K-band image
G representing the H-band image
B representing the J-band image

Optimize the RGB color scales such that a large dynamic range is visible (i.e., one can see the faintest of sources, while not allowing the bright sources to saturate large regions of the image). Adjusting the color scales is an iterative process, and ultimately depends on the goal of presenting the image. Do you want to show detailed structure in a nebula? Scaling and creating these images is certainly an "art" that takes much practice.

Properly align the composite image by selecting "Align" in the "Zoom" menu.

To communicate the angular scales relevant in this image, place a white 1' scale bar somewhere clearly visible in the image, but not detracting from interesting features or sources. Label this scale bar with clearly visible font: 1' .

Accurately determine the coordinates of the center of the image, and the width and height (in angular dimensions), by placing a rectangle outlining the image border.

Go to the DSS website:

http://stdatu.stsci.edu/cgi-bin/dss_form

and download the POSS2/UKSTU Red (R), Blue (B), and IR (I) images of the same field as your object. In the same ds9 window as the RGB color-composite image you created with the JHK images of your object, create another RGB color-composite image *in a different frame* with:

R representing the POSS2/UKSTU I image
G representing the POSS2/UKSTU R image
B representing the POSS2/UKSTU B image

Optimize the color scales of this BRI composite image, and WCS-align this image with the JHK composite image. Select the scale bar and label in the JHK composite image, and copy and paste them into the BRI composite image.

Print each composite image. On each page, record the object name and filters used to create the composite image. **Turn in these pages at the end of lab.**

Save the images as JPG files (named "jhk-composite.jpg" and "bri-composite.jpg") in the "data" directory within your home directory.

Log off the X Windows system. Then, log out of your unix account by entering "exit" at the prompt.