Astroquery_Day2_Part3

March 21, 2016

```
In [9]: %%bash
        pip install astroquery

Requirement already satisfied (use --upgrade to upgrade): astroquery in /Users/adam/anaconda/envs/esopy
Requirement already satisfied (use --upgrade to upgrade): beautifulsoup4>=4.3.2 in /Users/adam/anaconda,
Requirement already satisfied (use --upgrade to upgrade): keyring>=4.0 in /Users/adam/anaconda/envs/esop
Requirement already satisfied (use --upgrade to upgrade): requests>=2.4.3 in /Users/adam/anaconda/envs/
Requirement already satisfied (use --upgrade to upgrade): html5lib>=0.999 in /Users/adam/anaconda/envs/
Requirement already satisfied (use --upgrade to upgrade): astropy>=0.4.1 in /Users/adam/anaconda/envs/es
Requirement already satisfied (use --upgrade to upgrade): six in /Users/adam/anaconda/envs/esopython201(
Requirement already satisfied (use --upgrade to upgrade): numpy>=1.6.0 in /Users/adam/anaconda/envs/esop
```

```
In [10]: from astroquery.eso import Eso
         from astropy import coordinates
         from astropy import units as u
```

```
In [11]: rslt = Eso.query_instrument('naco',target='Sgr A*')
```

```
In [12]: coords = coordinates.SkyCoord(rslt['Target Ra Dec'], unit=(u.hour, u.deg))
```

```
In [13]: coords
```

```
Out[13]: <SkyCoord (ICRS): (ra, dec) in deg
            [(266.41658333, -29.00666667), (266.41483333, -29.00661111),
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```

```
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```

In [14]: `%matplotlib` inline
          import `pylab` as `pl`
          pl.plot(coords.ra.deg, coords.dec.deg, '.')

Out[14]: [<matplotlib.lines.Line2D at 0x10ee25b38>]
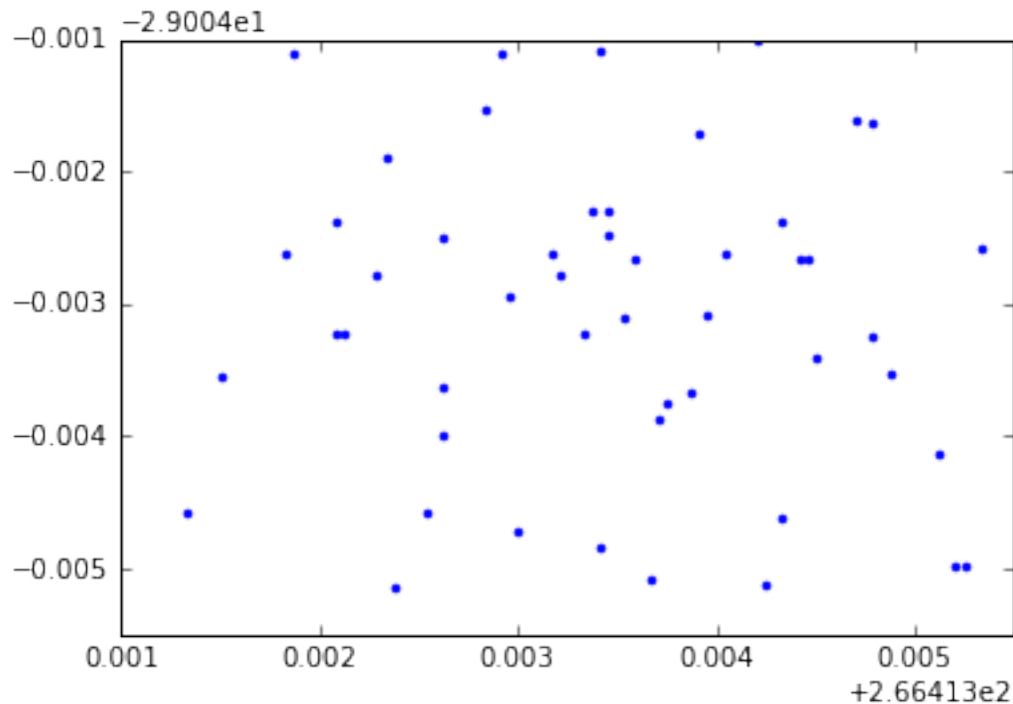
In [15]: import `aplpy`
          F = aplpy.FITSFigure('gc_2mass_k.fits')
          F.show_grayscale(vmax=1000)
          F.show_contour('gc_bolocam_gps.fits', convention='calabretta')
          F.show_markers(coords.ra.deg, coords.dec.deg)
          sgrastar = coordinates.SkyCoord.from_name('Sgr A*')
          F.recenter(sgrastar.ra.deg, sgrastar.dec.deg, radius=0.01)

```
/Users/adam/anaconda/envs/esopython2016/lib/python3.5/site-packages/matplotlib/artist.py:221: Matplotlib
axes property.  A removal date has not been set.
  warnings.warn(_get_axes_msg, mplDeprecation, stacklevel=1)

INFO: Auto-setting vmin to  4.221e+02 [aplpy.core]

WARNING: FITSFixedWarning: LONPOLE2= 180.000000000 /lonpole
invalid alternate code, keyword resembles LONPOLEa but isn't. [astropy.wcs.wcs]
WARNING: FITSFixedWarning: LATPOLE2= 0.00000000000 /latpole
invalid alternate code, keyword resembles LATPOLEa but isn't. [astropy.wcs.wcs]
```
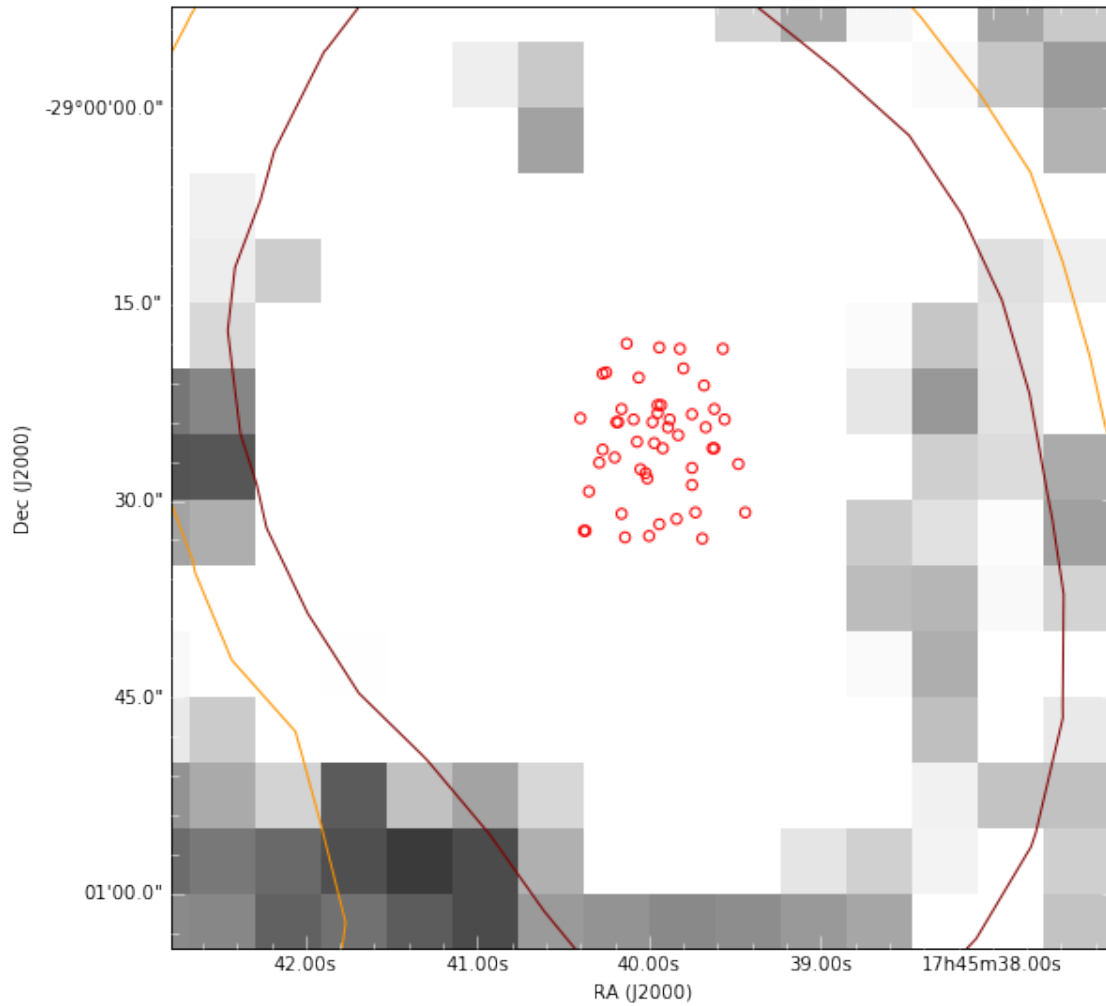
In [16]: # load table from previous section

In [17]: # crossmatch with... 2mass

In [18]: from astroquery.irsa import Irsa

In [19]: Irsa.list_catalogs()

Out[19]: {'a1763t2': 'Abell 1763 Source Catalog',
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3

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'safires70': 'Spitzer Archival Far-Infrared Extragalactic Survey (SAFIRES) MIPS 70 micron Cata
'sage_ar_irac': 'SAGE IRAC Single Frame + Mosaic Photometry Archive (more complete, less relia
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'sage_ar_irac_match': 'SAGE IRAC Matched Epoch Catalog (more complete, less reliable)',
'sage_ar_irac_off': 'SAGE IRAC Offset Position Epoch 1 and Epoch 2 Archive (more complete, les
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'sage_cat_irac_match': 'SAGE IRAC Matched Epoch Archive (more reliable)',
'sage_cat_irac_off': 'SAGE IRAC Offset Position Epoch 1 and Epoch 2 Catalog (more reliable)',
'sage_cat_m160': 'SAGE MIPS 160 um Combined Epoch Catalog (more reliable)',
'sage_cat_m24': 'SAGE MIPS 24 um Epoch 1 and Epoch 2 Catalog  (more reliable)',
'sage_cat_m24_match': 'SAGE MIPS 24 um Matched Epoch Catalog (more reliable)',
'sage_cat_m70': 'SAGE MIPS 70 um Combined Epoch Catalog (more reliable)',
'sage_full_m160': 'SAGE MIPS 160 um Combined Epoch Catalog (more complete, less reliable)',
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'sage_full_m24_match': 'SAGE MIPS 24 um Matched Epoch Full List (more complete, less reliable)
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'sagecatiracv2': "SAGE Winter '08 IRAC Epoch 1 and Epoch 2 Catalog (more reliable)",
'sagecatmips24v2': "SAGE Winter '08 MIPS 24 um Epoch 1 and Epoch 2 Catalog  (more reliable)",
'sagefull': 'SAGE-Var LMC Full Catalog',
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'sagesmc_iracadr3': 'SAGE-SMC IRAC Single Frame + Mosaic Photometry Archive v1.5',
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'sagesmc_iraccdr3': 'SAGE-SMC IRAC Single Frame + Mosaic Photometry Catalog v1.5',
'sagesmc_iracep1a': 'SAGE-SMC IRAC Epoch 1 Archive  (less reliable)',
'sagesmc_iracep1c': 'SAGE-SMC IRAC Epoch 1 Catalog (more reliable)',
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'sagesmc_mips24ep1c': 'SAGE-SMC MIPS 24um Epoch 1 Catalog (more reliable)',
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'sagesmc_mips24f': 'SAGE-SMC MIPS 24 um Epoch 0, Epoch 1, and Epoch 2 Full List (more complete
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'sagevar': 'SAGE-Var LMC Variable Catalog',
'sass_v3': 'SASS October 2011 Catalog',
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'scan_dat_2': '2MASS Second Incremental Release Survey Scan Info',
'scf_info': '2MASS LMC/SMC Calibration Merged Point Source Information Table',
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'scosmos_mips_24_go2': 'S-COSMOS MIPS 24um MAIN Photometry Catalog June 2007 ((Aug 2008: Impor
'scosmos_mips_24_go2_deep': 'S-COSMOS MIPS 24um DEEP Photometry Catalog June 2007 ((Aug 2008: ]
'scosmos_mips_24_go3': 'S-COSMOS MIPS 24 Photometry Catalog October 2008',
'scosmos_mips_70_v3': 'S-COSMOS MIPS 70um Photometry Catalog v3 Jan 2009',
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'sdwfs_ch1_epoch2': "SDWFS Aug '09 DR1.1 IRAC 3.6um-Selected 3x30sec Coadd, epoch 2 (Aug '07)"
'sdwfs_ch1_epoch3': "SDWFS Aug '09 DR1.1 IRAC 3.6um-Selected 3x30sec Coadd, epoch 3 (Feb '08)"
'sdwfs_ch1_epoch4': "SDWFS Aug '09 DR1.1 IRAC 3.6um-Selected 3x30sec Coadd, epoch 4 (Mar '08)"
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'sdwfs_ch2_epoch1': "SDWFS Aug '09 DR1.1 IRAC 4.5um-Selected 3x30sec Coadd, epoch 1 (Jan '04)"
'sdwfs_ch2_epoch2': "SDWFS Aug '09 DR1.1 IRAC 4.5um-Selected 3x30sec Coadd, epoch 2 (Aug '07)"
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'sdwfs_ch2_epoch4': "SDWFS Aug '09 DR1.1 IRAC 4.5um-Selected 3x30sec Coadd, epoch 4 (Mar '08)"
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'sdwfs_ch4_epoch2': "SDWFS Aug '09 DR1.1 IRAC 8.0um-Selected 3x30sec Coadd, epoch 2 (Aug '07)"
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'sdwfs_ch4_epoch4': "SDWFS Aug '09 DR1.1 IRAC 8.0um-Selected 3x30sec Coadd, epoch 4 (Mar '08)"
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'sepm70': 'SEP MIPS 70 micron Point Source Catalog',
'sepmext': 'SEP MIPS Extended Source Catalog',
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'servscdfsi12': 'SERVS CDFS 2-band Catalog (highly reliable)',
'servscdfsi2': 'SERVS CDFS 4.5 micron Catalog',
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'servseni12': 'SERVS ELAIS N1 2-band Catalog (highly reliable)',
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'servseni2': 'SERVS ELAIS N1 4.5 micron Catalog',
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'servsxmmi2': 'SERVS XMM-LSS 4.5 micron Catalog',
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'shelaep2': 'SHELA Epoch 2 IRAC Catalog',
'shelaep3': 'SHELA Epoch 3 IRAC Catalog',
'shelasdss': 'SHELA-SDSS Stripe 82 Catalog',
'simple': 'SIMPLE Photometry Catalog',
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'sixxf_link': '2MASS 6X w/LMC/SMC Merged Point Source Link Table',
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'slmcovv2': 'SEIP MIPS Coverage Table',
'slphotdr4': 'SEIP Source List',
'sltracev2': 'SEIP Traceback Table',
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'spuds_mips': 'SpUDS MIPS Catalog',
'ssdf1': 'SSDF IRAC Ch1 Catalog',
'ssdf2': 'SSDF IRAC Ch2 Catalog',
'ssid2': 'SAGE-Spec ID Search',
'summary': 'IRAS Large Galaxies Catalog',
'swire_lhisod': 'SWIRE Lockman Hole ISOCAM Deep Field Catalog',
'swire_lhisos': 'SWIRE Lockman Hole ISOCAM Shallow Field Catalog',
'tables': 'Available tables at NASA/IPAC Infrared Science Archive',
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'ucac4_sources': 'USNO CCD Astrograph Catalog (UCAC4)',
'urat1': 'The First USNO Robotic Astrometric Telescope Catalog (URAT1)',
'usno_b1': 'USNO-B1 (United States Naval Observatory B1.0 Catalog)',
'velcara': 'Vela-Carina Archive (more complete, less reliable)',
'velcarc': 'Vela-Carina Catalog (highly reliable)',
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'wise_allsky_3band_p3as_cdd': 'WISE 3-Band Cryo Atlas Metadata Table',
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                'wise_allsky_4band_p3am_xrf': 'WISE All-Sky Frame Cross-Reference Table',
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                'wise_allwise_p3as_psd': 'AllWISE Source Catalog',
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                'xfls_iallv': 'Extragalactic FLS IRAC Bandmerged Verification Field Catalog',
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                'xfls_m1t2': 'Extragalactic FLS MIPS 24 micron Extended Source Catalog',
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                'xfls_m1t5': 'Extragalactic FLS MIPS 24 micron Point Source Catalog',
                'xfls_m2': 'Extragalactic FLS MIPS 70 micron Catalog',
                'xfls_m3': 'Extragalactic FLS MIPS 160 micron Catalog',
                'xfls_w2': 'Extragalactic FLS WIYN/Hydra Spectroscopic Catalog',
                'xfls_w3': 'Extragalactic FLS WIYN/Hydra Line Strength and Equivalent Width Catalog',
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                'ysoggd1215obj': 'YSOVAR GGD 12-15 Object Table',
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                'ysol1688lc': 'YSOVAR L1688 Light Curve Table',
                'ysol1688obj': 'YSOVAR L1688 Object Table',
                'yson1333lc': 'YSOVAR NGC1333 Light Curve Table',
                'yson1333obj': 'YSOVAR NGC1333 Object Table'}

In [20]: rslt = Irsa.query_region('Sgr A*', radius=10*u.arcmin, catalog='pt_src_cat')
         rslt

Out[20]: <Table masked=True length=500>
```

```
       ra     dec      clon     ...        dist              angle          id
      deg     deg                ...        arcs               deg
    float64 float64   object    ...       float64            float64       object
    ------- ------- ------------ ... ----------------- ------------------ ------
    266.541 -28.941 17h46m09.85s ... 459.33338199999997 58.420993000000003      0
    266.539 -28.939 17h46m09.27s ... 456.28099500000002 57.248691000000001      1
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    266.542 -28.934 17h46m10.05s ... 474.96516400000002 56.045482999999997      3
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    266.535 -28.935 17h46m08.43s ...         454.981067 54.994160999999998      5
    266.538 -28.938 17h46m09.09s ... 456.69620300000003 56.617438999999997      6
    266.541 -28.938 17h46m09.83s ... 465.33253999999999 57.196688000000002      7
    266.539 -28.935 17h46m09.40s ...         465.347711 55.914127999999998      8
        ...     ...          ... ...               ...                ...    ...
    266.482 -28.855 17h45m55.80s ...         586.17899 20.684032999999999    490
    266.479 -28.859 17h45m55.04s ... 570.07834300000002 20.228916999999999    491
    266.482 -28.858 17h45m55.63s ... 576.90266899999995          20.789037    492
    266.466 -28.849 17h45m51.94s ... 593.19416100000001          15.276467    493
    266.468 -28.851 17h45m52.33s ... 585.55087500000002 16.007439999999999    494
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    266.472 -28.852 17h45m53.36s ... 587.84205599999996 17.320962000000002    497
    266.468 -28.849 17h45m52.26s ... 592.51437699999997 15.725013000000001    498
    266.467 -28.861 17h45m51.97s ... 549.77417200000002          16.562427    499
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In [21]: twomass_coords = coordinates.SkyCoord(rslt['ra'], rslt['dec'], frame='fk5', unit=(u.deg, u.deg

In [22]: twomass_coords.match_to_catalog_sky(...)

```
        ---------------------------------------------------------------------------

        TypeError                                 Traceback (most recent call last)

        <ipython-input-22-852d265fcf65> in <module>()
    ----> 1 twomass_coords.match_to_catalog_sky(...)


        /Users/adam/anaconda/envs/esopython2016/lib/python3.5/site-packages/astropy/coordinates/sky_coor
        742             self_in_catalog_frame = self.transform_to(catalogcoord)
        743         else:
    --> 744             raise TypeError('Can only get separation to another SkyCoord or a '
        745                             'coordinate frame with data')
        746


        TypeError: Can only get separation to another SkyCoord or a coordinate frame with data
```