lrg_binz_PD_map_0916

November 18, 2016

```
In [1]: %matplotlib inline
        from astropy.table import Table
        from astropy.io import fits as pf
        import pylab as p
        import matplotlib.pyplot as plt
        import numpy as np
        import healpy as hp
        from matplotlib import cm
        cool_cmap = cm.hot_r
        cool_cmap.set_under('w')
```

```
In [2]: #Now we read OD maps and systematics maps for 0.2 sq degree (NSIDE=128) pixles. we apply regres
        #Using the coefficients we make PD maps in different redshift bins.

        OD_55_z_60 = np.loadtxt('cats/Lrg_obs_density_55_z_60_map.in')
        OD_60_z_65 = np.loadtxt('cats/Lrg_obs_density_60_z_65_map.in')
        OD_65_z_70 = np.loadtxt('cats/Lrg_obs_density_65_z_70_map.in')
        OD_70_z_75 = np.loadtxt('cats/Lrg_obs_density_70_z_75_map.in')
        OD_75_z_85 = np.loadtxt('cats/Lrg_obs_density_75_z_85_map.in')
        OD_z_85    = np.loadtxt('cats/Lrg_obs_density_z_85_map.in')

        #Read all the maps in arrays for regression.
        w1_covMed_map_p2  = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p2_NN.fits", fiel
        w1_Med_map_p2     = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p2_NN.fits", fiel
        w1_moonlev_map_p2 = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p2_NN.fits", fiel

        PSF_FWHM_z_map_p2 = hp.fitsfunc.read_map("../Lrg_healpy/sdss_sys/sdss_sys_map_p2.fits", field=0
        skyflux_z_map_p2  = hp.fitsfunc.read_map("../Lrg_healpy/sdss_sys/sdss_sys_map_p2.fits", field=1
        r_ext_map_p2      = hp.fitsfunc.read_map("../Lrg_healpy/sdss_r_ext_map_p2.fits", field=0, hdu=1

        star_map_05 = np.loadtxt("../Lrg_healpy//sdss_sys/allstars17.519.9Healpixall256.dat")
        star_map_p2 = hp.pixelfunc.ud_grade(star_map_05,nside_out=128, pess= True)

        sdss_footprint_p2 = np.where(skyflux_z_map_p2 > 0)

        w1_covMed_map_p2[np.isnan(w1_covMed_map_p2)]=-0
        w1_Med_map_p2[np.isnan(w1_Med_map_p2)]=-0
        w1_moonlev_map_p2[np.isnan(w1_moonlev_map_p2)] = -0

        PSF_FWHM_z_map_p2[np.isnan(PSF_FWHM_z_map_p2)] = -0.0
        skyflux_z_map_p2[np.isnan(skyflux_z_map_p2)]   = -0.0
        r_ext_map_p2[np.isnan(r_ext_map_p2)] =-0.0

        star_map_p2[np.isnan(star_map_p2)] = -0.0
        print len(OD_55_z_60), len(OD_60_z_65), len(OD_65_z_70), len(OD_70_z_75), len(OD_75_z_85 ),len(

/Users/abhi/Library/Enthought/Canopy_64bit/User/lib/python2.7/site-packages/healpy/pixelfunc.py:270: Ru
  return np.absolute(m - badval) <= atol + rtol * np.absolute(badval)
/Users/abhi/Library/Enthought/Canopy_64bit/User/lib/python2.7/site-packages/IPython/kernel/__main__.py:26

NSIDE = 128
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```
In [3]: #Regression variables systematics.
        rv_w1_covMed_p2  = w1_covMed_map_p2[sdss_footprint_p2]
        rv_w1_moonlev_p2 = w1_moonlev_map_p2[sdss_footprint_p2]
        rv_w1_Med_p2     = w1_Med_map_p2[sdss_footprint_p2]

        rv_r_ext_p2     = 10**r_ext_map_p2[sdss_footprint_p2]
        rv_z_psf_p2     = PSF_FWHM_z_map_p2[sdss_footprint_p2]
        rv_z_skyflux_p2 = skyflux_z_map_p2[sdss_footprint_p2]

        rv_star_map_p2  = star_map_p2[sdss_footprint_p2]

        #prepare for regression
        X_rv = np.column_stack((rv_w1_covMed_p2, rv_w1_moonlev_p2, rv_w1_Med_p2,rv_star_map_p2, rv_r_ex
        print "done"
```

```
done
```

```
In [4]: #Now we do regression in every bin, one by one and make PD maps.
        lrg_od_55_z_60 = OD_55_z_60[:,3][sdss_footprint_p2]
        #print len(lrg_od_55_z_60), min(lrg_od_55_z_60), max(lrg_od_55_z_60), len(w1_covMed_map_p2), le


        # now we build regression models using linear regression from Scikit learn
        from sklearn import linear_model
        clf_55_z_60 = linear_model.LinearRegression(fit_intercept=True )
        clf_55_z_60.fit(X_rv,lrg_od_55_z_60)
        print clf_55_z_60.coef_,clf_55_z_60.intercept_
        print "done"
```

```
[ -1.34815575e-03   6.11758815e-02  -1.48270689e-02   7.71472692e-06
  -8.97512508e-02  -3.86088431e-01   8.01868046e-03] 1.7389677435
done
```

```
In [5]: lrg_od_60_z_65 = OD_60_z_65[:,3][sdss_footprint_p2]
        from sklearn import linear_model
        clf_60_z_65 = linear_model.LinearRegression(fit_intercept=True )
        clf_60_z_65.fit(X_rv,lrg_od_60_z_65)
        print clf_60_z_65.coef_,clf_60_z_65.intercept_
        print "done"
```

```
[ -4.55796342e-04  -8.78664556e-02  -3.89697154e-02   2.47583349e-05
  -1.12258766e-01  -4.97975559e-01   1.22245712e-02] 2.89410988808
done
```

```
In [6]: lrg_od_65_z_70 = OD_65_z_70[:,3][sdss_footprint_p2]
        from sklearn import linear_model
        clf_65_z_70 = linear_model.LinearRegression(fit_intercept=True )
        clf_65_z_70.fit(X_rv,lrg_od_65_z_70)
        print clf_65_z_70.coef_,clf_65_z_70.intercept_
        print "done"
```

```
[  1.03973149e-03   3.08354499e-02  -4.26474420e-02   1.68099432e-05
  -1.02760979e-01  -4.02493207e-01   1.13721505e-02] 3.18600104427
done
```

```
In [7]: lrg_od_70_z_75 = OD_70_z_75[:,3][sdss_footprint_p2]
        from sklearn import linear_model
        clf_70_z_75 = linear_model.LinearRegression(fit_intercept=True )
        clf_70_z_75.fit(X_rv,lrg_od_70_z_75)
        print clf_70_z_75.coef_,clf_70_z_75.intercept_
        print "done"
```

```
[  1.03489991e-03   1.01236363e-01  -2.83612167e-03  -2.00060394e-05
   1.07887276e-01  -3.70162089e-02   1.89042851e-02] 2.03592474394
done
```

```
In [8]: lrg_od_75_z_85 = OD_75_z_85[:,3][sdss_footprint_p2]
        from sklearn import linear_model
        clf_75_z_85 = linear_model.LinearRegression(fit_intercept=True )
        clf_75_z_85.fit(X_rv,lrg_od_75_z_85)
        print clf_75_z_85.coef_,clf_75_z_85.intercept_
        print "done"
```

```
[  1.96765991e-03   1.89208515e-01   3.53760145e-02   2.50015371e-05
   3.76438619e-01   6.17162146e-01   3.06534519e-02] 0.539013667103
done
```

```
In [9]: lrg_od_z_85 = OD_z_85[:,3][sdss_footprint_p2]
        from sklearn import linear_model
        clf_z_85 = linear_model.LinearRegression(fit_intercept=True )
        clf_z_85.fit(X_rv,lrg_od_z_85)
        print clf_z_85.coef_,clf_z_85.intercept_
        print "done"
```

```
[  1.09002704e-03   3.54404918e-02   1.82691899e-02   8.06170761e-06
   1.90019639e-01   2.76276532e-01   8.64619244e-03] -0.13856453652
done
```

```
In [10]: w1_covMed_map_01  = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p01_NN.fits", fie
         w1_Med_map_01     = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p01_NN.fits", fie
         w1_moonlev_map_01 = hp.fitsfunc.read_map("../Lrg_healpy/wise_sys/wise_sys_map_p01_NN.fits", fie

         PSF_FWHM_z_map_01 = hp.fitsfunc.read_map("../Lrg_healpy/sdss_sys/sdss_sys_map_p01.fits", field=
         skyflux_z_map_01  = hp.fitsfunc.read_map("../Lrg_healpy/sdss_sys/sdss_sys_map_p01.fits", field=
         r_ext_map_01      = hp.fitsfunc.read_map("../Lrg_healpy/sdss_sys/sdss_sys_map_p01.fits", field=


         w1_covMed_map_01[np.isnan(w1_covMed_map_01)]=-0
         w1_Med_map_01[np.isnan(w1_Med_map_01)]=-0
         w1_moonlev_map_01[np.isnan(w1_moonlev_map_01)] = -0

         PSF_FWHM_z_map_01[np.isnan(PSF_FWHM_z_map_01)] = -0.0
         skyflux_z_map_01[np.isnan(skyflux_z_map_01)]   = -0.0
         r_ext_map_01[np.isnan(r_ext_map_01)] =-0.0


         star_map_p01 = hp.pixelfunc.ud_grade(star_map_05,nside_out=512, pess= True)


         #theta_map_05 [np.isnan(theta_map_05)] =-99.0

         #lrgs_obs_den_map_05[np.isnan(lrgs_obs_den_map_05)]=-0.0


         print len(skyflux_z_map_01[~np.isnan(skyflux_z_map_01)]), len(skyflux_z_map_01[np.where(skyflu

         print "done"
```

```
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INDXSCHM = IMPLICIT
NSIDE = 512
ORDERING = RING in fits file
INDXSCHM = IMPLICIT
3145728 834480
done
```

```
In [11]: sdss_footprint_01 = np.where(skyflux_z_map_01 > 0)


         rv_w1_covMed_01  = w1_covMed_map_01[sdss_footprint_01]
         rv_w1_moonlev_01 = w1_moonlev_map_01[sdss_footprint_01]
         rv_w1_Med_01     = w1_Med_map_01[sdss_footprint_01]

         rv_r_ext_01      = 10**r_ext_map_01[sdss_footprint_01]
         rv_z_psf_01      = PSF_FWHM_z_map_01[sdss_footprint_01]
         rv_z_skyflux_01  = skyflux_z_map_01[sdss_footprint_01]
         #rv_theta_01      = 1.0/np.sin(theta_map_01[sdss_footprint_01])
         star_map_p01 = hp.pixelfunc.ud_grade(star_map_05,nside_out=512, pess= True)

         rv_star_map_01  = star_map_p01[sdss_footprint_01]
         print "done"
```

```
done
```

```
In [12]: constant_55_z_60 = clf_55_z_60.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_55_z_60  = constant_55_z_60+ clf_55_z_60.coef_[0]*rv_w1_covMed_01 +  clf_55_z_60.coef_
         print "done"
```

```
done
```

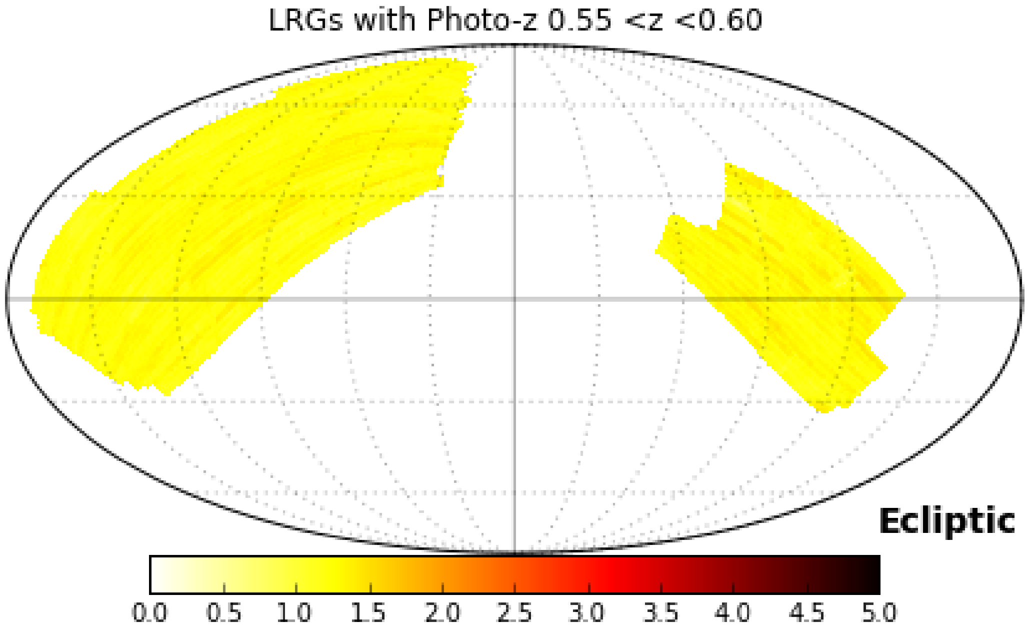
```
In [13]: NSIDE_p01 = 512
         Pd_55_z_60 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_55_z_60[sdss_footprint_01] = lrgs_pd_55_z_60
         print "done"
```

```
done
```

```
In [14]: hp.visufunc.mollview(Pd_55_z_60,coord=['G','E'],title="LRGs with Photo-z 0.55 <z <0.60",max =5
         #hp.visufunc.mollview(pz_85,coord=['G','E'],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig('plots/Lrg predicted density 0.55 <z <0.60.pdf')

         np.savetxt('cats/Lrg_pre_density_55_z_60_map.in', np.c_[Pd_55_z_60], header='Predicted Density
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00'.
The interval between meridians is 30 deg -0.00'.
```



```
In [15]: constant_60_z_65 = clf_60_z_65.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_60_z_65  = constant_60_z_65+ clf_60_z_65.coef_[0]*rv_w1_covMed_01 +  clf_60_z_65.coef_
         print "done"
```

```
done
```

```
In [16]: Pd_60_z_65 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_60_z_65[sdss_footprint_01] = lrgs_pd_60_z_65
         print "done"
```

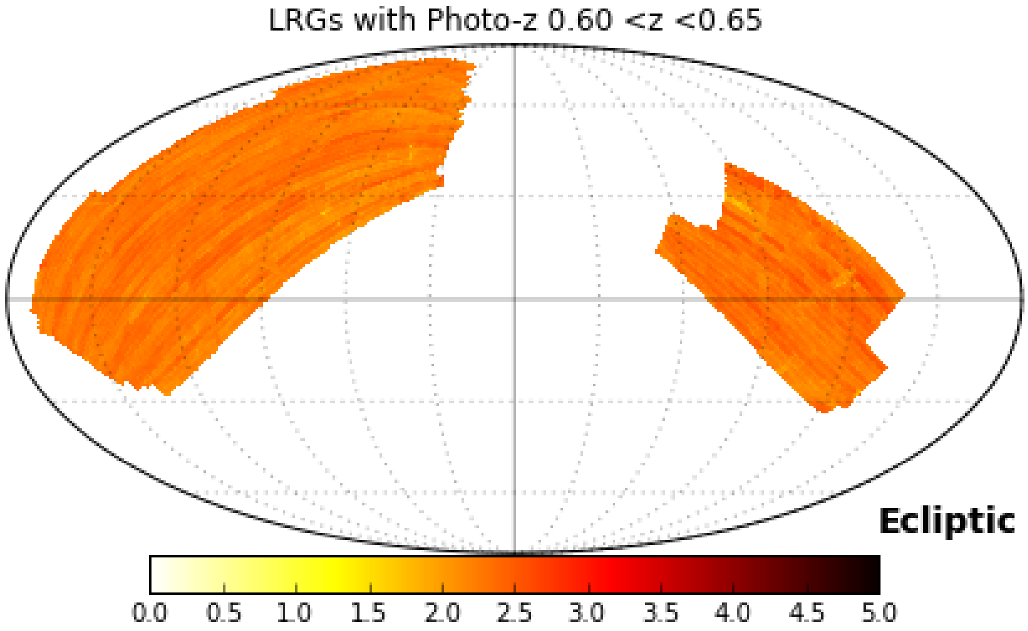
```
done
```

```
In [17]: hp.visufunc.mollview(Pd_60_z_65,coord=[’G’,’E’],title="LRGs with Photo-z 0.60 <z <0.65",max =5
         #hp.visufunc.mollview(pz_85,coord=[’G’,’E’],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig(’plots/Lrg predicted density 0.60 <z <0.65.pdf’)

         np.savetxt(’cats/Lrg_pre_density_60_z_65_map.in’, np.c_[Pd_60_z_65], header=’Predicted Density

         print "done"
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00’.
The interval between meridians is 30 deg -0.00’.
done
```



```
In [18]: constant_65_z_70 = clf_65_z_70.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_65_z_70  = constant_65_z_70+ clf_65_z_70.coef_[0]*rv_w1_covMed_01 +  clf_65_z_70.coef_
         print "done"
```

```
done
```

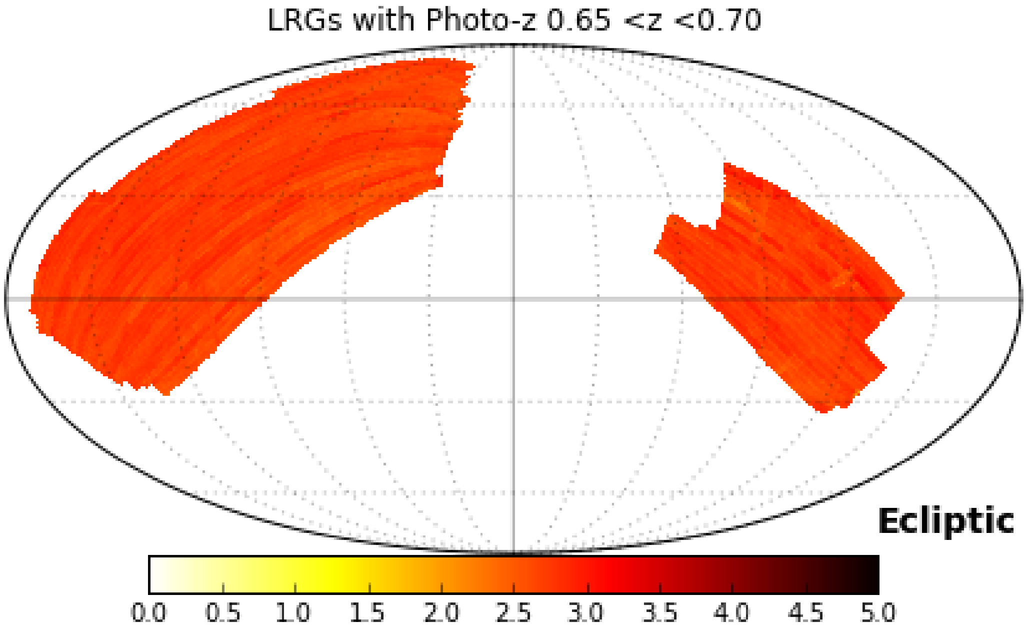
```
In [19]: Pd_65_z_70 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_65_z_70[sdss_footprint_01] = lrgs_pd_65_z_70
         print "done"
```

```
done
```

```
In [20]: hp.visufunc.mollview(Pd_65_z_70,coord=['G','E'],title="LRGs with Photo-z 0.65 <z <0.70",max =5
         #hp.visufunc.mollview(pz_85,coord=['G','E'],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig('plots/Lrg predicted density 0.65<z<0.70.pdf')

         np.savetxt('cats/Lrg_pre_density_65_z_70_map.in', np.c_[Pd_65_z_70], header='Predicted Density
         print "done"
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00'.
The interval between meridians is 30 deg -0.00'.
done
```



```
In [21]: constant_70_z_75 = clf_70_z_75.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_70_z_75  = constant_70_z_75+ clf_70_z_75.coef_[0]*rv_w1_covMed_01 +  clf_70_z_75.coef_
         print "done"
```

```
done
```

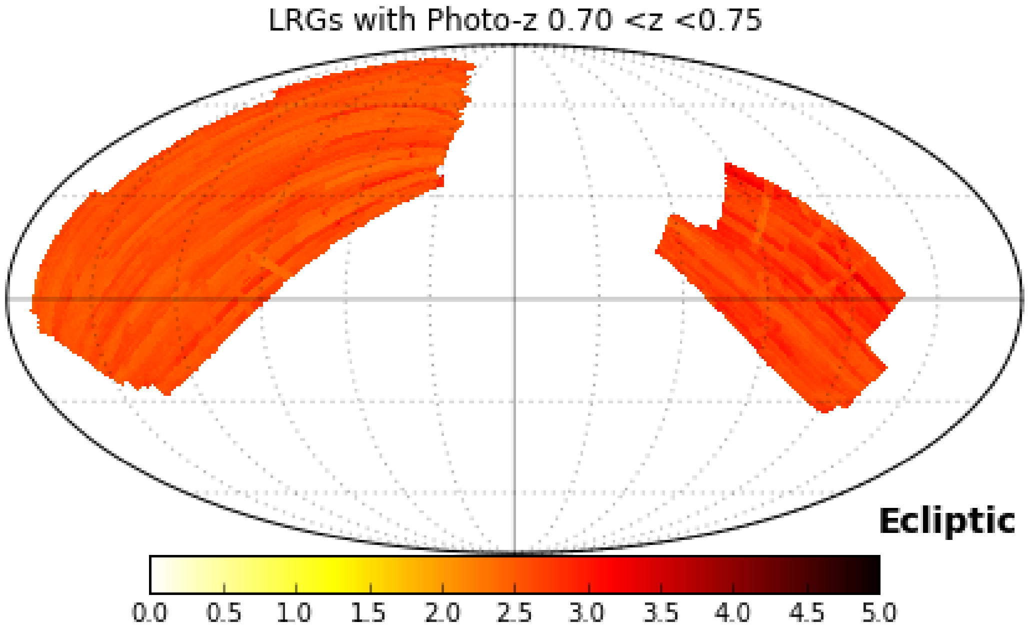
```
In [22]: Pd_70_z_75 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_70_z_75[sdss_footprint_01] = lrgs_pd_70_z_75
         print "done"
```

```
done
```

```
In [23]: hp.visufunc.mollview(Pd_70_z_75,coord=['G','E'],title="LRGs with Photo-z 0.70 <z <0.75",max =5
         #hp.visufunc.mollview(pz_85,coord=['G','E'],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig('plots/Lrg predicted density 0.70 <z <0.75.pdf')

         np.savetxt('cats/Lrg_pre_density_70_z_75_map.in', np.c_[Pd_70_z_75], header='Predicted Density
         print "done"
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00'.
The interval between meridians is 30 deg -0.00'.
done
```



```
In [24]: constant_75_z_85 = clf_75_z_85.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_75_z_85  = constant_75_z_85+ clf_75_z_85.coef_[0]*rv_w1_covMed_01 +  clf_75_z_85.coef_
         print "done"
```

```
done
```

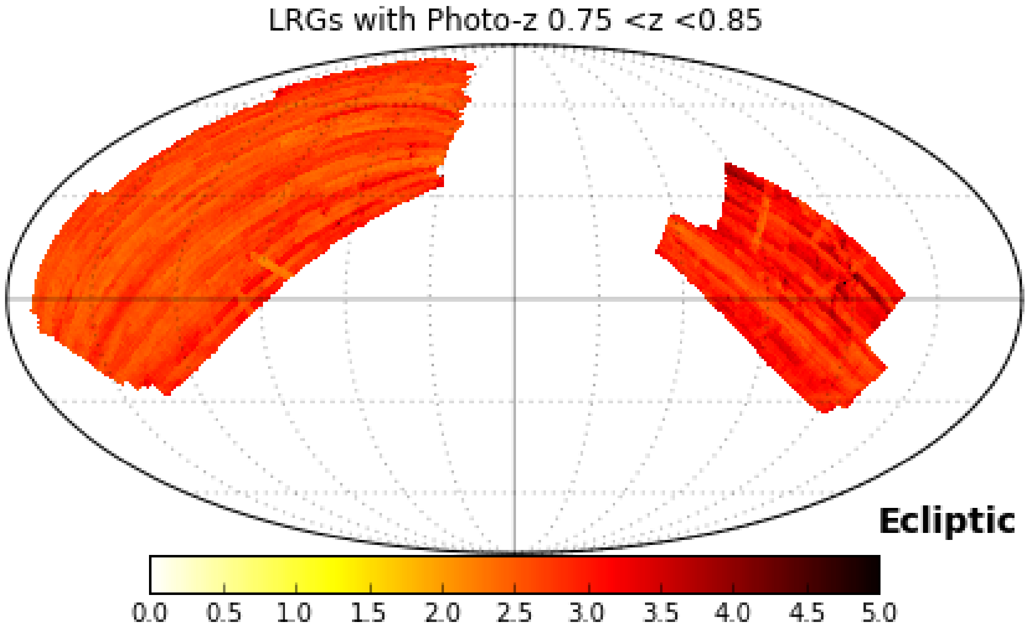
```
In [25]: Pd_75_z_85 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_75_z_85[sdss_footprint_01] = lrgs_pd_75_z_85
         print "done"
```

```
done
```

```
In [26]: hp.visufunc.mollview(Pd_75_z_85,coord=['G','E'],title="LRGs with Photo-z 0.75 <z <0.85",max =5
         #hp.visufunc.mollview(pz_85,coord=['G','E'],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig('plots/Lrg predicted density z 0.75 <z <0.85.pdf')

         np.savetxt('cats/Lrg_pre_density_75_z_85_map.in', np.c_[Pd_75_z_85], header='Predicted Density
         print "done"
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00'.
The interval between meridians is 30 deg -0.00'.
done
```



```
In [27]: constant_z_85 = clf_z_85.intercept_*(np.zeros(len(rv_w1_covMed_01))+1.0)

         lrgs_pd_z_85  = constant_z_85+ clf_z_85.coef_[0]*rv_w1_covMed_01 +  clf_z_85.coef_[1] *rv_w1_m
         print "done"
```

```
done
```

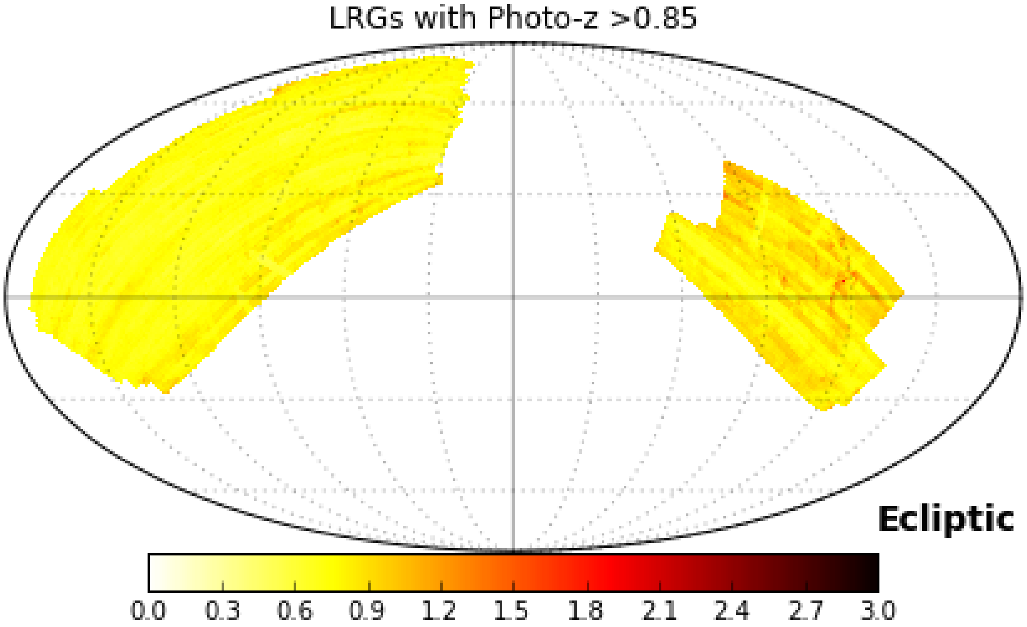
```
In [28]: Pd_z_85 = np.zeros(hp.nside2npix(NSIDE_p01))
         Pd_z_85[sdss_footprint_01] = lrgs_pd_z_85
         print "done"
```

```
done
```

```
In [29]: hp.visufunc.mollview(Pd_z_85,coord=[’G’,’E’],title="LRGs with Photo-z >0.85",max =3,min =0.0,c
         #hp.visufunc.mollview(pz_85,coord=[’G’,’E’],title="LRGs with Photo-z >0.85",max =2,min =0,cmap
         hp.graticule(alpha = 0.35)
         fig = plt.gcf()
         ax = plt.gca()
         image = ax.get_images()[0]
         cmap = fig.colorbar(image, ax=ax, orientation="horizontal",shrink=0.5,anchor=(0.5,2.90))
         plt.savefig(’plots/Lrg predicted density z >0.85.pdf’)

         np.savetxt(’cats/Lrg_pre_density_z_85_map.in’, np.c_[Pd_z_85], header=’Predicted Density (z > 
         print "done"
```

```
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00’.
The interval between meridians is 30 deg -0.00’.
done
```



```
In [ ]:
```