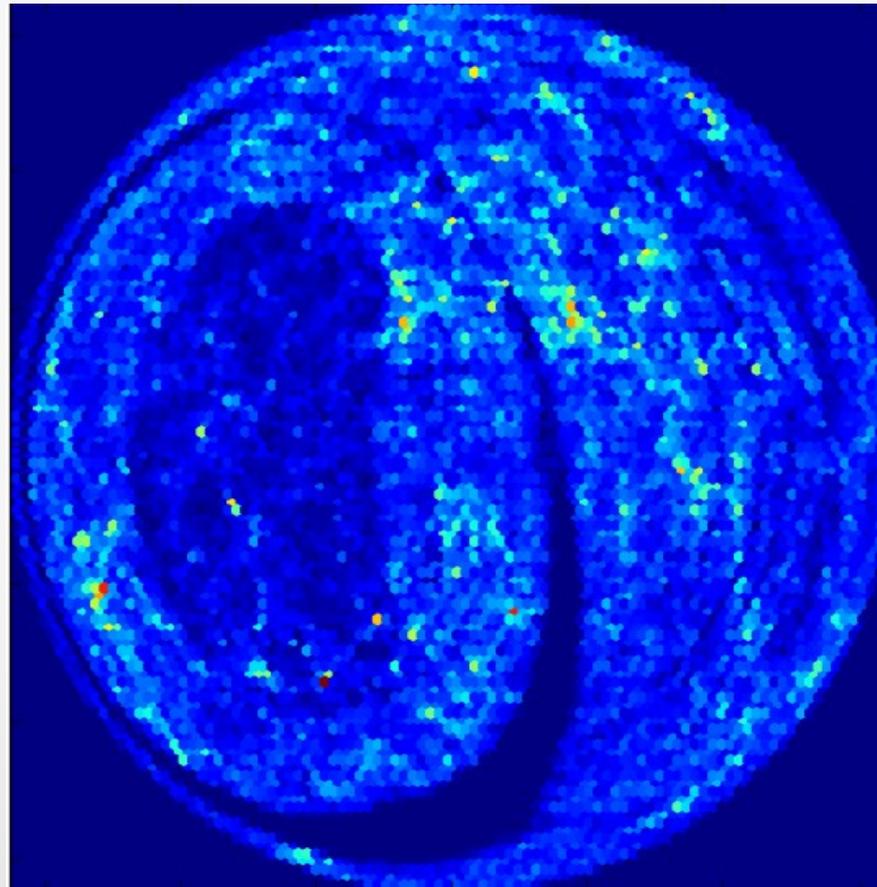




# Topics in Exploring the Local Universe through Density Maps

Tiger Shi

Adviser: Dr. James Annis



DES Gravitational Wave Galaxy Catalog.

# Overview:

- Building Maps of the Galactic Halo
  - Selecting RC Stars from CasJobs
  - Map Projections of RC Stars
  - Halo RC Stars using Galaxia foreground subtraction:
    - Northern RC Stars
    - Southern RC Stars
  - Halo RC Stars using Trilegal foreground subtraction
- Building maps of the  $z \sim 1/3$  galaxy distribution
  - DES PhotoZ Catalog Maps

# Selecting RC Stars from CasJobs

## 'Arianna's RC Stars' Details

Resubmit Job

| JobID            | TaskName           | Context        | Queue | Submitted            | Started              | Finished            | Status   |
|------------------|--------------------|----------------|-------|----------------------|----------------------|---------------------|----------|
| 14014337         | Arianna's RC Stars | DR12           | 500   | 7/7/2015 10:35:01 AM | 7/7/2015 10:35:03 AM | 7/7/2015 2:19:08 PM | Finished |
| Executed on Rows |                    | Message        |       |                      |                      |                     |          |
| DR12_Long        | 5147254            | Query Complete |       |                      |                      |                     |          |
| Query            |                    |                |       |                      |                      |                     |          |

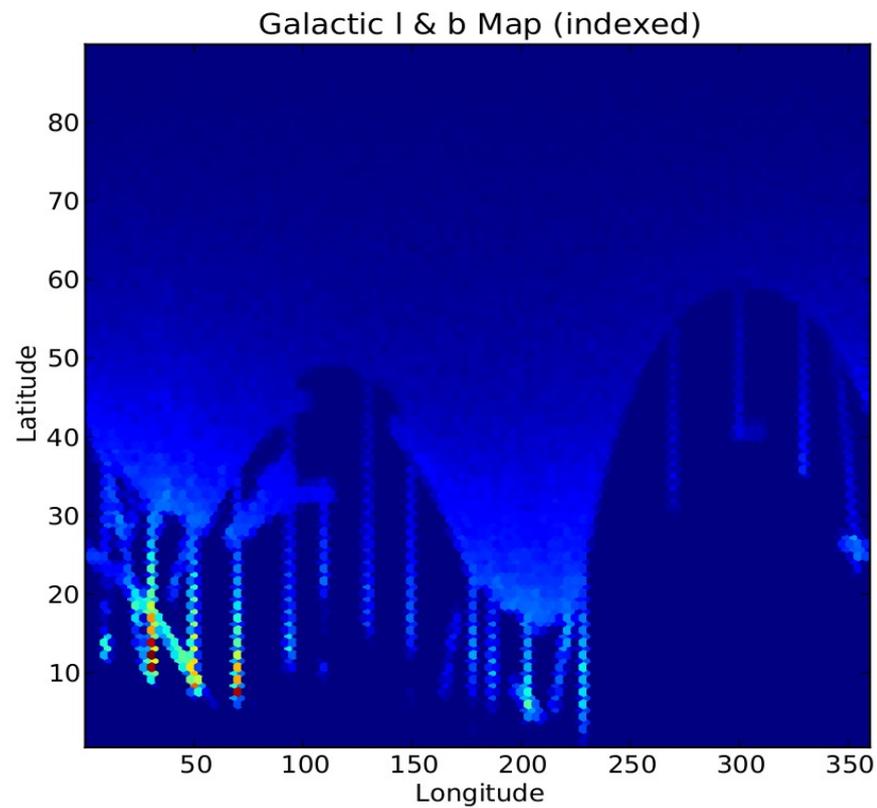
```
select ra, dec, l, b, dered_i,
       dered_g - dered_r as dgr, dered_r - dered_i as dri, dered_i - dered_z as diz into mydb.RC from star
where i between 13 and 20
     and dered_g - dered_r between 0.142 and 0.439
     and dered_r - dered_i between 0.022 and 0.147
     and dered_i - dered_z between 0.003 and 0.054
```

SDSS Skyserver  
CasJobs Database  
(<http://skyserver.sdss.org/casjobs/>)

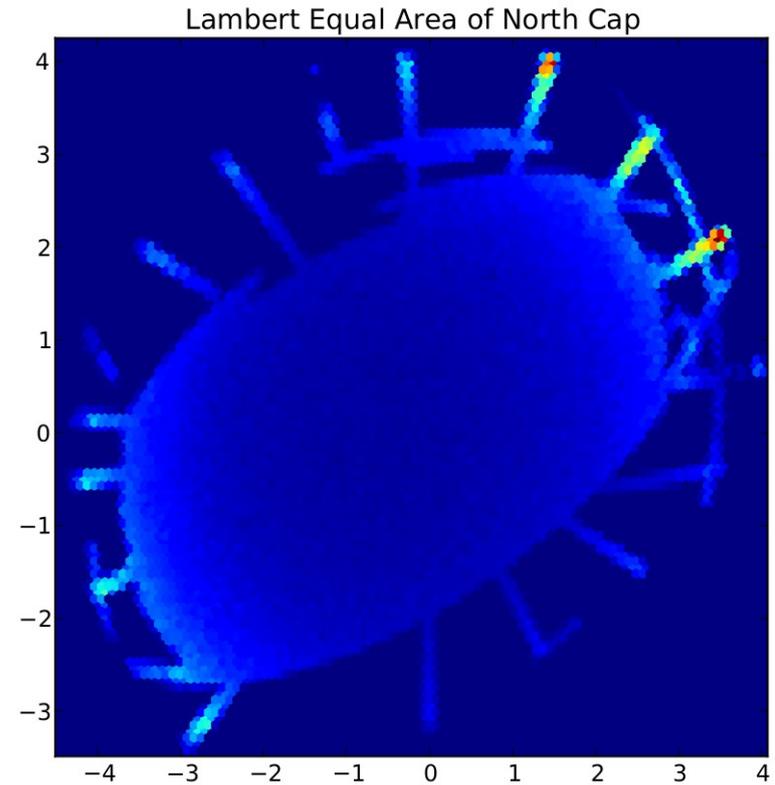
| ra               | dec                | l                | b                 | dered_i  | dgr       | dri        | diz         |
|------------------|--------------------|------------------|-------------------|----------|-----------|------------|-------------|
| float [8]        | float [8]          | float [8]        | float [8]         | real [4] | real [4]  | real [4]   | real [4]    |
| 62.328958078689  | -1.21879844549078  | 192.882114098957 | -36.0101807733384 | 14.19165 | 0.3799419 | 0.1289282  | 0.01444721  |
| 62.4235774640985 | -1.18410126458898  | 192.910340584824 | -35.9120440112515 | 14.41258 | 0.4367208 | 0.1375513  | 0.01763916  |
| 62.457110558994  | -1.11160419899829  | 192.858210720123 | -35.844252263662  | 16.84251 | 0.4073391 | 0.1073513  | 0.04016685  |
| 62.534482623892  | -1.21902193799254  | 193.021344859145 | -35.8383981871498 | 17.35168 | 0.3970795 | 0.1159401  | 0.02287865  |
| 62.6343602116389 | -1.22613780844413  | 193.09602464119  | -35.758693846669  | 14.87323 | 0.3712158 | 0.1021185  | 0.005001068 |
| 62.2281663080582 | -0.669784547811611 | 192.247980718512 | -35.7917322644125 | 16.4673  | 0.3958187 | 0.1172237  | 0.01995087  |
| 62.2870633040249 | -1.07998958336435  | 192.710310253109 | -35.9689682912723 | 16.09474 | 0.4284458 | 0.129509   | 0.02438545  |
| 62.3685457514316 | -0.668901910992885 | 192.342764970781 | -35.6743242865133 | 18.88552 | 0.2205238 | 0.07118416 | 0.02199745  |
| 62.6504422753522 | -1.05971664078218  | 192.935336043444 | -35.6541517819906 | 16.78615 | 0.3610363 | 0.09801674 | 0.02743149  |
| 62.6170368654196 | -1.21349582643902  | 193.071310347666 | -35.7662837644157 | 14.3216  | 0.4154873 | 0.1288223  | 0.02487946  |
| 62.5359423556531 | -1.24122142717037  | 193.045253195729 | -35.8493227181051 | 19.65527 | 0.2387409 | 0.09127617 | 0.02510262  |
| 62.4536561364617 | -0.757013591840668 | 192.491028974756 | -35.652049837578  | 15.2374  | 0.4127512 | 0.09661102 | 0.008406639 |
| 62.5298683396766 | -0.781952836069666 | 192.568322138638 | -35.6022286577525 | 16.8534  | 0.3862152 | 0.1224842  | 0.04869652  |
| 62.5619609705726 | -1.15182127101153  | 192.970547104768 | -35.7786187356508 | 17.33475 | 0.3673763 | 0.1297989  | 0.01973343  |
| 62.5089395374324 | -0.726634918575359 | 192.497378020862 | -35.5891850827171 | 18.72716 | 0.3040886 | 0.06977844 | 0.01317024  |
| 62.4460783770272 | -1.11817057075353  | 192.857518338655 | -35.8570766775505 | 17.2527  | 0.3773746 | 0.1214714  | 0.01558495  |
| 62.571217698242  | -1.17684146075202  | 193.002600992024 | -35.7845741523638 | 16.56903 | 0.3548069 | 0.1146049  | 0.01875496  |
| 62.5361780096911 | -1.13338191934039  | 192.934123017732 | -35.7900825768006 | 15.23317 | 0.3514252 | 0.1006021  | 0.007191658 |
| 62.5082412054905 | -1.21214658541399  | 192.996530755575 | -35.8565918649044 | 17.32226 | 0.4196911 | 0.1380329  | 0.04728889  |
| 62.5090981945926 | -1.21059601542579  | 192.995508498089 | -35.8550260077409 | 16.15444 | 0.3443508 | 0.08642578 | 0.01119232  |
| 62.503019223719  | -1.24295834635278  | 193.024825865326 | -35.8778251335714 | 15.99354 | 0.3463306 | 0.1040354  | 0.02619076  |
| 62.4964809919612 | -1.13682542423783  | 192.910851993026 | -35.8251671258148 | 14.55305 | 0.3924637 | 0.1107521  | 0.004577637 |
| 62.4942198371069 | -1.17928792889586  | 192.953138180873 | -35.8503271468003 | 15.42065 | 0.3717194 | 0.1163502  | 0.01897049  |
| 62.4429272211866 | -1.22313333152184  | 192.963744401008 | -35.9172477058713 | 16.8262  | 0.362339  | 0.1321201  | 0.025383    |
| 62.4419680243036 | -1.05373474760158  | 192.788293444169 | -35.8251426056349 | 16.2479  | 0.4085579 | 0.1415234  | 0.04929733  |
| 62.4227274143595 | -1.22036603343276  | 192.947224589042 | -35.9326278071007 | 15.04329 | 0.4337244 | 0.1247301  | 0.02597332  |
| 62.3531844899051 | -1.23508590110694  | 192.915366512556 | -35.9988533415592 | 13.49381 | 0.4074955 | 0.1123705  | 0.004175186 |
| 62.318241357479  | -1.2394964708428   | 192.896251809619 | -36.030489696064  | 15.02554 | 0.4074221 | 0.1244116  | 0.02641678  |

# Projecting the RC Stars $13 < i < 20$

Plate Carree:

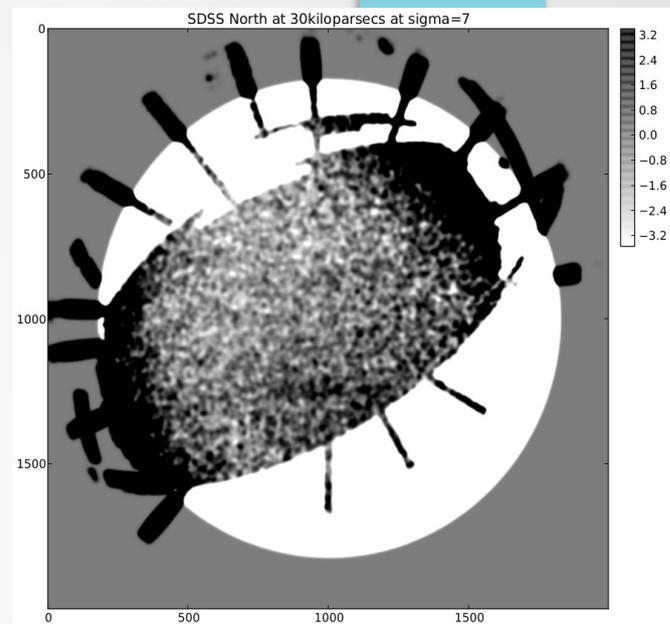
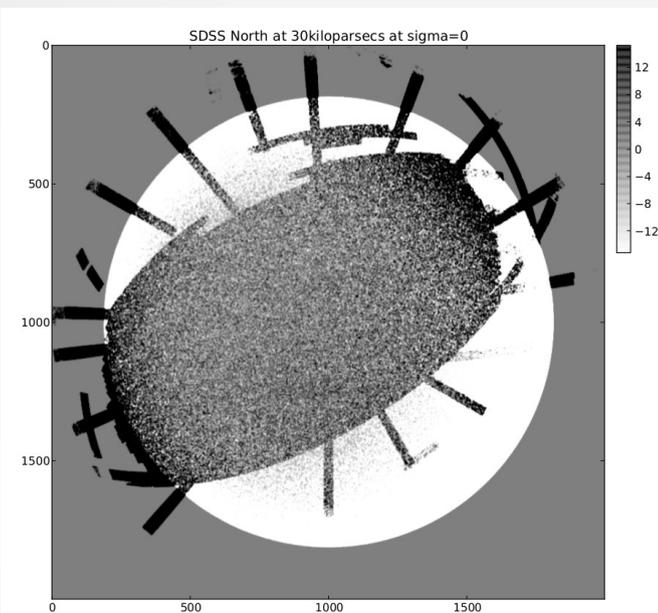


Lambertian Equal Area:

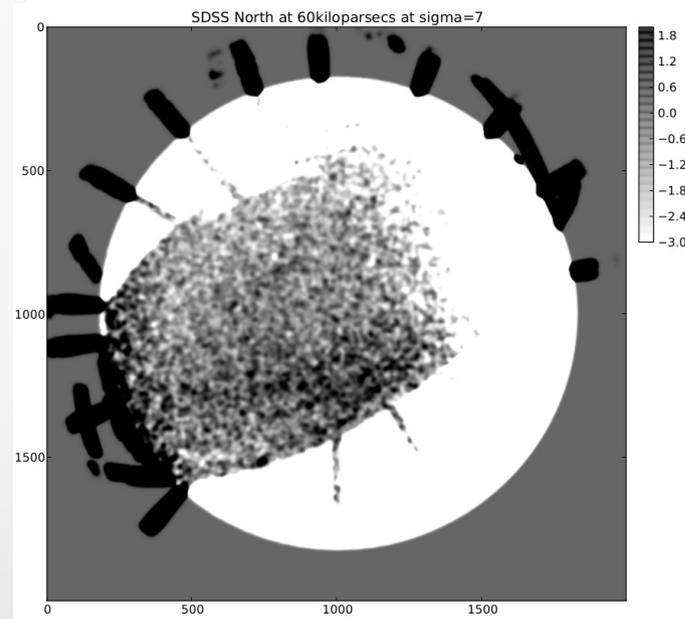
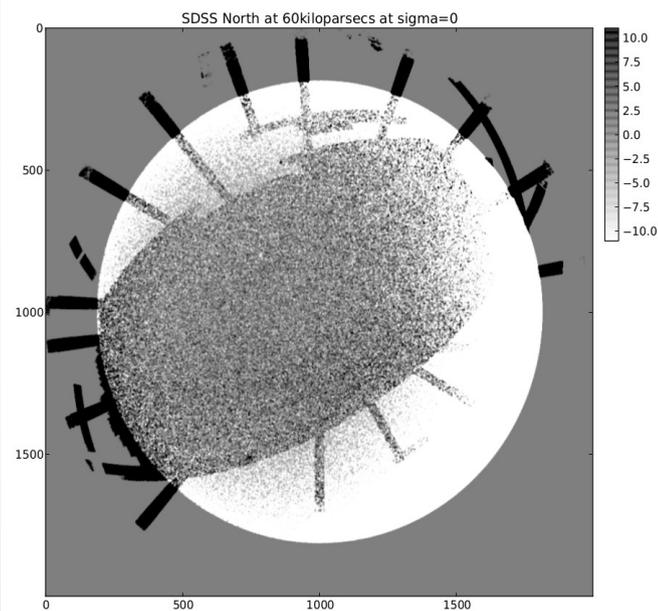


# Plotting SDSS North RC Star Residuals

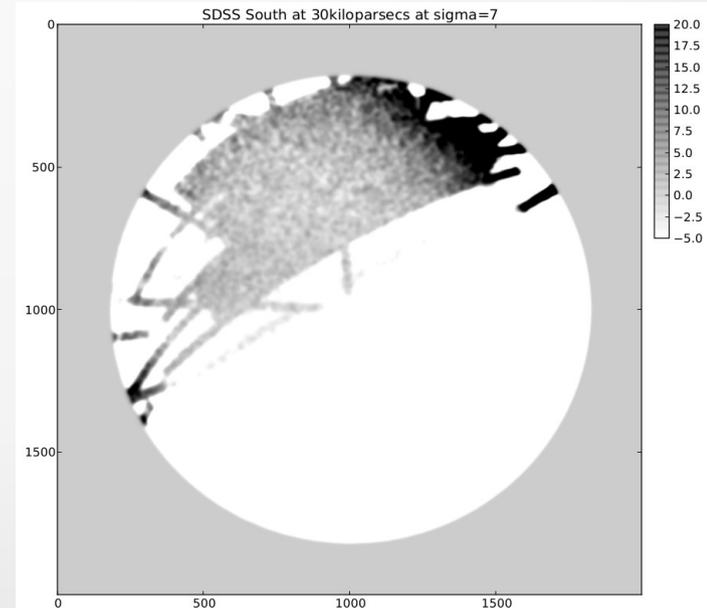
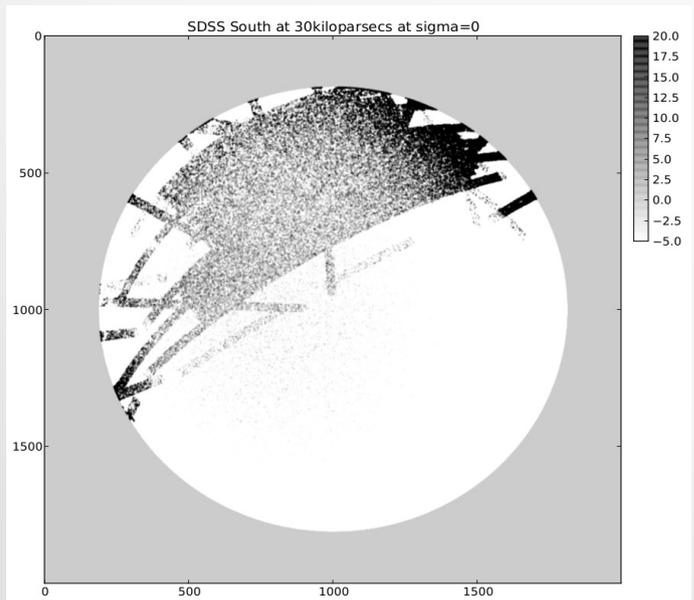
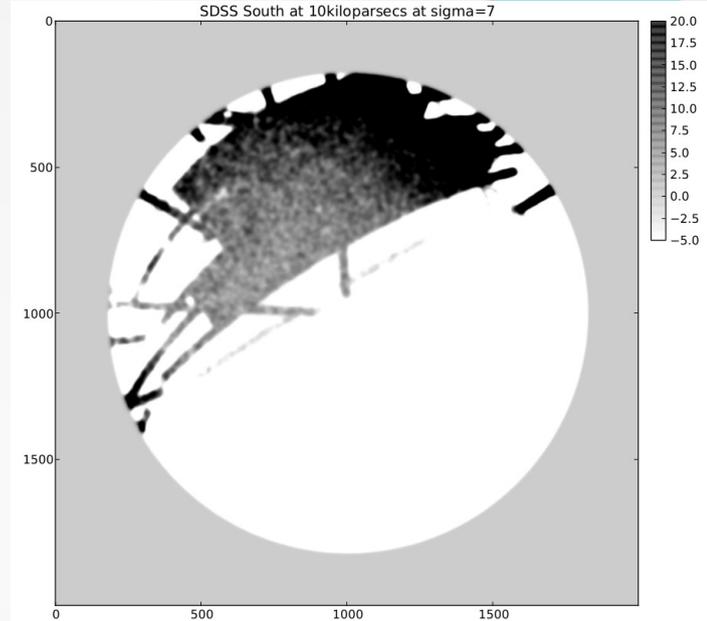
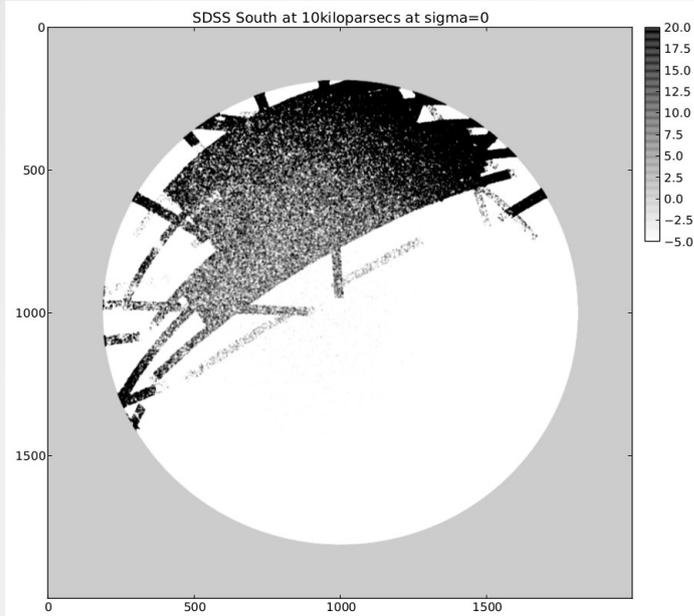
30 kpc Bin:



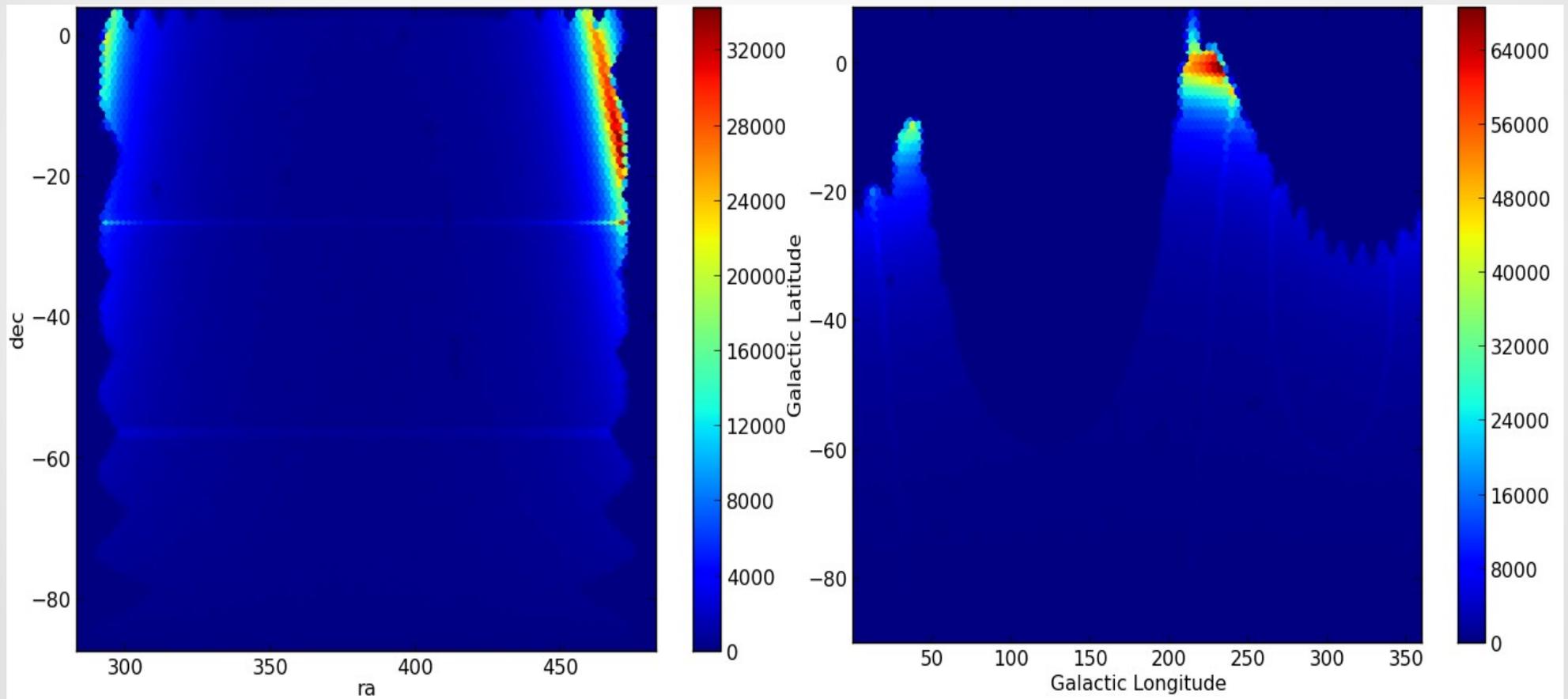
60 kpc Bin:



# Plotting SDSS South RC Star Residuals

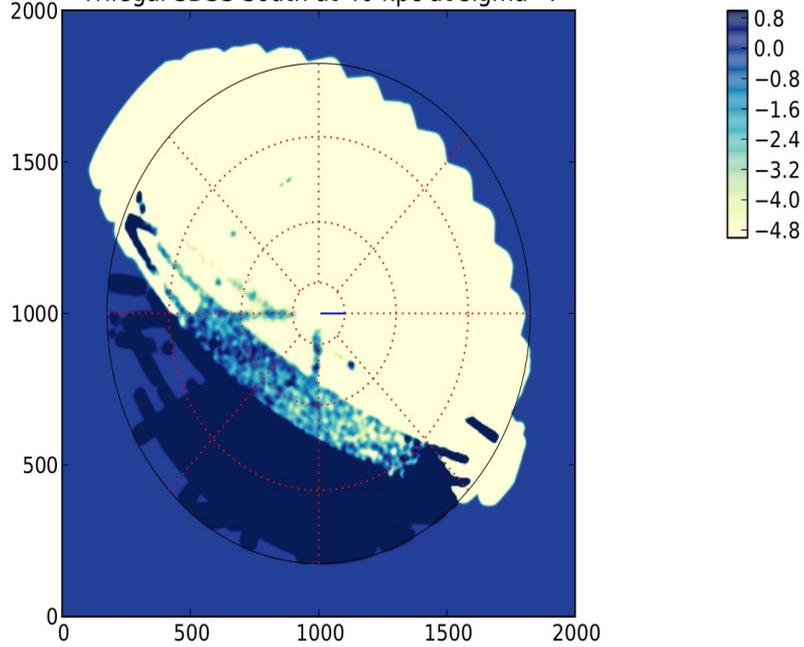


# Trilegal Model: RC Star Density

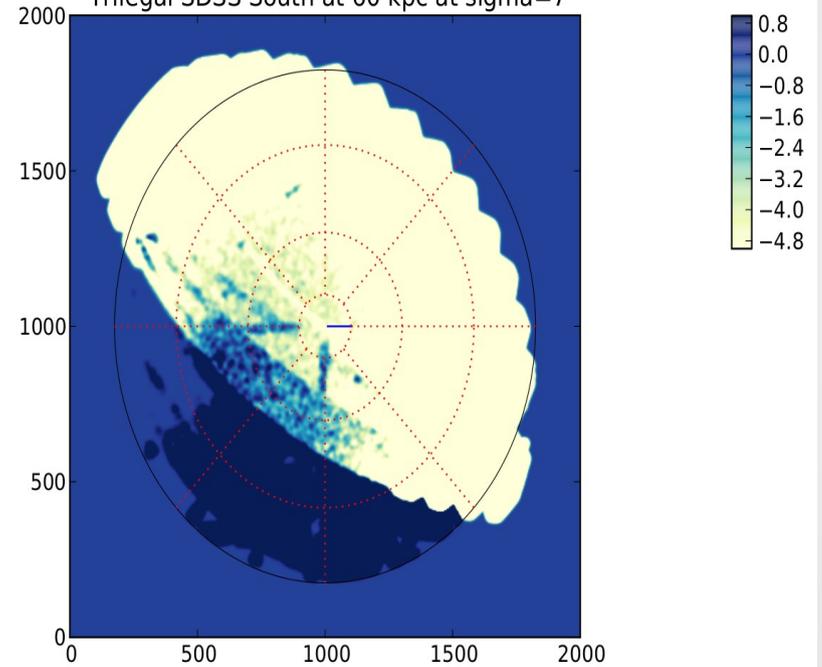


# Trilegal Foreground Subtraction

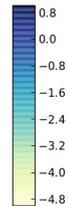
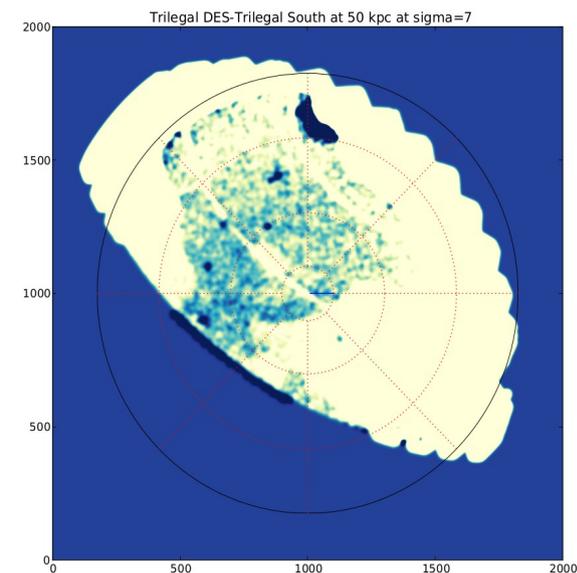
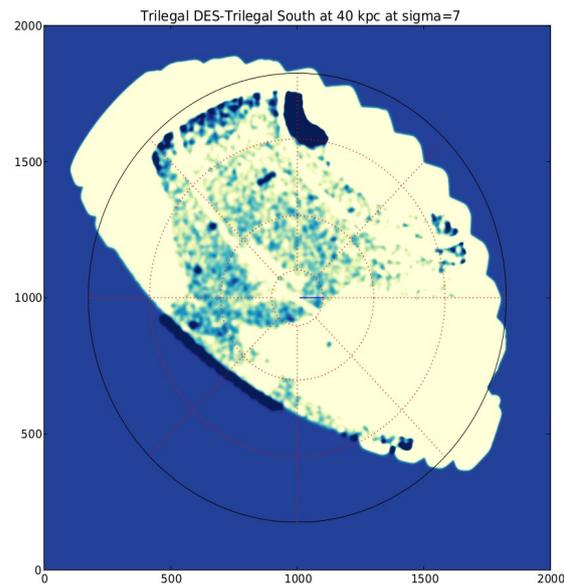
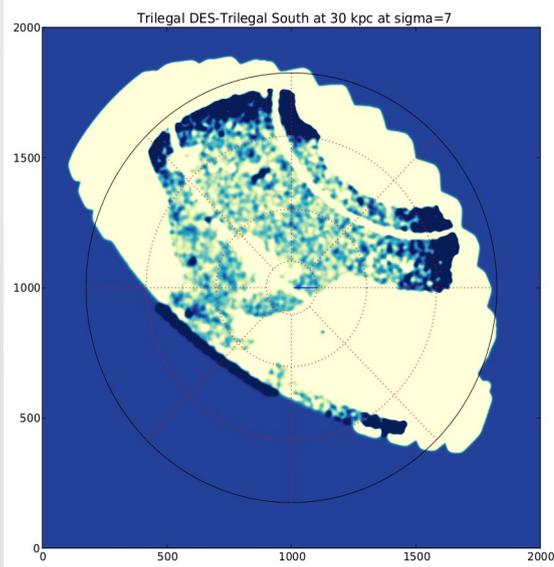
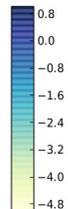
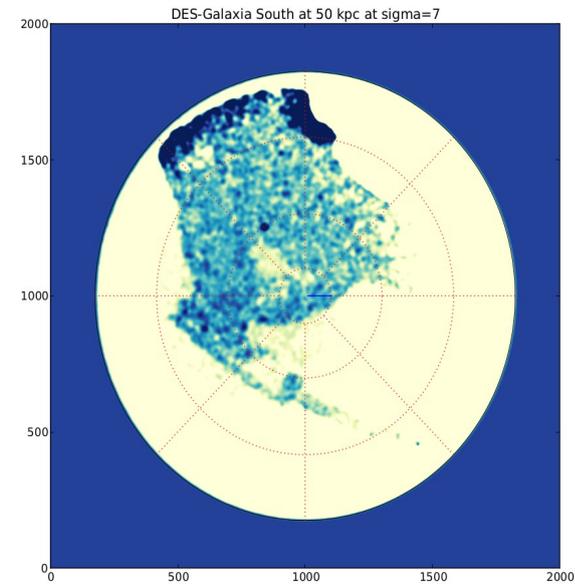
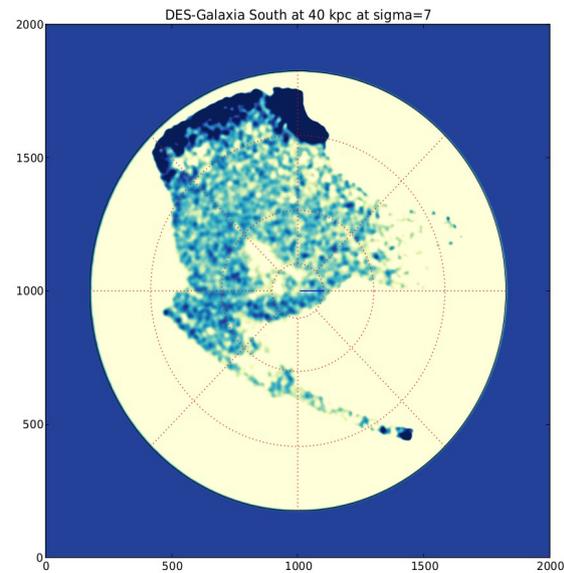
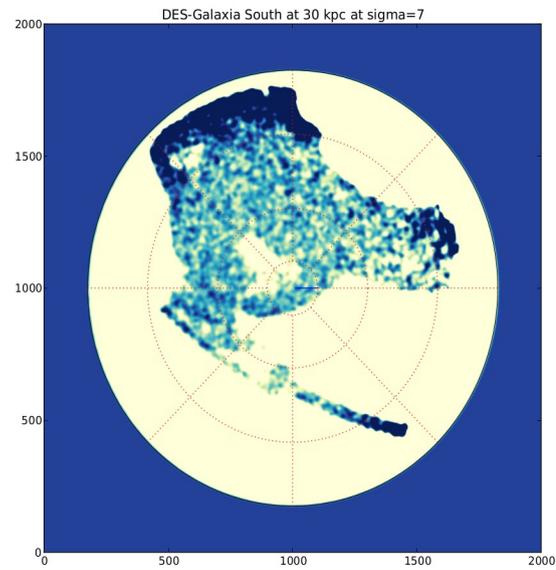
Trilegal SDSS South at 40 kpc at sigma=7



Trilegal SDSS South at 60 kpc at sigma=7

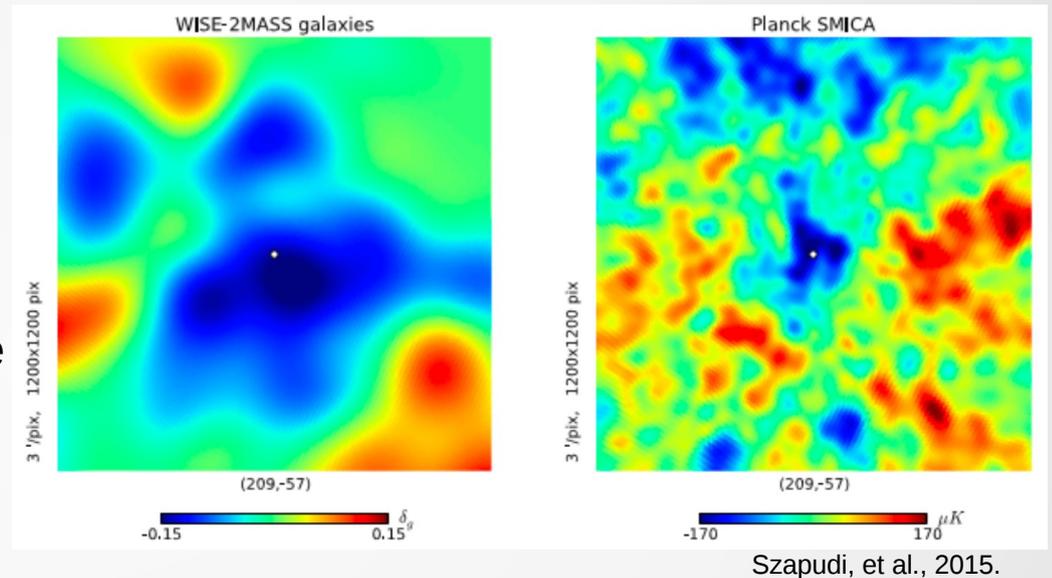


# DES RC Stars with Galaxia and Trilegal

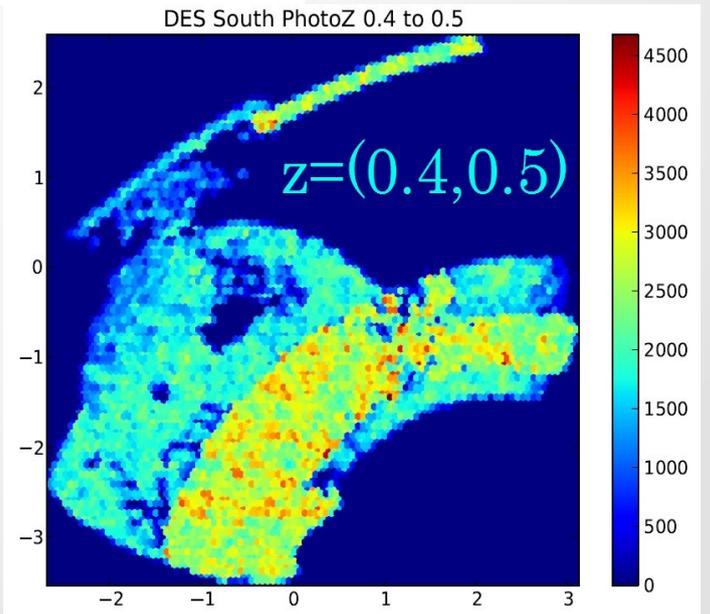
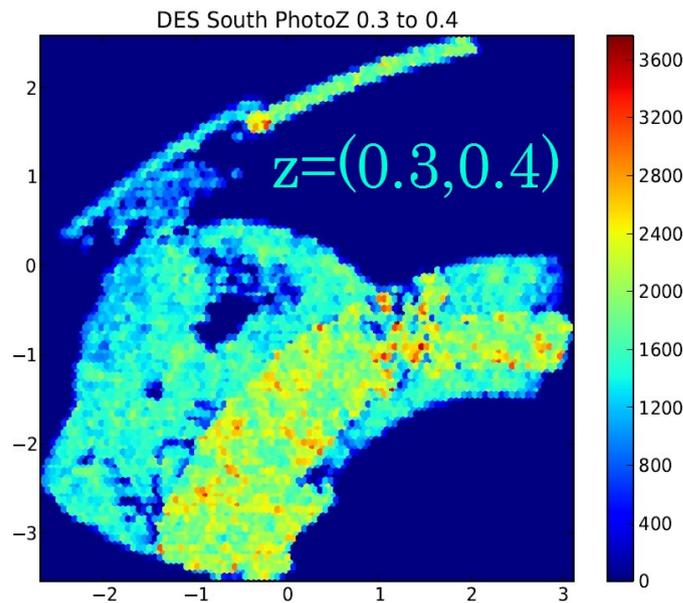
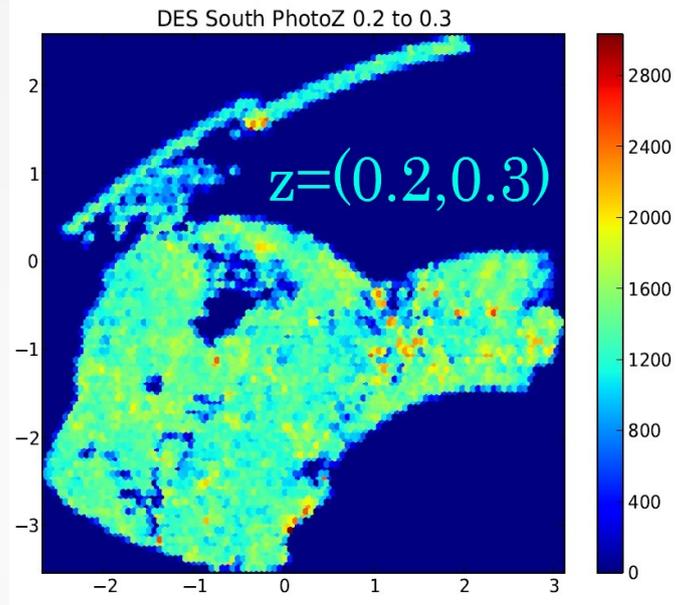
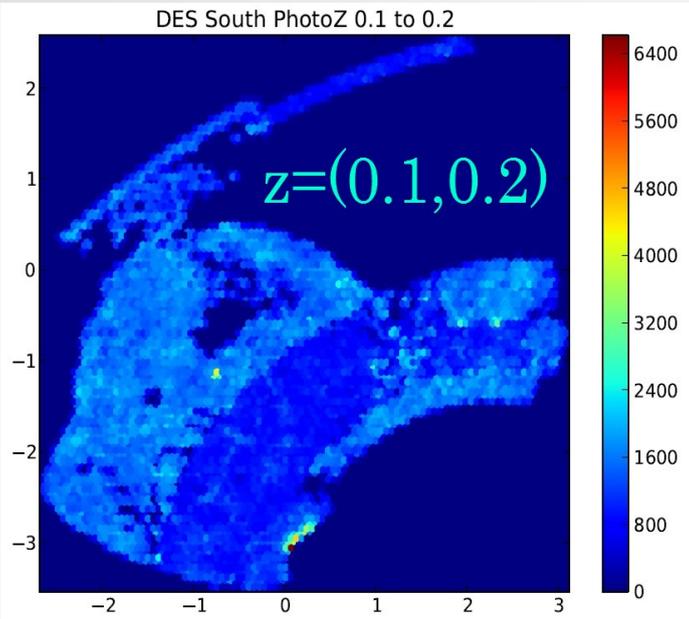


# Planck's Cold Spot: Literature

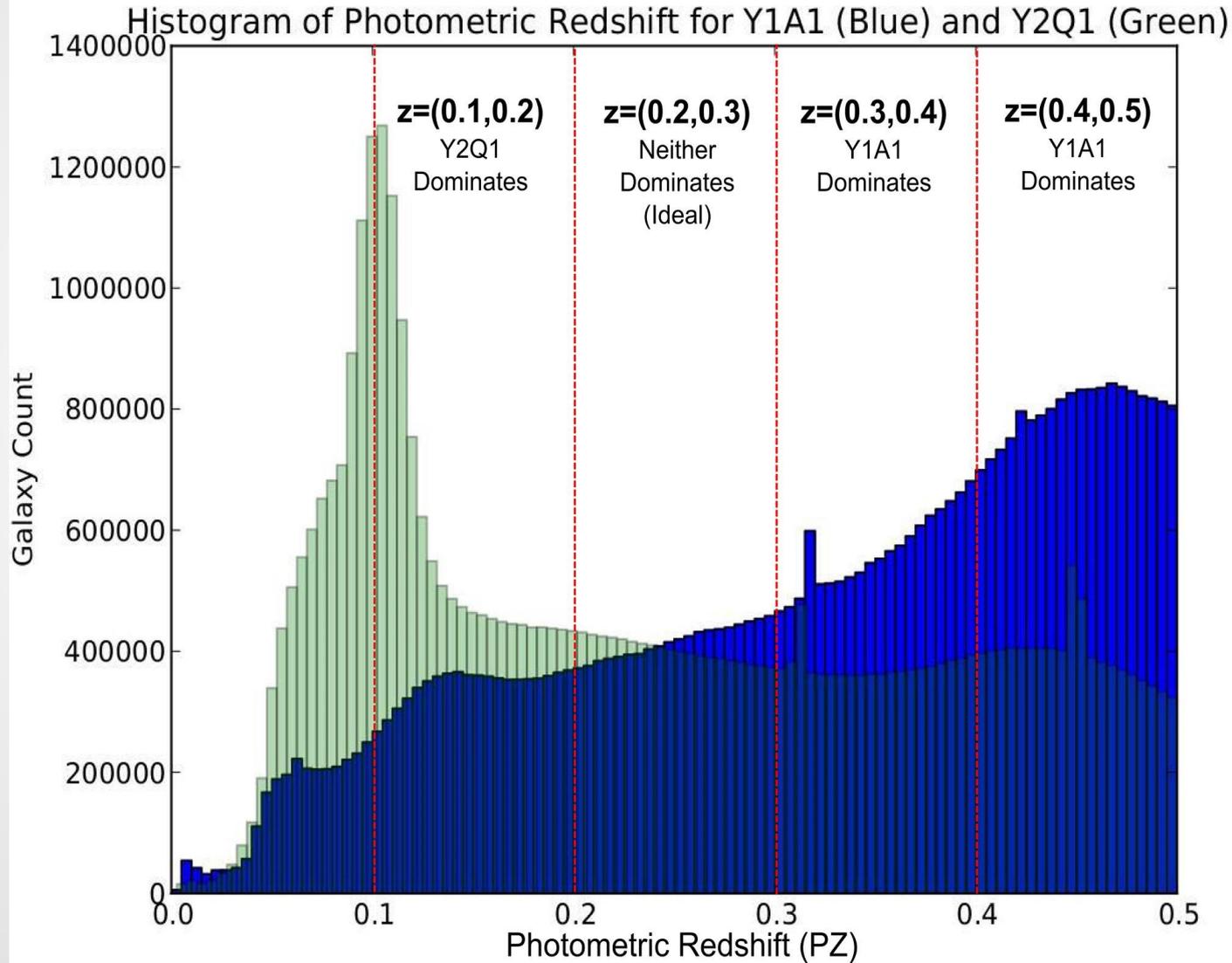
- Szapudi, et al., 2015:
  - Found evidence suggesting the existence of a supervoid
  - WISE-2MASS IF Galaxy Catalogue
- Bremer, et al., 2010:
  - Could not find evidence for supervoid
  - Area of coverage was too small for the conclusions to be believable
  - VIMOS Spectrograph on the VLT
- Granett, et al., 2010:
  - Also could not detect supervoid
  - MegaCam Imaging
  - “Due to the limited sky coverage of our [the] survey, we [Granett's team] cannot draw a definite conclusion regarding the existence of a coherent supervoid structure.”



# Galaxy Density Maps from Y1A1 and Y2Q1 with $i < 20$



# Plotting DES Data: Photo Z Check



# Conclusion:

- Building Maps of the Galactic Halo
  - Selecting RC Stars from CasJobs
  - Map Projections of RC Stars
  - Halo RC Stars using Galaxia foreground subtraction:
    - Northern RC Stars
    - Southern RC Stars
  - Halo RC Stars using Trilegal foreground subtraction
- Building maps of the  $z \sim 1/3$  galaxy distribution
  - DES PhotoZ Catalog Maps

# Questions?

- Special Thanks to Dr James Annis and the DES team