

UNIVERSITY OF WATERLOO

PHYS 437A Assignment 3

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This week, I compared my list of 284 primaries to Ryan's list of 274 primaries to check if the extra 10 in my list were the ones missing in Ryan's list and why Ryan excluded them.

I made a script called “284_primaries_compared_to_274.py” to compare the two lists and print the primaries in my list that were missing from Ryan's list. When I did that, instead of getting back 10 extra primaries, I got back 23. 23 primaries in my list that weren't in Ryan's list. These were primaries that Ryan cut that I did not cut.

I then went back to last week's script to see what was going on. I found out that there was a discrepancy between my cut of primaries not within the SDSS survey and Ryan's cut. I had cut 64 primaries in that cut, as the SDSS DR8 CrossID tool did not give back those primaries when I queried them in the database (ie. these galaxies were not within 0.5 arcminutes of a detection in SDSS). However, 13 of those primaries were in Ryan's list of 274 primaries. These were primaries I cut that Ryan did not cut. Using the SDSS DR8 and DR13 Navigate Tools [13] [14] (I used both, since the DR8 tool did not show the masked regions), these 13 were in fact in SDSS. The CrossID tool was not sufficient at providing all the primaries that were in SDSS that I queried. The 13 primaries that I should not have cut were namely:

1. NGC0628
2. NGC1073
3. NGC2775
4. NGC2903
5. NGC3169
6. NGC3184
7. NGC3344
8. NGC4559
9. NGC4725
10. NGC4736
11. NGC5005
12. NGC5371
13. NGC7714

So in all, I had 23 extra primaries in my final list, not the expected 10, from Ryan's list and Ryan had 13 primaries which I cut from my list. That means I cut 13 that I shouldn't have cut, leaving me with 297 primaries, not 284 primaries after applying the second cut, and 23 primaries extra which are in badly masked regions or regions of incomplete coverage. This would leave me with $284 + 13 - 23 = 274$ primaries - the same as Ryan.

I checked to make sure my first and third cuts were applied properly. This involved writing in last week's script, “871_to_274_cuts.py”, code which looked into each list of cut primaries for each cut and making sure each primary that I cut was not in Ryan's list (ie. the first and third cuts I applied were the same primaries that Ryan cut). Both the first and third cuts cut primaries that Ryan also cut. Therefore, the 23 extra primaries Ryan must have cut in his second cut, and they must have been primaries in badly masked regions, or regions of incomplete coverage.

To check why Ryan cut these extra 23 primaries (why they were in badly masked regions or regions of incomplete coverage), I queried the 23 primaries in the SDSS DR8 and DR13 Navigate Tool. I provide reasoning

for why they are cut, as well as pictures to support my reasoning.

1. NGC2549 - Galaxy very close to edge of survey
2. PGC042549 - Galaxy very close to edge of survey
3. NGC0573 - Not sure why this isn't in Ryan's list
4. NGC0864 - Not sure why this isn't in Ryan's list
5. NGC1012 - Near survey edge
6. NGC1924 - In badly masked region
7. NGC2690 - In badly masked region and near edge of survey
8. NGC3359 - Near badly masked region
9. NGC4348 - Near survey edge
10. NGC4602 - Near survey edge
11. NGC4604 - Near survey edge
12. NGC4691 - Not sure why this isn't in Ryan's list
13. NGC6015 - Near survey edge
14. NGC6070 - Badly masked region
15. NGC6118 - At edge of survey
16. NGC6339 - Near badly masked region
17. NGC6384 - In badly masked region
18. NGC6675 - Near edge of survey
19. NGC7814 - Not sure why this isn't in Ryan's list
20. PGC005363 - Not sure why this isn't in Ryan's list
21. UGC03258 - Not sure why this isn't in Ryan's list
22. UGC10288 - In badly masked region
23. UGC12857 - Not sure why this isn't in Ryan's list

Most of the 23 primaries are clearly in bad regions, but for some it isn't immediately clear why Ryan removed them from his sample.

These masked regions were taken directly from the SDSS. They are regions where scientists are advised to exclude using objects and spectra from within for their scientific analysis. The regions may be masked for a variety of reasons, such as due to saturation of pixels from bright stars, trails left from comets and asteroids, low quality data, and areas of bad seeing. They are in the form of convex polygons. The masked regions in SDSS are broken down into five types: [1]

1. BLEEDING and BRIGHT STAR masks

These are masks around bright stars and their corresponding bleeding columns. They are built from the fPM files' saturated pixels and object masks. Saturated pixels which overlap with an object mask with a radius of ≥ 1 arcmin are chosen for the masks so as to pick out significantly large and saturated stars. Specifically, the BLEEDING mask corresponds to the original fPM saturated pixel mask and the BRIGHT STAR mask corresponds to the original fPM object mask.

2. TRAIL masks

These are masks of the trails left over from fast moving objects in our solar system, such as comets, asteroids, satellites, etc. Like the BRIGHT_STAR mask, these are also built from the original fPM object masks, except trails are chosen as objects which are long and thin and don't correspond to a BRIGHT_STAR mask so as to exclude long BLEEDING masks which may look like a trail.

3. HOLE masks

These are masks of regions of low quality data.

4. SEEING masks

These are masks of bad seeing. They are constructed from the psField files. The seeing value, or PSF width, is defined as:

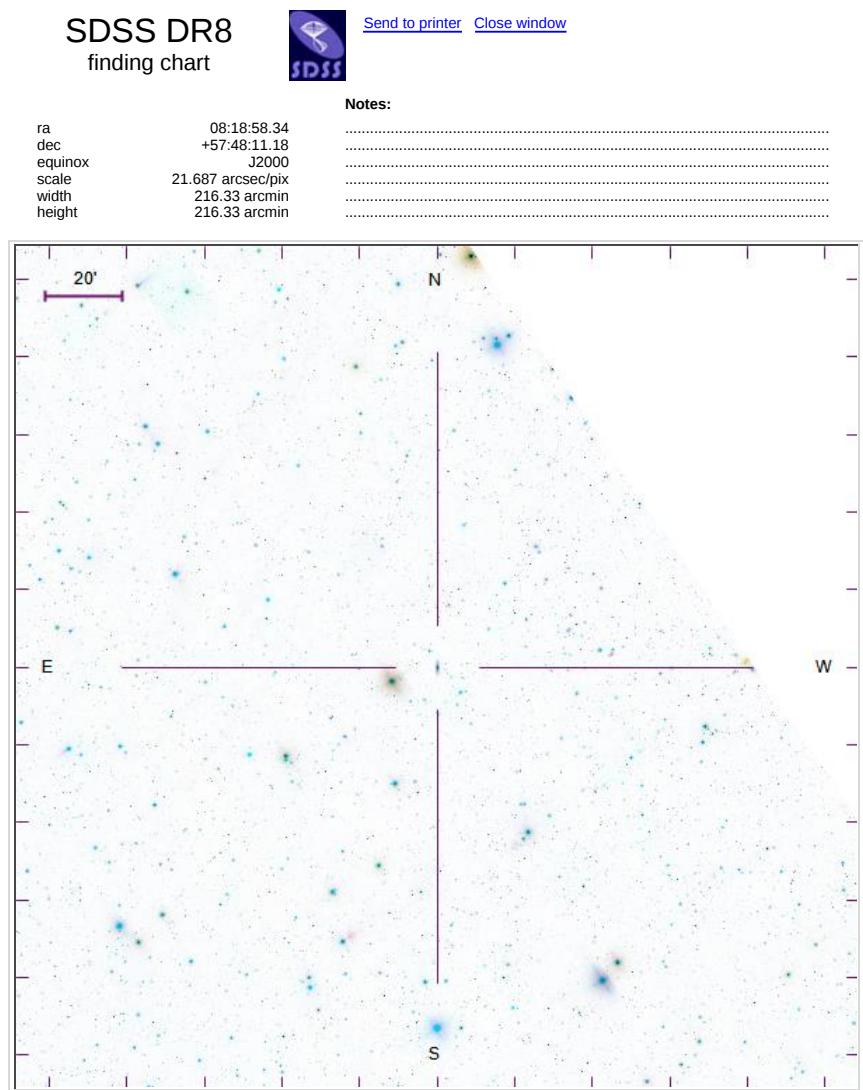
$$\text{seeing} = 0.2652\sqrt{n_{eff}} \text{ arcsec}$$

where n_{eff} is the effective area of the PSF, $n_{eff} = \frac{(\sum I)^2}{\sum(I^2)}$. A threshold value for bad seeing may be defined with the above to generate SEEING masks of regions that don't meet the threshold. The threshold value can be varied to see how it affects the science analysis.

The DR8 masks are provided in DR9 [1] as .ply files [4]. These are files of polygons with defined boundaries that represent the various masked regions in the survey area for each of the types of masks. These can be accessed and downloaded from the New York University Value Added Galaxy Catalog (NYU-VAGC) [10]. Mangle is a suite of open-source software designed to deal with these kinds of masks [8]. An example file of a DR6 mask .ply file provided by the Mangle QuickStart guide is shown below:

```
11703 polygons
pixelization 1d
snapped
polygon 166 ( 3 caps , 0.9850746 weight , 7 pixel , 0.000000718634762972 str):
 0.7267712268958714000 -0.6639725256513610000 0.17590926333616059000 4.754251672e-07
 0.7274799450886469000 -0.6635710579833587000 0.1744889122570982000 -4.497969565e-07
 0.6371069972696829000 0.7476143077536453000 0.1875300532502615000 1
polygon 845 ( 4 caps , 0.9850746 weight , 7 pixel , 0.000000352071120351 str):
 0.7274799450886469000 -0.6635710579833587000 0.1744889122570982000 4.497969565e-07
 0.7267712268958714000 -0.6639725256513610000 0.17590926333616059000 -4.754251672e-07
 -0.2579174969480784000 -0.0225303614924208000 0.9659042124243267000 1.0037539709664121
 0.6371069972696829000 0.7476143077536453000 0.1875300532502615000 1
( ... )
```

I'm not sure how to use Mangle, need to read further into it. Maybe I can use .ply files with another software to do what I need to do? I also can't seem to access DR8 masks from the SDSS website. I need authorization which I don't have (see [4]).

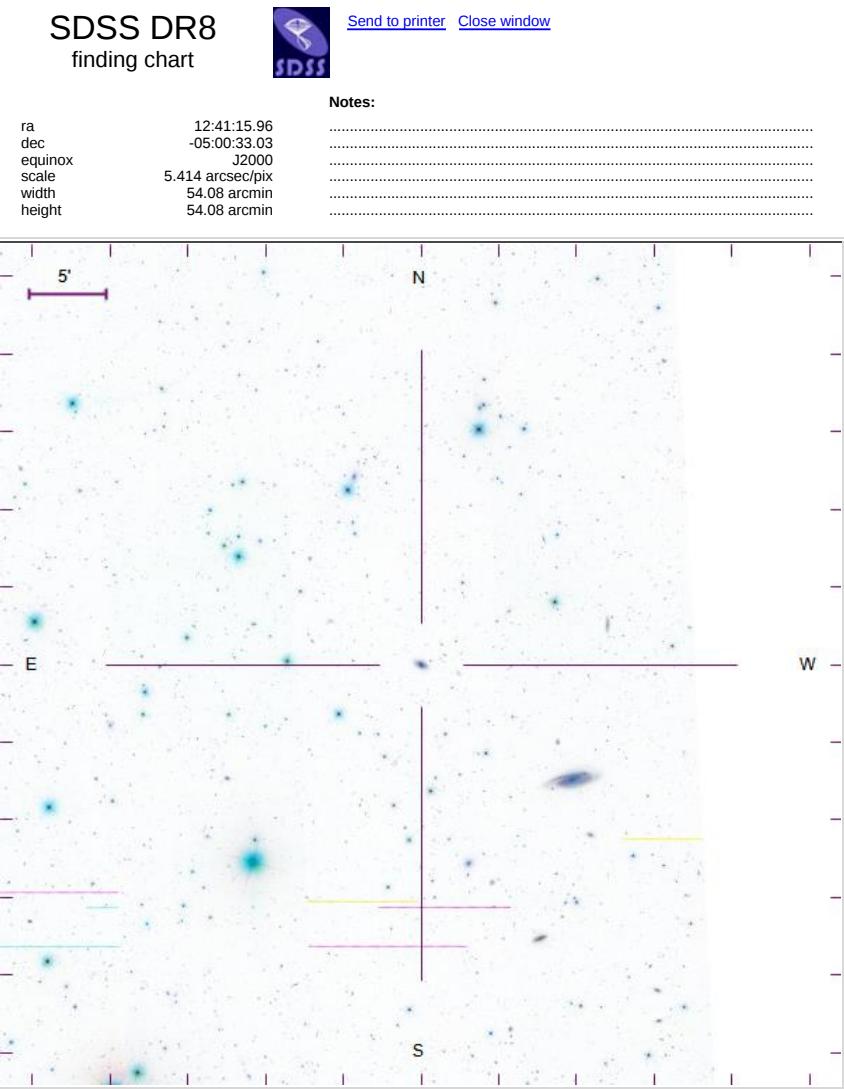


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Figure 1: NGC2549 SDSS DR8 Navigate Tool image with masks

<http://skyserver.sdss.org/dr8/en/tools/chart/printc...>



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Figure 2: PGC042549 SDSS DR8 Navigate Tool image with masks

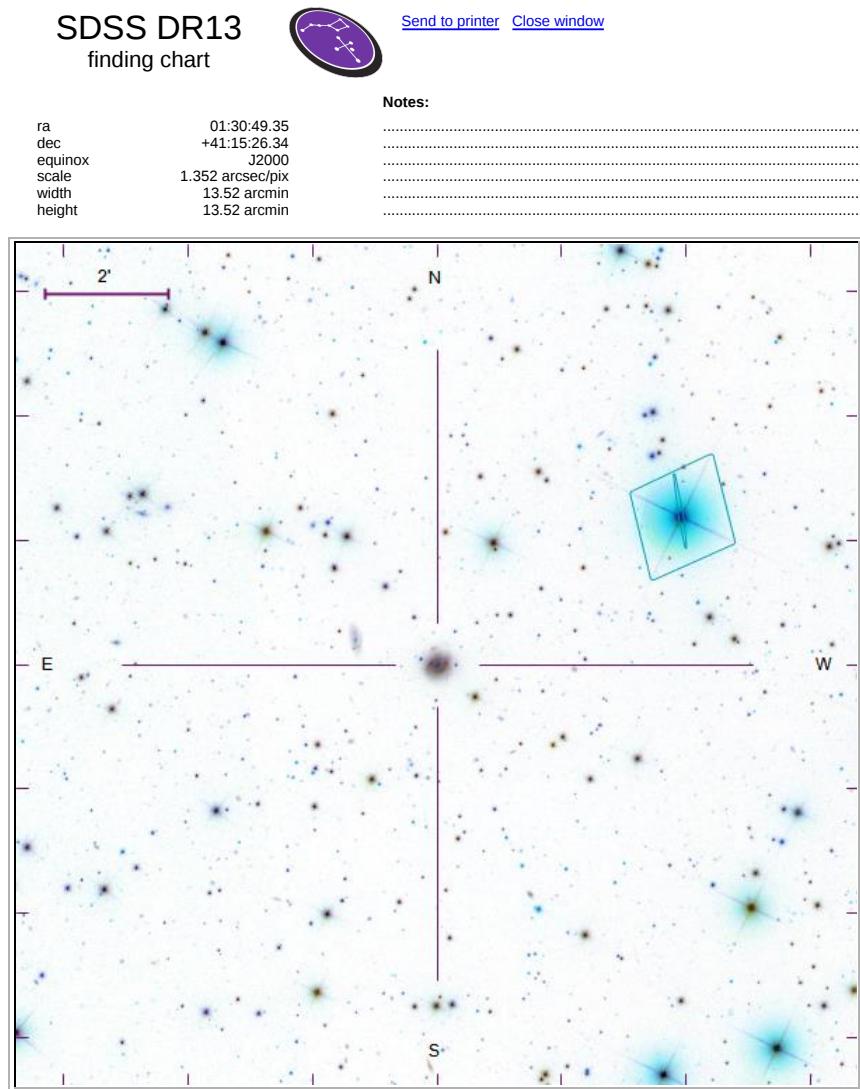


Figure 3: NGC0573 SDSS DR8 Navigate Tool image with masks

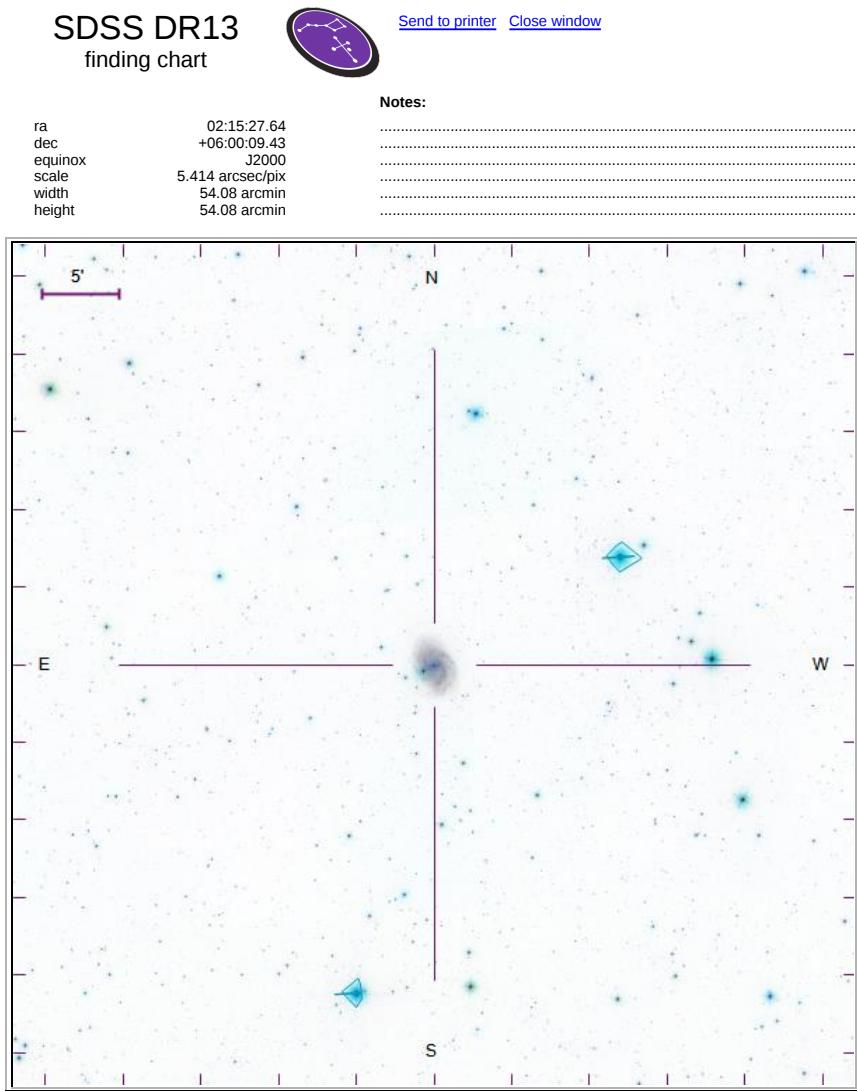


Figure 4: NGC0864 SDSS DR8 Navigate Tool image with masks

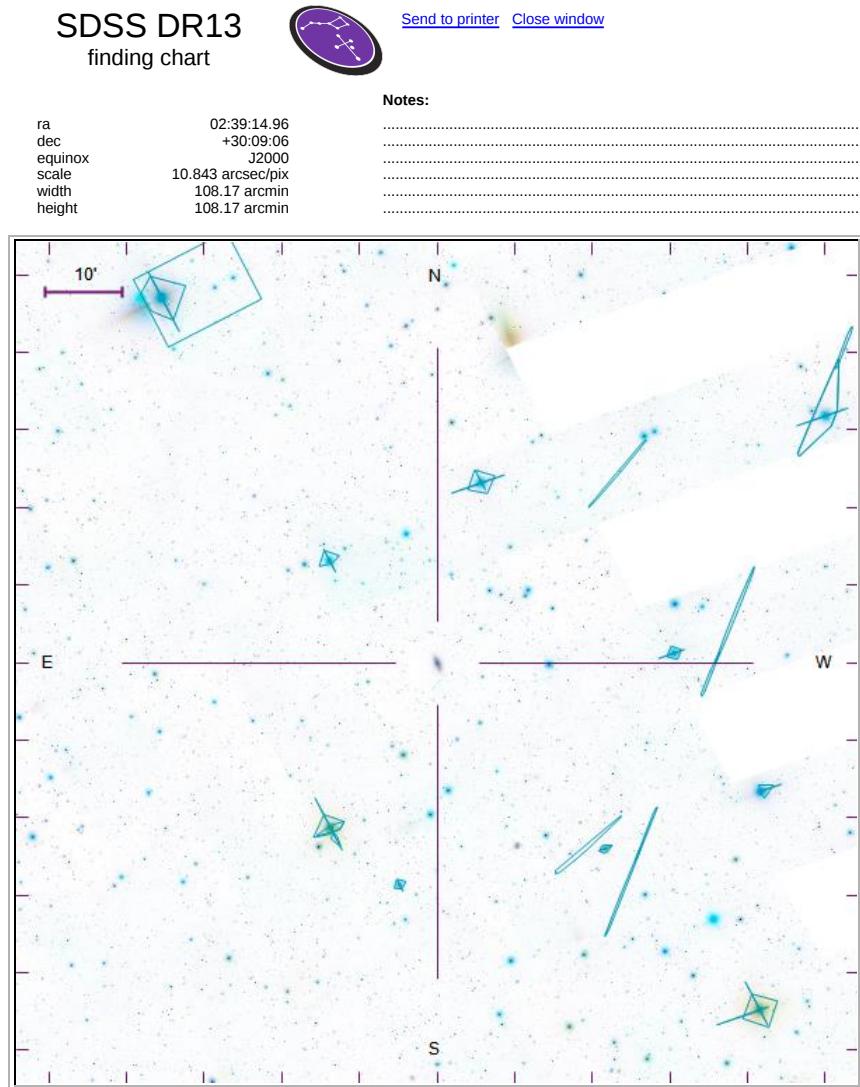
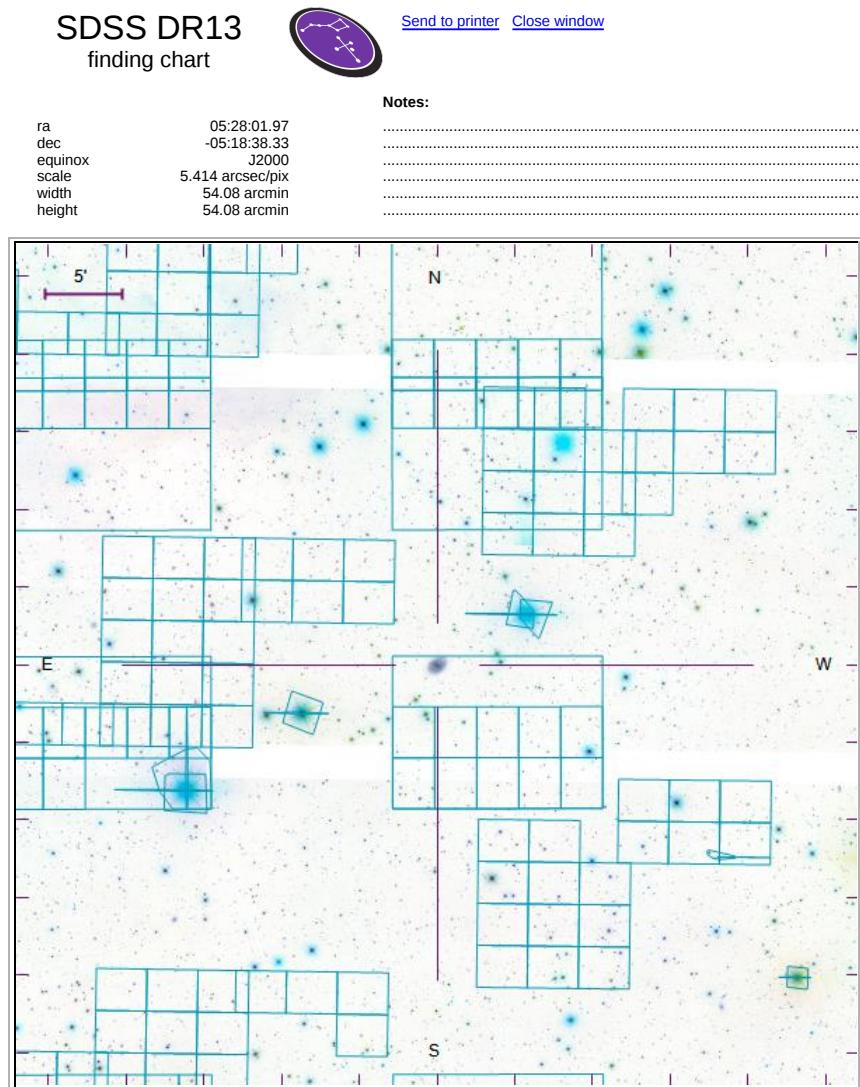


Figure 5: NGC1012 SDSS DR8 Navigate Tool image with masks



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Figure 6: NGC1924 SDSS DR8 Navigate Tool image with masks

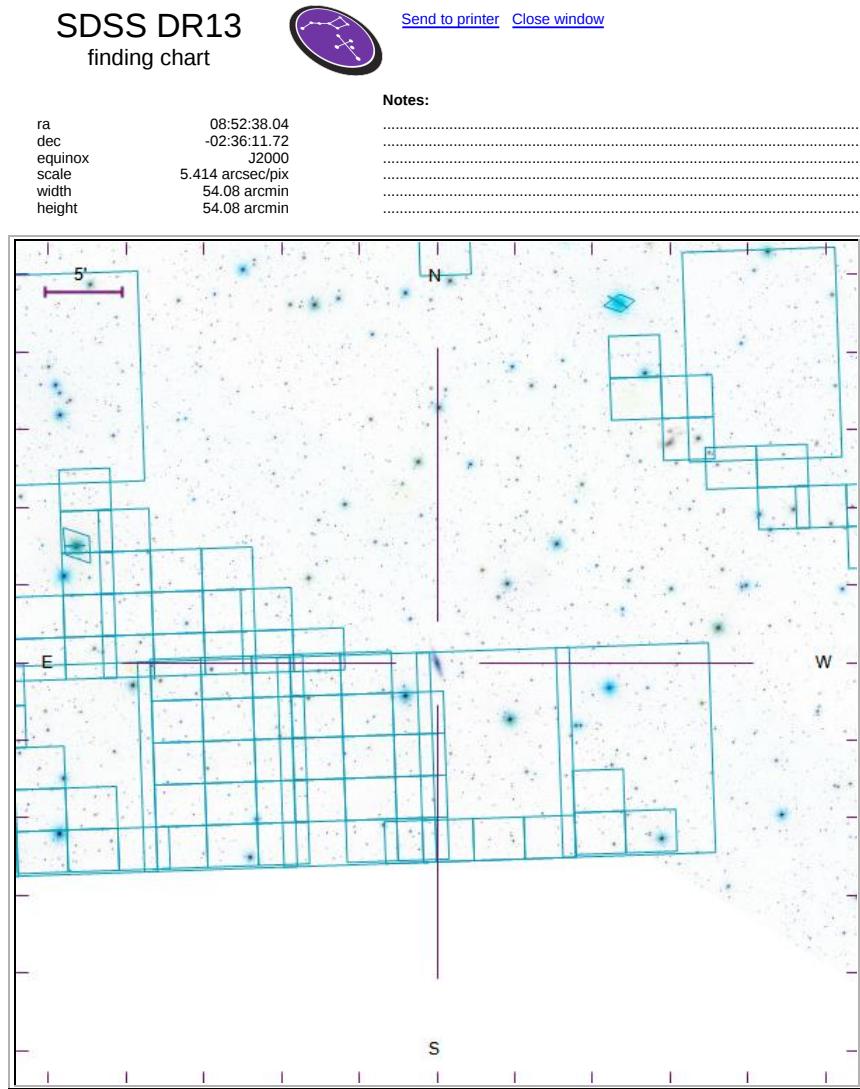


Figure 7: NGC2690 SDSS DR8 Navigate Tool image with masks

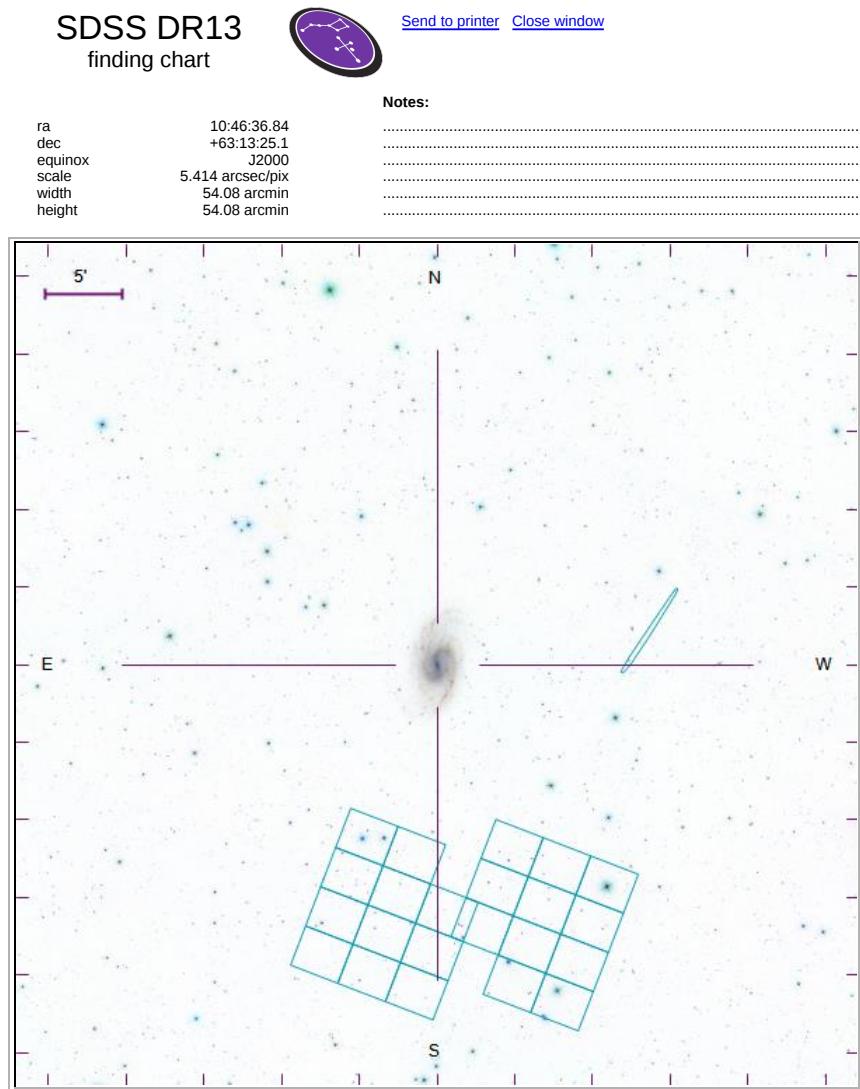


Figure 8: NGC3359 SDSS DR8 Navigate Tool image with masks

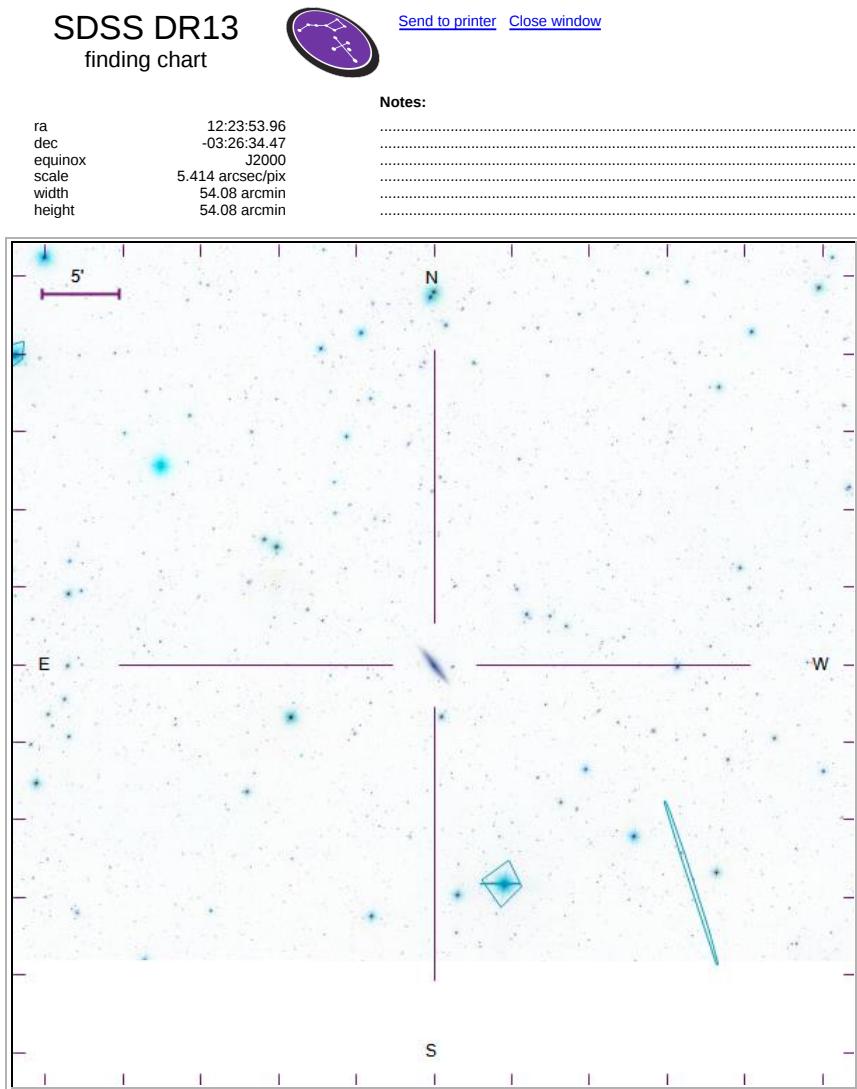


Figure 9: NGC4348 SDSS DR8 Navigate Tool image with masks

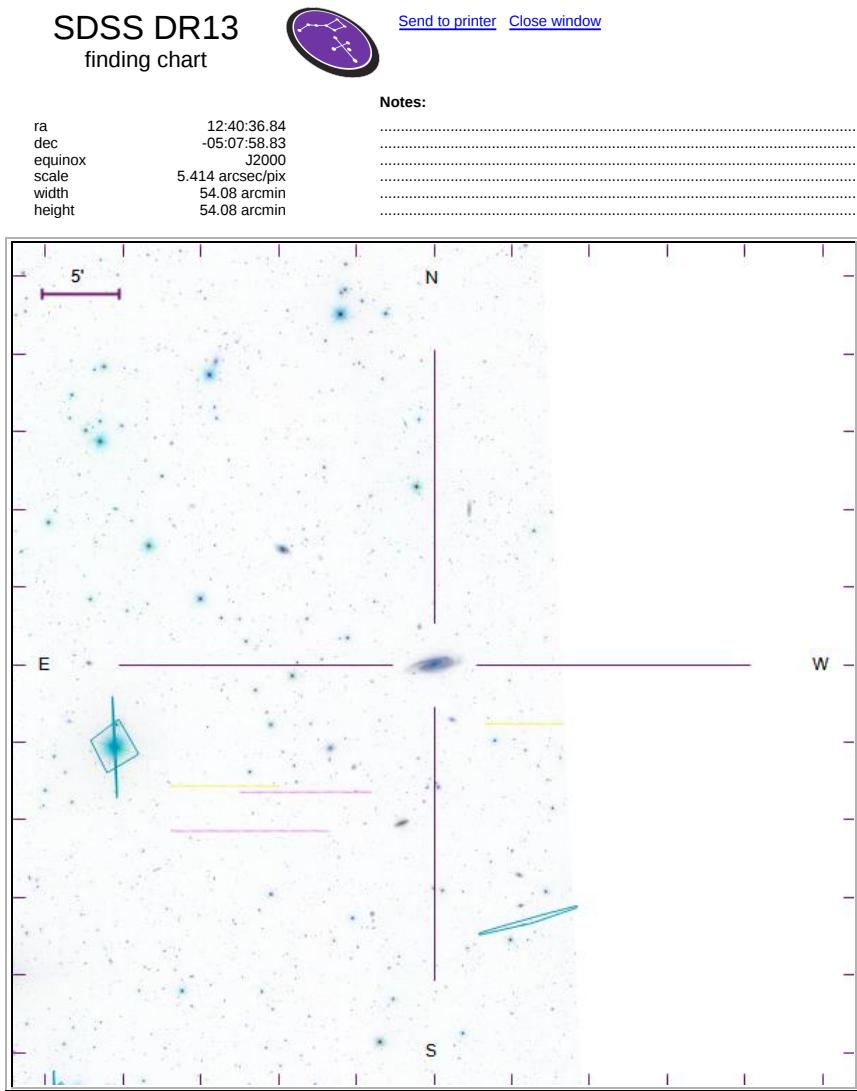


Figure 10: NGC4602 SDSS DR8 Navigate Tool image with masks

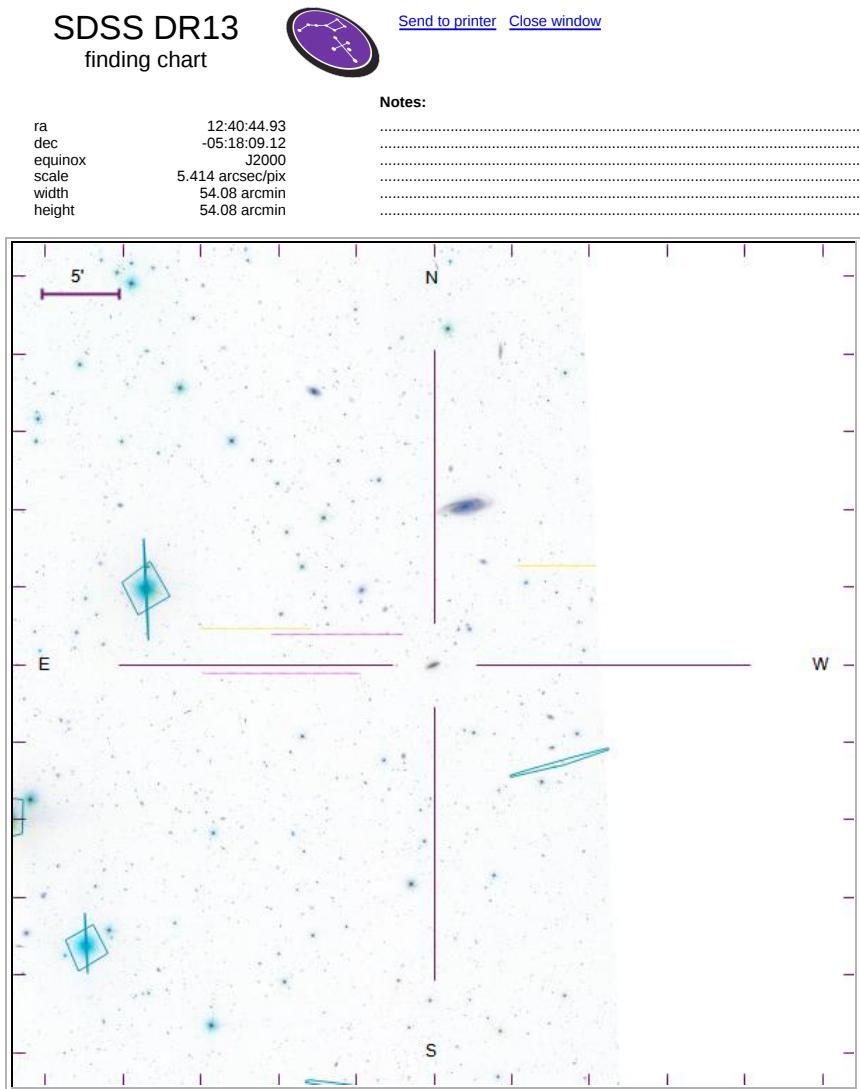


Figure 11: NGC4604 SDSS DR8 Navigate Tool image with masks

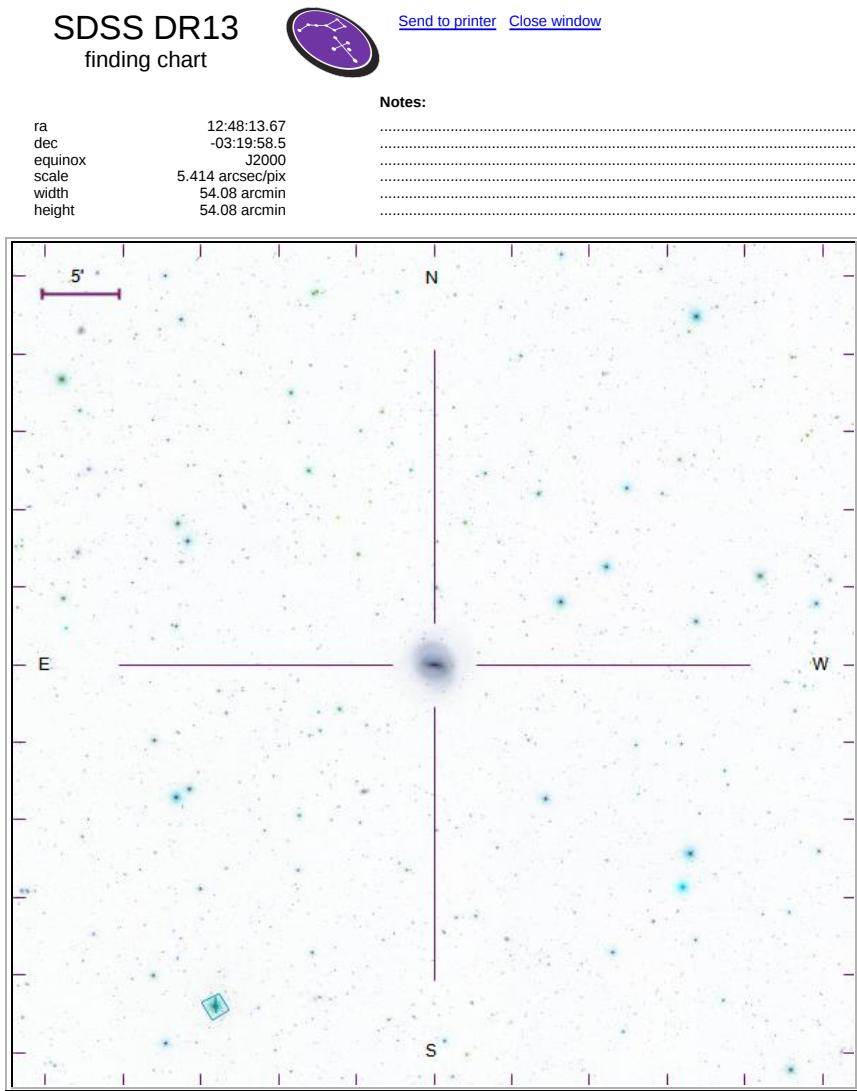


Figure 12: NGC4691 SDSS DR8 Navigate Tool image with masks

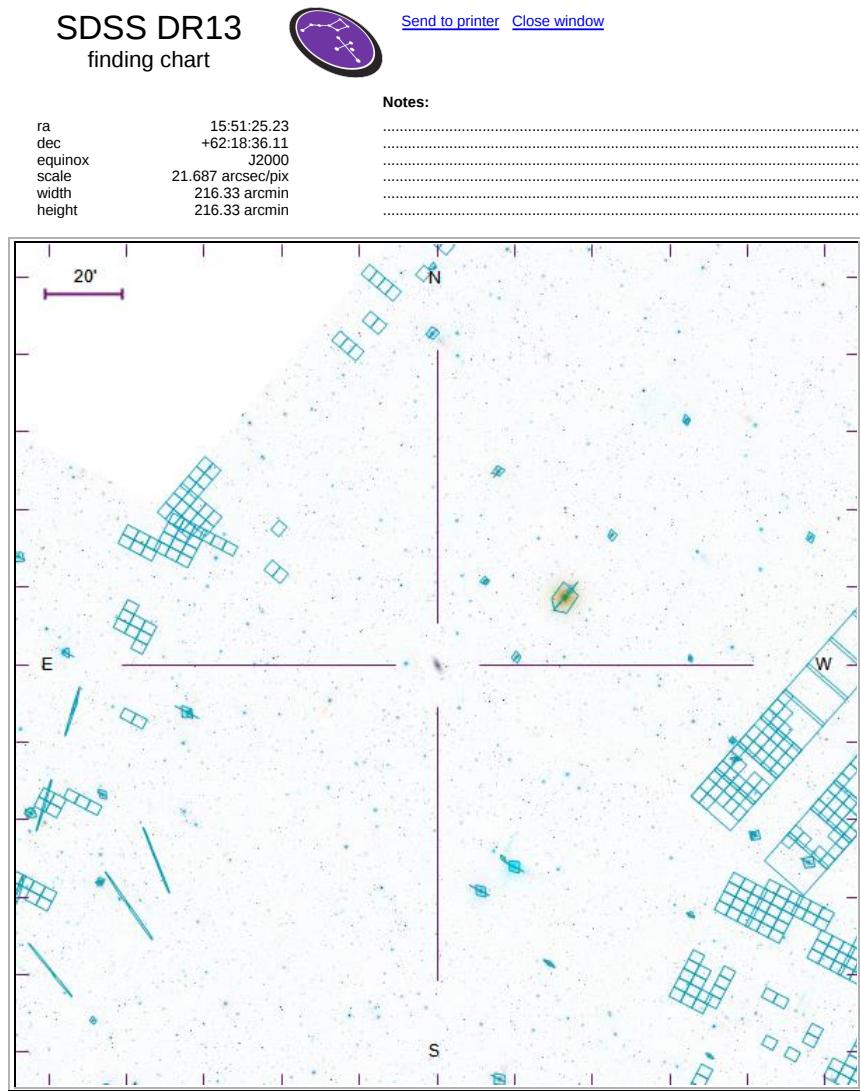


Figure 13: NGC6015 SDSS DR8 Navigate Tool image with masks

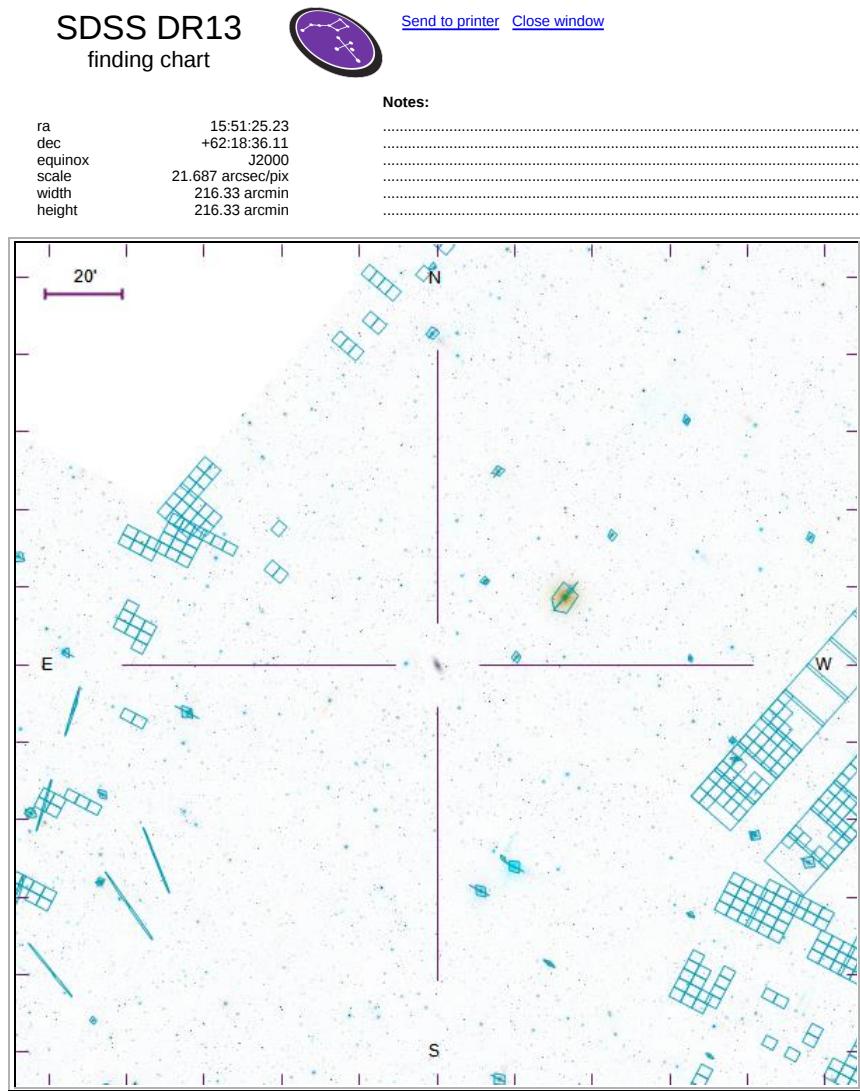


Figure 14: NGC6015 SDSS DR8 Navigate Tool image with masks

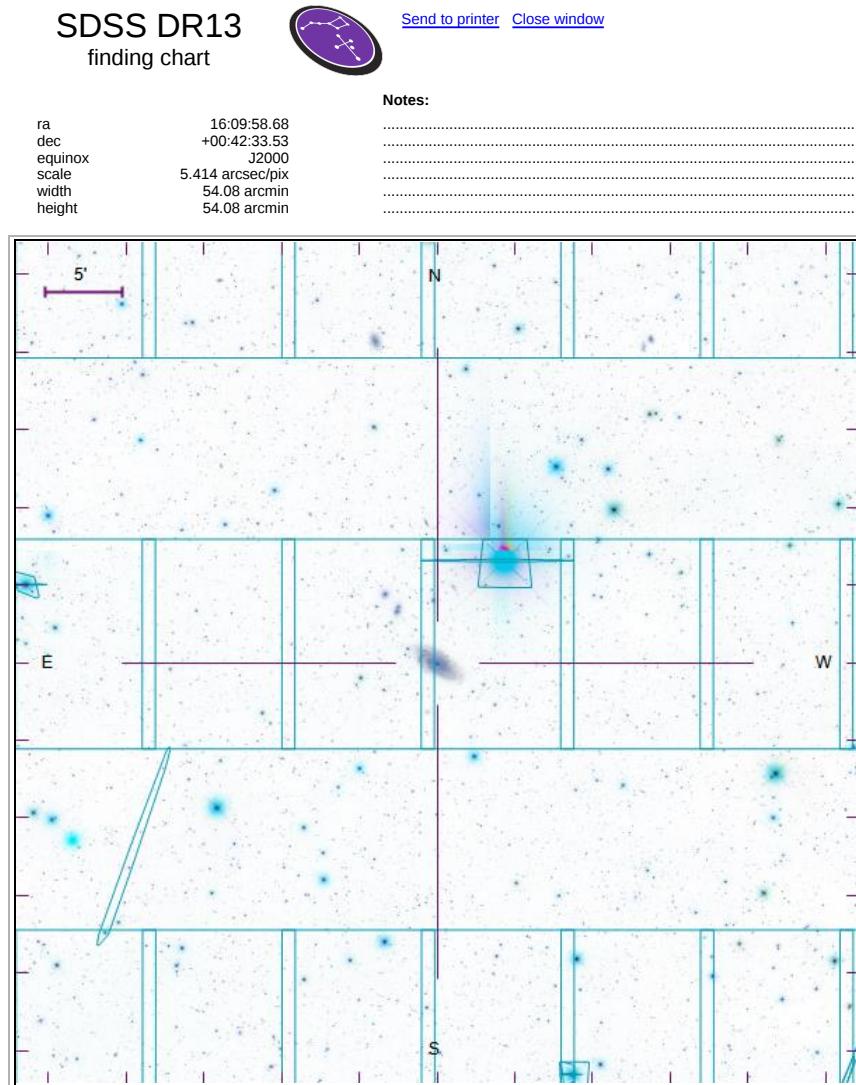


Figure 15: NGC6070 SDSS DR8 Navigate Tool image with masks

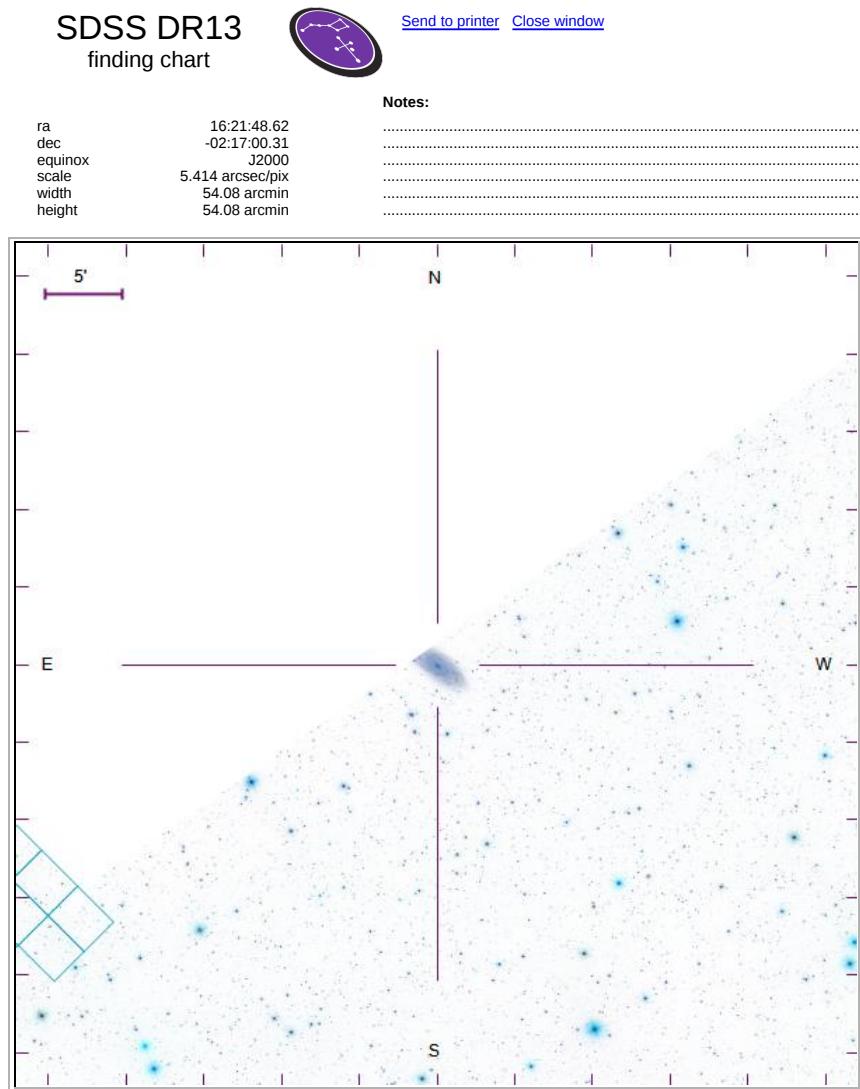


Figure 16: NGC6118 SDSS DR8 Navigate Tool image with masks

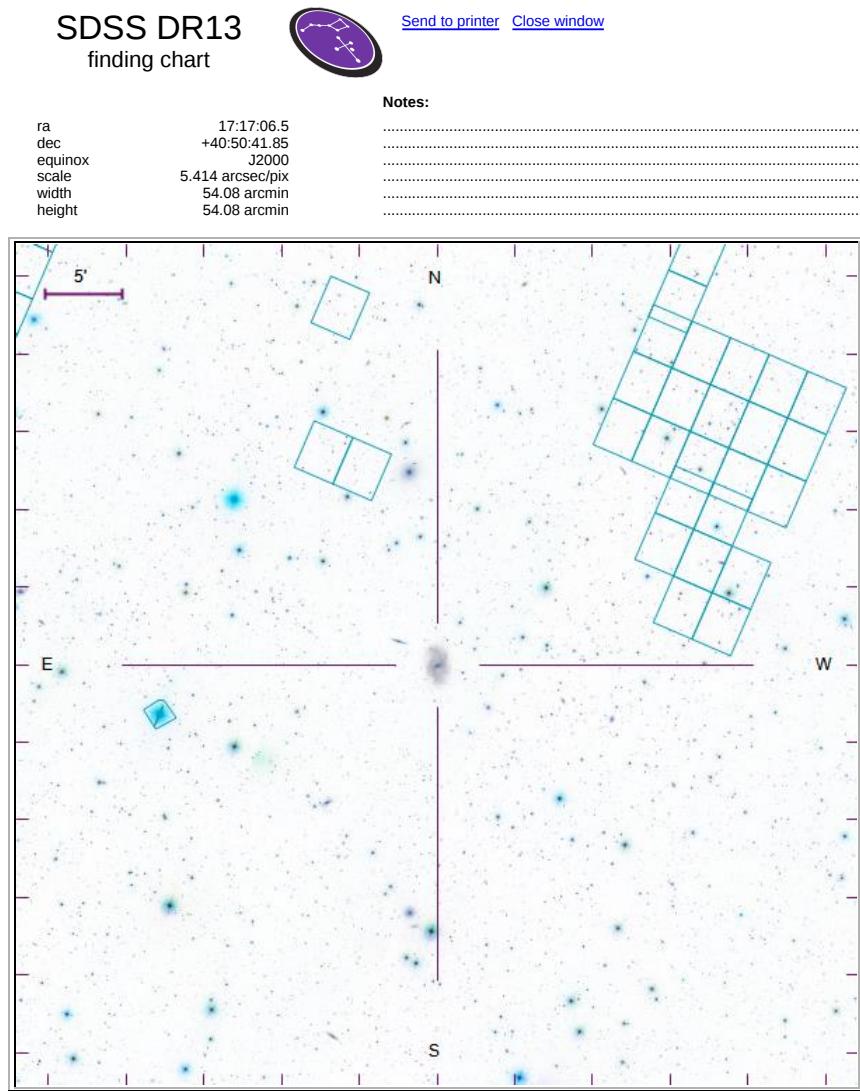


Figure 17: NGC6339 SDSS DR8 Navigate Tool image with masks

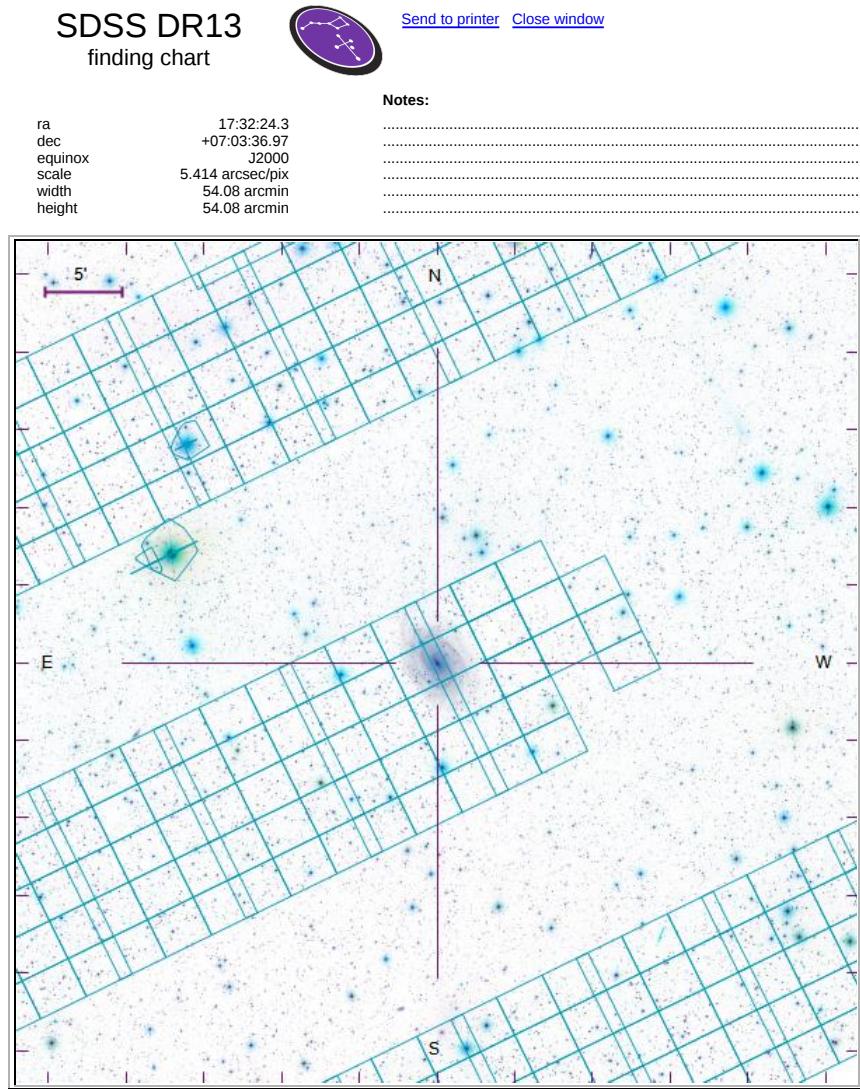


Figure 18: NGC6384 SDSS DR8 Navigate Tool image with masks

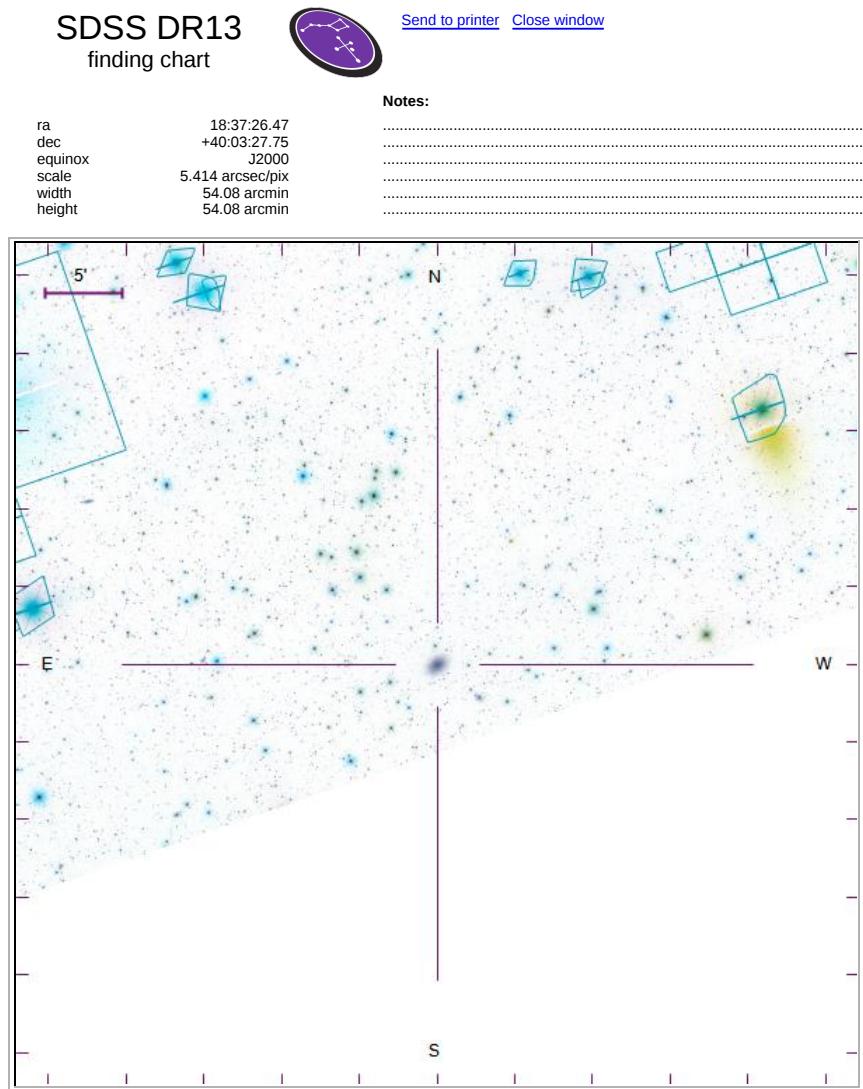


Figure 19: NGC6675 SDSS DR8 Navigate Tool image with masks

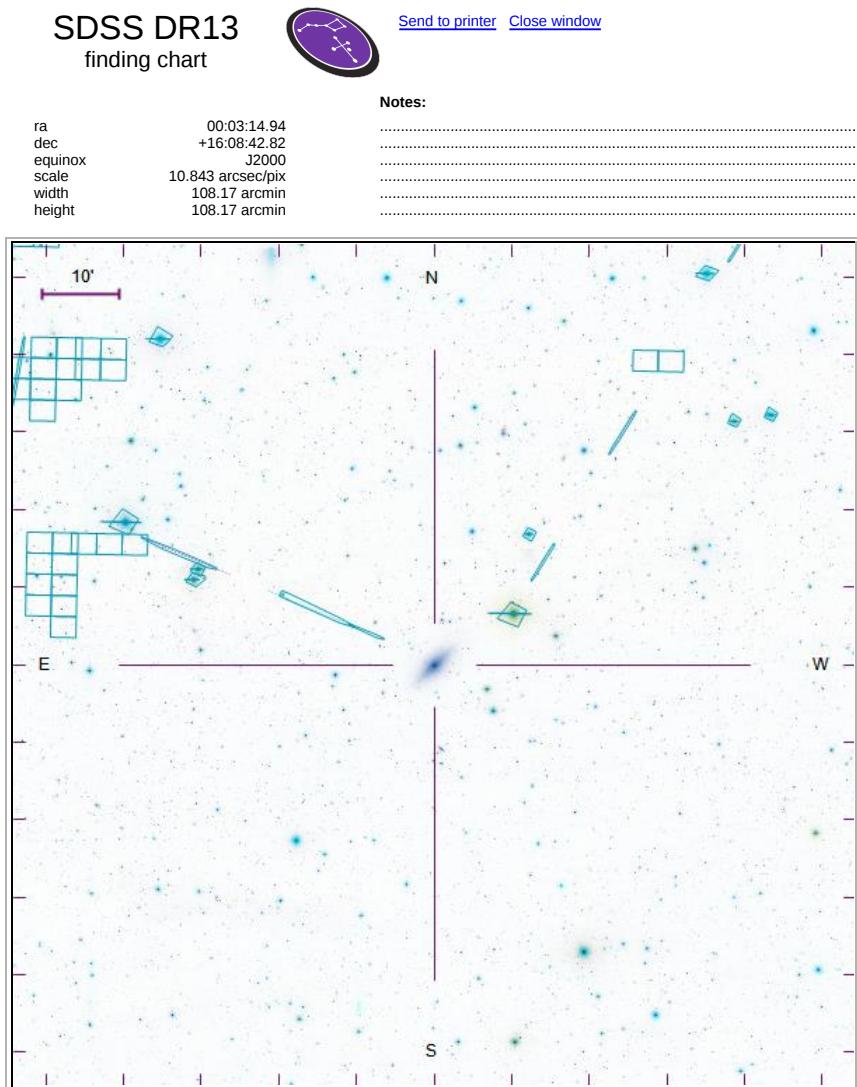


Figure 20: NGC7814 SDSS DR8 Navigate Tool image with masks

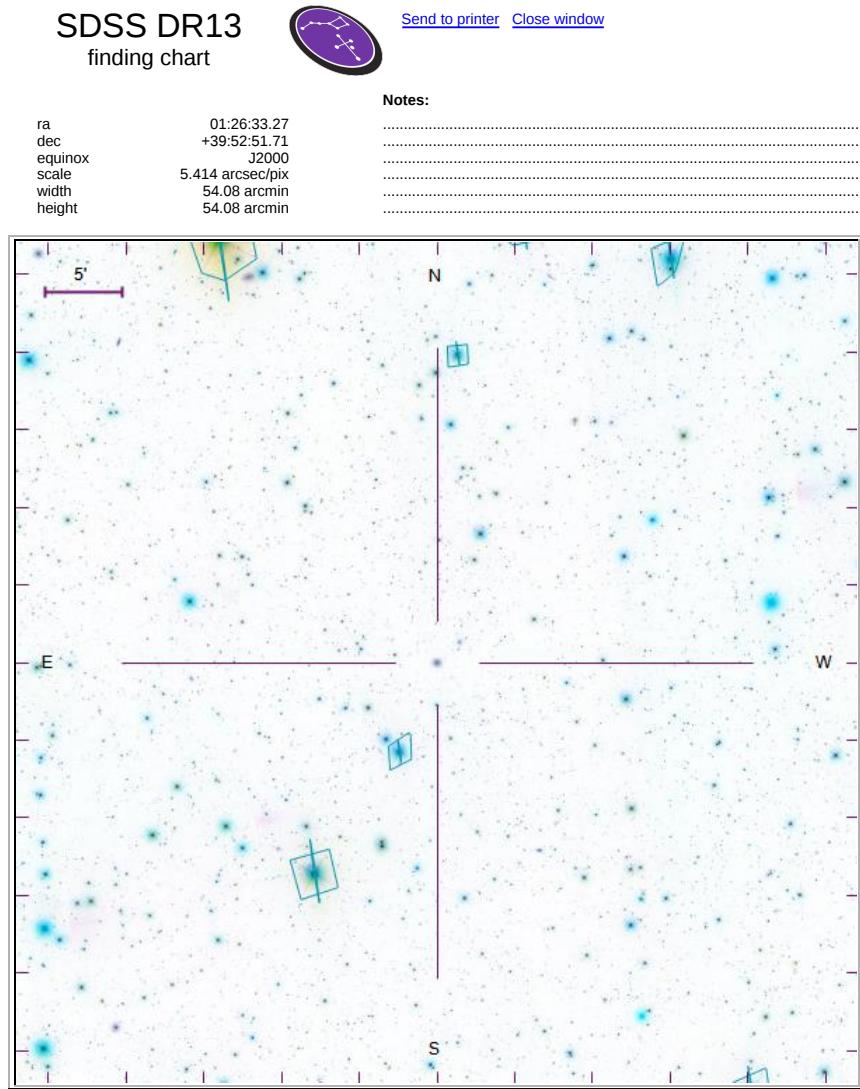


Figure 21: PGC005363 SDSS DR8 Navigate Tool image with masks

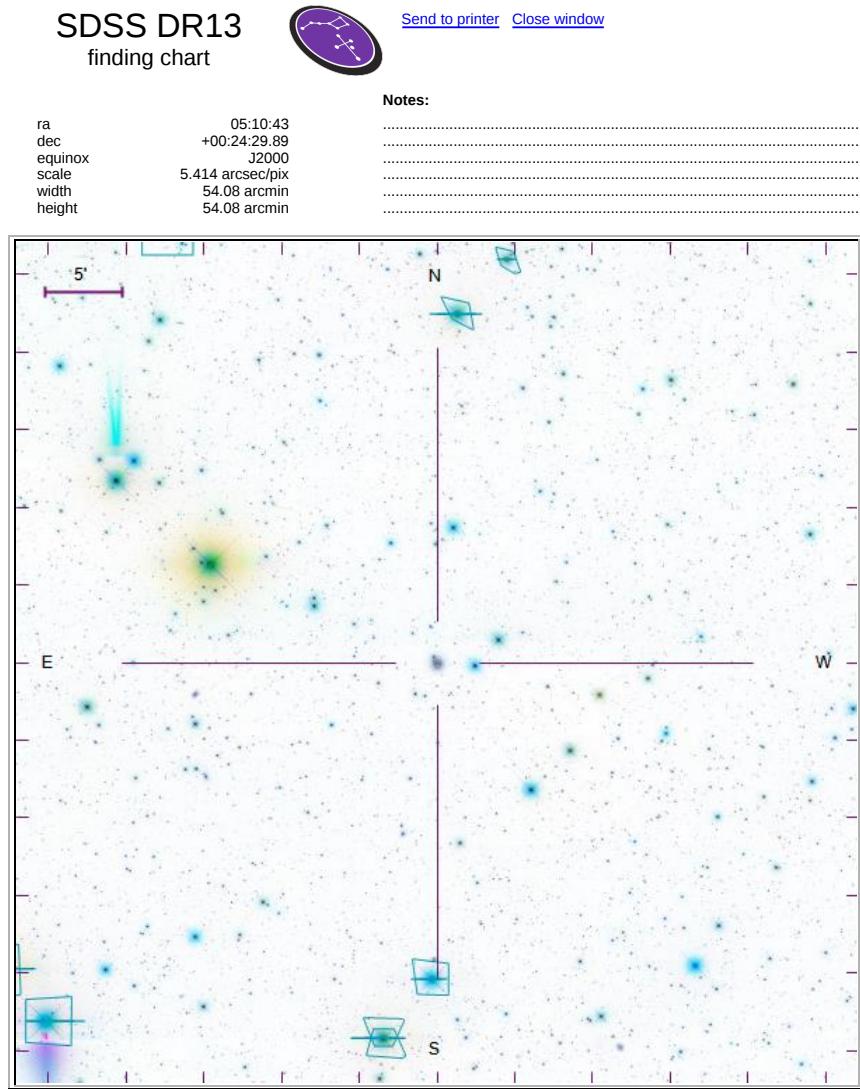


Figure 22: UGC03258 SDSS DR8 Navigate Tool image with masks

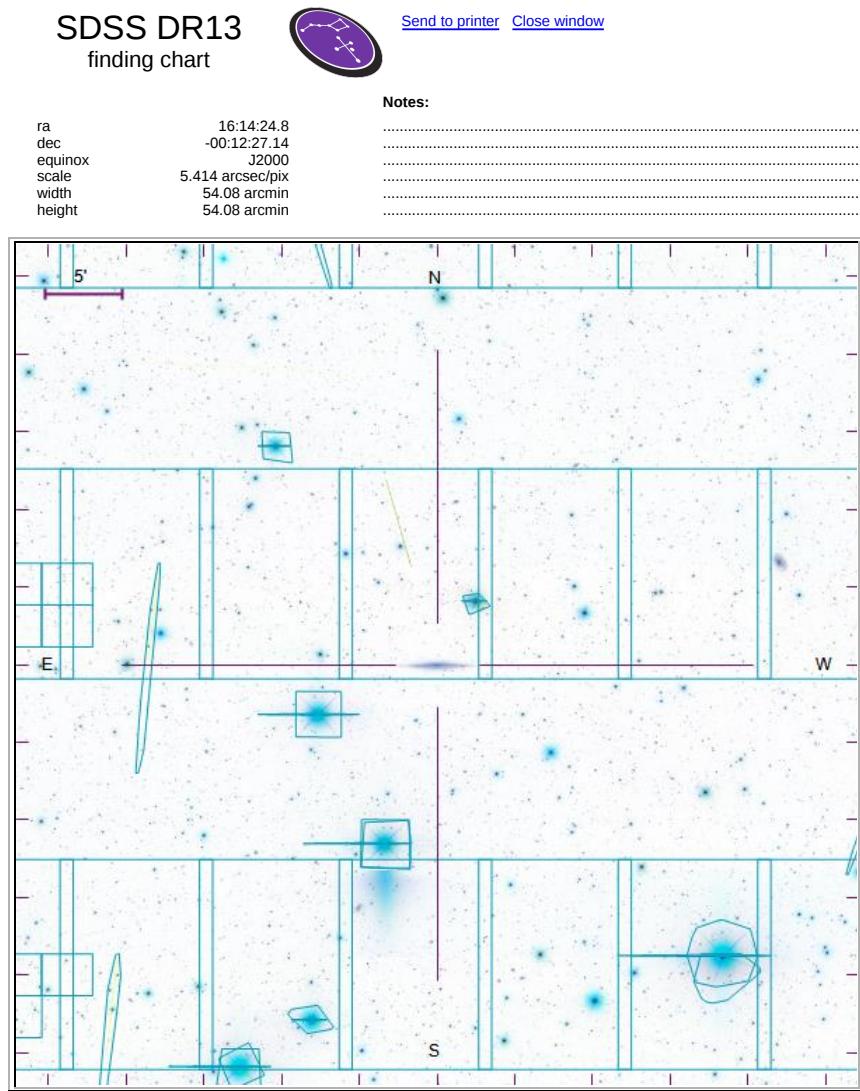


Figure 23: UGC10288 SDSS DR8 Navigate Tool image with masks

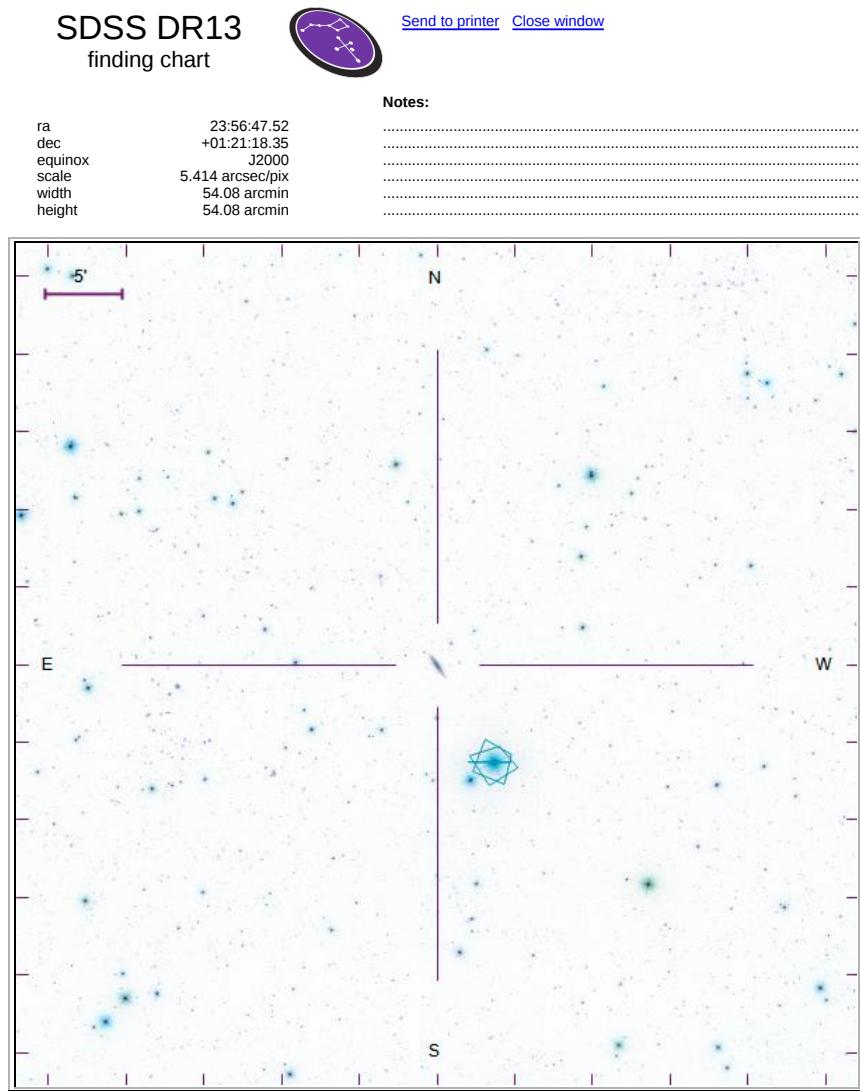


Figure 24: UGC12857 SDSS DR8 Navigate Tool image with masks

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