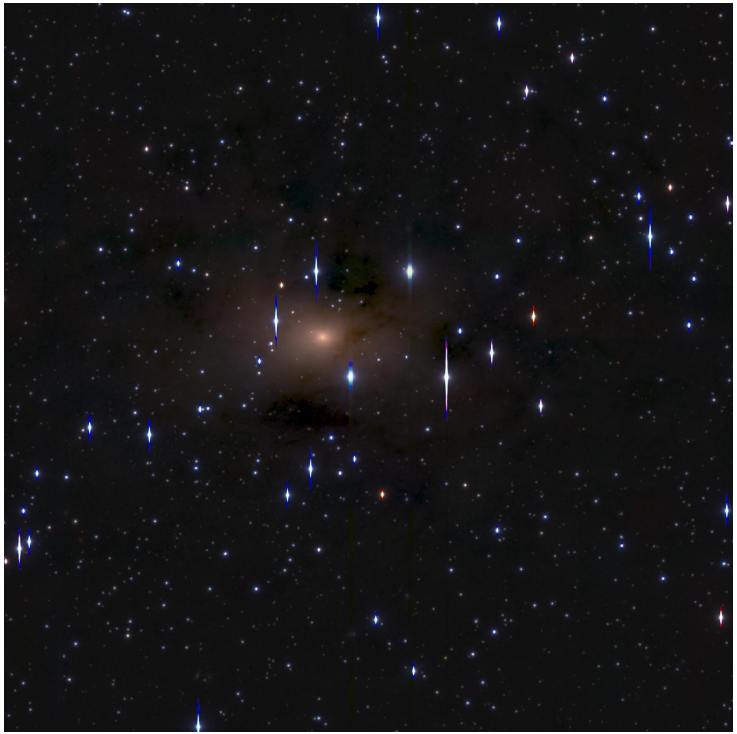
Globular Cluster Candidates in Maffei 1

Samuel Hinton & Ricardo Salinas

Motivations

- Why are globular clusters interesting
- What specifically makes us interested in Maffei 1
- What can we do with these we can’t with other galaxies? (ie resolve things)

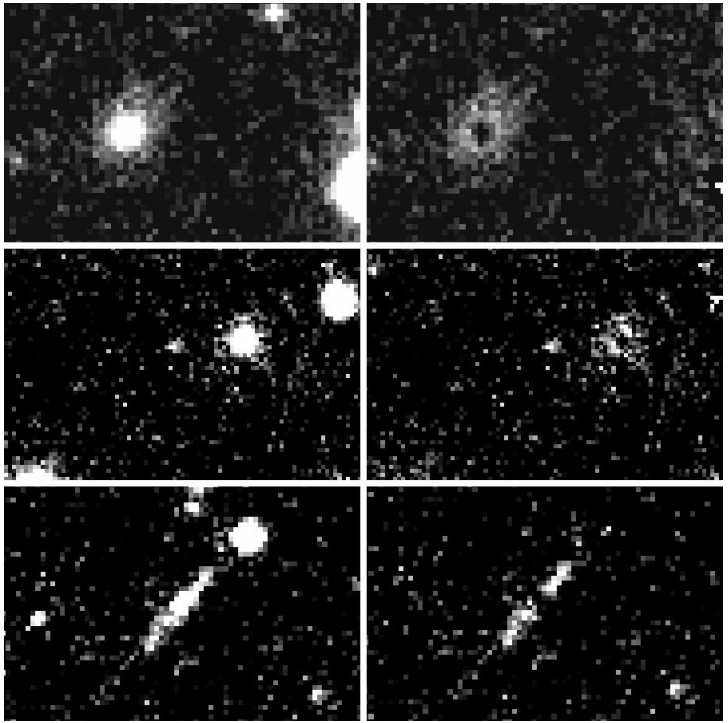
Therefore, this is what I am going to do



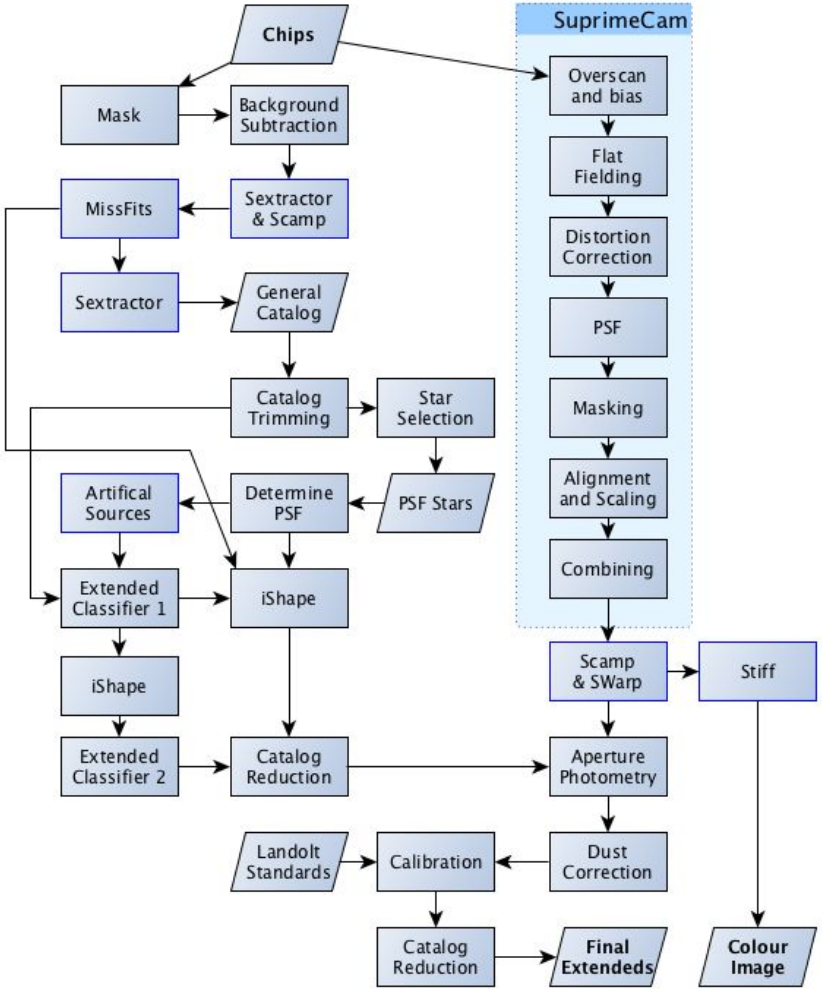
The failure of the naive solution

- Use PSF subtracted photometry to manually classify sources
  - Fairly simple to do
  - Time consuming, but still feasible
  - Except this method cannot determine at all the probability for detecting a source

- Need a solution that can be tested
  - Generate artificial images
  - Determine GCs
  - Use this to quantify probability of detection



The Solution:

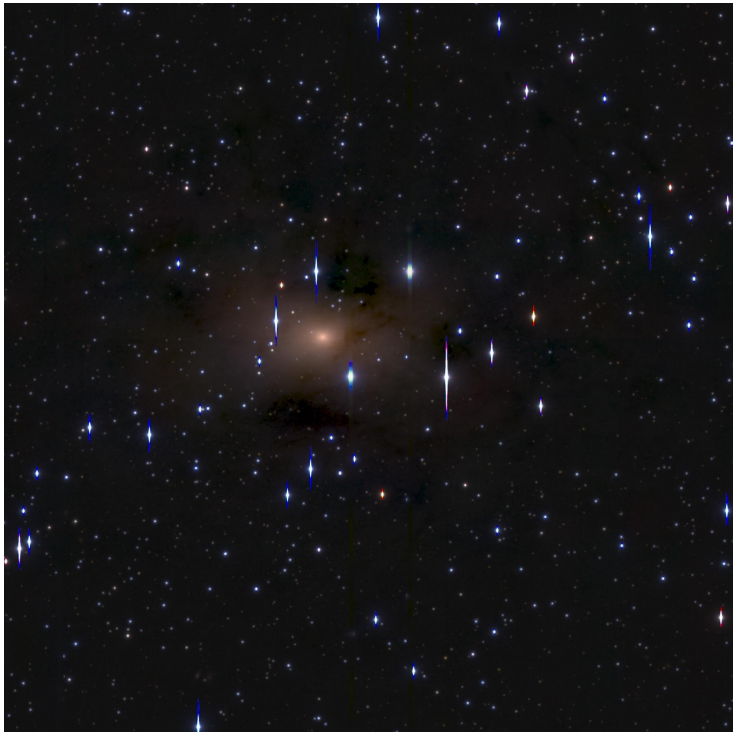


Data reduction:

Mosaics and calibration data use the SDFRED2 pipeline. Output mosaics are Scamped and SWarped to give correct WCS.

Tiles for classification use the *z'* band image. Scamped to correct WCS.

Colour image produced using mosaics and Stiff.



Classification System:

- Machine learning classifier
  - 40% training data
  - 35% test data
  - 25% validation data
- Uses simple Boosted Decision Tree
  - Boost number, tree depth and training weights determined by Matthews Correlation Coefficient score against validation data.
  -

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Matthews correlation corefficient: 0.9285
Extended correct: 94.7%
False negative: 5.3%
Point correct: 99.0%
False positive: 1.0%
Num True positive / Num Positive: 0.927
Num True positive / Num Actual Positive: 0.947
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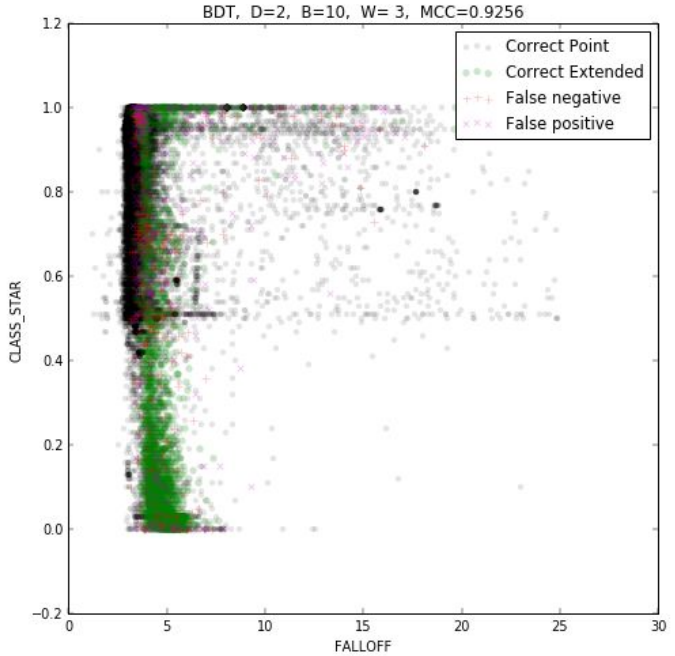
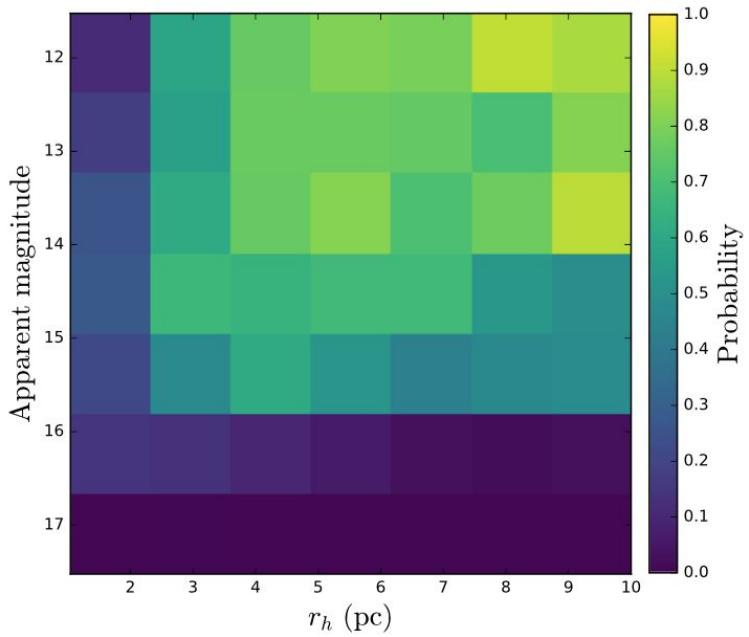
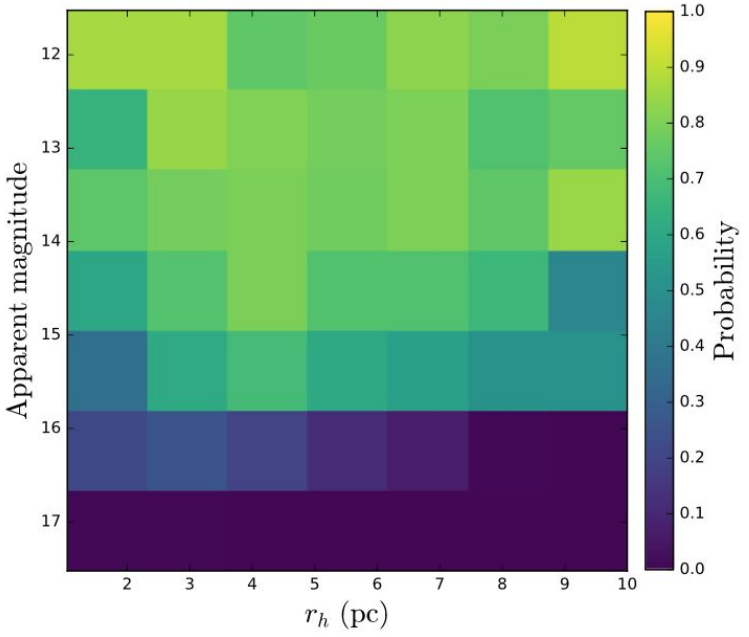


Classification System:

Classifier 1



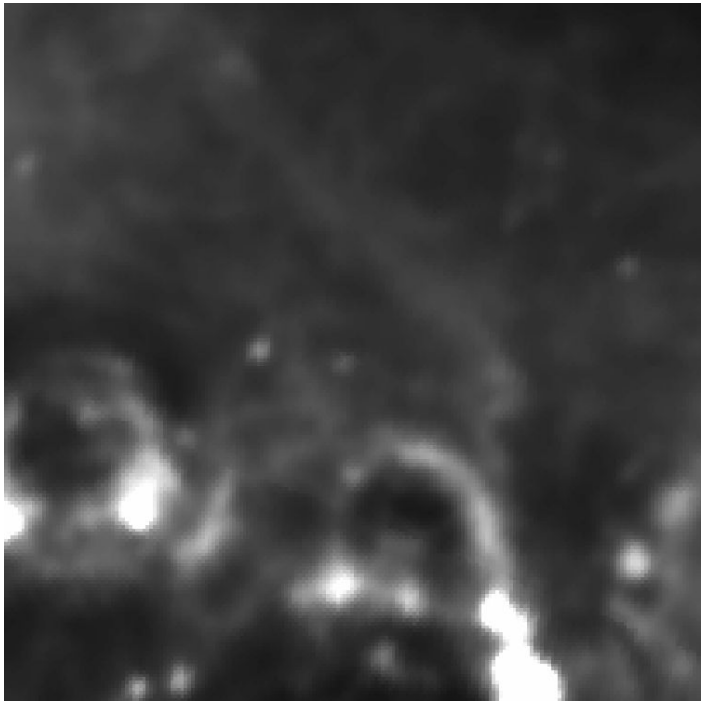
Classifier 2



Photometry:

- Performed on final mosaics
- Dust extinction calculated from interpolated IRSA dust map for each target.
- Photometric calibrations calculated from Landolt standards transformed into SDSS bands.

IRSA dust map

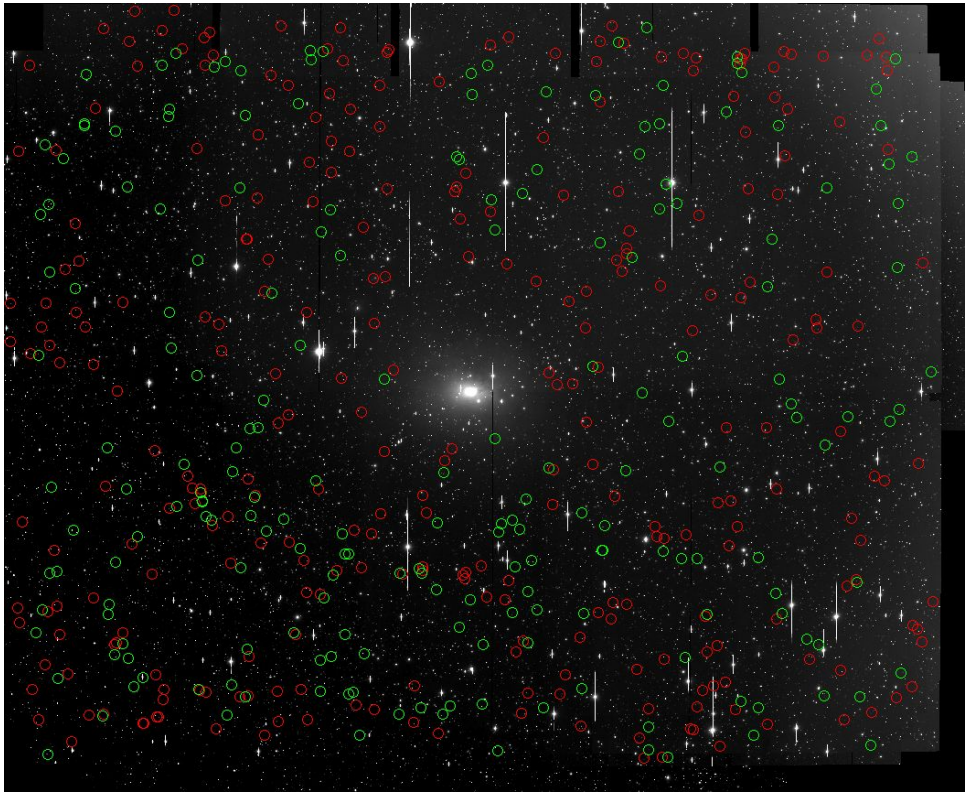


Classification Results:

Location of candidates around Maffei 1.

Class A candidates

Class B candidates



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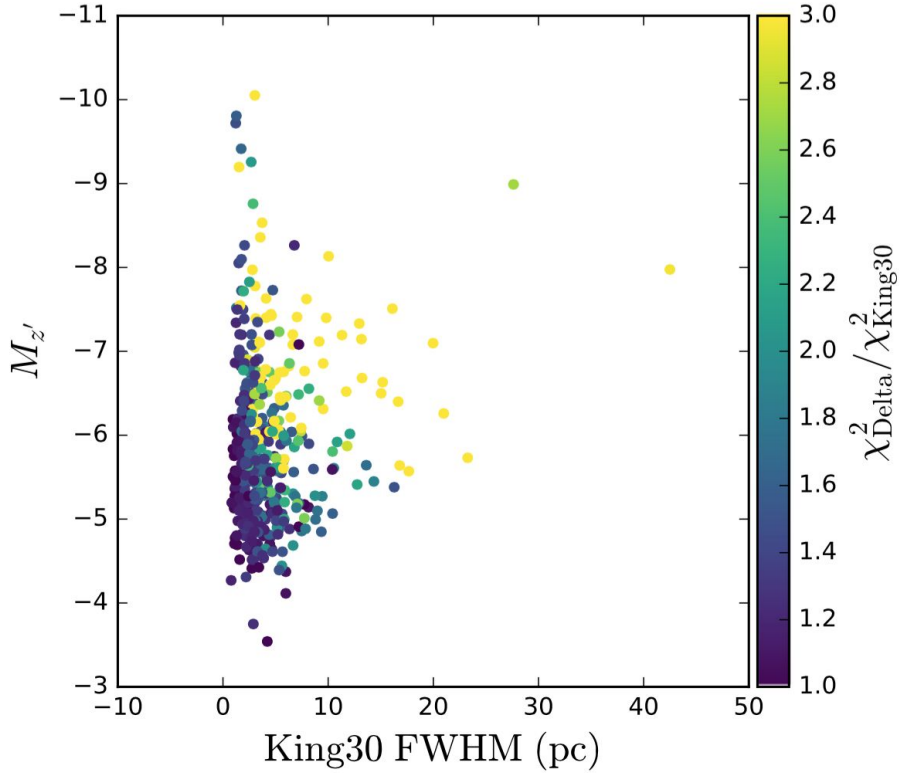

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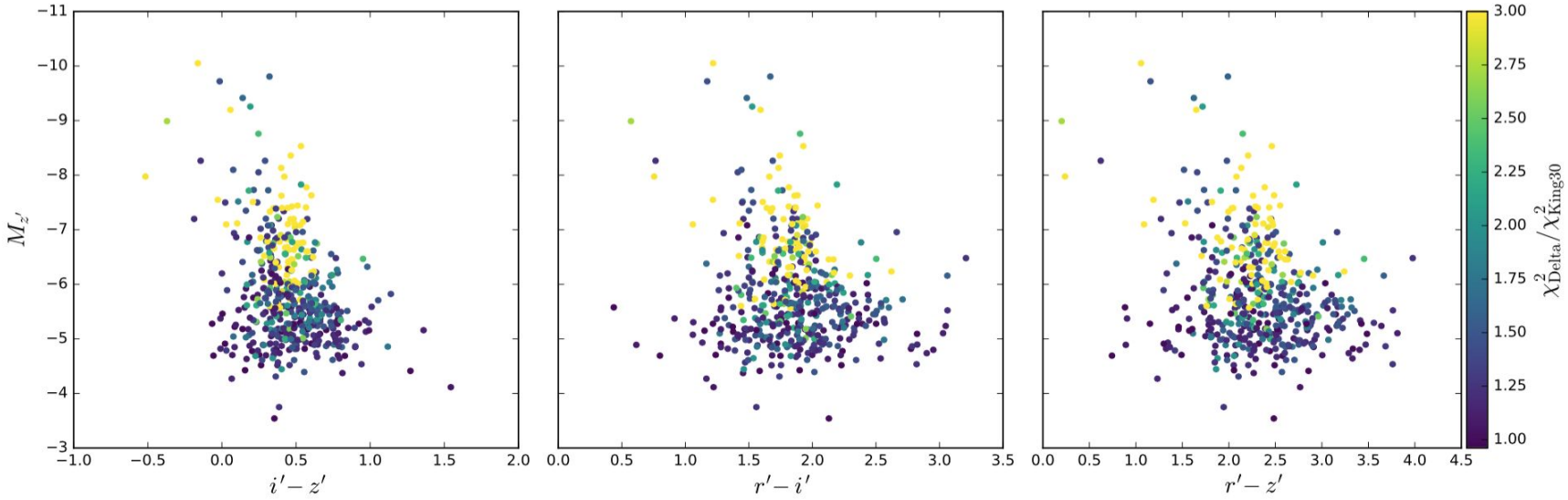


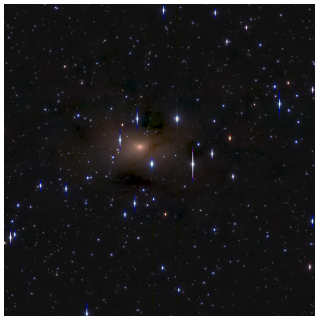
Final Product

Catalogs of GC candidates for spectroscopic follow up.

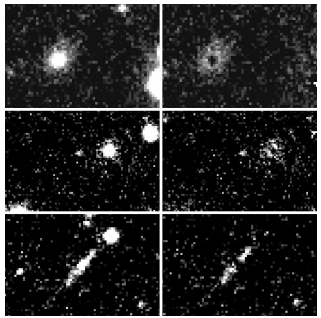
ID	RA	DEC	ϵ	$M_{z'}$	$m_{z'}$	$r' - z'$	King_{30} FWHM (pc)
A1	39° 34′ 26.472″	59° 53′ 22.920″	0.03	-12.120	15.037	1.258	1.15
A2	39° 32′ 11.832″	59° 52′ 29.388″	0.10	-6.315	20.842	2.587	4.88
A3	39° 33′ 13.680″	59° 52′ 0.732″	0.07	-7.405	19.752	2.475	7.04
A4	39° 29′ 7.800″	59° 51′ 57.600″	0.25	-7.624	19.533	2.525	4.10
A5	39° 39′ 9.540″	59° 51′ 36.720″	0.17	-6.039	21.118	2.119	3.64
A6	39° 32′ 39.048″	59° 50′ 18.024″	0.20	-6.108	21.048	2.398	3.84
A7	39° 32′ 41.100″	59° 50′ 1.176″	0.24	-7.073	20.084	2.526	6.64
A8	39° 39′ 18.360″	59° 49′ 41.196″	0.10	-6.037	21.120	2.622	5.48
A9	39° 39′ 14.544″	59° 49′ 37.056″	0.16	-5.606	21.550	2.567	10.54
A10	39° 36′ 51.912″	59° 49′ 23.628″	0.17	-7.189	19.968	2.227	11.32

Questions?

A



B



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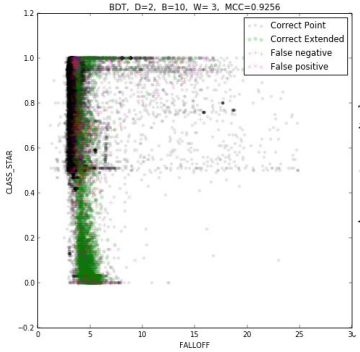

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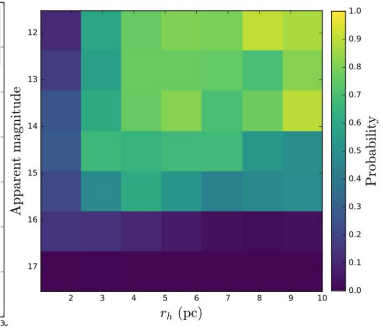

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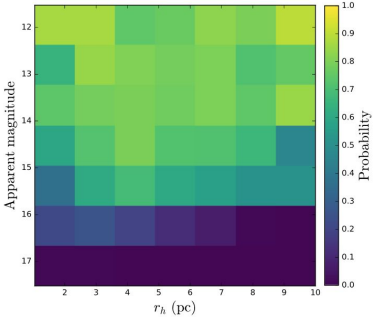

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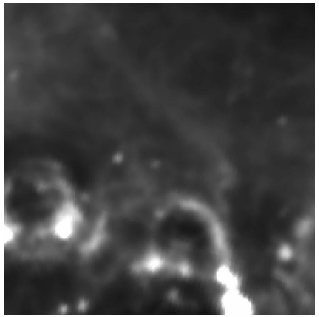
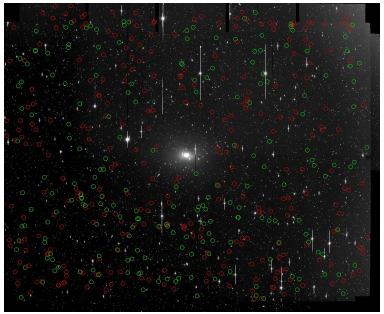
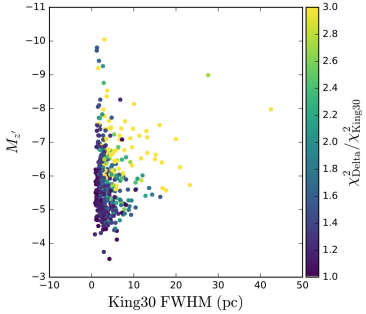


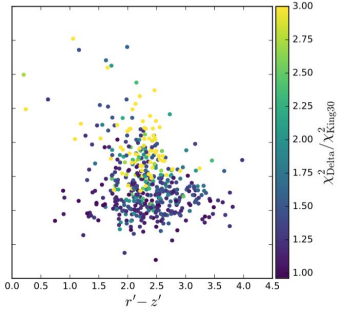
G



H



I



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