Cosmography with Galaxy Clusters
SHEDDING LIGHT ON DARK ENERGY

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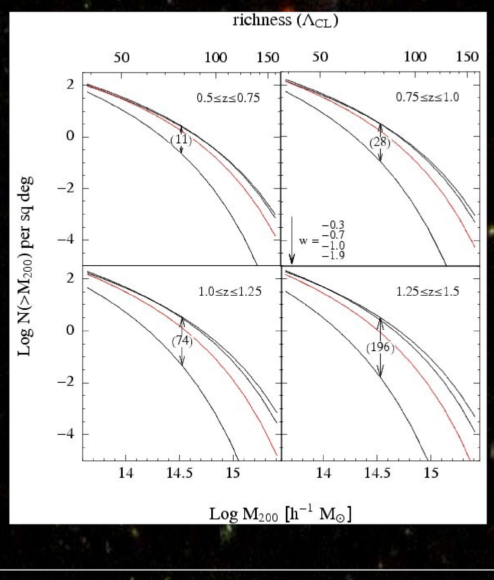
LSS & DE



Dark Energy affects the Large Scale Structure formation in the Universe. Therefore, cluster abundance observations can be used to probe the Dark Energy equation of state parameter, w.

To obtain tight constraints from this kind of experiment, a reliable sample of galaxy clusters must be obtained from deep (up to z ~ 1) wide-field image surveys (thousands of sq deg). And accurate mass estimates for this sample is also required.

This motivates a three-fold approach, focusing on the development of:

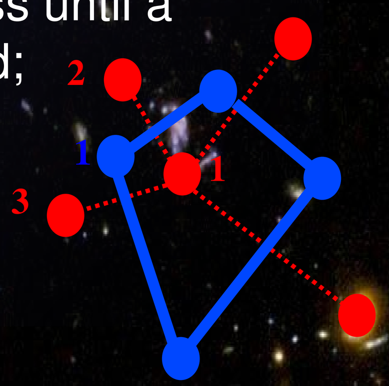
(1) a computational environment (2DPHOT) aiming to perform accurate star/galaxy separation up to faint flux levels;

(2) the Voronoi Tessellation cluster finding algorithm, to obtain cluster catalogs with high completeness and purity up to high redshifts;

(3) a weak lensing mass estimator, to be used in conjunction with other observables, like the optical richness, to calibrate mass observable relations.

THE TESSELATION

Take any point (1) in the plane; walk along the bisector between 1 and its first neighbour (**2**) until the point (1) equidistant from 1, 2 and a third point (3); relabel 3 as 2 and repeat the process until a polygon is formed; repeat for every point in the plane.

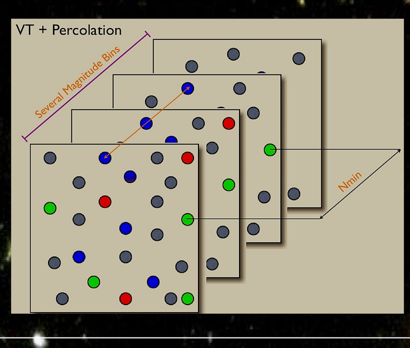


CLUSTER FINDING

The **distribution of cell densities** sets a clustering threshold. This **threshold** is where the deviation from a given background distribution is maximum.

Each detected cluster must be found in at least **N** successive **redshift or magnitude bins**.

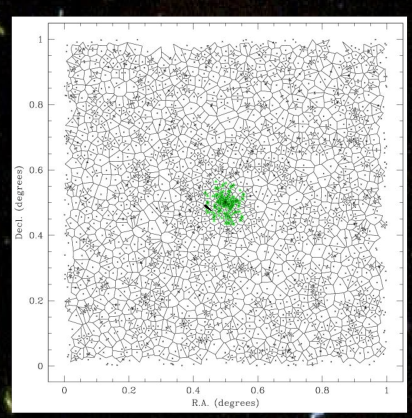
PERCOLATION

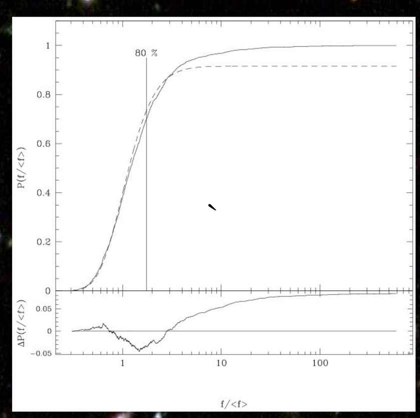


MOCK CATALOGS

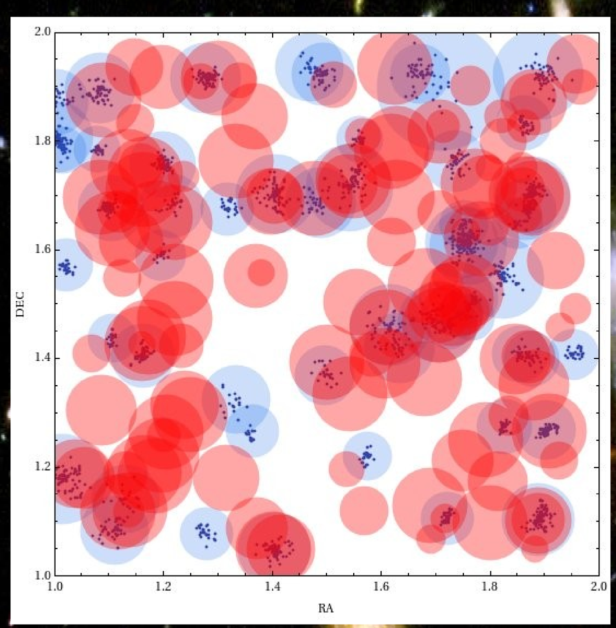
We test our cluster finder on mock catalogs made for the Dark Energy Survey cluster finder comparison project by Risa Wechsler and Michael Busha. This procedure aims to understand the selection function of the underlying dark matter halos.

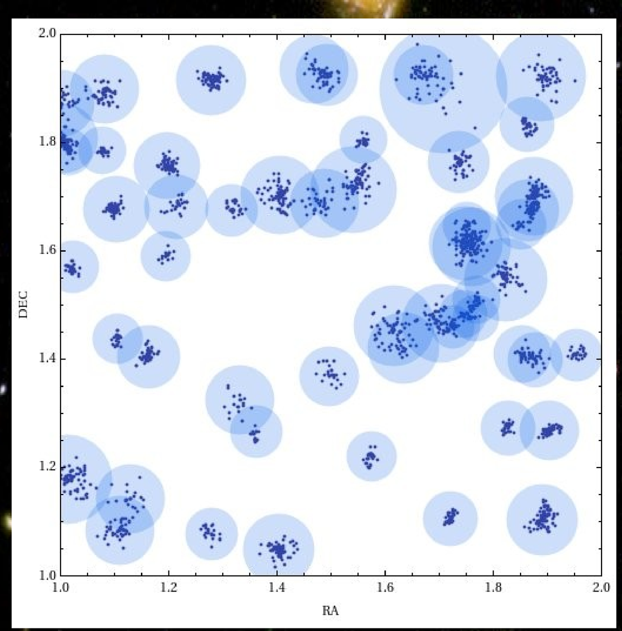
RANDOM BACKGROUND & CLUSTER (KING PROFILE)



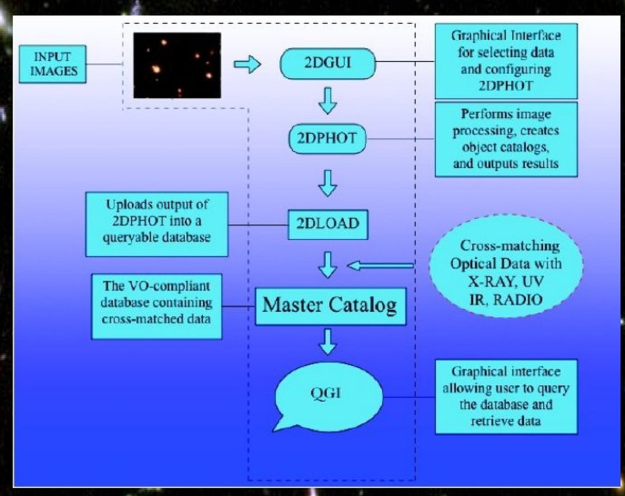


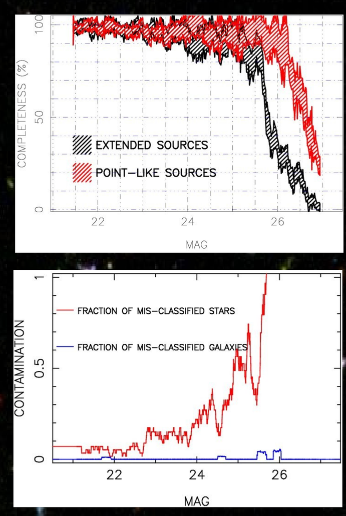
TESSELLATIONS ON THE MOCKS





2DPHOT- La Barbera et al. 2008, PASP





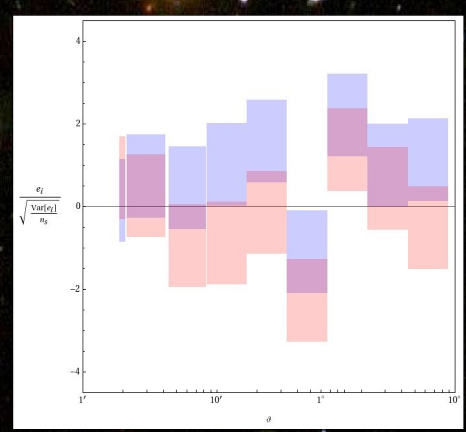
STAR/GALAXY SEPARATION ON DEEP IMAGES

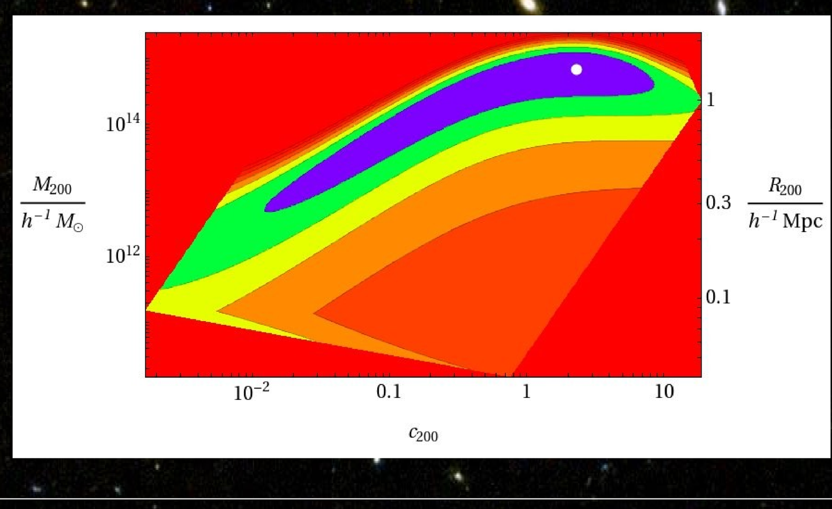
To test our pipeline with data similar in quality to what will be gathered by future wide field surveys, we process images from the Deep fields obtained as part of the LEGACY Survey: four fields of 1 sq deg each, in five bands (depth up to r'=25).

MASS ESTIMATES VIA WEAK LENSING

We are developing a method to obtain mass estimates for nearby clusters using the ellipticity of background galaxies around each cluster. This requires that the ellipticity is corrected for PSF distortions. We are presently applying linear corrections (Hirata & Seljak 2003), but alternative methods, such as obtaining the corrected ellipticities directly from the 2DPHOT pipeline, are also being considered.

WEAK LENSING MASS OF THE CLUSTER ABELL 2142





CONCLUSIONS, ONGOING & FUTURE WORK

We show preliminary results of a three-fold approach to the study of dark energy using galaxy clusters. We use both data and mock catalogs to calibrate our methods and a complete pipeline, going from the survey images to a reliable galaxy cluster catalog, is being constructed.

The image processing package is being used to process the Deep data and the resulting galaxy catalogs will be processed using the Voronoi Tesselation algorithm, which is presently being calibrated with the mock catalogs. Mass estimates will then be obtained for a subsample of the clusters found in those fields.

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