

A Merging Systems Detection Algorithm & First Catalog.

Martín de los Rios, Mariano Dominguez & Dante Paz

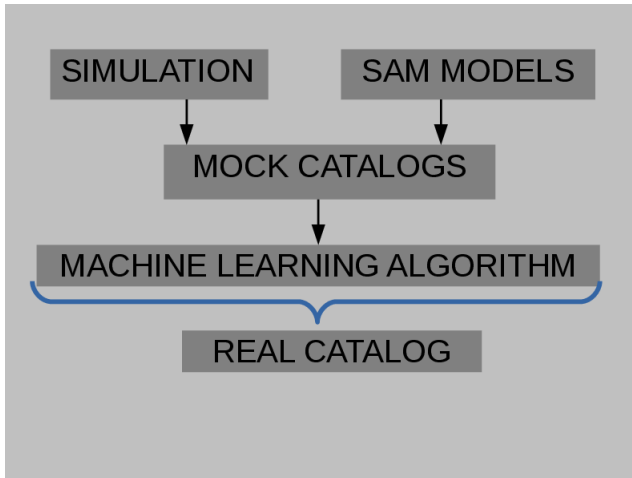
April 6, 2015

Mock Catalog.
Millenium

Machine learning algorithm applied for identification of
substructures.

Results.
Real catalogs of galaxy clusters.

Future work.



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 - ▶ SAM: Guo et al. 2010
 - ▶ *Snapshots* = 64
- ▶ Millenium simulation:
Springel et al. 2005.

Clusters identification.

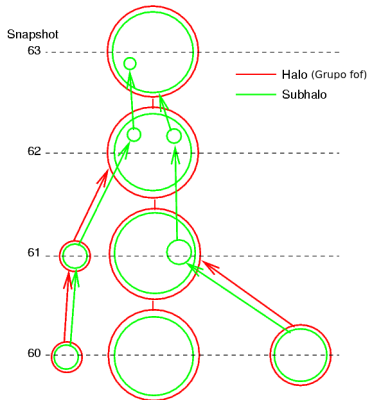
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- ▶ We assign each identified cluster with a fof-group in the simulation.

Study of the merger trees.

- Based on the subhalos merger trees, we construct the merger tree for every fof group in the simulation.



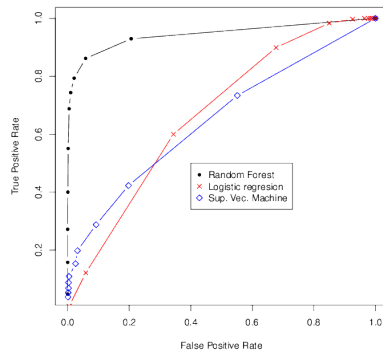
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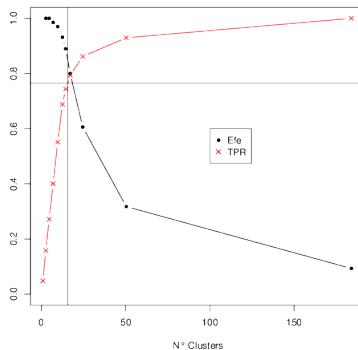
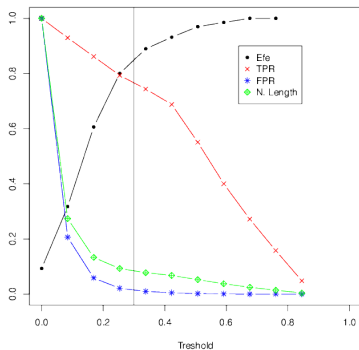
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- ▶ Dressler-Shectman test.
- ▶ Non gaussianity test.
- ▶ Color.
- ▶ Number of galaxies.





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- ▶ After that, we estimate the velocity dispersion and the virial radius.

$$\begin{aligned}
 R_{vir} &= \frac{\pi}{2} \frac{ngal(ngal - 1)}{\sum_{i>j}^{ngal} R_{ij}^{-1}} \\
 \sigma &= \frac{\sqrt{\pi}}{ngal(ngal - 1)} \sum_{i=1}^{ngal-1} \omega_i g_i \\
 \omega_i &= i(ngal - i) \\
 g_i &= v_{i+1} - v_i
 \end{aligned}$$

(1)

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- ▶ We compare the virial radius of the identified substructures with the virial radius of the subhalos, finding that we are overestimating the real values.
- ▶ We compare the velocity dispersion of the identified substructures with the velocity dispersion of the associated subhalos, finding that our values are in good concordance with the real values.

With this association between substructure and subhalos in the mock, we find 3 cases:

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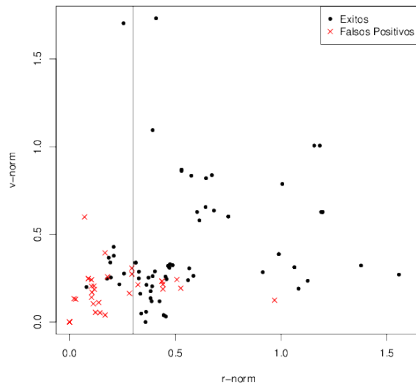
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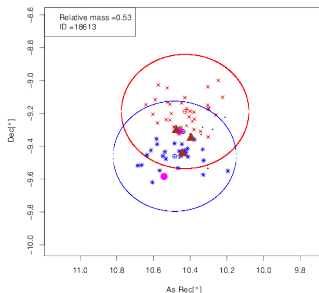
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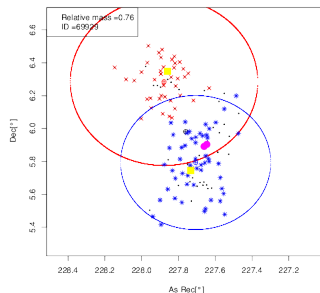
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Abell 85



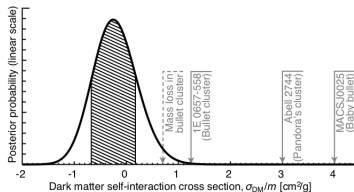
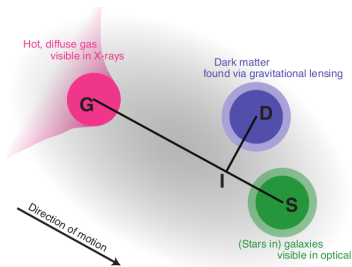
Abell
2029/2033



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The non gravitational interactions of dark matter in galaxy clusters. *Harvey et al. 2015*



$$\sigma_{DM}/m \leq 0.47 \text{ cm}^2/\text{g} \text{ (95\%CL)}$$

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- ▶ Construct a catalog of relaxed clusters in order to study the dark matter equation of state.
- ▶ Reconstruct the 3d merger with the Bayesian techniques presented by *Dawson et al. 2012*.



THANK YOU