Galaxy Cluster detection with Weak Lensing: Towards an Euclid Weak Lensing galaxy cluster catalogue.

Keywords: Galaxy Clusters, Weak Lensing, Inverse problems

Context

Clusters of galaxies are the largest and most massive collapsed structures in the Universe. Their content reflects that of the Universe : 85% of dark matter and less than 15% of ordinary matter in the galaxies and the inter-galactic gas. Clusters contain valuable information on cosmology, and are particularly important for dark matter studies. Weak Lensing is the process in which light from background galaxies is bent by foreground objects (i.e cluster of galaxies) as it travels toward us. The resulting distorsions in the shape of background galaxies provides a direct way to probe the total mass distribution of galaxy clusters. Upcoming full-sky weak lensing surveys such as Euclid will offer for the first time the possibility to detect galaxy clusters based on their lensing signal i.e. directly on their total mass. This will allow us to build a galaxy cluster catalogue representative of the true cluster population, providing new constraints on galaxy cluster abundances in the Universe.

Subject :

The student will work on applying an existing algorithm (GLIMPSE) to detect and estimate the mass of galaxy clusters from weak lensing data. The objectives of the intership are the following:

1- Get familiar with the various weak lensing galaxy cluster detection and mass estimation methods currently available
2- Compare the results obtained with GLIMPSE to the standard techniques based on simulated galaxy/halos catalogues

The proposed work will allow the student to learn about inverse problems, sparse image processing and their application to astronomical problems.

Candidate

The candidate should be a Master/Engineer student in either physics/astrophysics or signal/image processing. Experience with python coding would be advantageous.

Intership

The intership will take place in the Astrophysical Department of CEA Saclay (http://irfu.cea.fr/Sap), at the interface of the Galaxy Clusters group and the Cosmostat group. Supervision will be jointly performed by Sandrine Pires (Astrostatistician and Weak Lensing expert) and Gabriel Pratt (Galaxy Cluster expert).

- Deadline for applications: 28 February 2009
- Contact: Sandrine Pires (sandrine.pires@cea.fr)
- Duration: 4-6 months
- Possibility to continue for a phD: no

References

[1] Leonard, A. et al., "*GLIMPSE: accurate 3D weak lensing reconstructions using sparsity*", 2014, MNRAS, 440, 1281

[2] Hamana, T. et al., "*Searching for massive clusters in weak lensing surveys*", 2004, MNRAS, 350, 893

[3] Maturi, M. et al., "*An optimal filter for the detection of galaxy clusters through weak lensing*", 2005, A&A, 442, 851

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