

Guido Cupani – Curriculum Vitae

PERSONAL INFORMATION

Name: Guido Cupani
Gender: Male
Position: Postdoctoral research fellow
Date of birth: 29 June 1981
Place of birth: Pordenone, Italy
Nationality: Italian
Home address: Via Einaudi n. 23
I-33083 Villotta di Chions, PN, Italy
Office address: Department of Astronomy
University of Trieste
Via Bazzoni n. 2
I-34131 Trieste, Italy

CONTACT INFORMATION

Home phone: (39-0434) 63 09 77
Office phone: (39-040) 31 99 257
Mobile phone: (39-389) 99 54 914
Fax: (39-0434) 63 02 31
E-mail address: cupani@oats.inaf.it

EDUCATION

Doctorate in Physics, University of Trieste, Italy (2006-2008).

- Dissertation: *Non-equilibrium Dynamics of Galaxy Clusters* (3 April 2009).
- Advisor: Prof. Marino Mezzetti.

Masters degree (Laurea magistrale) in Astrophysics and Space Physics, University of Trieste, Italy (2003-2005).

- Thesis: *Dynamics in Cluster Outskirts: Theory and Analysis of Numerical Simulations* (7 November 2005).
- Advisor: Prof. Marino Mezzetti.
- Grade: 110/110 cum laude.

Bachelors degree (Laurea) in Physics, University of Trieste, Italy (2000-2005).

- Thesis: *On the Inevitability of Macro-Objectivation Problem in Quantum Mechanics* (10 November 2003).
- Advisor: Prof. GianCarlo Ghirardi.
- Grade: 110/110 cum laude.

SCHOOLS, CONFERENCES, MEETINGS

Milan X-Shooter meeting (Milan, Italy, 27-28 October 2009).

Workshop *Modeling the Evolution of Cosmic Structures* (Sesto, BZ, Italy, 28 July - 2 August 2008).

International conference *Tracing Cosmic Evolution with Clusters of Galaxies: Six Years Later* (Sesto, BZ, Italy, 25-29 June 2007).

National School of Astrophysics (8th cycle, 4th course): *Cluster of Galaxies – Astrophysical Plasma* (Trieste, Italy, 1-6 October 2006).

DPG School on Physics 2006: *Dark Matter and Dark Energy* (Bad Honnef, Germany, 16-21 July 2006).

GRANTS AND
AWARDS

Postdoctoral research fellowship at the Department of Astronomy University of Trieste (DAUT) (1 July – 31 December 2009).

- Research project: *Dynamical Analysis of Galaxy Systems*.
- Advisor: Prof. Marino Mezzetti.

Doctorate scholarship of the University of Trieste (2006-2008)

- Doctorate project: *Clusters of Galaxies: Dynamics and Large-Scale Structure*.
- Advisor: Prof. Marino Mezzetti.

Summer Student Scholarship at Fermi National Accelerator Laboratory (Fermilab), USA (August-September 2003).

- Advisors: Dr. George Velev, Dr. Guram Chlachidze.

Scholarship of the University College of Sciences Luciano Fonda of Trieste (2000-2003). The scholarship was awarded after an open competition and renewed for merit during three academic years.

RESEARCH
ACHIEVEMENTS
AND INTERESTS

My past research has been focused on the dynamics of galaxy clusters, with a particular attention to the cluster outskirts, where the matter is not set to dynamical equilibrium. I adopted a theoretical approach based on the standard Spherical Collapse Model (SCM) and compared it to simulated data, to keep the whole 3-dimensional dynamics under control. This approach was meant to set new constraint to the problem of estimating the mass profiles of clusters from the observation of member galaxies. The main results of this work can be summarized as follows.

- **Dynamics of the non-equilibrium region.** Despite the variance between individual clusters, a common infall velocity profile is clearly recognizable in the region which surrounds the turnaround radius r_t (i.e., the radius where the infall motion is exactly balanced by the Hubble flow velocity). As a consequence of the common dynamical behaviour, all clusters are consistent with a unique mass profile in the non-equilibrium region (Cupani, Mezzetti, & Mardirossian 2008). This profile is in good agreement with the prediction of the Spherical Collapse Model, once the angular momentum of groups with respect to cluster center is taken into account. The new formulation of SCM with angular momentum gives a consistent description of the non-equilibrium dynamics of the cluster outskirts, and is easily adapted to different values of the matter density parameter Ω_0 and of the redshift z (Cupani, Mezzetti, & Mardirossian, in prep.).
- **Cluster mass estimation through the Fair Galaxies.** Starting from the previous results, I developed and tested a new technique for the estimation of the mass profiles and the total mass in clusters. This technique is based on the identification of a particular subset of member galaxies in clusters, the so-called Fair Galaxies, which are proved to be suitable to reconstruct the overall infall motion of matter in the cluster outskirts. The Fair Galaxies are identified on the redshift-space distribution of galaxies (i.e. the distribution of line-of-sight velocities *vs.* sky-plane distance from the cluster centre), making the mass estimation technique easily applicable to the analysis of observed clusters. The technique was implemented and tested on simulated data and was proven to be reliable from 1 up to 7 virialization radii, within a typical uncertainty factor of 1.5. The technique

was subsequently applied to the analysis of observed clusters from the CIRS (Rines & Diaferio 2006) and produced results in agreement with previous mass estimates (Cupani, Mezzetti, & Mardirossian 2010).

Recently, I have been also involved in the analysis of spectroscopic observation taken with the second-generation spectrograph X-Shooter at ESO-VLT. I acquired experience in testing and using the X-Shooter pipeline and I have been involved in X-Shooter data reduction together with different research groups at the Astronomical Observatories of Padua and Capodimonte. Given my background in cosmology, I am particularly interested in exploiting the X-Shooter capabilities to constrain the physical and chemical properties of the Intergalactic Medium through the observation of medium- and high-redshift QSO pairs.

LIST OF
PUBLICATIONS

Cupani G., Mezzetti M., Mardirossian F., *Cluster mass estimation through Fair Galaxies* (October 2009). E-print: arXiv:0910.2882. Submitted to Mon. Not. R. Astron. Soc.

Cupani G., *Non-equilibrium Dynamics of Galaxy Clusters*. Doctorate Thesis (April 2009). Stored in the Institutional Archive of Trieste University.

Cupani G., Mezzetti M., Mardirossian F., *Mass estimation in the outer non-equilibrium region of galaxy clusters* (October 2008). E-print: arXiv:0807.3239. Published on Mon. Not. R. Astron. Soc., Vol. 390, Issue 2, pp. 645-654 .

Cupani G., Mezzetti M., *Effects of angular momentum in the Spherical Collapse Model*. In preparation.

Cupani G., Mezzetti M., *Non-stationary corrections to the Jeans formalism*. In preparation.
