

# CURRICULUM VITAE

## Luca Tornatore

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## Personal Informations

Date of Birth      1975, December 21<sup>st</sup>  
Citizenship      Italian Republic

## Education

**Ph.D. in Physics**, Department of Astronomy, University of Trieste, 4/14/2005

– Thesis title:

*Hydrodynamical Simulations of Galaxy Clusters: Thermodynamics and Chemical Enrichment.*

– Advisor:

Prof. Stefano Borgani

**Graduation in Physics**, Department of Physics, University of Padova, Italy, 12/21/1999.

– Thesis title:

*Effects of Radiative Cooling and Supernovae Heating on the Evolution of Intra-Cluster Medium*

– Advisor:

Dr. Ornella Pantano

## Other Education Experiences

– Summer School on Parallel Computing, 1999, held at supercomputing centre CINECA, Bologna

## Positions held

- May 2005 – May 2007 : post-doc at S.I.S.S.A, Trieste
- June 2007 – April 2010: post-doc at Department of Astronomy, University of Trieste

## **Research interests**

- Cosmology and Large Scale Structure of the Universe
- Numerical Simulations of large-scale structure, IGM and Galaxy Clusters.
- Physics of Intra-Cluster Medium in Galaxy Clusters and Galaxies-ICM interplay
- Physics of Intergalactic Medium and Galaxies-IGM interplay
- Chemical Enrichment of Intergalactic Medium and Intracluster Medium

*The focus of the research activity is mainly on the chemo/thermodynamical properties of baryons in both gaseous and stellar component, and on their evolution across the Universe history in different environments (voids, diffuse medium, collapsed objects). Particularly, the interest is on the interplay between gas and galaxies in both Galaxy Clusters and IGM, on the galactic feedback mechanisms at different ages, and on the evolution of galactic properties and IGM properties at both low and high redshifts. A specific attention is given to the chemical enrichment of the universe.*

## **Working experience**

He has accumulated a significant experience in collaborative working within large international groups being involved in large programs of numerical simulations and european networks.

In particular, he is actively developing the Gadget code widely used for cosmological and astrophysical simulations in collaboration with MPA group (Volker Springel, the developers' leader, and Dr. Klaus Dolag).

In the framework of that involvement, he has been

visiting MPA institute in Garching several times between 2003 and 2009, for a total period of about a year.

He has been involved in the large OWLS collaboration in Leiden, where he has been visiting in 2005 and 2007. Along with collaborators Stefano Borgani and Matteo Viel has been involved in two Virgo consortium meetings (2007 at Leiden University, 2008 at Nottingham University) for setting up collaborations and projects.

He has been involved in the *CosmoComp* European network.

### **Related Skills**

- Professional knowledge in scientific and non-scientific computer science
- nine-years experience in parallel computer programming and in developing massively parallel applications for cosmological simulations
- nine-year experience in international collaboration for co-developing segments of a worldwide-used parallel code, and projecting and running very large numerical simulations on international facilities
- experience in developing massively parallel codes for analysis of large simulations and comparison with relevant observational data

### **Teaching Experiences**

- Introduction to programming / Numerical Methods (partial) at S.I.S.S.A., Trieste,
  - 2005-2006
  - 2006-2007

- Lecture on advanced numerical methods in astrophysics at the Advanced School on Parallel Computation, 2006, CINECA, Bologna

### **Co-supervision of undergraduate students** **- at Department of Astronomy, Trieste**

Alexandro Saro	2005 <i>now post-doc at the same Dep.</i>
Dunja Fabjan	2006 <i>now Ph.D. Student at the same Dep.</i>
Massimo Viola	2008 <i>now Ph.D. Student in Heidelberg</i>
Filippo Bonaventura	2008

### **Co-supervision of Ph.D. Students** **- at Department of Astronomy, Trieste**

Alexandro Saro	2006 – 2009 <i>now post-doc at the same Dep.</i>
Edoardo Tescari	2008 – 2009 ( <i>still in progress</i> )
Dunja Fabjan	2007 – 2009 ( <i>still in progress</i> )

### **- at S.I.S.S.A., Trieste**

Marco Valdes	2006-2009 <i>now post-doc at IPMU, Tokio U.</i>
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### **- at MPA, Garching**

Umberto Maio	2006-2009 <i>now post-doc at MPE, garching</i>
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### **Publications on Refereed Journals**

**Tornatore**, L., Borgani, S., Viel, M., Springel, V.  
The impact of feedback on the low redshift Intergalactic medium  
2009, MNRAS, in press

Dayal, P.; Ferrara, A.; Saro, A.; Salvaterra, R.; Borgani, S.; **Tornatore**, L  
Lyman Alpha emitter evolution in the reionization epoch  
MNRAS, 2009, in press

Fabjan, D., Borgani, S., **Tornatore**, L., Saro, A., Murante, G., Dolag, K.  
Simulating the effect of AGN feedback on the metal enrichment of galaxy clusters  
MNRAS, 2009, in press

Wiersma, Robert P. C.; Schaye, Joop; Theuns, Tom;  
Dalla Vecchia, Claudio; **Tornatore**, Luca  
Chemical enrichment in cosmological, smoothed particle  
hydrodynamics simulations  
MNRAS, 2009, 399, 574

Maio, U., Ciardi, B., Yoshida, N., Dolag, K., **Tornatore**, L.  
The onset of star formation in primordial halos  
MNRAS, 2009, 503, 25

Tescari, E., Viel, M., **Tornatore**, L., Borgani, S.  
Damped Lyman-alpha systems in high-resolution  
hydrodynamical simulations  
MNRAS, 397, 411

Saro, A., Borgani, S., **Tornatore**, L., De Lucia, G., Dolag,  
K., Murante, G.  
Simulating the formation of a protocluster at  $z \sim 2$   
MNRAS, 2009, 392, 795

Borgani, S., Fabjan, D., **Tornatore**, L., Schindler, S.,  
Dolag, K., Diaferio, A.  
The chemical enrichment of the ICM from  
hydrodynamical simulations  
SSRV, 2008, 134, 379

Fabjan, D., **Tornatore**, L., Borgani, S., Saro, A., Dolag, K.  
Evolution of the metal content of the intra-cluster  
medium with hydrodynamical simulations  
2008, MNRAS, in press

Cora, S. A., **Tornatore**, L., Tozzi, P., Dolag, K.  
On the dynamical origin of the ICM metallicity evolution  
2008, MNRAS, in press

Rasia, E., Mazzotta, P., Bourdin, H., Borgani, S.,  
**Tornatore**, L., Ettori, S., Dolag, K., Moscardini, L.  
X-Mas2 : study systematics on the ICM metallicity  
measurements  
2008, ApJ, 674, 728

Viola, M., Monaco, P., Borgani, S., Murante, G.,  
**Tornatore**, L., How does gas cool in dark matter  
haloes?  
MNRAS, 2008, 383, 777

**Tornatore**, L., Borgani, S., Dolag, K., Matteucci, F.  
Chemical enrichment of galaxy clusters from  
hydrodynamical simulations  
MNRAS, 2007, 382, 1050.

**Tornatore**, L., Ferrara, A., Schneider, R.  
Population III stars: hidden or disappeared?  
MNRAS, 2007, 382 945.

Maio, U., Dolag, K., Ciardi, B., **Tornatore** L.  
Metal and molecule cooling in simulations of structure  
formation 2007, MNRAS, 379, 963.

Borgani, S., Dolag, K., Murante, G., Cheng, L.-M.,  
Springel, V., Diaferio, A., Moscardini, L., Tormen, G.,  
**Tornatore**, L., Tozzi, P. Hot and cooled baryons in  
smoothed particle hydrodynamic simulations of galaxy  
clusters: physics and numerics  
2006, MNRAS, 367, 1641

Saro, A., Borgani, S., **Tornatore**, L., Dolag, K., Murante,  
G., Biviano, A., Calura, F., Charlot, S.  
Properties of the galaxy population in hydrodynamical  
simulations of clusters  
2006, MNRAS, 373, 397

Diaferio, A., Borgani, S., Moscardini, L., Murante, G.,  
Dolag, K., Springel, V., Tormen, G., **Tornatore**, L.,  
Tozzi, P.  
2005, MNRAS, 356, 1477

Cheng, L.M., Borgani, S., Tozzi, P., **Tornatore**, L.,  
Diaferio, A., Dolag, K., He, X.T., Moscardini, L., Murante,  
G., Tormen, G. 2005, A&A, 431, 405

Ettori, S., Borgani, S., Moscardini, L., Murante, G., Tozzi,  
P., Diaferio, A., Dolag, K., Springel, V., Tormen, G.,  
**Tornatore**,L. 2004, MNRAS, 354, 111

Murante, G., Arnaboldi,M., Gerhard, O., Borgani, S.,  
Cheng, L.M., Diaferio, A., Dolag, K., Moscardini, L.,  
Tormen, G., **Tornatore**, L., Tozzi, P.  
2004, ApJL, 607, 83

**Tornatore**, L., Borgani, S., Matteucci, F., Recchi, S., Tozzi, P.

2004, MNRAS, 349L, 19

Borgani, S., Murante, G., Springel, V., Diaferio, A., Dolag, K., Moscardini, L., Tormen, G., **Tornatore**, L., Tozzi, P.

2004, MNRAS, 348, 1078

**Tornatore**, L., Borgani, S., Springel, V., Matteucci, F., Menci, N., Murante, G.

2003, MNRAS, 342, 1025

Finoguenov, A., Borgani, S., **Tornatore**, L., Böhringer, H.

2003, A&A, 398L, 35

### **Contributed talks in international conferences**

Tornatore, L., Borgani, S.

*The Impact of Feedback on the Low-Redshift Intergalactic Medium*

2009, The Chemical Enrichment of the Intergalactic Medium – Lorentz center, Leiden University

Tornatore, L., Borgani, S., Murante, G., Dolag, K., Saro, A., Fabjan, D.

*Studying the chemical properties of ICM using numerical simulations*

2007, Sesto 2007 – Tracing Cosmic Evolution with Galaxy Clusters

Tornatore, L., Borgani, S., *Chemical enrichment of galaxy clusters in hydrodynamical simulations,*

2006, in “CRAL-2006 – chemodynamics: from first stars to local galaxies,”EAS, 24, 2007

Tornatore, L., Borgani, S.

*The history of ICM's enrichment in simulations*

2005, Ringberg workshop M87, Distant Clusters of Galaxies

Tornatore, L., Borani, S.

*Galaxy clusters chemodynamics in numerical simulations*

2004, Turin, IAU Colloquium no. 195, “Outskirts of galaxy clusters: intense life in the suburbs”

Tornatore, L., Borgani, S., Recchi, S., Matteucci, F.  
*ICM Chemodynamics in numerical simulations*  
2003, Vulcano, Chemical Enrichment of the ICM and IGM

### **Successful applications @ international facilities**

Tornatore, L., Borgani, S., Matteucci, F.  
*Simulating the effect of cooling and heating in the intra-cluster medium,*  
**standard project CINECA SP4**, 2002, 18000h

Tornatore, L., Borgani, S., Matteucci, F.  
*Investigating thermodynamics and chemistry of Galaxy Clusters,*  
**standard project CINECA SP4**, 2003, 10000 h

Borgani, S., Diaferio, A., Dolag, K., Moscardini, L., Murante, G.,  
Springel, Tormen, G., Tornatore, L., Tozzi, P.,  
*A Tree+SPH High-Resolution Simulation of Cosmic Web,*  
**Key-Project CINECA**, 2003, 50000h on IBM SP4.

Borgani, S., Tornatore, L.  
*Simulating the chemo-thermodynamics of intra-cluster medium,*  
**NERSC** (National Energy Research Scientific Computing Center),  
2004, 20000h, Seaborg facility

Tornatore, L., Borgani, S., Murante, G., Ling-Mei, C., Tozzi, P.  
*Simulating the heating and metal enrichment of the intra-cluster medium,*  
**standard project CINECA**, 2004, 10000 h

Murante, G., Borgani, S., Chen, L.M., Diaferio, A., Dolag, K.,  
Moscardini, L., Springel, V., Tormen, G., Tornatore, L., Tozzi, P.,  
*A Tree+SPH High-Resolution Resimulation of a Galaxy Cluster,*  
**Key-Project CINECA**, 2004, 40000h on IBM SP4

Tornatore, L., Borgani, S., Murante, G., Ling-Mei, C., Tozzi, P.  
*Simulating the heating and metal enrichment of the intra-cluster medium,*  
**standard project CINECA**, 2005, 7000 h

Tornatore, L., Dolag, K., Murante, G., Moscardini, L.  
*Tree+SPH Simulations of the Chemical Enrichment of the Intra-Cluster Medium,*  
**standard project CINECA**, 2006, 5000h

Murante, G., Borgani, S., Dolag, K., Tornatore, L., Saro, A.,  
*Properties of the Galaxy Population in High-Resolution Cluster Simulations,*

**standard project CINECA**, 2006, 15000h on IBM SP5

Tornatore, L., Ferrara, A., Schneider R.,  
*Simulating the fading of the first stars,*

**SISSA internal project**, 2006, 50000h @ CINECA

Borgani, S., Murante, G., Saro, A., Tornatore, L., Dola, K.,  
*Simulations of Galaxy Clusters with AGN feedback,*

**standard project CINECA**, 2007, 20000h

Viel, M., Borgani, S., Tornatore, L.,  
*The Galaxy-Intergalactic Medium Interplay,*

**key-project CINECA**, 2007, 200000h

Ferrara, A., Tornatore, L., Schneider R.,  
*Where are the first stars?,*

**SISSA internal project**, 2007, 50000h @ CINECA

Tornatore, L., Borgani, S., Murante, G., Viel, M.,  
*Simulating the impact of galactic outflows on the IGM,*

**standard project CINECA**, 2008, 300000h

Borgani, S., Moscardini, L., Murante, L., Tornatore, L., Viel, M.,  
*High-resolution simulations of the Warm-Hot Universe,*

**Key-project CINECA**, 2008, 400000h

Valdes, M., Ferrara, A., Tornatore, L.

*Simulating the impact of DM-decay on the hydrogen temperature at very high redshifts,*

**SISSA internal project**, 2008, 30000h @ CINECA

Viel, M., Borgani, S., Tornatore, L.,

*The Galaxy-Intergalactic Medium Interplay and the role of galactic winds at  $z \sim 2-4$ ,*

**standard project CINECA**, 2009, 50000h

Fabjan, D., Borgani, S., Dolag, K., Murante, G., Tornatore, L.,

*Simulations of feedback effects on the properties of galaxy clusters,*

**standard project CINECA**, 2009, 50000h