

Curriculum Vitae for MATIAS J. ISON

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Date of birth: April 15, 1977
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Educational Background:

Universidad de Buenos Aires (UBA), Buenos Aires, Argentina

- Ph.D. in physics *April 2006 (expected)*
Dissertation title: "Dynamics and thermodynamics
of non-extensive systems"
Adviser: Dr C.O. Dorso (codorso@df.uba.ar).
- Licenciado en Ciencias Físicas (M.S. in Physics) *March 1996 – December 2001*
Average grade: 9.22. (1 to 10 scale)

Advanced specialization courses: Computational Physics, Non-Linear Dynamics, Biophysics, Statistics in Experimental Physics, Neural Networks, Complex systems, Industrial Mathematics, Introduction to Computational Biology (one semester courses). The utilization of Complex Nuclear Reactions (Université Paris, 2005), "On the Concept of Information and its role in Nature", UBA (2002) (short courses).

Refereed Publications:

- [1] "Dynamics and thermodynamics of fragment emission from excited sources", [M.J.Ison](#) and C.O.Dorso, *Physical Review C* **71**, 064603 (2005).
- [2] "Role of Coulomb interaction in fragmentation", [M.J.Ison](#) and C.O.Dorso, *Physical Review C* **69**, 027001 (2004).
- [3] "Enhancement of kinetic energy fluctuations due to expansion", A.Chernomoretz, F.Gulminelli, [M.J.Ison](#), and C.O.Dorso, *Physical Review C* **69**, 034610 (2004).
- [4] "Caloric Curves in two and three-dimensional Lennard-Jones-like systems including Long-range forces", [M.J.Ison](#), A.Chernomoretz and C.O.Dorso, *Physica A* **341C**, 389-400 (2004).
- [5] "Dynamical properties of constrained drops", [M.Ison](#), P.Balenzuela, A.Bonasera & C.O.Dorso, *Eur.Jour.Phys.A* **14**, 451 (2002).
- [6] "Nonequilibrium effects in fragmentation", A. Chernomoretz, [M. Ison](#), S. Ortiz and C. O. Dorso, *Physical Review C* **64**, 024606 (2001).
- [7] "Dynamical aspects of isoscaling", C.O.Dorso, C.R.Escudero, [M.J.Ison](#) and J.A.Lopez, submitted to *Physical Review C* (2005). arxiv: nucl-th/0504036.

Proceedings:

“Dynamical aspects of fragmentation”, [M.J.Ison](#) and C.O.Dorso, submitted to *Acta Phys. Hung. A* (2005), arxiv: nucl-th/0511027.

“Information theory of open fragmenting systems”, F.Gulminelli, Ph.Chomaz, O.Juillet, [M.J.Ison](#) and C.O.Dorso, submitted to *Acta Phys. Hung. A* (2005), arxiv: nucl-th/0511012.

“Dynamics and thermodynamics of constrained systems”, [M.J.Ison](#), P.Balenzuela, A.Bonasera and C.O.Dorso, *CRIS 2002, 4th Catania Relativistic Ion Studies, AIP Conference Proceedings*, **644**, 167 (2002).

“Asymptotic distances in phase space for excited drops”, [M.J.Ison](#), P.Balenzuela and C.O.Dorso, *Proceedings of the IV Latin American Symposium on Nuclear Physics*, pages 99-103, ISBN:9687845368, Printed in Mexico, 2001.

Invited seminar presentations:

“*Dynamics, thermodynamics and nonequilibrium effects in fragmentation*”, Laboratoire de Physique Corpusculaire (Seminaire GANIL-LPC, Caen, France), June 10, 2005.

“*Excited small systems, criticality, non-linearity and more...*”, Los Alamos National Laboratory, March 22, 2004. Invited scientist. Travel expenses and lodging paid by LANL, University of California.

Presentations and schools:

“*Dynamical aspects of fragmentation*”, VI Latin American Symposium on Nuclear Physics and Applications. Iguazú (Argentina), October 3-7, 2005. Type of contribution: Poster.

“*Termodinámica de sistemas Lennard-Jones generalizados con interacciones de largo rango*”, II Taller Regional de Física Estadística y sus Aplicaciones a la Materia Condensada. Córdoba, Argentina, May 27-29, 2004. Type of contribution: Poster.

“*The importance of being finite: Phase transitions in small systems*” Pan-American Advanced Studies Institute extension: Albuquerque, USA, March 13-20 04. This workshop was organized for approx.10 students chosen from the original PASI (see below). (Airline ticket and full accomodation paid by The Consortium of the Americas via NSF-DOE). Type of contribution: Oral.

Pan-American Advanced Studies Institute on: “*Modern Challenges in Statistical Mechanics: Patterns, Noise and the Interplay of Nonlinearity and Complexity*” held in Bariloche, Argentina from June 2-15, 2002. (Airline ticket and full accommodation paid by The Consortium of the Americas via NSF-DOE National Science Foundation-Department of Energy).

“*Thermodynamical properties of constrained drops with and without Coulomb interaction*”, MEDYFINOL '02, XIII Meeting on Nonequilibrium Statistical Mechanics and Nonlinear Physics. Held at Colonia, Uruguay. December 9-13, 2002.

“*Asymptotic distances in phase space for excited drops*”, IV Latin American Symposium on Nuclear Physics, held in (DF) Mexico between September 24-28, 2001. Invited by the Jefferson National Lab (USA) (Airline ticket, accommodation and inscription fee paid by Jeff. National Lab via “National Science Foundation Americas Grant”).

“*Third Winter School J.J.Giambiagi, Physics and Biology*”, which took place in the University of Buenos Aires between July 23-28, 2001.

“*Photographic exploration of the evolution of an electrical discharge in a coaxial gun*”, 85th meeting of the Asociación Física Argentina (AFA), Buenos Aires, September 2000.

Scholarships and research positions:

- Invited scientist, Laboratoire de Physique Corpusculaire, Caen, France, March 25-April 25 2005.
- University of Buenos Aires Ph. D. scholarship. From April 2002 to March 2006.
- Fundación Antorchas. Scholarship awarded for a two months visit at the Laboratoire de Physique Corpusculaire, Caen (France). April 2004.
- University of Buenos Aires research assistantship. From October 2000 to March 2002.

Participation in research projects:

- *Metamorphoses of Complex Systems* (UBACyT X308). Main researcher, H.G.Solari.
- *Phase transitions in related finite systems* (CONICET PIP 5969). Main researcher, C.O.Dorso.
- *Phase transitions in finite systems* (UBACyT X139). Main researcher, C.O.Dorso.
- *Microscopic dynamics of fragmentation* (UBACyT TW98). Main researcher, C.O.Dorso.

Teaching experience:

Teaching assistant, Physics department, University of Buenos Aires. From March 1, 2001 until present.

Courses taught:

- Computational Physics (Advanced specialization course – Graduate level)

Homepage: <http://www.lafec.df.uba.ar/fiscomp.html>

- Statistical Mechanics (Reichl, Huang level)
- Laboratories (mechanics and electricity)
- Classical electrodynamics
- Classical Mechanics

Computer proficiency:

- Operating systems: Unix (Linux), Windows.
- Languages: Fortran, C, Matlab , Mathematica, Shell scripting (Bash, Awk), HTML.
- Proficient in Molecular Dynamics, Monte Carlo simulations and cluster recognition algorithms.
- Experienced in Neural networks, genetic algorithms, different numerical schemes for PDE's and ODE's.

Research accomplishments

My primary skills are in the fields of statistical mechanics and computational physics. However, my research interests encompass a wide variety of problems from neuroscience to complex systems: I am particularly interested in applying tools from statistical mechanics, computational physics and nonlinear dynamics to relevant biological problems.

My thesis work focuses on the dynamics and thermodynamics of fragmenting systems (systems that break into pieces) using extensive computer simulations. In particular, I contributed to extend the concept of phase transitions from infinite (usual thermodynamics) to finite small systems.

One of our major achievements has been the understanding of the role of non-equilibrium in the fragmentation process and the appearance of negative values in the specific heat [1], recently measured experimentally [2,3]. We also found an intrinsic connection between phase transitions and chaotic properties of the underlying dynamics [4]. We have given an important step in the understanding of the thermodynamics of systems with long-range forces in Refs. [5] and [6].

Very recently we started to explore the role of the isospin degree of freedom in fragmentation [7], the inequivalence of statistical ensembles in non-extensive systems and the description of open systems by means of an information theory approach [8].

[1] *Nonequilibrium effects in fragmentation*, A. Chernomoretz, M. Ison, S. Ortiz and C. O. Dorso, *Physical Review C* **64**, 024606 (2001).

[2] *Negative heat capacity in the critical region of nuclear fragmentation: an experimental evidence of the liquid-gas phase transition*, M. D'Agostino et al., *Physics Letters B* **473**, p.219 (2000).

[3] *Negative Heat Capacity for a Cluster of 147 Sodium Atoms*, M. Schmidt et al., *Physical Review Letters* **86**, 1191–1194 (2001).

[4] *Dynamical properties of constrained drops*, M.Ison, P.Balenzuela, A.Bonasera & C.O.Dorso, *Eur.Jour.Phys.A* **14**, 451 (2002).

[5] *Role of Coulomb interaction in fragmentation*, M.J.Ison and C.O.Dorso, *Physical Review C* **69**, 027001 (2004).

[6] *Caloric curves in two and three-dimensional generalized Lennard-Jones systems*, M.J.Ison, A.Chernomoretz & C.O.Dorso, *Physica A* **341C**, 389-400 (2004).

[7] *Dynamical aspects of isoscaling*, C.O.Dorso, C.R.Escudero, M.J.Ison and J.A.Lopez, submitted to *Physical Review C* (2005).arxiv: nucl-th/0504036.

[8] M.J.Ison, F.Gulminelli and C.O.Dorso, in preparation.

References:

Available upon request.