ALBERTO IMPARATO

CURRICULUM VITÆ

Informazioni Generali

- **Nato a**
- **Nazionalità:** italiana
- **Lingue straniere:** Inglese, Tedesco, Danese
- **Posizione Presente**: Lektor (Associate Professor), Aarhus University, Aarhus, Denmark.

- **Indirizzo professionale:**
- **indirizzo elettronico:**

Studi

- Laurea in Fisica (24 Gennaio 1996) Università di Napoli "Federico II". Voto: 110/110 *cum laude*.
  Titolo della tesi: Modelli su reticolo di vetri con dinamica vincolata.
  Relatore: Prof. Luca Peliti.
- International Max Planck Research School on Biomimetic Systems, Max Planck Institut for Colloids and Interfaces, Potsdam, Germania. 2000-2003.
- Dottorato in Fisica Teorica, Università di Potsdam, Germania (4 Luglio 2003)
  Titolo della tesi: Dynamic and Elastic properties of Fluid Bilayer Membranes. Supervisor Prof. Reinhard Lipowsky.

Abilitazione Scientifica Nazionale

- Sessione 2012 e 2018, abilitato per il settore 02/A2, *Fisica Teorica delle Interazioni Fondamentali*, Professore Ordinario.

- Sessione 2012, abilitato per il settore 02/B2, *Fisica Teorica della Materia*, Professore Associato.

Esperienze Didattiche

Qualifiche e Certificazioni

1. Italian Ministry for Education: qualification as High School Teacher of Physics, 2000.
2. Course in general university teaching methods, Aarhus University, January-April 2010.
3. Course in PhD Supervision, Aarhus University, January 2019.

Corsi tenuti

- A.A. 2009/2010 e 2011/2012, Statistical mechanics of soft matter, Aarhus University. Titolare del corso.
- A.A. 2012/2013, 2013/2014, Esercitazioni di Algebra Lineare, Aarhus University.
- A.A 2009/2010, 2010/2011, 2011/2012, 2012/2013, Protein Biophysics, Aarhus University, in collaborazione con altri 3 docenti.
- A.A. 2010/2011, 2012/2013, 2014/2015, 2020/2021 Introduction to Biophysics, Aarhus University. Titolare del corso, corso semestrale.
- A.A 2010/2011, 2011/2012, 2012/2013, 2013/2014, 2014/2015, 2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2020/2021, 2021/2022, 2022/2023 Advanced Statistical Physics (Former Statistical Physics II), Aarhus University. Titolare del corso, corso semestrale.
- A.A. 2014/2015, Phd Course, Path integrals in statistical mechanics with applications in soft and hard condensed matter physics. In collaborazione con un altro docente.
- A.A. 2014/2015, 2016/2017, 2018/2019, 2020/2021, 2022/2023 Analytical tools in theoretical physics (Mathematical methods for Physics). Titolare del corso, corso semestrale.
- A.A. 2022/2023 Quantum Mechanics II, co-titolare.

Alberto Imparato: Publications in Refereed Journals

1. A. Imparato, L. Peliti, Universal and non universal properties of a lattice glass model with kinetic constraints, *Phys. Lett. A*, **269**:154-157 (2000). http://dx.doi.org/10.1016/S0375-9601(00)00228-0

2. A. Imparato, J.C. Shillcock and R. Lipowsky, Lateral and transverse diffusion in two-component bilayer membranes, *Eur. Phys. J. E*, **11**:21-28 (2003). http://epje.epj.org/articles/epje/abs/2003/05/epje02195/epje02195.html

3. A. Imparato and L. Peliti, Kinetic barriers in RNA unzipping, *Eur. Phys. J. B*, **39**:357–363 (2004). http://dx.doi.org/10.1140/epjb/e2004-00201-3

4. A. Imparato, L. Peliti, Work probability distribution in single-molecule experiments, *Europhys. Lett.*, **69**: 643 (2005). http://dx.doi.org/10.1209/epl/i2004-10390-3

5. A. Imparato, J.C. Shillcock and R. Lipowsky, Shape fluctuations and elastic properties of two-component bilayer membranes, *Europhys. Lett.*, **69**: 650 (2005). http://dx.doi.org/10.1209/epl/i2004-10382-3

6. A. Imparato, L. Peliti, Work distribution and path integrals in general mean-field systems, *Europhys. Lett.*, **70**: 740 (2005). http://dx.doi.org/10.1209/epl/i2005-10067-5

7. A. Imparato, L. Peliti, Work probability distribution in systems driven out of equilibrium, *Phys. Rev. E*, **72**, 046114 (2005). http://dx.doi.org/10.1103/PhysRevE.72.046114

8. A. Imparato, L. Peliti, Evaluation of free energy landscapes from manipulation experiments, *J. Stat. Mech.*, P03005 (2006). http://dx.doi.org/10.1088/1742-5468/2006/03/P03005

9. A. Imparato, Surface tension in bilayer membranes with fixed projected area, *J. Chem. Phys.*, **124**: 154714 (2006). http://dx.doi.org/10.1063/1.2189847

10. A. Imparato, L. Peliti, Fluctuation relations for a driven Brownian particle, *Phys. Rev. E*, **74**, 026106 (2006). http://dx.doi.org/10.1103/PhysRevE.74.026106

11. A. Imparato and L. Peliti, The distribution function of entropy flow in stochastic systems, *J. Stat. Mech.*, L02001 (2007). http://dx.doi.org/10.1088/1742-5468/2007/02/L02001

12. A. Imparato, A. Pelizzola, M. Zamparo, Ising-Like model for protein mechanical unfolding, *Phys. Rev. Lett.*, **98**: 148102 (2007). http://dx.doi.org/10.1103/PhysRevLett.98.148102

13. A. Imparato, A. Pelizzola, M. Zamparo, Protein mechanical unfolding: a model with binary variables, *J. Chem. Phys*, **127**: 145105 (2007). http://dx.doi.org/10.1063/1.2776271

14. A. Imparato, S. Luccioli, A. Torcini, Reconstructing the free energy landscape of a mechanically unfolded model protein, *Phys. Rev. Lett.*, **99**: 168101 (2007). http://dx.doi.org/10.1103/PhysRevLett.99.168101

15. A. Imparato, L. Peliti, G. Pesce, G. Rusciano, A. Sasso, Work and heat probability distribution of an optically driven Brownian particle: Theory and experiments, *Phys. Rev. E*, **76**: 050101R (2007). http://dx.doi.org/10.1103/PhysRevE.76.050101

16. A. Imparato, A. Pelizzola, Mechanical unfolding and refolding pathways of ubiquitin, *Phys. Rev. Lett.*, **100**: 158104 (2008). http://dx.doi.org/10.1103/PhysRevLett.100.158104

17. A. Imparato, F. Sbrana, M. Vassalli, Reconstructing the free energy landscape of a polyprotein by single-molecule experiments, *Europhys. Lett*, **82**: 58006 (2008). http://dx.doi.org/10.1209/0295-5075/82/58006

18. S. Luccioli, A. Imparato, A. Torcini, Free energy landscape of mechanically unfolded model proteins: extended Jarzynski versus inherent structure reconstruction, *Phys. Rev. E*, **78**: 031907 (2008). http://dx.doi.org/10.1103/PhysRevE.78.031907

19. A. Imparato, P. Jop, A. Petrosyan, S. Ciliberto, Probability density functions of work and heat near the stochastic resonance of a colloidal particle, J. Stat. Mech. P10017 (2008). http://dx.doi.org/10.1088/1742-5468/2008/10/P10017

20. S. Mitternacht, S. Luccioli, A. Torcini, A. Imparato, A. Irbäck,Changing the mechanical unfolding pathway of FnIII10 by tuning the pulling strength, *Biophys. J.* **96**: 429, (2009). http://dx.doi.org/10.1016/j.bpj.2008.09.043

21. A. Imparato and L. Peliti, Work distribution in manipulated single biomolecules, *Phys. Biol.* **6**: 025011 (2009). Focus issue: Polymer physics of the cell. http://dx.doi.org/10.1088/1478-3975/6/2/025011

22. A. Imparato, V. Lecomte, F. Van Wijland, Equilibrium-like fluctuations in some boundary-driven open diffusive systems. *Phys. Rev. E* **80**: 011131 (2009). http://dx.doi.org/10.1103/PhysRevE.80.011131

23. A. Imparato, A. Pelizzola, M. Zamparo, Equilibrium properties and force-driven unfolding pathways of RNA molecules, *Phys. Rev. Lett.* **103**: 188102 (2009). http://dx.doi.org/10.1103/PhysRevLett.103.188102

24. Hans C. Fogedby, Alberto Imparato, Heat distribution function for motion in a general potential at low temperature, *J. Phys. A: Math. Theor.* **42**: 475004 (2009). http://dx.doi.org/10.1088/1751-8113/42/47/475004

25. S. Luccioli, A. Imparato, S. Mitternacht, A. Irbäck, A. Torcini, Unfolding times for proteins in a force clamp, *Phy. Rev E* **81**: 010902R (2010). http://dx.doi.org/10.1103/PhysRevE.81.010902

26. C. Barbetta, A. Imparato, J.-B. Fournier, On the surface tension of fluctuating quasi-spherical vesicles, *Eur. Phys. J. E* **31**: 333 (2010). http://dx.doi.org/10.1140/epje/i2010-10579-1

27. M. Caraglio, A. Imparato, A. Pelizzola, Pathways of mechanical unfolding of $FnIII_{10}$: low force intermediates, *J. Chem. Phys.* **133**: 065101 (2010). http://dx.doi.org/10.1063/1.3464476

28. G. Pesce, G. Volpe, A. Imparato, G. Rusciano, A. Sasso, Influence of rotational force fields on the determination of the work done on a driven Brownian particle, *J. Opt.* **13**: 044006 (2011). http://dx.doi.org/10.1088/2040-8978/13/4/044006

29. H. C. Fogedby, A. Imparato, A bound particle coupled to two thermostats, *J. Stat. Mech.* P05015 (2011). http://dx.doi.org/10.1088/1742-5468/2011/05/P05015

30. S. Luccioli, A. Imparato, S. Lepri, F. Piazza, A. Torcini, Discrete Breathers in a Realistic Coarse-Grained Model of Proteins, *Phys. Biol.* **8**: 046008 (2011). http://dx.doi.org/10.1088/1478-3975/8/4/046008

31. M. Caraglio, A. Imparato, A. Pelizzola, Direction dependent mechanical unfolding and Green Fluorescent Protein as a force sensor, *Phys. Rev. E* **84**: 021918 (2011). http://dx.doi.org/10.1103/PhysRevE.84.021918

32. F. Macchi, S.V. Hoffman, M. Carlsen, B. Vad, A. Imparato, C. Rischel, D.E. Otzen, Mechanical stress affects glucagon fibrillation kinetics and fibril structure, *Langmuir* **27**: 12539 (2011). http://dx.doi.org/10.1021/la202125c

33. M. V. Kristensen, P. Ahrendt, T. B. Lindballe, O. H. A. Nielsen, A. P. Kylling, H. Karstoft, A. Imparato, L. Hosta-Rigau, B. Stadler, H. Stapelfeldt, S. R. Keiding, Motion analysis of optically trapped particles and cells using 2D Fourier analysis, *Opt. Exp.* **20**:1954 (2012). http://dx.doi.org/10.1364/OE.20.001953

34. H. C. Fogedby, A. Imparato, Heat flow in chains driven by thermal noise, *J. Stat. Mech.* P04005 (2012). http://dx.doi.org/10.1088/1742-5468/2012/04/P04005

35. N. Golubeva, A. Imparato, L. Peliti, Efficiency of molecular machines with continuous phase space, *EPL* **97**: 60005 (2012). http://dx.doi.org/10.1209/0295-5075/97/60005

36. P. O. Heidarsson, I. Valpapuram, C. Camilloni, A. Imparato, G. Tiana, F. M. Poulsen, B. B Kragelund, and C. Cecconi, A highly compliant protein native state with a spontaneous-like mechanical unfolding pathway, *J. Am. Chem. Soc.*, **134**: 17068 (2012). http://dx.doi.org/10.1021/ja305862m

37. N. Golubeva, A. Imparato, Efficiency at maximum power of interacting molecular machines, *Phys. Rev. Lett.*, **109**: 190602 (2012) http://dx.doi.org/10.1103/PhysRevLett.109.190602

38. S. Ciliberto, A. Imparato, A. Naert, M. Tanase, Heat flux and entropy produced by thermal fluctuations, *Phys. Rev. Lett.*, **110**: 180601 (2013). http://dx.doi.org/10.1103/PhysRevLett.110.180601

39. K. Mikkelsen, A. Imparato, A. Torcini, Emergence of slow collective oscillations in neural networks with spike timing dependent plasticity, *Phys. Rev. Lett.*, **110**: 208101 (2013). http://dx.doi.org/10.1103/PhysRevLett.110.208101

40. N. Golubeva, A. Imparato, Maximum power operation of interacting molecular motors, *Phys. Rev. E*, **88**: 012114 (2013). http://dx.doi.org/10.1103/PhysRevE.88.012114

41. P. O. Heidarsson, M. R. Otazo, L. Bellucci, A. Mossa, A. Imparato, E. Paci, S. Corni, R. Di Felice, B. B. Kragelund, C. Cecconi, Single-molecule folding mechanism of an EF-hand neuronal calcium sensor, *Structure*, **21**: 1812 (2013). http://dx.doi.org/10.1016/j.str.2013.07.022

42. N. Golubeva, A. Imparato, M. Esposito, Entropy-generated power and its efficiency, *Phys. Rev. E*, **88**: 042115 (2013). http://dx.doi.org/10.1103/PhysRevE.88.042115

43. S. Ciliberto, A. Imparato, A. Naert, M. Tanase, Statistical properties of the energy exchanged between two heat baths coupled by thermal fluctuations, *J. Stat. Mech.* P12014 (2013). http://dx.doi.org/10.1088/1742-5468/2013/12/P12014

44. G. B. Cuetara, M. Esposito, A. Imparato, Exact fluctuation theorem without ensemble quantities, *Phys. Rev. E*, **89**: 052119 (2014). http://dx.doi.org/10.1103/PhysRevE.89.052119

45. K. Mikkelsen, A. Imparato, A. Torcini, Sisyphus Effect in Pulse Coupled Excitatory Neural Networks with Spike-Timing Dependent Plasticity, *Phys. Rev. E*, **89**: 062701 (2014). http://dx.doi.org/10.1103/PhysRevE.89.062701

46. N. Golubeva, A. Imparato, Efficiency at maximum power of motor traffic on networks, *Phys. Rev. E*, **89**: 062118 (2014). http://dx.doi.org/10.1103/PhysRevE.89.062118

47. H. C. Fogedby, A. Imparato, Heat fluctuations and fluctuation theorems in the case of multiple reservoirs, *J. Stat. Mech.* P11011 (2014). http://dx.doi.org/10.1088/1742-5468/2014/11/P11011

48. M. Caraglio, A. Imparato, Energy Transfer in molecular devices, *Phys. Rev. E*, **90**: 062712 (2014). http://dx.doi.org/10.1103/PhysRevE.90.062712

49. A. Xuereb, A. Imparato, A. Dantan, Heat transport in harmonic oscillator systems with correlated baths: Application to optomechanical arrays, *New J. of Phys.*, **17**: 055013 (2015), http://dx.doi.org/doi:10.1088/1367-2630/17/5/055013.

50. F. Nicacio, A. Ferraro, A. Imparato, M. Paternostro, F. L. Semião, Thermal transport in out-of-equilibrium quantum harmonic chains, *Phys. Rev. E*, **91**: 042116 (2015), http://dx.doi.org/10.1103/PhysRevE.91.042116.

51. N. Villadsen, D. Ø. Andreasen, J. Hagelskjær, Jan Thøgersen, A. Imparato, and S. Rud Keiding, Pushing the limit: investigation of hydrodynamic forces on a trapped particle kicked by a laser pulse, *Optics Express*, **23**: 13141–13152 (2015), http://dx.doi.org/doi:10.1364/OE.23.013141.

52. A. Imparato, Stochastic thermodynamics in many-particle systems, *New J. of Phys.*, **17** : 125004 (2015), http://dx.doi.org/10.1088/1367-2630/17/12/125004.

53. A. Bérut , A. Imparato, A. Petrosyan , S. Ciliberto, Stationary and transient Fluctuation Theorems for effective heat flux between hydrodynamically coupled particles in optical traps, *Phys. Rev. Lett.*, **116**: 068301 (2016), http://dx.doi.org/10.1103/PhysRevLett.116.068301.

54. A. Bérut , A. Imparato, A. Petrosyan , S. Ciliberto, The role of coupling on the statistical properties of the energy fluxes between stochastic systems at different temperatures, *J. Stat. Mech.* 054002 (2016), http://dx.doi.org/doi:10.1088/1742-5468/2016/05/054002.

55. A. Bérut , A. Imparato, A. Petrosyan , S. Ciliberto, Theoretical description of effective heat transfer between two viscously coupled beads, *Phys. Rev. E*, **94** 052148 (2016), http://dx.doi.org/doi:10.1103/PhysRevE.94.052148.

56. A. Argun, A.-R. Moradi, E. Pinçe, G. Baris Bagci, A. Imparato, G. Volpe, Non-Boltzmann stationary distributions and nonequilibrium relations in active baths, *Phys. Rev. E*, **94** 062150 (2016), http://dx.doi.org/doi:10.1103/PhysRevE.94.062150.

57. S. Olmi, D. Angulo-Garcia, A. Imparato, A. Torcini, Exact firing time statistics of neurons driven by discrete inhibitory noise, *Sci. Rep.*, **7** 1577 (2017), http://dx.doi.org/doi:10.1038/s41598-017-01658-8

58. H. C. Fogedby, A. Imparato, A minimal model of an autonomous thermal motor, *EPL* **119**: 50007 (2017), http://dx.doi.org/doi:10.1209/0295-5075/119/50007.

59. H. C. Fogedby, A. Imparato, Autonomous quantum rotator, *EPL* **122**: 10006 (2018), http://dx.doi.org/doi:10.1209/0295-5075/122/10006

60. M. Suñé, A. Imparato, Efficiency fluctuations in steady-state machines, *J. Phys. A: Math. Theor.* **52** 045003 (2019), http://dx.doi.org/doi:10.1088/1751-8121/aaf2f8

61. K. V. Hovhannisyan and A. Imparato, Quantum current in dissipative systems, *New J. of Phys.* **21**: 052001 (2019), http://dx.doi.org/doi:10.1088/1367-2630/ab1731

62. M. Suñé, A. Imparato, Out-of-equilibrium clock model at the verge of criticality, *Phys. Rev. Lett.* **123**: 070601 (2019), http://dx.doi.org/doi:10.1103/PhysRevLett.123.070601

63. M. Drewsen, A. Imparato, Quantum duets working as autonomous thermal motors, *Phys. Rev. E*, **100** 042138 (2019), http://dx.doi.org/doi:10.1103/PhysRevE.100.042138

64. K. V. Hovhannisyan, F. Barra, A. Imparato, Charging assisted by thermalization, *Phys. Rev. Research*, **2**: 033413 (2020), http://dx.doi.org/10.1103/PhysRevResearch.2.033413

65. A. Imparato, Out-of-equilibrium Frenkel-Kontorova model, *J. Stat. Mech.* 013214 (2021), http://dx.doi.org/10.1088/1742-5468/abda2a

66. A. Hewgill, G. De Chiara, A. Imparato, Quantum thermodynamically consistent local master equations, *Phys. Rev. Research*, **3**: 013165 (2021), http://dx.doi.org/10.1103/PhysRevResearch.3.013165

67. F. Barra, K. V. Hovhannisyan, A. Imparato, Quantum batteries at the verge of a phase transition, *New J. of Phys.* **24**: 015003 (2022), http://dx.doi.org/doi:10.1088/1367-2630/ac43ed

68. G. De Chiara, A. Imparato, Quantum fluctuation theorem for dissipative processes, *Phys. Rev. Research*, **4**: 023230 (2022), http://dx.doi.org/10.1103/PhysRevResearch.4.023230

69. R. Puebla, A. Imparato, A. Belenchia, M. Paternostro, Open Quantum Rotors: Connecting Correlations and Physical Currents, *Phys. Rev. Research* **4**: 043066 (2022), http://dx.doi.org/10.1103/PhysRevResearch.4.043066.

70. V. S. Dotsenko, P. Viot, A. Imparato, G. Oshanin, Cooperative dynamics in two-component out-of-equilibrium systems: Molecular "spinning tops", *J. Stat. Mech.*: 123211 (2022), http://dx.doi.org/10.1088/1742-5468/aca900.

71. V. S. Dotsenko, P. Viot, A. Imparato, G. Oshanin, Out-of-equilibrium dynamics of two interacting optically-trapped particles, *SciPost Phys. Core* **6**: 056 (2023) http://dx.doi.org/10.21468/SciPostPhysCore.6.3.056.

Pre-prints

1. P. Sgroi, G. Zicari, A. Imparato, M. Paternostro, Efficient excitation-transfer across fully connected networks via local-energy optimization, arXiv:2211.09079, `http://dx.doi.org/10.48550/arXiv.2211.09079`.

2. K. V. Hovhannisyan, A. Imparato, Energy conservation and fluctuation theorem are incompatible for quantum work, arXiv:2104.09364, `http://dx.doi.org/10.48550/arXiv.2104.09364`.

3. A. Imparato, N. Chancellor, G. De Chiara, A thermodynamic approach to optimization in complex quantum systems, arXiv:2305.06008, `http://dx.doi.org/10.48550/arXiv.2305.06008`.

4. A. Purkayastha, A. Imparato Interaction induced phase transition in quantum many-body detection probability, arXiv:2306.01586, `http://dx.doi.org/10.48550/arXiv.2306.01586`.

5. P. Viot, A. Argun, G. Volpe, A. Imparato, L. Rondoni, G. Oshanin, Destructive effect of fluctuations on the performance of a Brownian gyrator, arXiv:2307.05248, `http://dx.doi.org/10.48550/arXiv.2307.05248`

Peer-reviewed conference proceedings

1. A. Imparato, M. Giordano, M. Mango Furnari, Parallelization and Vectorization Effects on a Code Simulating a Vitreous Lattice Model with Costrained Dynamics, in: *ISHPC99, High Performance Computing*, Policronopoulos, Joe, Fukuda, Tomita (eds.), Springer-Verlag Lecture Notes in Computer Science, 1615 (Berlin, Heidelberg: Springer-Verlag 1999).

2. C.R. Calidonna, C. Di Napoli, A. Imparato, M. Mango Furnari, Experimenting with Cellular Automata Programming, in: *Advances in Computational Mechanics with High Performance Computing*, B.H.V. Topping (ed.), (Civil-Compress Press, 1999)

3. A. Imparato, L. Peliti, Work and heat probability distributions in out-of-equilibrium systems, *C. R. Physique.* **8**: 556 (2007). Contribution to Proceedings of the International conference "Work, Dissipation, and Fluctuations in Nonequilibrium Physics", Brussels, March 2006.

4. A. Imparato, S. Luccioli, A. Torcini, Out-of-equilibrium versus dynamical and thermodynamical transitions for a model protein. Proceedings of the "YKIS 2009 : Frontiers in Nonequilibrium Physics" conference in Kyoto, August 2009. *Prog. Theo. Phys. Suppl.* **184**: 339 (2010).

5. V. Lecomte, A. Imparato, F. Van Wijland, Current fluctuations in systems with diffusive dynamics, in and out of equilibrium. Proceedings of the "YKIS 2009 : Frontiers in Nonequilibrium Physics" conference in Kyoto, August 2009. *Prog. Theo. Phys. Suppl.* **184**: 276 (2010).

Science popularization

1. A. Imparato, Baglæns varmestrømning (Reversed heat current), Aktuel Naturvidenskab, **1** March 2016.