

CURRICULUM VITAE

Enrique Abad



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Personal information

Nationality: Spanish.

Date of birth: 3/11/1972.

Place of birth: Alicante (Spain).

Education

University of Heidelberg (Germany), M. Sc. (Physics), 1997

Université Libre de Bruxelles (Belgium), Ph. D. (Statistical Physics), 2003
(thesis supervisor: Prof. G. Nicolis)

Fellowship/research appointments

Wiener-Anspach Research Fellow, 2007-2008

University of Oxford (with Prof. M. Sansom)

CESCA Postdoctoral Fellow, 2003-2004

University of Barcelona (with Prof. F. Sagués)

NSF research grant, 1999-2000

State University of New York at Albany (with Prof. H.L. Frisch).

TMR network grant of the HMC programme (European Commission), 1998-1999

Université Libre de Bruxelles (with Prof. G. Nicolis)

Academic appointments

Associate professor at the Department of Applied Physics, 2011-present
Universidad de Extremadura

Permanent position at the Department of Applied Physics, 2010-2011
Universidad de Extremadura

Member of the research staff at the Department of Physics, 2008-2010
Universidad de Extremadura

Research assistant at the Center for Nonlinear Phenomena and Complex Systems,
2001-2007
Université Libre de Bruxelles

Brief description of main lines of research

I am well acquainted with the methodology of non-equilibrium statistical physics and the theory of stochastic processes. In this context, my main tools include Langevin equations, classical and fractional Fokker-Planck equations, master equations, ordinary and partial difference equations, Monte Carlo simulations, and variational techniques. I have made use of these methods in the past to study a variety of problems of interest in chemistry, physics, biology and social sciences. Among the topics studied are diffusion and reaction-diffusion systems, ratchet models for motor proteins, soft matter systems, random walks in regular, fractal and disordered media, pores in biological membranes, epidemic models, kinetic spin models and diverse problems in game theory. I obtained my degree in physics at the University of Heidelberg with a master thesis on a stochastic transport model inspired by the motion of motor proteins. I then moved to Belgium to do my PhD in the Department of Physics of the Free University of Brussels (ULB) under the supervision of Prof. G. Nicolis (thesis title: "Aspects of nonlinear dynamics in low-dimensional lattices: a multilevel approach"). Currently, my work in the Statistical Physics group at the University of Extremadura places special emphasis on problems related to non-Markovian transport giving rise to anomalous diffusion, both in the presence and in the absence of chemical reactions. I have also worked on stochastic models of ion channel transport at the Department of Biochemistry of the University of Oxford (prof. Sansom's group) and remain active in the subject till present.

List of peer-reviewed articles

47. "Iberian oak decline caused by *Phytophthora cinnamomi*: a spatiotemporal analysis incorporating the effect of host heterogeneities at landscape scale"

E. Cardillo, E. Abad, and S. Meyer
Forest Pathology **51**, e12667 (2021).

46. "Saturation excess overland flow accelerates the spread of a generalist soil-borne pathogen"

J. Wilkening, E. Cardillo, E. Abad, and S. Thompson
J. Hydrol. **593**, 125821 (2021).

45. "First-encounter time of two diffusing particles under confinement"

F. Le Vot, S.B. Yuste, E. Abad, and D.S. Grebenkov

Phys. Rev. E **102**, 032118 (2020).

44. “Reaction-diffusion and reaction-subdiffusion equations on arbitrarily evolving domains”

E. Abad, C.N. Angstmann, B.I. Henry, A.V. MacGann, F. Le Vot, and S.B. Yuste
Phys. Rev. E **102**, 032111 (2020).

43. “Continuous time random walk in a velocity field: role of domain growth, Galilei-invariant advection-diffusion, and kinetics of particle mixing”

F. Le Vot, E. Abad, R. Metzler, and S.B. Yuste
New. J. Phys. **22**, 073048 (2020).

42. “Standard and fractional Ornstein-Uhlenbeck process on a growing domain”

F. Le Vot, S.B. Yuste, and E. Abad
Phys. Rev. E **100**, 012142 (2019).

41. “First-passage properties of mortal random walks: Ballistic behavior, effective reduction of dimensionality, and scaling functions for hierarchical graphs”

V. Balakrishnan, E. Abad, T. Abil, and J. J. Kozak
Phys. Rev. E. **99**, 062110 (2019).

40. “Encounter-controlled coalescence and annihilation on a one-dimensional growing domain”

F. Le Vot, C. Escudero, E. Abad, and S. B. Yuste
Phys. Rev. E **98**, 032137 (2018).

39. “Random walks on lattices. Influence of competing reaction centers on diffusion controlled processes”

E. Abad, T. Abil, A. Santos, and J. J. Kozak
Physica A **511**, 336 (2018).

38. “Topographic effects on dispersal patterns of *Phytophthora cinnamomi* at a standscale in a Spanish heathland”

E. Cardillo, A. Acedo, and E. Abad
PLoS ONE **13**, e0195060 (2018).

37. “Continuous-time random-walk model for anomalous diffusion in expanding media”

F. Le Vot, E. Abad, and S.B. Yuste
Phys. Rev. E **96**, 032117 (2017).

36. “Molecular Dynamics Simulations of Fullerene Diffusion in Polymer Melts”

I. Volgin, S.V. Larin, E. Abad, and S.V. Lyulin
Macromolecules **50**, 2207 (2017).

35. “Diffusion in an expanding medium: Fokker-Planck equation, Green’s function and first-passage properties”

S.B. Yuste, E. Abad, and C. Escudero
Phys. Rev. E **94**, 032118 (2016).

34. “Anomalous diffusion and dynamics of fluorescence recovery after photobleaching in the random comb model”

S. B. Yuste, E. Abad, and A. Baumgaertner

- Phys. Rev. E **94**, 012118 (2016).
33. “Optimal search strategies of space-time coupled random walkers with finite lifetimes”
D. Campos, E. Abad, V. Méndez, S. B. Yuste, and K. Lindenberg
Phys. Rev. E **91**, 052115 (2015).
32. “Competing reaction processes on a lattice as a paradigm for catalyst deactivation”
E. Abad and J.J. Kozak
Phys. Rev. E **91**, 022106 (2015).
31. “A reaction-subdiffusion model of fluorescence recovery after photobleaching (FRAP)”
S.B. Yuste, E. Abad, and K. Lindenberg
J. Stat. Mech. P11014 (2014).
30. “Lattice statistical theory of random walks on a fractal-like geometry”
J. J. Kozak, R. Garza-López, and E. Abad
Phys. Rev. E **89**, 032147 (2014).
29. “Evanescence Continuous Time Random Walks”
E. Abad, S.B. Yuste, and K. Lindenberg
Phys. Rev. E **88**, 062110 (2013).
28. “Energetics of Multi-Ion Conduction Pathways in Potassium Ion Channels”
P. W. Fowler, E. Abad, O. Beckstein, and M.S.P. Sansom
J. Chem. Theory Comput. **9**, 5176 (2013).
27. “Detailed examination of a single conduction event in a potassium channel”
P. W. Fowler, O. Beckstein, E. Abad, and M.S.P. Sansom
J. Phys. Chem. Lett. **4**, 3104 (2013).
26. “Exploration and trapping of mortal random walkers”
S.B. Yuste, E. Abad, and K. Lindenberg
Phys. Rev. Lett. **110**, 220603 (2013).
(Editor’s suggestion).
25. “Elucidating the role of subdiffusion and evanescence in the target problem: some recent results”
E. Abad, S.B. Yuste, and K. Lindenberg
Mathematical Modelling of Natural Phenomena **8**, 100 (2013).
24. “Survival probability of an immobile target in a sea of evanescent diffusive or subdiffusive traps: a fractional equation approach”
E. Abad, S.B. Yuste, and K. Lindenberg
Phys. Rev. E **86**, 061120 (2012).
23. “On a novel iterative method to compute polynomial approximations to Bessel functions of the first kind and its connection to the solution of fractional diffusion/diffusion-wave problems”
S.B. Yuste and E. Abad
J. Phys. A: Math. Theor. **44**, 075203 (2011).
22. “Reaction-subdiffusion model of morphogen gradient formation”

S.B. Yuste, E. Abad, and K. Lindenberg
Phys. Rev. E **82**, 061123 (2010).

21. “Synchronous vs. asynchronous diffusion-reaction processes involving geminate radical pairs”

K.G. Urie, J.J. Kozak, and E. Abad
Physica A **389**, 4061 (2010).

20. “Perturbation theory for the one-dimensional reaction-diffusion equation with a quadratic nonlinearity of coalescence/annihilation type”

E. Abad and H.L. Frisch
Phys. Scr. **81**, 055802 (2010).

19. “Reaction-subdiffusion and reaction-superdiffusion equations for evanescent particles performing continuous time random walks”

E. Abad, S.B. Yuste, and K. Lindenberg
Phys. Rev. E **81**, 031115 (2010).

18. “Divergent series and memory of the initial condition in the long-time solution of some anomalous diffusion problems”

S. B. Yuste, R. Borrego, and E. Abad
Phys. Rev. E **81**, 021105 (2010).

17. “Survival probability of a subdiffusive particle in a d-dimensional sea of mobile traps”

R. Borrego, E. Abad, and S.B. Yuste
Phys. Rev. E **80**, 061121 (2009).

16. “Narrow escape time to a structured target located on the boundary of a microdomain”

J. Reingruber, E. Abad, and D. Holcman
J. Chem. Phys. **130**, 094909 (2009).

15. “On a novel rate theory for transport in narrow ion channels and its application to the study of flux optimization via geometric effects”

E. Abad, J. Reingruber, and M.S.P. Sansom
J. Chem. Phys. **130**, 085101 (2009).

14. “Efficiency of trapping processes in regular and disordered networks”

A. García Cantú and E. Abad
Phys. Rev. E **77**, 031121 (2008).

13. “Fluctuation Assisted Diffusion through Ion Channels”

E. Abad and J. J. Kozak
Physica A **380**, 172 (2007).

12. “Inverted regions induced by geometric constraints on a classical-encounter controlled binary reaction”

E. Abad and J. J. Kozak
Physica A **370**, 501 (2006).

11. “A first-passage method for the study of the efficiency of a two-channel reaction on a lattice”

E. Abad

Phys. Rev. E **72**, 021107 (2005).

10. “Collective reorientation in isolated Smectic-C Langmuir monolayer droplets induced by line tension anisotropy”

J. Claret, R. Reigada, R. Albalat, J. Crusats, E. Abad, J. Ignés-Mullol, and F. Sagués
J. Phys. Chem. B **108**, 17274 (2004).

9. “Orientational structures in confined smectic-C domains in Langmuir monolayers”

R. Reigada, E. Abad, J. Crusats, J. Claret, J. Ignés-Mullol, and F. Sagués
J. Chem. Phys. **121**, 9066 (2004).

8. “On-lattice coalescence and annihilation of immobile reactants in loopless lattices and beyond”

E. Abad
Phys. Rev. E **70**, 031110 (2004).

7. “Synchronous vs. asynchronous dynamics of diffusion-controlled reactions”

E. Abad, G. Nicolis, J.L. Bentz, and J. J. Kozak
Physica A **326**, 69 (2003).

6. “Efficiency of encounter-controlled reaction between diffusing reactants in a finite lattice: topology and boundary effects”

J.L. Bentz, J.J. Kozak, E. Abad, and G. Nicolis
Physica A **326**, 55 (2003).

5. “Reactive dynamics on fractal sets: anomalous fluctuations and memory effects”

E. Abad, A. Provata, and G. Nicolis
Europhys. Lett. **61**, 586 (2003).

4. “Lattice kinetics of diffusion-limited coalescence and annihilation with sources”

E. Abad, T. Masser, and D. ben-Avraham
J. Phys. A **35**, 1483 (2002).

3. “Nonlinear reactive systems on a lattice viewed as Boolean dynamical systems”

E. Abad, P. Grosfils, and G. Nicolis
Phys. Rev. E **63**, 041102 (2001).

2. “One-Dimensional Lattice Dynamics of the Diffusion Limited Reaction $A+A \rightarrow A+S$: Transient Behavior”

E. Abad, H.L. Frisch, and G. Nicolis
J. Stat. Phys. **99**, 1397 (2000).

1. “Brownian motion in fluctuating periodic potentials”

E. Abad and A. Mielke
Annalen der Physik **7**, 9 (1998).

List of book chapters

6. “First-passage Processes and Encounter-controlled Reactions in growing domains”, in “Chemical Kinetics Beyond the Textbook”

E. Abad, C. Escudero, F. Le Vot, and S. B. Yuste

K. Lindenberg, R. Metzler, and G. Oshanin (Eds.) (World Scientific, 2019).

5. “Reaction-diffusion kinetics in growing domains”, in “Integrated Population Biology and Modeling”

C. Escudero, S. B. Yuste, E. Abad, and F. Le Vot

A.S.R. Srinivasa Rao and C.R. Rao (Eds.) (Elsevier, 2018)

4. “Fractional Reaction-Transport Equations Arising from Evanescent Continuous Time Random Walks”, in “Fractional Calculus: Theory”

E. Abad, S. B. Yuste, and K. Lindenberg

R.A.Z. Daou and X. Moreau (Eds.) (Nova Science Publishers, 2014).

3. “Arrival Statistics and Exploration Properties of Mortal Walkers”, in “First Passage Phenomena and Their Applications”

S. B. Yuste, E. Abad, and K. Lindenberg

R. Metzler, G. Oshanin, and S. Metzler (Eds.) (World Scientific, 2014).

2. “Reactions in Subdiffusive Media and Associated Fractional Equations”, in "Fractional Dynamics. Recent Advances"

S. B. Yuste, E. Abad, and K. Lindenberg

J. Klafter, S. C. Lim, and R. Metzler (Eds.) (World Scientific, 2011).

1. “Collective reorientation in smectic-C Langmuir monolayers”

E. Abad, R. Reigada, J. Claret, R. Albalat, J. Crusats, J. Ignés-Mullol, and F. Sagués
HPC-Europa report 2004, 409-415, CINECA.

Refereeing

“Physical Review Letters”, 2017-present

“New Journal of Physics”, 2011-present

“Physical Review E”, 2009-present

“Journal of Physics A: Mathematical and Theoretical”, “Journal of Physics: Condensed Matter” (IoP publishing), 2004-present.

“Mathematics in Computer Science”, 2007-present

“Reports on Progress in Physics” (IoP publishing), 2007-present