# Eduardo Enrique López Atencio

## Position and contact Information

Assistant Professor
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Languages: English, Spanish, some French
**Oxford College affiliation:** Visiting Research Fellow, Green Templeton College, University of Oxford

## Academic Qualifications

- **Graduate Studies:** May 2005. PhD in Theoretical Physics, Boston University, Boston, Massachusetts, United States.
- **Graduate Studies:** January 2000. Master of Arts in Physics, Boston University, Boston, Massachusetts, United States.
- **Undergraduate Studies:** December, 1995. Licenciado en Física, Universidad del Zulia, Maracaibo, Venezuela. Graduated Summa Cum Laude (first ever awarded to a Physics graduate at this institution).

## Positions Held

### Research

- Assistant Professor, Computational and Data Sciences, George Mason University. 08/2016 to present.
- Visiting Research Fellow, Green Templeton College, University of Oxford, 8/16 to present.
- Senior Research Fellow in Complexity Science, CABDyN Complexity Centre, and James Martin Fellow, Oxford Martin Programme on Complexity, University of Oxford. 8/12 to 7/16.
- Research Fellow, Green Templeton College, University of Oxford. 8/08 to 7/16.
- Research Fellow in Complexity Science, CABDyN Complexity Centre, University of Oxford. 4/08 to 8/12.
- Postdoctoral Fellow, Theoretical Division, Los Alamos National Laboratory. 4/05 to 4/08.
- Research Assistant, Center for Polymer Studies, Boston University. 9/98 to 4/05
- Interim Professor, University of Zulia 1/96-8/97
- Visiting Researcher (Colaborador visitante), Computational Physics Laboratory, Instituto Venezolano de Investigaciones Científicas (IVIC) [Venezuelan Institute for Scientific Research]. 11/95-5/97
- Research Assistant, Computational Physics Laboratory. IVIC 9/94-11/95

## Teaching

Main teaching positions in bold.

- Lecturer, Pembroke College, Oxford, Electromagnetism, Quantum Mechanics, Statistical and Thermal Physics, Solid State Physics, Academic years 2014 to 2016.
- Tutor for MBA program, Saïd Business School, GOTO program on Demographics and Big Data, Academic year, 2013-2014.
- Lecturer, The Queen's College, Oxford, Optics, Electromagnetism, and Condensed Matter Theory, Academic year 2009-2010
- Lab Demonstrator. University of Oxford, Department of Physics, Oxford, Academic year 2009-2010. First year mechanics.
- Faculty member. Boston University Academy (Secondary School level Math and Physics), Boston, MA (USA), Academic year 2000-2001
- Summer Faculty, Boston University, Department of Physics, Boston , MA (USA), Elementary Electromagnetism, Optics and Quantum Mechanics, Summer 2000.
- Lead mentor, Reserve Officers' Training Corps, US Navy unit, Boston, MA (USA), Calculus, Calculus based Mechanics and Electromagnetism, from Spring 1999 to 2003
- Teaching Fellow. Boston University, Department of Physics, Boston, MA (USA), Theory part: Calculus based Mechanics, Electromagnetism, and Quantum Mechanics, Lab part: Mechanics, Electromagnetism, Optics, Academic years 1997 to 2000 and 2001 to 2003. Best teaching fellow award 2002-2003
- Faculty member. Universidad del Zulia, Departamento de Física, Vector Calculus Electromagnetic Theory, Maracaibo, Venezuela, 4/96 to 12/02
- Interim Professor. University of Zulia, Department of Physics, Elementary Mechanics and Thermodynamics, Maracaibo, Venezuela 1/96-4/96
- Interim Teacher. Academia Merici, junior and senior level High School Physics, Caracas, Venezuela, 3/95-7/95.
- Teaching Assistant. University of Zulia, Department of Physics, Calculus based Mechanics, Maracaibo, Venezuela, 7/93-9/94

## Service

- Senior member of the Natural Sciences Society at Green Templeton college, 2013 to present.
- "CABDyN Complexity Centre" Series on Complexity, co-convenor, 2010 to 2013.
- Representative at Green Templeton College governing body for research fellows, 1/2010 to 3/2012.
- Pastoral college adviser, Green Templeton College, 10/2009 to present.

## Awards

- First ever Summa Cum Laude graduate of the Physics Department at University of Zulia.
- Teaching Fellow of the year award, voted by the Faculty of the Department of Physics of Boston University, for excellence in teaching for the academic year 2002-2003.
- Award from the Experimental College of Science, for achieving the highest GPA in the Physics program in Physics in 1994.
- MARAVEN Award to Academic Excellence, for attaining the highest GPA in 1993 in the Experimental College of Science. MARAVEN was a subsidiary of Venezuelan oil company PDVSA.
- Simón Rodríguez Award, for attaining the highest GPA in the Experimental College of Science. Two times: 1990 and 1993
- Honor Roll of the University of Zulia, for attaining one of the 10 highest GPA at Experimental College of Science. Obtained from 1990 to 1993.
- American Physical Society conference attendance award, March meeting 2005, award $1000.

## Publications

Articles in bold among selected publications

1. "Frictional unemployment on labor flow networks," R. L. Axtell, O. A. Guerrero, and E. López, Journal of Economic Behavior & Organization 160, 184-201 (2019).
2. "Personality traits and ego-network dynamics," S. Centellegher, E. Lpez, J. Saramki, B. Lepri (2017), PLoS ONE **12(3)**: e0173110. doi:10.1371/journal.pone.0173110.
3. "Understanding Unemployment in the Era of Big Data: Policy Informed by Data-Driven Theory," O. A. Guerrero and E. López, Policy & Internet 9 (1), 28-54 (2017).
4. "Channel-Specific Daily Patterns in Mobile Phone Communication", T. Aledavood, E. López, S. G. B. Roberts, F. Reed-Tsochas, E. Moro, R. I. M. Dunbar, J. Saramäki, ECCS2014 proceedings in Lecture Notes in Computer Science (2016).
5. "Firm-to-firm labor flows and the aggregate matching function: A network-based test using employer −employee matched records," O. A. Guerrero and E. López, Economic Letters **136**, 9, (2015).
6. "The network picture of labor flows", E. López, O. A. Guerrero, R. L. Axtell, *arXiv:1507.00248* & *http://ssrn.com/abstract=2631542* (2015).
7. "Daily Rhythms in Mobile Telephone Communication," T. Aledavood, E. Lpez, S. G. B. Roberts, F. Reed-Tsochas, E. Moro, R. I. M. Dunbar,and J. Saramäki (2015) PLoS ONE 10(9): e0138098. doi: 10.1371/journal.pone.0138098.
8. "The persistence of social signatures in human communication", J. Saramäki, E. A. Leicht, E. López, S. G. B. Roberts, F. Reed-Tsochas, R. I. M. Dunbar, Proc. Nat. Acad. Sci. USA, **111** (3) 942 (2014).
9. "Percolation in Multiplex Networks with Overlap" D. Cellai, E. López, J. Zhou, J.P. Gleeson, G. Bianconi, Phys. Rev. E **88**, 052811 (2013).
10. "The distribution of the number of node neighbors in random hypergraphs" E. López, J. Phys. A: Math. Theor. **46**, 305003 (2013).

11. "Weighted projected networks: mapping hypergraphs to networks" E. López, Phys. Rev. E **87**, 052813 (2013).

12. "Disorder induced Limited Path Percolation" E. López and L. A. Braunstein, Europhys. Lett. **97**, 66001 (2012).

13. "Advection, diffusion and delivery over a network" L. L. M. Heaton, E. López, P. K. Maini, M. D. Fricker, N. S. Jones, Phys. Rev. E **86**, 021905 (2012).

14. "Optimization of transport protocols with path-length constraints in complex networks" J. J. Ramasco, M. S. de La Lama, E. López, and S. Boettcher, Phys. Rev. E **82**, 036119 (2010)

15. "Growth-induced mass flows in fungal networks" L. Heaton, E. López, P. K. Maini, M. D. Fricker, and N. Jones, Proc. R. Soc. B **277**, 3265-3274 (2010).

16. "Effects of epidemic threshold definition on disease spread statistics", C. Lagorio, M. V. Migueles, L. A. Braunstein, E. López, and P. A. Macri, Physica A **338**, 755 (2009).

17. "Using relaxational dynamics to reduce network congestion", A. L. Pastore y Piontti, C. E. La Rocca, Z. Torozckai, L. A. Braunstein, P. A. Macri, and E. López, New J. Phys. **10**, 093007 (2008).

18. "Limited path percolation in complex networks", E. López, R. Parshani, R. Cohen, S. Carmi, and S. Havlin, Phys. Rev. Lett. **99** 188701 (2007).

19. "Optimal Paths and Minimal Spanning Trees in Random Weighted Networks". L. A. Braunstein, Z. Wu, Y. Chen, S. V. Buldyrev, S. Sreenivasan, T. Kalisky, R. Cohen, E. López, S. Havlin, and H. E. Stanley, invited review to the International Journal of Bifurcation and Chaos, **17**, 2215 (2007).

20. "Transport between multiple users in complex networks", S. Carmi, Z. Wu, E. López, S. Havlin, and H. E. Stanley, Europ. J. Phys. B **57**, 165 (2007).

21. "Topological Limits on Network Communications", S. Sreenivasan, R. Cohen, E. López, Z. Toroczkai, and H. E. Stanley, Phys. Rev. E **75**, 036105 (2007).

22. "Anomalous electrical and frictionless flow conductance in complex networks", E. López, S. Carmi, S. Havlin, S. V. Buldyrev, and H. E. Stanley, Physica D **224**, 69 (2006).

23. "Universal behavior of optimal paths in weighted networks with general disorder". Y. Chen, E. López, S. Havlin, and H. E. Stanley. Phys. Rev. Lett. **96**, 068702 (2006).

24. "Possible connection between the optimal path and flow in percolation clusters", E. López, S. V. Buldyrev, L. A. Braunstein, S. Havlin, and H. E. Stanley, Phys. Rev. E **72**, 056131 (2005).

25. "Current Flow in Random Resistor Networks: The role of Percolation in Weak and Strong Disorder" Z. Wu, E. López, L. A. Braunstein, S. V. Buldyrev, S. Havlin, and H. E. Stanley, Phys. Rev. E **71**, (R)045101 (2005).

26. "Anomalous Transport in Complex Networks". E. López, S. V. Buldyrev, S. Havlin, and H. E. Stanley, Phys. Rev. Lett. **94**, 248701 (2005).

27. "Universality of the optimal path in the strong disorder limit". S. V. Buldyrev, S. Havlin, E. López, and H. E. Stanley, Phys. Rev. E **70** (R)035102 (2004).

28. "Post-breakthrough Behavior in Flow through Porous Media". E. López, S. V. Buldyrev, N. V. Dokholyan, L. Goldmakher, S. Havlin, P. R. King, and H. E. Stanley, Phys. Rev. E **67**, 056314 (2003).

29. "Using percolation theory to predict oil field performance", P. R. King, S. V. Buldyrev, N. V. Dokholyan, S. Havlin, E. López, G. Paul, and H. E. Stanley, Phys. A **314**, 103 (2002).

30. "Uncertainty in oil production predicted by percolation theory", P. R. King, S. V. Buldyrev, N. V. Dokholyan, S. Havlin, E. López, G. Paul, and H. E. Stanley, Phys. A **306**, 376 (2002).

31. "Topological Defects with Long-Range Interactions". B. A. Mello, J. A. González, L. E. Guerrero, and E. López-Atencio, Phys. Lett. A **244**, 277 (1998).

32. "Long-Range Self-Affine Correlations in a Random Soliton Gas". L. E. Guerrero, E. López-Atencio, and J. A. González, Phys. Rev. E **55**, 7691 (1997).

## Book Chapters

1. S. Havlin, E. López, S. V. Buldyrev, and H. E. Stanley, "Anomalous Conductance and Diffusion in Complex Networks," 4.1-4.11 in *Diffusion Fundamentals Vol. 2*, eds. Jörg Kärger, Farida Grinberg, Paul Heitjan (Leipziger Universitätsverlag, Leipzig) (2005).

## Other Publications

1. "Physics of flow in random media". Eduardo López. Ph. D. Thesis, Boston University, 2005.

2. "Performing the Cavendish Experiment". Eduardo López, Jason St. John, and B. Lee Roberts. Lab guide for the Cavendish experiment at the Physics Department at Boston University.

3. "Transición al orden fractal en un sistema aleatorio tipo seno de Gordon" (*Transition to fractal order in a random sine-Gordon system*). Eduardo López. Undergraduate thesis, Universidad del Zulia, Maracaibo, Venezuela, 1995.

## Online Tool

Online visualization and simulation tool for the study workforce dynamics (*http://oguerr.com/laborsim/*).

## Supervision

1. Undergraduate research project supervision at University of Oxford:

   - Lewis Roberts, Department of Physics
     Degree: MPhys (Master of Physics)
     Project: "Uncovering Percolation in Random Networks"
     Currently: PhD candidate University of Bristol in Complex System
   - Edmund Barter. Department of Physics
     Degree: MPhys (Master of Physics)
     Project: "Users' behaviour analysis of online social networks"
     Currently: PhD candidate University of Bristol in Complex Systems
   - Christopher Chilton
     Degree: MPhys (Master of Physics)
     Project: "Limited Path Percolation in Cellular Automata Models of Vehicular Traffic"

- Tommy Khoo, Mathematics Institute
  Degree: MSc in Mathematical Foundations of Computer Science
  Project: "Information Theory and Multivariate Interactions"
  Currently: PhD candidate Dartmouth College in Mathematics
- Gregory Farquhar, Department of Physics
  Degree: MPhys (Master of Physics)
  Project: "The Origins of Scaling Relations for Urban Indicators"
  Currently: Finishing MPhys
- Freddie Green, Department of Physics
  Degree: MPhys (Master of Physics)
  Project: "The structure of Cities and their Scaling Laws"
  Currently: Finishing MPhys
- Daniel Burkhardt Cerigo, Department of Physics
  Degree: MPhysPhil (Master of Physics and Philosophy)
  Project: "Adaptive Percolation"
  Currently: Graduate Researcher at INET Oxford.

2. Doctoral supervision

- Zhenhua Wu, Boston University, Department of Physics
  Degree: PhD in Physics
  Article: "Current flow in random resistor networks: The role of percolation in weak and strong disorder", *Phys. Rev. E* **71** (4), 045101.
  Currently: Bioinformatics Scientist II at AVEO Oncology
- Yiping Chen, Boston University, Department of Physics
  Degree: PhD Physics
  Article: "Universal behavior of optimal paths in weighted networks with general disorder", *Phys. Rev. Lett.* **96** (6), 068702.
- Luke Heaton, University of Oxford, Doctoral Training Centre in Life Sciences Interface
  Degree: DPhil (Doctor of Philosophy) in Physics
  Articles: "Growth-induced mass flow in fungal networks", *Proc. Roy. Soc. B: Bio. Sci.* **277** (1698), 3265; "Advection, diffusion, and delivery over a network", *Phys. Rev. E* **86** (2), 021905.
  Currently: Postdoctoral Researcher Plant Sciences, University of Oxford

3. Postdoctoral supervision

- Jianguo Liu, University of Oxford, CABDyN Complexity Centre
  Working paper: Attention allocation in online environment
  Currently: Assistant Prof. University of Shanghai for Science and Technology

## Relevant Skills

- Continuous and discrete mathematical methods such as multivariate calculus, ordinary and partial differential equations, enumerative combinatorics, asymptotic methods, scaling theory.
- Probability, statistics, stochastic processes, branching processes.
- Statistical Physics methods such as ensemble theory, and maximum entropy models.
- Programming Languages and packages: C, Fortran, Python, Javascript, Mathematica programming, Matlab, R, NetLogo, dot graph language.

- Computational Tools: Multiple operating systems (Unix, Windows, Mac OS X), numerical and graph operation packages in python (scipy, networkx, igraph), graphviz and neato, Vernier LoggerPro teaching laboratory software.
- Expertise in Numerical Methods: Monte Carlo, Linear Algebra methods, Graph Theory algorithms (Dijkstra, Minimum Spanning Tree, etc.), non-linear algebraic equations methods (bisection, Newton-Raphson), Runge-Kutta method, integral and discrete transforms (wavelet, Fourier, Laplace, Karhunen-Loève), agent-based simulation methods, statistical methods.

## Workshop and Seminar series organization

- "Winter School in Networks". University of Warwick, January 5 to 8, 2011. Organizing committee and Lecturer.
- "Networks Constrained to Change". Green Templeton College, Oxford, March 21 to 23, 2011. Organizer.

## Grant writing and management activity

1. Principal co-investigator for the Social Sciences Division, University of Oxford incubator grant "Big data and development", funded for period 2015-2017, award 50000£.
2. TSB and EPSRC (UK) proposal "Self-organizing Adaptive Technology underlying Resilient Networks" (SATURN), funded 2009. Amount of award to University of Oxford: over 320000 £. Role in proposal: wrote University of Oxford workpackage. Lead partner: British Telecom. PI: Robert Ghanea-Hercock. Topic: Combination of physics and engineering techniques to the protection of UK Critical National Networks.
3. EU funded proposal "Harnessing ICT-enabled Collective Social Behaviour" (ICTeCollective), funded 2009. Amount of award 1.95 million €. Role in proposal: Co-coordinator of the entire proposal with Prof. Jari Saramäki (Aalto University). Lead partner: Aalto University (formerly Technical University of Helsinki), Helsinki, Finland. PI: Kimmo Kaski. Topic: Study of spatio-temporal patterns in large scale human dynamic datasets to uncover large scale temporal dynamics in social systems.
4. EU funded proposal "Monitoring and forecasting epidemics" (Epiwork), funded 2008. Amount of award: 6.32 million €. Role in proposal: wrote part of the work packages relating to epidemic thresholds and epidemic propagation in disordered social networks. Lead partner: Institute for Scientific Interchange, Torino, Italy. PI: Alessandro Vespignani, and Vittoria Colizza. Topic: Application of mathematical and physical tools to the forecasting of the propagation of infectious diseases.
5. Saïd foundation research assistance awards to create online labor network tool: *http://oguerr.com/laborsim/*, 9000 £.
6. Green Templeton College CumingaSaga research awards in 2011 and 2012, 6000 £.

## Media coverage about my work

- "Your number's up" by Miranda Johnson in The Economist online, January 10, 2014. http://www.economist.com/blogs/babbage/2014/01/social-networks

- "The only thing constant about friendship may be the number of your friends" by Emily Underwood, Science (USA), January 6, 2014.
  http://news.sciencemag.org/social-sciences/2014/01/only-thing-constant-about-friendship-may-be-number-your-friends.
- "Old pals act: why we only have so many new best friends" by Hannah Devlin, January 7, 2014.
  http://www.thetimes.co.uk/tto/science/article3967785.ece
- "Der Weg ist das Ziel" (The journey is the destination) by Dirk Brockmann in Physik Journal **7**, Nr. 2, 20 (2008).
- "Connections get you everywhere, but slowly" by Mark Buchanan in Physical Review Focus, October 25, 2007
  http://physics.aps.org/story/v20/st15.
- "Net advantage" by Davide Castelvecchi in Science News Magazine, November 18, 2007
  https://www.sciencenews.org/article/net-advantage.
- Los Alamos National Laboratory STE highlights for November 5-9, 2007.
- "New threshold for network stability" by Joab Jackson in Government Computer News of December 18, 2007
  http://gcn.com/articles/2007/12/17/new-threshold-for-network-stability.aspx.

## Refereeing

Referee for Scientific Reports, Physical Review E, European Journal of Physics, Europhysics Letters, Physica A, and Physica D.

## Select Distinguished Colloquia and Presentations at Conferences

- "Microdata, networks, and agent-based computing for unemployment" INET Oxford and Oxford Martin School seminar series, February 2015.
- "Limited Path Percolation in Complex Networks", Complexity Science seminar series, University of Bristol, November 2011.
- "Limited Path Percolation in Complex Networks" Invited talk for Leeds Applied Nonlinear Dynamics colloquium series, University of Leeds, September 2010.
- "Limited Path Percolation in Complex Networks", Invited talk for Warwick Complexity Forum, University of Warwick, April 2009.
- "Tools and Ideas from Complex Network Theory", Oxford BioNets Day, Department of Physics, University of Oxford, October 2008.
- "Limited Path Percolation in Complex Networks", CABDyN Complexity Centre colloquium series, University of Oxford, May 2008.
- "Percolation of efficient networks", Invited talk for the closing of European Project Dysonet. Palermo, Italy, November 2007.
- "Limited Path Percolation in Complex Networks", Invited talk for the colloquium series at University of Carolina at Chapel Hill, October 2007.

- "Flow in Random Networks". Invited talk for colloquium series at Emory University. Atlanta, Georgia, September 2006.
- "Transport on complex networks". Invited talk, Max Planck Institute for Complex Systems. Dresden, Germany, February 2006.
- "Physics of flow in random media". Invited talk, Institute for Scientific Interchange. Torino, Italy, February 2006.

## References

1. H. Eugene Stanley
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