

Izaak Neri (25 May 1983, Belgian)

Contact Information

S5.26
Department of Mathematics
King's College London
The Strand
London
WC2R 2LS
United Kingdom

Tel: +44 020 7848 0997
izaak.neri@kcl.ac.uk
<https://www.izaakneri.com/>

<http://orcid.org/0000-0001-9529-5742>

<http://www.researcherid.com/rid/O-4108-2015>

Current Position

Aug 2022 - Now **Senior Lecturer**
Department of Mathematics, King's College London

Sep 2018 - July 2022 **Lecturer**
Department of Mathematics, King's College London

Postdoctoral Experience

Sep 2016 - Aug 2018 **Postdoctoral Contract**
Max Planck Institute for the Physics of Complex Systems (Dresden)
Biological Physics Group of Prof. Dr. Frank Jülicher

Sep 2013 – Sep 2016 **ELBE PostDoctoral Fellowship**
Max Planck Institute for the Physics of Complex Systems
Max Planck Institute of Molecular Cell Biology and Genetics
Joint postdoc in the groups of Prof. Dr. Frank Jülicher and Prof. Dr. Marino Zerial

Sep 2010 – Sep 2013 **Postdoctoral contract on an ANR project**
University of Montpellier, Laboratoire Charles Coulomb (L2C)
Dr. Norbert Kern and Prof. Dr. Andrea Parmeggiani

Education

June 2020 **Fellow of the Higher Education Academy**
Recognition of attainment against the UK
Professional Standards Framework for teaching and learning support in
higher education

Fev 2006- Jun 2010 **PhD. in Physics**
KU Leuven, Institute for Theoretical Physics
Prof. Dr. Désiré Bollé
Thesis: Statistical Mechanics of Spin Models on Graphs

Jul 2005

Master of Science (Physics)

Ghent University
Prof. Dr. Jan Ryckebusch

Thesis: High Tc Superconductivity and the Hubbard Model

Publications (36)

8 Physical Review Letters
1 Physical Review X
3 Physical Review E
1 Physical review B
1 The European Physical Journal E
4 Journal of Statistical Mechanics
1 New Journal of Physics
2 Physical Biology
3 Journal of Physics A
1 Europhysics Letters
1 Proceedings in IEEE
4 arXiv
2 Physical Review Research
2 Book chapters
1 SciPost Physics
1 Theory of Probability and its Applications

Publication List

1. *Martingales for Physicists*
É. Roldán, [I. Neri](#), R Chetrite, S. Gupta, S. Pigolotti, F. Jülicher, K. Sekimoto
arxiv preprint, arXiv:2210.09983
2. *Phenomenological Boltzmann formula for currents*
M. Poletti, [I. Neri](#)
[arXiv preprint, arXiv:2208.02888](#)
3. *Extreme value statistics of edge currents in Markov jump processes and their use for entropy production estimation*
[I. Neri](#), M. Poletti
[arXiv preprint, arXiv:2208.02839](#)
4. *Optimal information usage in binary sequential hypothesis testing*
M. Dörpinghaus, [I. Neri](#), É. Roldán, F. Jülicher
Accepted for publication in [Theory of Probability and its Applications \(2022\)](#)
5. *Estimating entropy production rates with first-passage times*
[I. Neri](#)
J. Phys. A: Math. Theor. **55**, 304005 (2022)
<https://iopscience.iop.org/article/10.1088/1751-8121/ac736b/meta>
6. *Universal tradeoff relation between speed, uncertainty, and dissipation in nonequilibrium stationary states*
[I. Neri](#)
SciPost Physics **12**, 139 (2022)
<https://www.scipost.org/SciPostPhys.12.4.139>

7. *Instabilities of complex fluids with partially structured and partially random interactions*
G. Carugno, [I. Neri](#), P. Vivo
Phys. Biology **19**, 056001 (2022)
<https://iopscience.iop.org/article/10.1088/1478-3975/ac55f9>
8. *Dynamical systems on large networks with predator-prey interactions are stable and exhibit oscillations*
A. M. Mambuca, C. Cammarota, [I. Neri](#)
Physical Review E **105**, 014305 (2022)
<https://journals.aps.org/pre/abstract/10.1103/PhysRevE.105.014305>
9. *Antagonistic interactions can stabilise fixed points in randomly coupled, linear dynamical systems with inhomogeneous growth rates*
S. Cure, [I. Neri](#)
arXiv preprint, arXiv:2112.13498
10. *Modelling the effect of ribosome mobility on the rate of protein synthesis*
O. Dauloudet, [I. Neri](#), J. C. Walter, J. Dornigac, F. Geniet, A. Parmeggiani
Eur. Phys. J. E **44**, 1-15 (2022)
<https://link.springer.com/article/10.1140/epje/s10189-021-00019-8>
11. *Localization and universality of eigenvectors in directed random graphs*
F. L. Metz, [I. Neri](#)
Phys. Rev. Lett. **126**, 040604 (2021)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.126.040604>
12. *Linear stability analysis of large dynamical systems on random directed graphs*
[I. Neri](#), F. L. Metz
Phys. Rev. Research **2**, 033313 (2020)
<https://journals.aps.org/prresearch/abstract/10.1103/PhysRevResearch.2.033313>
13. *Universal transient behavior in large dynamical systems on networks*
W. Tarnowski, [I. Neri](#), P. Vivo
Phys. Rev. Research **2**, 023333 (2020)
<https://journals.aps.org/prresearch/abstract/10.1103/PhysRevResearch.2.023333>
14. *Second law of thermodynamics at stopping times*
[I. Neri](#)
Phys. Rev. Lett. **124**, 040601 (2020)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.124.040601>
15. *Spectral theory of sparse non-Hermitian random matrices*
F.L. Metz, [I. Neri](#), T. Rogers
J. Phys. A: Math. Theor. **52**, 434003 (2019)
<https://iopscience.iop.org/article/10.1088/1751-8121/ab1ce0>
16. *Integral fluctuation relations for entropy production at stopping times*
[I. Neri](#), E. Roldán, S. Pigolotti, F. Jülicher
J. Stat. Mech. (2019) 104006
<https://iopscience.iop.org/article/10.1088/1742-5468/ab40a0>
17. *Extreme Reductions of Entropy in an Electronic Double Dot*
S. Singh, E. Roldán, [I. Neri](#), I. M. Khaymovich, D. S. Golubev, V. F. Maisi, J. T. Peltonen, F. Jülicher, J. P. Pekola
Phys. Rev. B **99**, 115422 (2019)
<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.99.115422>
18. *Martingale Theory for Housekeeping Heat*
R. Chétrite, S. Gupta, [I. Neri](#), É. Roldán

EPL **124**, 60006 (2018)
<https://iopscience.iop.org/article/10.1209/0295-5075/124/60006>

19. *Testing Optimality of Sequential Decision-Making*
M. Dörpinghaus, I. Neri, É. Roldán, H. Meyr, F. Jülicher
arXiv: 1801.01574
20. *Generic Properties of Stochastic Entropy Production*
S. Pigolotti, I. Neri, E. Roldán, and F. Jülicher
Phys. Rev. Lett. **119**, 140604 (2017)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.119.140604>
21. *Statistics of Infima and Stopping Times of Entropy Production and Applications to Active Molecular Processes*
I. Neri, E. Roldán, and F. Jülicher
Phys. Rev. X **7**, 011019 (2017)
<https://journals.aps.org/prx/abstract/10.1103/PhysRevX.7.011019>
22. *An Information Theoretic Analysis of Sequential Decision-Making*
M. Dörpinghaus, É. Roldán, I. Neri, H. Meyr, F. Jülicher
IEEE International Symposium on Information Theory (ISIT), 3050-3054 (2017)
<https://ieeexplore.ieee.org/document/8007090>
23. *Eigenvalue Outliers of non-Hermitian Random Matrices with a Local Tree Structure*
I. Neri, and F. L. Metz
Phys. Rev. Lett. **117**, 224101 (2016)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.117.224101>
24. *Decision Making in the Arrow of Time*
E. Roldán, I. Neri, M. Dörpinghaus, H. Meyr, and F. Jülicher,
Phys. Rev. Lett. **115**, 250602 (2015)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.115.250602>
25. *Motor Protein Traffic Regulation by Supply-Demand Balance of Resources*
L. Ciandrini, I. Neri, J-C Walter, O. Dauloudet, and A. Parmeggiani
Phys. Biol. **11**, 056006 (2014)
Featured article, and in the 2014 highlights of Physical Biology
<https://iopscience.iop.org/article/10.1088/1478-3975/11/5/056006>
26. *On the Equivalence of Ising Models on ‘Small-World’ Networks and LDPC Codes on Channels with Memory*
I. Neri, and N. S. Skantzos
J. Phys. A **47**, 385002 (2014)
<https://iopscience.iop.org/article/10.1088/1751-8113/47/38/385002>
27. *Modelling Collective Cytoskeletal Transport and Intracellular Traffic*
A. Parmeggiani, I. Neri, and N. Kern
The Impact of Applications on Mathematics, 1-25 (2014)
28. *Exclusion Processes on Networks as Models for Cytoskeletal Transport*
I. Neri, N. Kern, and A. Parmeggiani
New Journal of Physics **15**, 085005 (2013)
<https://iopscience.iop.org/article/10.1088/1367-2630/15/8/085005>
29. *Modelling Cytoskeletal Traffic: an Interplay Between Passive Diffusion and Active Transport **
I. Neri, N. Kern, and A. Parmeggiani
Phys. Rev. Lett. **110**, 098102 (2013)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.110.098102>

30. *On the Spectra of Large Sparse Graphs with Cycles*
D. Bollé, F. L. Metz, and I. Neri
Spectral Analysis, Differential Equations and Mathematical Physics:
A Festschrift in Honor of Fritz Gesztesy's 60th Birthday, pages 35-58 (2013)
31. *Spectra of Sparse non-Hermitian Random Matrices: an Analytical Solution*
I. Neri, and F. L. Metz
Phys. Rev. Lett. **109**, 030602 (2012)
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.109.030602>
32. *Totally Asymmetric Simple Exclusion Process on Networks*
I. Neri, N. Kern, and A. Parmeggiani
Phys. Rev. Lett. **107**, 068702 (2011)
Appeared in Physics
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.107.068702>
33. *Spectra of Regular Graphs with Loops*
F. L. Metz, I. Neri, and D. Bollé
Phys. Rev. E **84**, 055101 (2011)
<https://journals.aps.org/pre/abstract/10.1103/PhysRevE.84.055101>
34. *Localization Transition in Symmetric Random Matrices*
F. L. Metz, I. Neri, and D. Bollé
Phys. Rev. E **82**, 031135 (2010)
<https://journals.aps.org/pre/abstract/10.1103/PhysRevE.82.031135>
35. *The Phase Diagram of Lévy Spin Glasses*
I. Neri, F. L. Metz, and D. Bollé,
J. Stat. Mech. P01010 (2010)
<https://iopscience.iop.org/article/10.1088/1742-5468/2010/01/P01010>
36. *The Cavity Approach to Parallel Dynamics of Ising Spins on a Graph*
I. Neri, and D. Bollé
J. Stat. Mech. P08009 (2009)
<https://iopscience.iop.org/article/10.1088/1742-5468/2009/08/P08009>
37. *Gallager error-correcting codes for binary asymmetric channels*
I. Neri, N. S. Skantzos, D. Bollé
J. Stat. Mech. P08009 (2008)
<https://iopscience.iop.org/article/10.1088/1742-5468/2008/10/P10018>

Talks at International Conferences, Workshops, and Schools (21 --- 8 invited and 13 contributed)

1. *Introduction to Martingales in Stochastic Thermodynamics (invited)*
(Post) Modern Thermodynamics
5-9 December 2022 (School for Phd Students, University of Luxembourg)
2. *Thermodynamic tradeoff relations involving first-passage times (invited)*
Stochastic thermodynamics: recent developments
14 June 2022 - 17 June 2022 (ICTS, online discussion meeting)
<https://www.youtube.com/watch?v=6E8pvgu8ICY>

3. *Dissipation bounds the moments of first-passage times of dissipative currents*
Interdisciplinary Challenges in Nonequilibrium Physics **(invited)**
12 April 2021 - 16 April 2021 (Erwin Schroedinger International Institute for
Mathematics and Physics, Vienna, Austria)
<https://www.youtube.com/watch?v=etZl4oHAcLo>
4. *Eigenvalue outliers of non-hermitian random matrices with a local tree structure*
Random Geometries and Multifractality in Condensed Matter and Statistical
Mechanics
24 June 2019 - 02 August 2019 (International Institute of Physics, Natal, Brazil)
5. *Stochastic thermodynamics with martingales (invited)*
Workshop on martingales in Finance and Physics
24 May 2019 (ICTP, Trieste, Italy)
6. *Martingale Theory for Universal Statistics of Stochastic Entropy Production*
(invited)
Stochastic Thermodynamics: Experiment and Theory
10-14 September 2018 (Dresden, Germany)
7. *Eigenvalue Outliers of non-Hermitian Random Matrices with a Local Tree
Structure (invited)*
XIII Brunel-Beilefeld Workshop on Random Matrix Theory
14 -16 December 2017 (Bielefeld, Germany)
8. *Stopping Times and Entropy Production of Nonequilibrium Steady States*
Current and Future Trends in Stochastic Thermodynamics
4 - 29 September 2017 (Nordita, Stockholm, Sweden)
9. *Universal Statistics of Infima and Stopping Times of Entropy Production*
Climate Fluctuations and Non-Equilibrium Statistical Mechanics: an
Interdisciplinary Dialogue
17 - 21 July 2017 (Dresden, Germany)
10. *Universal Statistics of Entropy Production in Langevin Processes (invited)*
Frontiers of Quantum and Mesoscopic Thermodynamics
9 - 15 July 2017 (Prague, Czech Republic)
11. *Statistics of Infima and Stopping Times of Entropy Production and Applications
to Active Molecular Processes*
DPG Condensed Matter Section Spring Meeting
6-10 March 2017 (Dresden, Germany)
12. *Eigenvalue Outliers of non-Hermitian Random Matrices with a Local Tree
Structure*
DPG Condensed Matter Section Spring Meeting
6-10 March 2017 (Dresden, Germany)
13. *The Endosomal Network Regulates Signal Specificity and Robustness using
Quanta of Phosphorylated Receptors*
12th International Congress of Cell Biology
21-25 July 2016 (Prague, Czech Republic)
14. *First-passage fluctuation theorems*
DPG Condensed Matter Section Spring Meeting
6-11 March 2016 (Regensburg, Germany)
15. *Exclusion Processes on Networks (invited)*
VU TASEP conference

11 June 2015 (Amsterdam, Netherlands)

16. Exclusion Processes on Networks
DPG Condensed Matter Section Spring Meeting
15-20 March 2015 (Berlin, Germany)
17. *Totally asymmetric simple exclusion process on networks*
Journées de Physique Statistique
24-25 January 2012 (Paris, France)
18. *Exclusion processes through networks*
Traffic and Granular Flow
25-27 September 2013 (Jülich, Germany)
19. *Modelling active transport and spatial-temporal organisation of motor proteins along the cytoskeleton*
European conference on complex systems
3-7 September 2012 (Brussels, Belgium)
20. *Transport on networks*
Journées plénières, Physique de la cellule au tissu
12-13 October 2011 (Lille, France)
21. *Steady states of spin models on graphs*
Statistical Physics and Computer Science
8-11 July 2010 (Beijing, China)

Posters at International Conferences (9)

1. *On a Test of Optimality for Decision Making*
Frontiers of Quantum and Mesoscopic Thermodynamics
9 - 15 July 2017 (Prague, Czech Republic)
2. *Infimum Law and First-Passage-Time Fluctuation Theorem for Entropy Production*
Stochastic Physics in Biology, Gordon Research Conference
8-13 May 2017 (Ventura, California)
3. *Infimum Law and First-Passage-Time Fluctuation Theorem for Entropy Production*
Circle Meeting
9-10 May 2016 (Paris, France)
4. *Infimum Law and First-Passage-Time Fluctuation Theorem for Entropy Production*
The Information, Probability and Inference in Systems Biology Conference
18-20 May 2016 (Klosterneuburg, Austria)
5. *Exclusion processes on networks*
International Summer School Fundamental Problems in Statistical Physics XIII
June 16-29 2013 (Leuven, Belgium)
6. *Modelling active transport and spatial-temporal organisation of motor proteins along the cytoskeleton*
13eme Journées de la Matière Condensée,
27-31 August 2012 (Montpellier, France)

7. *Modelling active transport and spatial-temporal organization of motor proteins along the cytoskeleton*
DPG Physics School on Forces and Flow in Biological Systems
23-28 September 2012 (Bad-Honnef, Germany)
8. *Transport on networks*
Workshop on Systems Biology, 2nd Baltic Autumn School
5-9 September 2011 (Lübeck, Germany)
9. *Gallager codes on asymmetric channel*
Annual Conference of the Middle European Cooperation in Statistical Physics
14-16 April 2008 (Puchberg-Wels, Austria)

Invited Talks at Scientific Institutes

1. *Spectral theory for networks and its applications to economy*
Financial computing and analytics seminar, University College London
23 November 2022
2. A first-passage perspective on trade-offs between dissipation, speed, and uncertainty
Mathematical Physics Seminar Series, Imperial College London
9 November 2022
3. *Leading eigenvalue and right eigenvector of infinitely large directed graphs*,
Bielefeld-Melbourne random matrices seminars
16 December 2020 (online seminar)
4. *Second law of thermodynamics at stopping times*,
Complex Systems Seminar, Queen Mary University of London
28 January 2020 (London, United Kingdom)
5. *Second law of thermodynamics at stopping times*,
DAMTP Statistical Physics and Soft Matter Seminar, University of Cambridge
29 October 2019 (Cambridge, United Kingdom)
6. *Stochastic thermodynamics with martingales*
Theoretical Condensed Matter Seminar, University of Nottingham
14 June 2019 (Nottingham, United Kingdom)
7. *Eigenvalue Outliers of non-Hermitian Sparse Random Matrices*
Disordered Systems Group, King's College London
28 November 2017 (London, United Kingdom)
8. *Decision Making in the Arrow of Time*
Laboratoire Charles Coulomb, Université Montpellier 2
14 December 2015 (Montpellier, France)
9. *Active Transport Processes along Networks*
Institute for Theoretical Physics, KULeuven
23 May 2012 (Leuven, Belgium)

Referral Activity

Phys. Rev. Lett., Phys. Rev. X, Phys. Rev. E, J. Phys. A: Math. and Theor., Europhys. Lett., J. Stat. Mech., Journal of Statistical Physics, Neural Computation, New Journal of Physics, Mathematical Biosciences, Entropy, Symmetry, Physica A: statistical mechanics and its

applications, International Journal of Molecular Sciences

Member of thesis committees (PhD and Habilitation)

- Jean-Francois Derivaux, Universite Libre de Bruxelles (ULB), *Stochastic thermodynamics of transport systems and reactive systems: an extended local equilibrium approach*, Thesis for Doctor of Philosophy, 3rd of June 2020 (private defense) and 3rd of July 2020 (public defense)
- Dr. Jean-Charles Walter, University of Montpellier, *Modeling the formation and the positioning of intracellular macromolecular assemblies: application to bacterial DNA segregation*, Thesis for Habilitation, 24th of June 2020
- Mayank Schreshtha, Queen Mary University of London, *Fluctuations and uncertainty in stochastic models with persistent dynamics*, Thesis for Doctor of Philosophy, 11th of January 2021
- Akriti Jindal, Department of Mathematics, Indian Institute of Technology Ropar Rupnagar, Punjab, India, *Mathematical modelling of driven diffusive transport processes: Analyses and simulations*, Thesis for Doctor of Philosophy, August 2021

Supervision of PhD students

- **Dr. Andrea Mambuca**
Thesis title: New results on the stability of large antagonistic systems on complex networks
Viva defence date: 11 February 2021
Online available [here](#)
- **Giorgio Carugno**
Thesis project: Phase coexistence and instabilities of polydisperse mixtures through the prism of random matrix theory
- **Gyeong-Gyun Ha**
Thesis project: Networks with higher order interactions
- **Adarsh Raghu**
Thesis project: to be determined (started in Oct 2022)

Research visits

- Scientific visit at the Federal University of Rio Grande do Sul for two weeks (29th of July till 9th of August 2019). Host: Prof. Fernando Metz at the Physics Institute

Awards

- *Best poster award* in the Workshop on Systems Biology, 2nd Baltic Autumn School, 5-9 September 2011 (Lübeck, Germany). Poster title: *Transport on networks*
- Outstanding APS Referee (lifetime award, received in 2020)

Organization of Workshops

Random Matrix Theory and Networks, 7-11 June 2021, Max Planck Institute for the Physics of Complex Systems

Editorial work

Member of the Editorial board of Physical Review E (2023-2025) (<https://journals.aps.org/pre/>)