

# Yongjoo BAEK

## PERSONAL INFORMATION

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DATE OF BIRTH: 7 January 1988  
ADDRESS: DAMTP, Centre for Mathematical Sciences  
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WEBSITE: <http://yongjoobaek.wordpress.com>

## EDUCATION

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FEB 2014 PhD in PHYSICS, KAIST  
THESIS: *Scaling analysis of nonequilibrium processes in random media*  
ADVISOR: Prof. Hawoong JEONG

FEB 2009 BS in PHYSICS (minor: MATHEMATICS), KAIST

## RESEARCH EXPERIENCE

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<i>Current</i> OCT 2017	Research Associate at DAMTP, University of Cambridge <ul style="list-style-type: none"><li>Hosted by Michael E. Cates</li></ul>
OCT 2014–SEP 2017	Post-Doctorate Fellow at DEPARTMENT OF PHYSICS, Technion <ul style="list-style-type: none"><li>Hosted by Yariv Kafri</li></ul>
MAR 2014–OCT 2014	Postdoctoral researcher at NATURAL SCIENCE RESEARCH INSTITUTE, KAIST <ul style="list-style-type: none"><li>Hosted by Hawoong Jeong</li></ul>
JUL 2008–AUG 2008	Student Exchange Program at DEPARTMENT OF PHYSICS, HKUST <ul style="list-style-type: none"><li>Hosted by K. Y. Michael Wong</li></ul>

## RESEARCH INTERESTS

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- **TRACKING THE EFFECTS OF MICROSCOPIC IRREVERSIBILITY IN ACTIVE MATTER**  
Active particles, which convert external energy to kinetic energy, form an important subclass of nonequilibrium systems. Since they violate detailed balance at the level of individual particles, their steady-state behaviors can be in stark contrast to the equilibrium counterparts. I am particularly interested in developing coarse-graining schemes which manifestly keep track of how the microscopic irreversibility affects macroscopic phenomena.
- **LARGE DEVIATIONS OF NONEQUILIBRIUM SYSTEMS**  
Large deviation functions can be regarded as nonequilibrium analogs of free energies. By studying the properties of these functions in simple lattice gas models, I aim to identify novel collective phenomena which are not captured by the conventional statistical physics at thermal equilibrium.
- **PHASE TRANSITIONS AND CRITICAL PHENOMENA ON COMPLEX NETWORKS**  
Various systems in nature and society can be represented as complex networks, whose structural properties are different from those of lattices. One may ask how these structural properties affect the phase diagram and critical scaling behaviors of various processes taking place on networks. I aim to address the question using tools of network theory and Monte Carlo methods.

## HONORS & AWARDS

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- 2015–2017 Lady Davis Post-Doctoral Fellowship
- APR 2014 Young Statistical Physicist Award from KOREA PHYSICAL SOCIETY
- MAR 2013 APS GSNP Student Speaker Award Finalist in APS MARCH MEETING  
Awarded for the oral talk, *Graphicality of random scale-free networks with general degree cutoffs*.
- JAN 2012 Outstanding Research Paper Award in BK21 YOUNG PHYSICISTS WORKSHOP  
Awarded for the journal article, *Fundamental Structural Constraint of Random Scale-Free Networks*, Y. BAEK *et al.*, Phys. Rev. Lett. **109**, 118701 (2012).
- FEB 2011 Outstanding TA Award from DEPARTMENT OF PHYSICS, KAIST  
Awarded for Classical Mechanics II, Fall Semester 2010.
- JAN 2010 Gold Prize in BK21 YOUNG PHYSICISTS WORKSHOP  
Awarded for the poster presentation, *The market behavior and performance of different strategy evaluation schemes*.
- 2009–2010 National Research Fellowship for Science and Engineering Graduates  
from KOREA SCIENCE AND ENGINEERING FOUNDATION
- 2005–2008 Presidential Science Scholarship  
from KOREA SCIENCE AND ENGINEERING FOUNDATION

## TEACHING EXPERIENCE

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- 2009–2010 Teaching Assistant at DEPARTMENT OF PHYSICS, KAIST
- FALL 2010: Classical Mechanics II
  - SPRING 2010: Classical Mechanics I
  - FALL 2009: Advanced Physics II

## SKILLS & SPECIALTIES

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- SPECIALTIES: Statistical physics, stochastic processes, large deviation theory, finite-size scaling, Monte Carlo method, network theory
- COMPUTER: C/C++, JAVA, MATLAB, MATHEMATICA, ubuntu,  $\LaTeX$
- LANGUAGE: ENGLISH (fluent), KOREAN (native)

## REFERENCES

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- MICHAEL E. CATES    Lucasian Professor  
DAMTP, CMS, University of Cambridge, Cambridge CB3 0WA, United Kingdom  
Phone: +44 1223 337912  
Email: [m.e.cates@damtp.cam.ac.uk](mailto:m.e.cates@damtp.cam.ac.uk)
- YARIV KAFRI    Professor  
Department of Physics, Technion, Haifa 32000, Israel  
Phone: +972 4 829 5936  
Email: [kafri@physics.technion.ac.il](mailto:kafri@physics.technion.ac.il)
- VIVIEN LECOMTE    Chargé de recherche CNRS  
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- HAWOONG JEONG    Professor  
Department of Physics and KI for BioCentury, KAIST, Daejeon 305-701, South Korea  
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- HYUNGGYU PARK    Professor  
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Email: [hgpark@kias.re.kr](mailto:hgpark@kias.re.kr)

## PUBLICATIONS

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### ARTICLES IN PEER-REVIEWED JOURNALS

1. Yongjoo BAEK, Yariv Kafri, and Vivien Lecomte, *Dynamical phase transitions in the current distribution of driven diffusive channels*, [arXiv:1710.07139](https://arxiv.org/abs/1710.07139) [cond-mat.stat-mech], *J. Phys. A: Math. Theor.* **51**, 105001 (2018).
2. Yongjoo BAEK, Alexandre P. Solon, Xinpeng Xu, Nikolai Nikola, and Yariv Kafri, *Generic long-range interactions between passive bodies in an active fluid*, [arXiv:1709.02281](https://arxiv.org/abs/1709.02281) [cond-mat.stat-mech], *Phys. Rev. Lett.* **120**, 058002 (2018).
3. Hyungjoon SOH, Yongjoo BAEK, Meesoon HA, and Hawoong JEONG, *Effects of a local defect on one-dimensional nonlinear surface growth*, [arXiv:1610.01074](https://arxiv.org/abs/1610.01074) [cond-mat.stat-mech], *Phys. Rev. E* **95**, 042123 (2017).
4. Yongjoo BAEK, Yariv KAFRI, and Vivien LECOMTE, *Dynamical symmetry breaking and phase transitions in driven diffusive systems*, [arXiv:1609.06732](https://arxiv.org/abs/1609.06732) [cond-mat.stat-mech], *Phys. Rev. Lett.* **118**, 030604 (2017).
5. Yongjoo BAEK, Yariv KAFRI, and Vivien LECOMTE, *Extreme current fluctuations of boundary-driven systems in the large- $N$  limit*, [arXiv:1602.07155](https://arxiv.org/abs/1602.07155) [cond-mat.stat-mech], *J. Stat. Mech.* **2016**, 053203 (2016).
6. Kihong CHUNG, Yongjoo BAEK, Meesoon HA, and Hawoong JEONG, *Universality classes of generalized epidemic process on random networks*, [arXiv:1512.04457](https://arxiv.org/abs/1512.04457) [cond-mat.stat-mech], *Phys. Rev. E* **93**, 052304 (2016).
7. Yongjoo BAEK and Yariv KAFRI, *Singularities in large deviation functions*, [arXiv:1505.05796](https://arxiv.org/abs/1505.05796) [cond-mat.stat-mech], *J. Stat. Mech.* **2015**, P08026 (2015).

8. Yongjoo BAEK, Meesoon HA, and Hawoong JEONG, *Effects of junctional correlations in the totally asymmetric simple exclusion process on random regular networks*, [arXiv:1410.2185](https://arxiv.org/abs/1410.2185) [cond-mat.stat-mech], Phys. Rev. E **90**, 062111 (2014).
9. Kihong CHUNG, Yongjoo BAEK, Daniel KIM, Meesoon HA, and Hawoong JEONG, *Generalized epidemic process on modular networks*, [arXiv:1312.0573](https://arxiv.org/abs/1312.0573) [physics.soc-ph], Phys. Rev. E **89**, 052811 (2014).
10. Yongjoo BAEK, Meesoon HA, and Hawoong JEONG, *Impact of sequential disorder on the scaling behavior of airplane boarding time*, [arXiv:1302.2107](https://arxiv.org/abs/1302.2107) [physics.soc-ph], Phys. Rev. E **87**, 052803 (2013).
11. Yongjoo BAEK, Daniel KIM, Meesoon HA, and Hawoong JEONG, *Fundamental Structural Constraint of Random Scale-Free Networks*, [arXiv:1207.0349](https://arxiv.org/abs/1207.0349) [cond-mat.stat-mech], Phys. Rev. Lett. **109**, 118701 (2012).
12. Yongjoo BAEK, Meesoon HA, and Hawoong JEONG, *Absorbing states of zero-temperature Glauber dynamics in random networks*, [arXiv:1112.5927](https://arxiv.org/abs/1112.5927) [cond-mat.stat-mech], Phys. Rev. E **85**, 031123 (2012).
13. Yongjoo BAEK, Sang Hoon LEE, and Hawoong JEONG, *Market behavior and performance of different strategy evaluation schemes*, [arXiv:1002.4744](https://arxiv.org/abs/1002.4744) [q-fin.PM], Phys. Rev. E **82**, 026109 (2010).

#### UNPUBLISHED PREPRINTS

1. Yongjoo BAEK, Meesoon HA, Hawoong JEONG, and Hyunggyu PARK, *Comment on "Fluctuation theorem for hidden entropy production"*, [arXiv:1402.1235](https://arxiv.org/abs/1402.1235) [cond-mat.stat-mech].

## PRESENTATIONS

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### ORAL TALKS

- 2018 (Invited) *Generic long-range interactions between bodies in an active fluid*, 8th KIAS Conference on Statistical Physics, Seoul, Korea, 9 – 12 Jul
- (Invited) *Generic long-range interactions between bodies in an active fluid*, SRitp Workshop 2018, Rehovot, Israel, 31 Dec 2017 – 12 Jan
- 2016 *Anomalous current fluctuations in diffusive systems*, IPS Conference 2016, Tel Aviv, Israel, 25 Dec
- Dynamical symmetry breaking and phase transitions in diffusive systems with open boundaries*, 9<sup>th</sup> Dynamics Days Asia Pacific, Hong Kong, 14–17 Dec
- Applicability of hydrodynamic theories for extreme current fluctuations*, STATPHYS 26, Lyon, France, 18–22 Jul
- Dynamical symmetry breaking in boundary-driven diffusive systems carrying atypical currents*, 7<sup>th</sup> KIAS Conference on Statistical Physics, Seoul, Korea, 4–7 Jul
- 2015 *Breakdown of the hydrodynamic limit for extreme current fluctuations*, Non-Equilibrium Statistical Physics Workshop, Bangalore, India, 26 Oct–18 Nov
- 2014 *Slow-bond effects in TASEP on networks*, 6<sup>th</sup> KIAS Conference on Statistical Physics, Seoul, Korea, 8–11 Jul
- The origin of increased mean entropy production after coarse-graining*, 11<sup>th</sup> Statistical Mechanics Conference, New Brunswick NJ, USA, 11–13 May
- Integral Fluctuation Theorem for Hidden Entropy Production*, Korean Physical Society Meeting, Daejeon, Korea, 23–25 Apr
- Crossover behavior of KPZ surface growth coupled to Ising degrees of freedom*, 4<sup>th</sup> Workshop on Non-Equilibrium Fluctuation Theorems, Busan, Korea, 12–14 Jan
- 2013 *1D sign phase transition revisited*, 17<sup>th</sup> Statistical Physics Workshop, Tongyeong, Korea, 31 Oct–3 Nov
- Is the Junction Occupancy Meaningful in ASEP on the Bethe Lattice?*, STATPHYS 25, Seoul, Korea, 22–26 Jul
- Graphicality of random scale-free networks with general degree cutoffs*, APS March Meeting, Baltimore MD, USA, 18–22 Mar
- 2012 *An analytical solution for graphicality of random scale-free networks*, Workshop on the Open Problems of the Glass Transition and Related Topics, Fukuoka, Japan, 16–20 Dec
- Effect of passenger queue arrangements on scaling behaviors of airplane boarding time*, Korean Physical Society Meeting, Pyeongchang, Korea, 24–26 Oct

- 2011 *Mean-field approach to TASEP on networks and beyond*, Korean Physical Society Meeting, Busan, Korea, 19–20 Oct
- Fate of zero-temperature Glauber dynamics in random networks*, 16<sup>th</sup> Workshop for Statistical Physics, Busan, Korea, 17–19 Aug
- Absorbing states of zero-temperature Glauber dynamics in quenched random networks*, 105<sup>th</sup> Statistical Mechanics Conference, New Brunswick NJ, USA, 8–10 May
- Sample-to-sample fluctuations in the zero-temperature Glauber dynamics on complex networks*, Korean Physical Society Meeting, Daejeon, Korea, 13–15 Apr
- 2010 *Strategy preference and profitability in stock markets*, Econophysics Colloquium, Taipei, Taiwan, 4–6 Nov
- Opinion dynamics with noise on annealed scale-free networks*, Korean Physical Society Meeting, Pyeongchang, Korea, 20–22 Oct
- The market behavior and performance of different strategy evaluation schemes*, APS March Meeting, Portland OR, USA, 15–19 Mar
- 2009 *A study of the racial distribution and human dispersal through the statistical analysis of genetic phenotype*, 4<sup>th</sup> COREN Conference, Seoul, Korea, 28 Nov
- The market behavior and performance of different strategy evaluation schemes*, 15<sup>th</sup> Workshop for Statistical Physics, Gwangju, Korea, 12–14 Aug

## POSTERS

- 2018 *Negative mobility of passive bodies in active fluids*, Fundamental Problems in Active Matter: a 2018 Aspen Winter Conference, Aspen CO, USA, 29 Jan – 2 Feb
- 2014 *Fluctuation Theorem for Hidden Entropy Production and the Origin of Irreversibility*, 2014 Summer School on Active Systems, Gwangju, Korea, 22 Jun–4 Jul
- 2013 *Does a 1D dynamic phase transition exist for Ising degrees of freedom coupled to KPZ growth?*, Korean Physical Society Meeting, Changwon, Korea, 30–31 Oct
- Linkwise Understanding of ASEP on the Bethe Lattice*, STATPHYS 25 Satellite Meeting: Frontier of Statistical Physics and Information Processing, Kyoto, Japan, 11–14 Jul
- Bimodality coefficient as an indicator of phase transition*, Korean Physical Society Meeting, Daejeon, Korea, 24–26 Apr
- 2012 *Role of degree cutoff in graphicality of scale-free networks*, International Conference on Mathematical Modeling in Physical Sciences, Budapest, Hungary, 3–7 Sept
- Effect of degree cutoff on graphicality of scale-free networks*, 5<sup>th</sup> KIAS Conference on Statistical Physics, Seoul, Korea, 3–6 Jul
- Airplane boarding time: random boarding vs. back-to-front policy*, Korean Physical Society Meeting, Daejeon, Korea, 25–27 Apr
- TASEP on networks: is more different?*, 5<sup>th</sup> BK21 Young Physicists Workshop, Daejeon, Korea, 12–13 Jan
- 2011 *Noisy opinion dynamics on complex networks*, 4<sup>th</sup> BK21 Young Physicists Workshop, Pohang, Korea, 20 Jan
- 2010 *Performance of strategy evaluation schemes for different price patterns*, STATPHYS 24, Cairns, Australia, 19–24 Jul
- Analysis of genetic distance networks extracted from phenotype distribution*, STATPHYS 24 Satellite Meeting: New Frontiers in Complex Networks, Seoul, Korea, 12–16 Jul
- Phenotypic clues to human dispersal*, Korean Physical Society Meeting, Daejeon, Korea, 21–23 Apr
- The market behavior and performance of different strategy evaluation schemes*, 3<sup>rd</sup> BK21 Young Physicists Workshop, Seoul, Korea, 15 Jan

## ATTENDED SCHOOLS

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- 22 AUG–3 SEP 2016 The Beg Rohu Summer School: Concepts and Methods of Statistical Physics  
Ecole Nationale de Voile, Beg Rohu, Saint Pierre Quiberon, France  
Fisher–KPP equation and applications; statistics of rare events and large deviations; machine learning; nonequilibrium statistical physics; nonperturbative renormalization group
- 2 JUL–18 JUL 2015 Bangalore School on Statistical Physics - VI  
Raman Research Institute, Bangalore, India  
Large deviations and fluctuation relations; nonadditive systems; interacting particle systems; soft matter physics; sandpile models; molecular motors
- 24 AUG–30 AUG 2014 Pyeongchang Summer Institute 2014  
Alpensia Resort, Pyeongchang, Korea  
Fluctuations and responses in stochastic processes; exactly solvable many-body stochastic processes; quantum field theory of many particles
- 22 JUN–4 JUL 2014 2014 Summer School on Active Systems  
GIST, Gwangju, Korea  
Principles of nonequilibrium statistical physics; molecular motors and chaperones; low Reynolds number hydrodynamics; cell mechanics; collective behavior of active particles
- 20–24 JAN 2014 11<sup>th</sup> KIAS–APCTP Winter School on Statistical Physics  
POSTECH, Pohang, Korea  
Shannon information theory; classical and quantum thermodynamics of information; information entropy production by feedback control
- 28 JAN–1 FEB 2013 10<sup>th</sup> KIAS–APCTP Winter School on Statistical Physics  
High1 Resort, Jeongseon, Korea  
Linear response theory; dynamical equations for coarse-grained variables; Mori–Zwanzig projection formalism
- 30 JAN–3 FEB 2012 9<sup>th</sup> KIAS–APCTP Winter School on Statistical Physics  
POSTECH, Pohang, Korea  
Monte Carlo simulations; molecular dynamics simulations; numerical algorithms for network studies
- 19–31 JUL 2011 The Beg Rohu Summer School of Statistical Physics and Complex Systems  
Ecole Nationale de Voile, Beg Rohu, Saint Pierre Quiberon, France  
Statistical physics approaches to economics and finance; the mathematics of mixing things up; information, physics, and computation; statistical physics for biological systems
- 24–28 JAN 2011 8<sup>th</sup> KIAS–APCTP Winter School on Statistical Physics  
Phoenix Park, Pyeongchang, Korea  
Stochastic processes; matrix ansatz for asymmetric simple exclusion process; fluctuation theorems
- 2–5 FEB 2010 7<sup>th</sup> APCTP–KIAS Winter School on Statistical Physics  
Phoenix Park, Pyeongchang, Korea  
Surface phase transition
- 24–27 AUG 2009 APCTP School on Econophysics  
APCTP, Pohang, Korea  
Financial time series; agent-based modeling; mathematical finance