Kyung Hyuk Kim

Post-doctoral Senior Fellow
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Education

Ph.D. in Physics, University of Washington, Seattle, 1999-2006
M.S. in Physics, University of Washington, Seattle, 2000
Ph.D. Program in Physics, University of California, Davis, 1998-1999
B.S. in Physics, Seoul National University, Seoul, Korea, 1998

Areas of Research

Gene regulatory networks and synthetic gene circuits

- Noise sensitivity analysis: an extension of metabolic control analysis
- Noise propagation and modularity: dynamic response and transfer function
- Gene circuit module interface condition: retroactivity

Areas of Graduate Research

Thesis Topic: Stochastic driven systems far from equilibrium
Advisors: Prof. Marcel den Nijs and Prof. Hong Qian.

- Molecular scale refrigeration (with Dr. Qian):
  Thermodynamics, Jarzynski equality and fluctuation theorems
- Universal scaling behaviors and phase transitions (with Dr. den Nijs):
  Driven interface growth (KPZ-type), One-dimension stochastic flow

Professional Experience

Post-doctoral Senior Fellow to Dr. Herbert M. Sauro
Department of Bioengineering, University of Washington
Jun. 2007 - Present

Post-Doctoral Fellow to Dr. Hong Qian
Department of Applied Mathematics, University of Washington
Jan. 2007 - May 2007

Research assistant to Dr. Hong Qian
Department of Applied Mathematics, University of Washington
Fluctuation theorems of a molecular refrigerator
Oct. 2006 - Dec. 2006

Research assistant to Dr. Marcel den Nijs
Department of Physics, University of Washington

Dynamic screening in a two-species asymmetric exclusion process
Jan. 2004 - Sep. 2006

Teaching Assistant
Department of Physics, University of Washington
Jan. 2003 - Dec. 2003

Research assistant to Dr. Hong Qian
Department of Applied Mathematics, University of Washington
Entropy production of Brownian macromolecules with inertia
Jan. 2002 - Dec. 2002

Teaching Assistant
Physics Department, University of Washington, Seattle
Jul. 1999 - Dec. 2001

Research assistant to Dr. Rena Zieve
Department of Physics, University of California, Davis
The influence of columnar defects on the superconducting transition temperature of UBe13
Jan. 1999 - Jun. 1999

Publications and Papers in Preparation

- K. H. Kim, and H. M. Sauro. Non-local Elasticity and Noise Propagation in Synthetic Gene Circuits. (in preparation)
- K. H. Kim, and H. M. Sauro. Modular Analysis of Noise Propagation in Synthetic Gene Circuits. (in preparation)
- K. H. Kim, and H. M. Sauro. Stochastic Retroactivity in Synthetic Gene Circuits. (in preparation)
- K. H. Kim, and H. M. Sauro. Stochastic Control Analysis for Biochemical Reaction Systems. arXiv:0904.3124 [q-bio.QM] (submitted) (2009)
- K. H. Kim, H. Qian, and H. M. Sauro. Sensitivity Regulation based on Noise Propagation in Stochastic Reaction Networks. arXiv:0805.4455v2 (2008).
- K. H. Kim and M. den Nijs. Dynamic Screening in a Two-Species Asymmetric Simple Exclusion Process. *Phys. Rev. E* **76**, 021107 (2007).
- K. H. Kim. Heat Dissipation from Brownian Particles under Hydrodynamic Interactions. cond-mat/0609636 (2006).
- K. H. Kim and H. Qian. Fluctuation Theorems of a Molecular Refrigerator. *Phys. Rev. E* **75**, 022102 (2007).
- K. H. Kim and H. Qian. Entropy Production of Brownian Macromolecules with Inertia. *Phys. Rev. Lett.* **93**, 120602 (2004).

Research Skills

- Numerical methods: Monte-Carlo simulations, Molecular dynamic simulation.
- Computation: C, C++, Mathematica, Matlab.

- Analytical methods: Differential equations (ODE and PDE), Stochastic processes and stochastic differential equations, Matrix product ansatz for lattice gas systems.

Conferences and Workshops

- *Sensitivity Analysis and Module Interface Conditions on Stochastic Gene Circuits*
  2nd Workshop on Stochasticity in Biochemical Reaction Networks. Banff, BC. Sept. 25 - Sept. 27, 2009 (Oral)
- *Systems Biology Workbench (Tutorial)*
  International Conference on Systems Biology. Palo Alto, CA. Aug. 30, 2009 (Oral)
- *Stochastic Control Analysis for Biochemical Reaction Systems*
  Foundations of Systems Biology and Engineering. Denver, CO. Aug. 9 - Aug. 12, 2009 (Poster)
- *Stochastic Control Analysis for Biochemical Reaction Systems*
  DIMACS Workshop on Control Theory and Dynamics in Systems Biology. Piscataway, NJ. May 18 - May 20, 2009 (Poster)
- *Systems and Synthetic Biology: A Match Made in Heaven*
  2008 BMES Annual Fall Meeting. Saint Louis, MO. Oct. 2 - Oct. 4, 2008 (Oral)
- *Stochastic Control Analysis for Biological Reaction Networks*
  2008 Workshop for Young Researchers in Mathematical Biology. Columbus, OH. Sept. 2 - Sept. 4, 2008 (Poster)
- *Noise Propagation and Sensitivity for Stochastic Reaction Networks*
  International Conference on Systems Biology. Götenborg, Sweden. Aug. 23 - Aug. 28, 2008 (Poster)
- *Systems Biology Workbench (Tutorial)*
  International Conference on Systems Biology. Götenborg, Sweden. Aug. 22, 2008 (Oral)
- *Stochastic Control Analysis for Biological Reaction Systems*
  IMA Hot Topics Workshop: Stochastic Models for Intracellular Reaction Networks. Minneapolis, MN. May 11 - May 13, 2008 (Poster)
- *Stochastic Control Analysis for Biological Reaction Systems*
  Systems Biology and Engineering. Seattle, WA. Apr. 20 - Apr. 21, 2008. (Poster)
- *Stochastic Biochemical Control Theory*
  The Eighth International Conference on Systems Biology. Long Beach, CA. Oct. 1 - Oct. 6, 2007. (Poster)
- *Dynamic Screening in a Two-Species Asymmetric Simple Exclusion Process*
  The 2nd KIAS Conference on Statistical Physics. KIAS. Seoul, Korea. Jul. 3 - Jul. 6, 2006. (Poster)
- *Entropy Production of Brownian Macromolecules with Inertia*
  Satellite Meeting of STATPHYS 22. KIAS. Seoul, Korea. Jun. 29 - Jul. 2, 2004. (Poster)
- Proteomics Workshop IV: Molecular Machines at IPAM. University of California at Los Angeles. May 24 - May 28, 2004.

- Opportunities in Biology for Physicists, A Topical Conference of the American Physical Society. San Diego. Jan. 30 - Feb. 1, 2004.
- *Entropy Pumping in Brownian Particles Under Velocity Feedback Control*
  88th Statistical Mechanics Conference. Rutgers University. Dec. 15 - Dec. 17, 2002. (Short Talk)

Referring

- Referee for Molecular Systems Biology, BMC Systems Biology, Molecular BioSystems, IEEE Transactions on Biomedial Circuits and Systems (2009).
- Referee for BMC Systems Biology, Molecular BioSystems, Physics Letters A, and Physical Review Letters (2008).
- Referee for Molecular Systems Biology, and IEEE Transactions on Biomedical Circuits and Systems (2007).

Teaching Experiences

- *Systems and Synthetic Biology: Stochastic Systems and Gillespie Algorithm/Chemical Langevin Equation*. Feb. 11, 13, and 18, 2009. (Course lecture)
- *Systems and Synthetic Biology: Effects of Noise*. Apr. 25, 2008. (Course lecture)
- *Systems and Synthetic Biology: The Basis of the Gillespie Stochastic Simulation Algorithm*. Apr. 24, 2008. (Course lecture)

Condensed Matter Journal Club Talks

- *Quantum Computation and Information Theory*. Apr. 13, 2006.
- *Boltzmann Equations for Dilute Gases*. Jan. 25, 2006.
- *BCS Ground States*. Nov. 9, 2005.
- *Integer Quantum Hall Effect*. Apr. 27, 2005.
- *Two-state Models for Single Molecular Motors*. May 14, 2003.