

TSVI TLUSTY – C.V. 10/2019

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EDUCATION AND EMPLOYMENT

- 2015– *Distinguished Professor*, Department of Physics, UNIST, Ulsan.
2015– *Group Leader*, Center for Soft and Living Matter, Institute for Basic Science.
2011–2015 *Long-term Member*, *Institute of Advanced Study*, Princeton.
2005–2013 *Senior researcher*, Physics of Complex Systems, Weizmann Institute.
2000–2004 *Fellow*, Center for Physics and Biology, *Rockefeller University*, New York.
Host: Prof. Albert Libchaber
1995–2000 *Ph.D. in Physics*, Weizmann Institute,
“Universality in Microemulsions”, Supervisor: Prof. Samuel A. Safran.
1991–1995 *M.Sc. in Physics*, Weizmann Institute.
1988–1990 *B.Sc. in Physics and Mathematics*, Hebrew University, Jerusalem.

Teaching: *Landmark Experiments in Biology* (2006-8); *Statistical Physics* - graduates (2007-8, 2016-19); *Information in Biology* (2012); *Errors and Codes* (IAS, 2012); *Theory of Living Matter* (2016);

Review Board: *SystemsX.ch* – Systems Biology in Switzerland, *Swiss National Fund*.
CRI - Centre de Recherches Interdisciplinaires, Paris.

Students and post-doctoral fellows

- William Pineros (postdoc 2019-)
John McBride (postdoc, 2018-)
Somya Mani (postdoc, 2018-)
Tamoghna Das (postdoc, 2018-)
Ashwani Tripathi (postdoc, 2018-)
Vladimir Reinharz (postdoc, 2018- , Prof. at Montreal U. from 2020)
Seongmin Jeong (postdoc, 2016-)
Sandipan Dutta (postdoc, 2016-)
YongSeok Jho (research fellow, 2016-2017, Prof. at GyeongSang U.)
Yoni Savir (Ph.D., 2005-2011, Prof. at Technion)
Adam Lampert (Ph.D., 2008-2012, Prof. at U. Arizona)
Arbel Tadmor (M.Sc., 2006-2008, researcher at TRON)
Maria Rodriguez Martinez (Postdoc, 2007-2009, PI at IBM Zurich)

Tamar Friedlander (postdoc, 2009 -2012, Prof. at Hebrew University)

Collaborations

Albert Libchaber (Rockefeller University)

Stanislas Leibler (Rockefeller University and Institute for Advanced Study)

Jean-Pierre Eckmann (Geneva University)

Steve Granick (IBS center for soft and living matter)

Hyuk Kyu Pak (IBS center for soft and living matter)

G.V. Shivashankar (Singapore National University and NCBS Bangalore)

Jordi Soriano-Fradera (Barcelona University)

Elisha Moses (Physics, Weizmann Inst.)

Uri Alon (Molecular Cell Biology, Weizmann Inst.)

Roy Bar-Ziv (Materials and Interfaces, Weizmann Inst.)

Ron Milo (Plant Biology, Weizmann Inst.)

Yoni Savir (Technion)

LIST OF PUBLICATIONS 10/2019

1. Tlusty T & Berger J (1992) A Simple Maximization Technique for Statistical-Mechanics Expressions. *Am J Phys* 60(4):379-380.
2. Safran SA & Tlusty T (1996) Curvature elasticity models of microemulsions. *Ber Bunsen Phys Chem* 100(3):252-263.
3. Bar-Ziv R, Meller A, Tlusty T, Moses E, Stavans J, Safran SA (1997) Localized dynamic light scattering: Probing single particle dynamics at the nanoscale. *Phys Rev Lett* 78(1):154-157.
4. Bar-Ziv R, Tlusty T, & Moses E (1997) Critical dynamics in the pearling instability of membranes. *Phys Rev Lett* 79(6):1158-1161.
5. Tlusty T, Safran SA, Menes R, & Strey R (1997) Scaling laws for microemulsions governed by spontaneous curvature. *Phys Rev Lett* 78(13):2616-2619.
6. Meller A, Bar-Ziv R, Tlusty T, Moses E, Stavans J, Safran SA (1998) Localized dynamic light scattering: A new approach to dynamic measurements in optical microscopy. *Biophys J* 74(3):1541-1548.
7. Tlusty T, Meller A, & Bar-Ziv R (1998) Optical gradient forces of strongly localized fields. *Phys Rev Lett* 81(8):1738-1741.
8. Bar-Ziv R, Tlusty T, Moses E, Safran SA, & Bershadsky A (1999) Pearling in cells: A clue to understanding cell shape. *Proc Nat Acad Sci USA* 96(18):10140-10145.
9. Bernheim-Groswasser A, Tlusty T, Safran SA, & Talmon Y (1999) Direct observation of phase separation in microemulsion networks. *Langmuir* 15(17):5448-5453.

10. Tlusty T & Safran SA (2000) Defect-induced phase separation in dipolar fluids. *Science* 290(5495):1328-1331.
11. Tlusty T & Safran SA (2000) Microemulsion networks: the onset of bicontinuity. *J Phys-Condens Mat* 12(8A):A253-A262.
12. Tlusty T, Safran SA, & Strey R (2000) Topology, phase instabilities, and wetting of microemulsion networks. *Phys Rev Lett* 84(6):1244-1247.
13. Tlusty T & Safran SA (2001) Entropic networks in colloidal self-assembly. *Philos T Roy Soc A* 359(1782):879-881.
14. Bar-Ziv R, Tlusty T, & Libchaber A (2002) Protein-DNA computation by stochastic assembly cascade. *Proc Nat Acad Sci USA* 99(18):11589-11592.
15. Zilman A, Tlusty T, & Safran SA (2003) Entropic networks in colloidal, polymeric and amphiphilic systems. *J Phys-Condens Mat* 15(1):S57-S64.
16. Tlusty T, Bar-Ziv R, & Libchaber A (2004) High-Fidelity DNA Sensing by Protein Binding Fluctuations. *Phys Rev Lett* 93(25):258103-258104.
17. Biron D, Alvarez-Lacalle E, Tlusty T, & Moses E (2005) Molecular Model of the Contractile Ring. *Phys Rev Lett* 95(9):098102-098104.
18. Safran SA, Gov N, Nicolas A, Schwarz US, & Tlusty T (2005) Physics of cell elasticity, shape and adhesion. *Physica A* 352(1):171-201.
19. Soriano J, Breskin I, Moses E, & Tlusty T (2006) Percolation approach to study connectivity living neural networks. *9th Granada Seminar - Cooperative Behavior in Neural Systems* AIP, eds Garrido PL, Marro J, & Torres JJ (AIP, Granada, SPAIN), Vol 887, pp 96-106.
20. Beatus T, Tlusty T, & Bar-Ziv R (2006) Phonons in a one-dimensional microfluidic crystal. *Nature Phys* 2(11):743-748.
21. Breskin I, Soriano J, Moses E, & Tlusty T (2006) Percolation in Living Neural Networks. *Phys Rev Lett* 97(18):188102-188104.
22. Itzkovitz S, Tlusty T & Alon U (2006) Coding limits on the number of transcription factors. *Bmc Genomics* 7(1):239.
23. Sagi D, Tlusty T, & Stavans J (2006) High fidelity of RecA-catalyzed recombination: a watchdog of genetic diversity. *Nucleic Acids Res* 34(18):5021-5031.
24. Shinar G, Dekel E, Tlusty T, & Alon U (2006) Rules for biological regulation based on error minimization. *Proc Nat Acad Sci USA* 103(11):3999-4004.
25. Tlusty T (2006) Screening by symmetry of long-range hydrodynamic interactions of polymers confined in sheets. *Macromolecules* 39(11):3927-3930.
26. Eckmann J-P, Feinerman O, Gruendlinger L, Moses E, Soriano J, & Tlusty T (2007) The physics of living neural networks. *Physics Reports* 449(1-3):54-76.

27. Beatus T, Bar-Ziv R, & Tlusty T (2007) Anomalous Microfluidic Phonons Induced by the Interplay of Hydrodynamic Screening and Incompressibility. *Phys Rev Lett* 99(12):124502-124504.
28. Savir Y & Tlusty T (2007) Conformational Proofreading: The Impact of Conformational Changes on the Specificity of Molecular Recognition. *PLoS ONE* 2(5):e468.
29. Tlusty T (2007) A model for the emergence of the genetic code as a transition in a noisy information channel. *J Theo Bio* 249(2):331-342.
30. Tlusty T (2007) A relation between the multiplicity of the second eigenvalue of a graph Laplacian, Courant's nodal line theorem and the substantial dimension of tight polyhedral surfaces. *Elec J Linear Algebra* 16:315-324.
31. Beatus T, Bar-Ziv R, & Tlusty T (2008) One-Dimensional Microfluidic Crystals Far From Equilibrium. *Prog Theor Phys* 117:123-130.
32. Savir Y & Tlusty T (2008) Optimal Design of a Molecular Recognizer: Molecular Recognition as a Bayesian Signal Detection Problem. *IEEE J Select Topics Sign Proc* 2(3):390-399.
33. Soriano J, Rodriguez Martinez M, Tlusty T, & Moses E (2008) Development of input connections in neural cultures. *Proc Nat Acad Sci USA* 105(37):13758-13763.
34. Tadmor AD & Tlusty T (2008) A Coarse-Grained Biophysical Model of E. coli and Its Application to Perturbation of the rRNA Operon Copy Number. *PLoS Comp Bio* 4(5):e1000038.
35. Tlusty T (2008) Rate-Distortion Scenario for the Emergence and Evolution of Noisy Molecular Codes. *Phys Rev Lett* 100(4):048101-048104.
36. Tlusty T (2008) A simple model for the evolution of molecular codes driven by the interplay of accuracy, diversity and cost. *Phys Bio* 5(1):016001.
37. Tlusty T (2008) Casting polymer nets to optimize noisy molecular codes. *Proc Nat Acad Sci USA* 105(24):8238-8243.
38. Beatus T, Tlusty T, & Bar-Ziv R (2009) Burgers Shock Waves and Sound in a 2D Microfluidic Droplets Ensemble. *Phys Rev Lett* 103(11):114502-114504.
39. Lampert A & Tlusty T (2009) Mutability as an altruistic trait in finite asexual populations. *J Theo Bio* 261(3):414-422.
40. Savir Y & Tlusty T (2009) Molecular recognition as an information channel: The role of conformational changes. in *43rd Annual Conference on Information Sciences and Systems (CISS)* pp 835-840.
41. Tlusty T (2009) The physical language of molecular codes: A rate-distortion approach to the evolution and emergence of biological codes. in *43rd Annual Conference on Information Sciences and Systems (CISS)* pp 841-846.

42. Tlusty T & Eckmann JP (2009) Remarks on bootstrap percolation in metric networks. *J Phys A* 42(20):205004.
43. Cohen O, Kesselman A, Soriano J, Moses E, & Tlusty T (2010) Quorum percolation in living neural networks. *EuroPhys Lett* 89(1):18008.
44. Rodríguez Martínez M, Soriano J, Tlusty T, Pilpel Y, & Furman I (2010) Messenger RNA fluctuations and regulatory RNAs shape the dynamics of a negative feedback loop. *Phys Rev E* 81(3):031924.
45. Savir Y, Noor E, Milo R, & Tlusty T (2010) Cross-species analysis traces adaptation of Rubisco toward optimality in a low-dimensional landscape. *Proc Nat Acad Sci USA* 107(8):3475-3480.
46. Savir Y & Tlusty T (2010) RecA-Mediated Homology Search as a Nearly Optimal Signal Detection System. *Molecular Cell* 40(3):388-396.
47. Tlusty T (2010) A colorful origin for the genetic code: Information theory, statistical mechanics and the emergence of molecular codes. *Phys Life Rev* 7(3):362-376.
48. Eckmann J-P, Moses E, Stetter O, Tlusty T, & Zbinden C (2010) Leaders of neuronal cultures in a quorum percolation model. *Frontiers in Computational Neuroscience* 4:12.
49. Lampert A & Tlusty T (2011) Density Dependent Cooperation as a Mechanism for Persistence and Coexistence. *Evolution* 65(10):2750-2759.
50. Beatus T, Bar-Ziv R, & Tlusty T (2012) The physics of 2D microfluidic droplet ensembles. *Physics Reports*, 516(3): 103–145.
51. Levary D, Eckmann J-P, Moses E & Tlusty T (2012) Loops and self-reference in the construction of dictionaries. *Phys Rev X*, 2(3): 031018.
52. Savir Y, Waysbort N, Antebi Y, Tlusty T, & Friedman N (2012) Balancing speed and accuracy of polyclonal T cell activation: a role for extracellular feedback. *BMC Systems Biology* 6.
53. Maeda YT, Tlusty T, Libchaber A (2012) Effects of folding and sequence on thermophoresis of genome DNA and small RNA. *Proc Nat Acad Sci USA*, online.
54. Iyer KV, Maharana S, Gupta S, Libchaber AJ, Tlusty T, Shivashankar GV (2012) Spatial organization of chromosomes is linked to global gene expression program. *PLoS One* 7(10): e46628.
55. Pugatch R, Barkai N, & Tlusty T. Asymptotic doubling rate of cells in fluctuating environment as an information rate. *arXiv*:1308.0623.
56. Lampert A & Tlusty T (2013) Resonance-Induced Discrete Body-Size Distributions. *Proc Nat Acad Sci USA*, 110(1):205-209.
57. Savir Y & Tlusty T. (2013) The ribosome as an optimal decoder: a lesson in molecular recognition. *Cell* 153(2):471-479.

58. Friedlander T Mayo A Tlusty T & Alon U. (2013) Mutation Rules and the Evolution of Sparseness and Modularity in Biological Systems. *PLoS One* 8(8): e70444.
59. Shani I, Beatus T, Bar-Ziv R. & Tlusty T (2014) Long-range orientational order in 2D microfluidic dipoles. *Nature Physics* 10 (2), 140-144.
60. Friedlander T, Mayo AE, Tlusty T, Alon U (2015) Evolution of bow-tie architectures in biology. *PLoS Comput Biol* 11(3):e1004055. doi: 10.1371/journal.pcbi.
61. Lampert A & Tlusty T (2016) Where two are fighting the third wins: Stronger selection implies greater polymorphism. *PLoS one* 11.
62. Savir Y, Kagan J & Tlusty T (2015) Binding of transcription factors adapts to resolve information-energy trade-off. *J Stat Phys*, 1-12.
63. Tlusty T (2016) Self-referring DNA: a remark on physical and geometrical aspects. *Phil Trans Roy Soc A*, 374: 20150070.
64. Mitchell MR, Tlusty T & Leibler S (2016) Strain analysis of protein structures and low dimensionality of mechanical allosteric couplings, *Proc. Nat Acad Sci USA* 113(40) E5847-E5855.
65. Tlusty T Libchaber A & Eckmann JP (2017) Physical model of the sequence-to-function map of proteins, *Physical Review X*, 7(2): 021037.
66. Beatus T, Shani I, Bar-Ziv R, & Tlusty T (2017) Two-dimensional flow of driven particles: a microfluidic pathway to the non-equilibrium frontier. *Chemical Society Reviews*, 46: 5620-5646.
67. Dutta S, Eckmann JP Libchaber A & Tlusty T (2018) Green function of correlated genes and the mechanical evolution of protein. *Proc Nat Acad Sci USA* 115(20):E4559-E4568.
68. Paneru G, Lee DY, Tlusty T, & Pak HK (2018) Lossless Brownian Information Engine. *Phys Rev Lett* 120(2):020601.
69. Jee AY, Dutta S, Cho YK, Tlusty T, & Granick S (2018) Enzyme leaps fuel antichemotaxis. *Proc Nat Acad Sci USA* 115(1):14-18.
70. Ha MY, Yoon TJ, Tlusty T, Jho Y, & Lee WB (2018) Widom Delta of Supercritical Gas-Liquid Coexistence. *J Phys Chem Lett* 9(7):1734-1738.
71. Condon, A., H. Kirchner, D. Larivière, W. Marshall, V. Noireaux, T. Tlusty and E. Fourmentin (2018). "Will biologists become computer scientists?" *EMBO reports*.
72. Jee AY, Cho YK, Granick S & Tlusty T (2019) Catalytic enzymes are active matter. *Proc Natl Acad Sci USA* 115, E10812-E10821.
73. Ha MY, Yoon TJ, Tlusty T, Jho Y & Lee WB (2019). Universality, scaling and collapse in supercritical fluids. *J. Phys. Chem, Lett.* 10.1021/acs.jpcllett.9b033

74. Paneru G, Dutta S, Tlusty T & Pak HK (2019) Approaching and violating thermodynamic uncertainty bounds on fluctuation-dissipation tradeoffs of information engines. *arXiv*: 1911.09835.
75. Paneru G, Dutta S, Sagawa T, Tlusty T & Pak HK (2019) Efficiency fluctuations and noise induced refrigerator-to-heater transition in an information engine. *arXiv*: 1911.09833
76. Jee AY, Chen K, Tlusty T, Zhao J. & Granick S (2019) Enhanced diffusion and enzyme dissociation. *J. Am. Chem. Soc.* 141, 51, 20062-20068
77. McBride JM & Tlusty T (2019) Imperfect fifths pack into musical scales. *arXiv*:1906.06171 (2019).
78. Piñeros WD & Tlusty T (2019) Kinetic Proofreading and the Limits of Thermodynamic Uncertainty. *arXiv*:1911.04673.
79. Mani S & Tlusty T (2019) Regeneration comes for free with biological development in a generative Boolean model. *arXiv*:1911.06659.
80. Reinharz V & Tlusty T (2019) Unspecific binding but specific disruption of the group I intron by the StpA chaperone. *arXiv*:1911.03046.
81. Eckmann J-P, Roujemont J & Tlusty T (2019) Proteins: The physics of amorphous evolving matter. *Reviews of Modern Physics.* 91, 03100.