Zubair Azad

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Citizenship: United States

Education and Qualifications

Post-Doc in Electrical Engineering — **Los Angeles, CA**
University of California, Los Angeles. Advisor: Aydogan Ozcan — 2016 - present

Ph.D. in Physics. ***Nonequilibrium Dynamics of Nanoconfined DNA*** — **Raleigh, NC**
North Carolina State University. Advisor: Robert Riehn — 2016

- 2 publications in peer-reviewed journals and 4 in preparation
- Discovered nonequilibrium steady state conditions (>30 min) for large DNA loops (>3 µm), pioneering the study of DNA quaternary structural dynamics as mediated by proteins, external stresses, and confinement geometry
- Discovered the mutual exclusion of DNA and negative ions in solution when driven far out of equilibrium by strong AC electric fields, advancing the understanding of DNA-ion interactions beyond the "free-draining" assumption
- Derived physical models for nonequilibrium dynamics of nanoconfined DNA loops and ions including entanglements, ion dynamics, and DNA-ion interactions
- Designed and executed laser-based fluorescence microscopy in novel micro/nanofluidic devices for simultaneous 4-channel imaging and manipulation of single molecules (DNA, proteins, lipids) and single cells (*E. coli*, HeLa)
- Process massive image datasets (>100 GB) in less than 10 minutes with parallel computing

M.Sc. in Physics — **Raleigh, NC**
North Carolina State University. — 2014

M.Eng. in Applied Physics. ***Properties of Nanoscale Ionic Materials*** — **Ithaca, NY**
Cornell University. Advisor: Emmanuel Giannelis — 2011

B.A. in Physics, Minor in Biology. — **Ithaca, NY**
Cornell University. — 2010

Skills

Nanofabrication
Extensive: electron beam lithography, photolithography, wet and dry reactive ion etching, wet and dry thermal oxide growth, development, post-process RCA/JTBaker, spin-coating, O_2 plasma
Moderate: metal evaporation, liftoff *Basic:* AFM, profilometry, ellipsometry

Micro/Nanofluidics
Extensive: design, prototypes, fabrication, hardware/software development for device support, bonding, surface treatments, voltage/pressure regulation

Microscopy
Extensive: bright/dark-field, wide-field fluorescence, multi-color confocal laser scanning, TIRF, SEM

Molecular biology
Basic: mini/maxiprep, cell cultures, PCR, restriction, ligation, transfection, cloning, DNA staining, gels

Software
Extensive: Matlab, ImageJ, POVRay, Art of Illusion, AutoCAD, Inkscape, Layout Editor
Moderate: LabVIEW, Mathematica, Java *Basic:* Maple, Fortran, C++, Python

Languages

English and Bengali (fluent) Spanish, Turkish, and Arabic (basic readability)

Honors and Awards

NCSU Doctoral Dissertation Award 2016
NCSU Departmental Supplement of Excellence 2011

Teaching Experience

Teaching Assistant: Instrumentation and Data Analysis (PY 252, NCSU, 3 terms) 2013 - 2014
Teaching Assistant: Electricity and Magnetism (PY 208, NCSU, 2 terms) 2011 - 2012
Teaching Assistant: General Physics II (PHYS 1102, Cornell, 1 term) 2011
Teaching Assistant: Physics II: Electromagnetism (PHYS 2213, Cornell, 1 term) 2010

Memberships and Interests

American Physical Society since 2013
Biophysical Society since 2016
NCSU Graduate Physics Student Association, Web Administrator 2014

Publications

1. **Azad, Z.**, Riehn, R., (2016). *DNA Drift in a Nanofluidic Ionic Concentration Gradient*. In preparation.
2. **Azad, Z.**, Riehn, R., (2016). *Entanglements in the Nonequilibrium Dynamics of Loops of Large Nanoconfined DNA*. In preparation.
3. **Azad, Z.**, Riehn, R., (2016). *Mutual Exclusion of DNA and Fluorescent Anions in Strong AC Electric Fields*. In preparation.
4. Roushan, M., **Azad, Z.**, Ray, P. D., Lifshits, G. I., Lim, S. F., Wang, H., Riehn, R., (2016). *Motor-like DNA Motion Due to an ATP-Hydrolyzing Protein*. In preparation.
5. **Azad, Z.**, Roushan, M., Riehn, R., (2015). *DNA Brushing Shoulders: Targeted Looping and Scanning of Large DNA Strands*. Nano Letters **15**(8), 5641–5646.
6. Roushan, M., **Azad, Z.**, Lim, S. F., Wang, H., Riehn, R., (2015). *Interference of ATP with the fluorescent probes YOYO-1 and YOYO-3 modifies the mechanical properties of intercalator-stained DNA confined in nanochannels*. Microchimica Acta **182**(7-8), 1561–1565.

Posters

1. **Azad, Z.**, Roushan, M., Riehn, R., (2016). *Non-Equilibrium Interactions Between Large DNA Molecules*. NCSU 12th Annual Graduate Research Symposium.
2. **Azad, Z.**, Roushan, M., Riehn, R., (2016). *Non-Equilibrium Interactions Between Large DNA Molecules*. Biophysical Society 60th Annual Meeting.
3. **Azad, Z.**, Roushan, M., Riehn, R., (2015). *DNA Brushing Shoulders: Targeted Looping and Scanning of Large DNA Strands*. MRSEC 7th Annual Triangle Soft Matter Workshop.
4. Roushan, M., **Azad, Z.**, Kaur, P., Lin, J., Countryman, P., Lim, S. F., Wang, H., Riehn, R., (2015). *Detection of DNA Folds and Knots in Nanovolumes*. MRSEC 7th Annual Triangle Soft Matter Workshop.
5. Roushan, M., **Azad, Z.**, Riehn, R., (2015). *A Nanofluidic Assay for DNA-Processive Motor Proteins*. Gordon Research Conference.

Talks

1. **Azad, Z.**, Riehn, R., (2016). *Do Ions Flow Freely Through Confined DNA?* APS March Meeting.

2. Roushan, M., Livshits, G.**, Azad, Z.**, Wang, H., Riehn, R., (2016). *Detection of ATP hydrolysis through motion of nanoconfined DNA*. APS March Meeting.
3. **Azad, Z.**, Riehn, R., (2015). *When DNA Collides With Itself*. APS March Meeting.
4. **Azad, Z.**, Riehn, R., (2014). *Targeted Manipulation of Single Large DNA Molecules*. APS March Meeting.
5. **Azad, Z.**, Riehn, R., (2013). *Ionosphere Perturbation of Single DNA Molecules in AC Electric Fields*. APS March Meeting.
6. Fernandes, N.**, Azad, Z.**, Giannelis, E., (2011). *A Silica Nanoparticle Based Ionic Material*. APS March Meeting.