

Mohammad Heiranian

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Professional Training

Postdoctoral Associate	Chemical and Environmental Engineering	Yale University, USA	Present
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Education

Ph.D.	Theoretical and Applied Mechanics	University of Illinois at Urbana-Champaign, USA	2020
M.S.	Theoretical and Applied Mechanics	University of Illinois at Urbana-Champaign, USA	2016
B.S.	Mechanical Engineering	University of Manitoba, Canada	2012

Advisors

Prof. Narayana R. Aluru (M.S. and Ph.D.)

Prof. Menachem Elimelech (Postdoctoral Associate)

Research Interests & Statement

Nanotechnology, Nanofluidics, Computational Biophysics, Computational Nanoscience, Membrane Technology

Using molecular dynamics simulations and ab initio calculations, I study phenomena that occur in nanoscale pores/channels such as graphene, MoS₂ and biological membranes with applications to water desalination, power generation, energy storage, biomolecule detection, *etc.*

Publications and Scholarly Work

Peer-reviewed Journal Articles

1. Heiranian, M., Taquidin, A., Aluru, N. R. "Revisiting Sampson's theory for flow in ultrathin nanopores," *Physical Review Research*. 2020, 2(4), 043153.
2. Taquidin, A., Heiranian, M., Aluru, N. R. "Interfacial properties of water on hydrogenated and fluorinated graphene surfaces," *The Journal of Physical Chemistry C*. 2020, 124(39), 21467-21475.
3. Snapp, P., Heiranian, M., Hwang, M., Bashir, R., Aluru, N. R., Nam, S. "Current understanding and emerging applications of 3D crumpling mediated 2D material-liquid interactions," *Current Opinion in Solid State and Materials Science*. 2020, 24(3), 100836.
4. Hwang, M., Heiranian, M., Kim, Y., You, S., Leem, J., Taqieddin, A., Faramarzi, V., Jing, Y., Park, J., van der Zande, A., Nam, S., Aluru, N. R., Bashir, R. "Ultrasensitive detection of nucleic acids using deformed graphene channel field effect biosensors," *Nature Communications*. 2020, 11(1), 1-11.
5. Heiranian, M., Aluru, N. R. "Nanofluidic transport theory with enhancement factors approaching one," *ACS Nano*. 2019, 14(1), 272-281.
6. Kwon, S. S., Choi, J., Heiranian, M., Kim, Y., Chang, W. J., Knapp, P., Wang, M. C., Aluru, N. R., Park, W. I. "Electrical double layer of supported atomically-thin materials," *Nano Letters*. 2019, 19(7), 4588-4593.
7. Nandigana, V., Heiranian, M., Aluru, N. R. "Single ion transport with a single-layer graphene nanopore," *International Journal of Mechanical and Mechatronics Engineering*. 2019, 13(7), 479-483.
8. Zhang, Y., Heiranian, M., Janicek, B., Budrikis, Z., Zapperi, S., Huang, P., Johnson, H. T., Aluru, N. R., Lyding, J. W., Mason, N. "Strain modulation of graphene by nanoscale substrate curvatures: a molecular view," *Nano Letters*. 2018, 18(3), 2098-2104.
9. Farimani, A. B., Heiranian, M., Aluru, N. R. "Identification of amino acids with sensitive nanoporous MoS₂: towards machine learning-based prediction," *npj 2D Materials and Applications*. 2018, 2(1), 1-9.

10. Heiranian, M., Wu, Y., Aluru, N. R. "Molybdenum disulfide and water interaction parameters," *The Journal of Chemical Physics*. 2017, 147(10), 104706.
11. Barati Farimani, A., Heiranian, M., Min, K., Aluru, N. R. "Antibody subclass detection using graphene nanopores," *The Journal of Physical Chemistry Letters*. 2017, 8(7), 1670-1676.
12. Feng, J. D., Graf, M., Liu, K., Ovchinnikov, D., Dumcenco, D., Heiranian, M., Nandigana, V., Aluru, N. R., Kis, A., Radenovic, A. "Single-layer MoS₂ nanopores as nanopower generators," *Nature*. 2016, 536(7615), 197-200.
13. Farimani, A. B., Heiranian, M., Aluru, N. R. "Nano-electro-mechanical pump: Giant pumping of water in carbon nanotubes," *Scientific Reports*. 2016, 6(1), 1-6.
14. Heiranian, M., Farimani, A. B., Aluru, N. R. "Water desalination with a single-layer MoS₂ nanopore," *Nature Communications*. 2015, 6(1), 1-6.
15. Farimani, A. B., Heiranian, M., Aluru, N. R. "Electromechanical signatures for DNA sequencing through a mechanosensitive nanopore," *Journal of Physical Chemistry Letters*. 2015, 6(4), 650-657.
16. Venkatesan, G. A., Lee, J., Farimani, A. B., Heiranian, M., Collier, C. P., Aluru, N. R., Sarles, S. A. "Adsorption kinetics dictate mono layer self-assembly for both lipid-in and lipid-out approaches to droplet interface bilayer formation," *Langmuir*. 2015, 31(47), 12883-12893.

Conferences, Symposiums & Seminars

1. BPS Biophysical Society 59th Annual Meeting – Feb 2015
2. 68th Annual Meeting of the APS Division of Fluid Dynamics – Nov 2015
3. NCSA Blue Waters Symposium for Petascale Science and Beyond – Jun 2016
4. APS March Meeting – Mar 2017
5. NCSA Blue Waters Symposium for Petascale Science and Beyond – May 2017
6. APS March Meeting – Mar 2018
7. APS March Meeting – Mar 2019
8. MechSE Fluid Mechanics Seminars – Mar 2020

Other

Referee of articles for the peer reviewed journals of *Microfluidics and Nanofluidics* and *Desalination*.

Awards

- Michael Sutton Memorial Award for outstanding research in mechanical engineering (2018)
- Shell Design Award for the best capstone paper (2011/2012)
- International Undergraduate Student Scholarship (Fall 2011 and Spring 2012)
- UMSU Scholarship (Fall 2011 and Spring 2012)
- Randy Futros Memorial Award (Fall 2010 and Spring 2011)
- International Undergraduate Student Scholarship (Fall 2010 and Spring 2011)
- UMSU Scholarship (Fall 2010 and Spring 2011)
- Technical Communication Report Prize-Engineering (Spring 2011)
- International Undergraduate Student Scholarship (Fall 2009)
- International Undergraduate Student Entrance Scholarship (Fall 2008)

Teaching

1. Teaching assistant for TAM 335- Introductory Fluid Mechanics, University of Illinois at Urbana-Champaign
Jan 2013 – May 2013
2. Teaching assistant for TAM 210/211- Statics, University of Illinois at Urbana-Champaign
Aug 2013 – Dec 2013
3. Teaching assistant for TAM 210/211- Statics, University of Illinois at Urbana-Champaign
Aug 2017 – Dec 2017
4. Teaching assistant for ME 200- Thermodynamics, University of Illinois at Urbana-Champaign
Jan 2020 – May 2020