

October 24, 2024

Farshid Mohammad-Rafiee

Associate Professor of the Soft and Living Matter

Current Address

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Current Positions

2023 – Visiting Scholar University of Pennsylvania
2011 – Associate Professor of Physics, Department of Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran

Education

2005 Ph.D., Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran.
Supervisor: Professor Ramin Golestanian
2000 B.Sc., Physics, Sharif University of Technology, Tehran, Iran.
1996 High School Diploma, Beheshti High School under the supervision of National Organization for Development of Exceptional Talents, Zanjan, Iran.

Prior Positions

2007-2011 Assistant Professor of Physics, Department of Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran
2006-2007 Postdoctoral Research Associate in Theoretical Biophysics, Research Group of Dr Pierre Sens, Laboratoire Gulliver, ESPCI, Paris, France
2005–2006 Assistant Professor of Physics, Department of Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran

Awards & Honors

2014–2019 ICTP Junior Associateship, ICTP, Trieste, Italy
2009 The prize for the best researchers of Zanjan Province, Iran
2006–2007 CNRS Postdoctoral Scholarship, ESPCI, Paris, France
2002 1st Rank, PhD students, IASBS, Zanjan, Iran
2001 1st Rank, Graduate Students, IASBS, Zanjan, Iran
2000 6th Rank, National Graduate Entrance Exam in Physics, Iran
2000 9th Rank, National Student Olympiad in Physics, Iran
1996–2000 Consistently ranked within the top 10% of undergraduate students, Sharif University of Technology, Tehran, Iran
1996–2000 Scholarship, Institute for Theoretical Physics and Mathematics (IPM), Tehran, Iran
1996 First Prize, National Entrance Exam in Physics, Sharif University of Technology, Tehran, Iran
1995 Honored as one of the top 50 students in the National Computer Science Olympiad, Iran
1995 Second Prize (Silver Medal), National Physics Olympiad, Iran

Visiting Positions

- October 1, 2023 - Present, Visiting Scholar at the Center for Soft and Living Matter (Professor Andrea Liu's group), University of Pennsylvania, USA
- September 20 - December 20, 2021, Department of Theoretical Physics, Saarland University, Saarbrücken, Germany
- June 25 - September 14, 2018, Visiting Scholar, Department of Fluid Physics, Pattern Formation and Biocomplexity, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany
- March 4 - April 7, 2018, Visiting Scholar, the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
- July 16 - September 14, 2016, Visiting Scholar, Department of Fluid Physics, Pattern Formation and Biocomplexity, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany
- February 29 - April 5, 2016, Visiting Scholar, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
- March 1 - April 10, 2015, Visiting Scholar, the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
- June 8 - August 5, 2013, Visiting Scholar, Department of Fluid Physics, Pattern Formation and Biocomplexity, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany
- June 2 - September 1, 2006, Visiting Scholar, Laboratoire de Physico-Chimie Théorique, ESPCI, Paris, France
- November 11 - December 20, 2005, Visiting Scholar, Laboratoire de Physique des Fluides Organisés, Collège de France, Paris, France
- January 19 - May 4, 2004, Visiting Scholar, Workshop "Statistical Mechanics of Molecular and Cellular Biological Systems", Isaac Newton Institute for Mathematical Sciences, Cambridge, UK
- May 16 - August 15, 2003, Visiting Scholar, Theory Group, Max-Planck-Institute for Polymer

Peer-Reviewed Publications

1. F. Mohammad-Rafiee, and R. Golestanian, "Nonlinear Mechanical Response of DNA due to Anisotropic Bending Elasticity", *Eur. Phys. J. E* **12**, 599-604 (2003).
2. F. Mohammad-Rafiee, and R. Golestanian, "Electrostatic Contribution to Twist Rigidity of DNA", *Phys. Rev. E* **69**, 061919 (2004).
3. F. Mohammad-Rafiee, I. M. Kulić, and H. Schiessel, "Theory of Nucleosome Corkscrew Sliding in the Presence of Synthetic DNA Ligands", *J. Mol. Biol.* **344**, 47-58 (2004).
4. F. Mohammad-Rafiee, and R. Golestanian, "The Effect of Anisotropic Bending Elasticity on the Structure of Bend DNA", *J. Phys.: Condens. Matter* **17**, S1165- S1170 (2005).
5. F. Mohammad-Rafiee, and R. Golestanian, "Elastic Correlations in the Structure of Nucleosomal DNA", *Phys. Rev. Lett.* **94**, 238102 (2005).
6. D. Norouzi, F. Mohammad-Rafiee, and R. Golestanian, "Effect of Bending Anisotropy on the 3D Conformation of Short DNA Loops", *Phys. Rev. Lett.* **101**, 168103 (2008).
7. M. Ghorbani, and F. Mohammad-Rafiee, "Twist-stretch correlation of DNA", *Phys. Rev. E* **78**, 060901 (Rapid Communication) (2008).
8. A. Chepelianskii, F. Mohammad-Rafiee, E. Trizac, and E. Raphael, "On the Effective Charge of Hydrophobic Polyelectrolytes", *J. Phys. Chem. B* **113**, 3743-3749 (2009).

9. L. Mollazadeh-Beidokhti, J. Deseigne, D. Lacoste, F. Mohammad-Rafiee, and H. Schiessel, “Stochastic model for nucleosome sliding under an external force”, *Phys. Rev. E* **79**, 031922 (2009).
10. L. Mollazadeh-Beidokhti, F. Mohammad-Rafiee, and H. Schiessel, “Active nucleosome displacement: a theoretical approach”, *Biophys. J.* **96**, 4387-4398 (2009).
11. M. Ghorbani, and F. Mohammad-Rafiee, “Geometrical correlations in the nucleosomal DNA conformation and the role of the covalent bond rigidity”, *Nucl. Acids. Res.* **39**, 1220-1230 (2011).
12. L. Mollazadeh-Beidokhti, F. Mohammad-Rafiee, and H. Schiessel, “Nucleosome dynamics between tension-induced states”, *Biophys. J.* **102**, 2235-2240 (2012).
13. W. Pezeshkian, N. Nikoofard, D. Norouzi, F. Mohammad-Rafiee, and H. Fazli, “Distribution of counterions and interaction between two similarly charged dielectric slabs: Roles of charge discreteness and dielectric inhomogeneity”, *Phys. Rev. E* **85**, 061925 (2012).
14. D. Norouzi, and F. Mohammad-Rafiee, “DNA conformation and energy in nucleosome core: a theoretical approach”, *J. Biomol. Struct. Dyn.* **32**, 104-114 (2014).
15. S.M. Hashemi, P. Sens, and F. Mohammad-Rafiee, “Regulation of the membrane wrapping transition of a cylindrical target by cytoskeleton adhesion”, *J. R. Soc. Interface* **11**, 20140769 (2014).
16. H. Fatemi, F. Khodabandeh, and F. Mohammad-Rafiee, “Elastic model for dinucleosome structure and energy”, *Phys. Rev. E* **93**, 042409 (2016).
17. B. Shakiba, M. Dayeri, and F. Mohammad-Rafiee, “Modeling of Ribosome Dynamics on a ds-mRNA under an External Load”, *J. Chem. Phys.* **145**, 025101 (2016).
18. Z. Eidi, F. Mohammad-Rafiee, M. Khorrami, and A. Gholami, “Modelling of Dictyostelium discoideum movement in a linear gradient of chemoattractant”, *Soft Matter* **13**, 8209-8222 (2017).
19. A. Rezaie-Dereshgia, and F. Mohammad-Rafiee, “Effects of dielectric inhomogeneity on electrostatic twist rigidity of a helical biomolecule in Debye-Hückel regime”, *J. Chem. Phys.* **148**, 135101 (2018).
20. A. Atakhani, F. Mohammad-Rafiee, and A. Gholami, “Influence of cross-linking and retrograde flow on formation and dynamics of lamellipodium”, *PLoS ONE* **148**, e0213810 (2019).
21. A. Khosravanizadeh, P. Sens, and F. Mohammad-Rafiee, “Wrapping of a nanowire by a supported lipid membrane”, *Soft Matter* **15**, 7490-7500 (2019).
22. F. Khodabandeh, H. Fatemi, and F. Mohammad-Rafiee, “Insight into the unwrapping of the dinucleosome”, *Soft Matter* **16**, 4806-4813 (2020).
23. S.G. Nodehi, G.V. Shivashankar, J. Prost, and F. Mohammad-Rafiee, “The characteristics of nuclear membrane fluctuations in stem cells”, *J. R. Soc. Interface* **18**, 20201010 (2021).
24. R. Kor, and F. Mohammad-Rafiee, “Theoretical study of RNA-polymerase behavior considering the backtracking state”, *Soft Matter* **18**, 5979-5988 (2022).
25. A. Khosravanizadeh, P. Sens, and F. Mohammad-Rafiee, “Role of particle local curvature in cellular wrapping”, *J. R. Soc. Interface* **19**, 20220462 (2022).
26. S. Rahbar, F. Mohammad-Rafiee, L. Santen, and R. Shaebani, “Growth of Stress-Responsive Bacteria in 3D Colonies under Confining Pressure”, *bioRxiv 2024.10.03.616465* (2024).
27. S. Rahbar, A. Khosravanizadeh, and F. Mohammad-Rafiee, “Forces acting on a hard flat wall by a grafted fluctuating actin filament”, *to be submitted* (2024).
28. M. Chitsaazha, K. Mehrara, F. Mohammad-Rafiee, “Exploring Ribosomal Dynamics: Theoretical Model for Translation and Frame-Shifting Phenomena”, *in preparation*.

Colloquia, Talks, and Posters

1. Aug. 17-22, 2002: The 7th School on Physics, IASBS, Zanjan, Iran (Invited Talk).
2. May 5-16, 2003: International Workshop on “Proteomics: Protein Structure, Function and Interactions”, ICTP, Trieste, Italy (Poster Presentation).
3. Jan. 19-May 4, 2004: Workshop on “Statistical Mechanics of Molecular and Cellular Biological Systems”, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK (Contributed Talk).
4. Jun. 5-25, 2004: International Summer School on Soft and Biological Matter, IASBS, Zanjan, Iran (Contributed Talk).
5. Jun. 27-Jul. 1, 2004: Statistical Physics of Complex Fluids: STATPHYS22 Satellite Meeting, IASBS, Zanjan, Iran (Poster Presentation).
6. May 26-27, 2005: The 11th Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran (Contributed Talk).
7. July 9-13, 2007: 23rd IUPAP International Conference on Statistical Physics (STATPHYS 23), Genova, Italy (Poster Presentation).
8. May 26-27, 2011: The 17th Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran (Invited Talk).
9. Oct. 30, 2011: Department of Physics, Sharif University of Technology, Tehran, Iran (Colloquium).
10. Nov. 29, 2011: Department of Physics, University of Zanjan, Zanjan, Iran (Colloquium).
11. Feb. 25-29, 2012: The 17th Winter School on Physics, IASBS, Zanjan, Iran (Invited Talk).
12. Feb. 16-21, 2013: The 18th School on Physics, IASBS, Zanjan, Iran (Invited Talk).
13. Oct. 24, 2013: Workshop on Physics of Polymers and Biopolymers, Institute for Research in Fundamental Sciences, Tehran, Iran (Invited Talk).
14. Dec. 18-19, 2014: The 6th IPS Conference on Statistical Physics, Soft Matter, and Complex Systems, University of Zanjan, Zanjan, Iran (Invited Talk).
15. Jan. 24-29, 2015: The 20th School on Physics, IASBS, Zanjan, Iran (Invited Talk).
16. May 25-26, 2017: The first workshop on quantum dynamics of open systems and fluctuation forces, Bijar Faculty of Science and Engineering, University of Kurdistan, Iran (Invited Talk).
17. Feb. 11-16, 2017: The 22nd School on Physics, IASBS, Zanjan, Iran (Invited Talk).
18. Feb. 3-8, 2018: The 23rd School on Physics, IASBS, Zanjan, Iran (Invited Talk).
19. May 27-28, 2018: The 23rd Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran (Invited Talk).
20. Dec. 27, 2018: The Physics Society of Iran Annual Meeting, University of Tehran, Iran (Contributed Talk).
21. Apr. 11, 2019: Workshop on Non-equilibrium Soft Matter, School of Nano Science, Institute for Research in Fundamental Sciences, Tehran, Iran (Invited Talk).
22. Jul. 1, 2021: the High School Students Gathering
23. Dec. 14, 2020: Department of Physics, Bu-Ali Sina University, Hamedan, Iran (Colloquium).
24. Mar. 8, 2021: Department of Physics, Urmia University, Urmia, Iran (Colloquium).
25. Jul. 10-15, 2021: The 26th School on Physics, IASBS, Zanjan, Iran (Invited Talk).
26. Jan. 6, 2022: the Zanjan Physics Teachers’ Association, Zanjan, Iran (Colloquium).
27. Feb. 15-16, 2023, Advanced School on Soft Matter, School of Nano Science, Institute for Research in Fundamental Sciences, Tehran, Iran (Invited Talk).

28. Jun. 12-13, 2024: Center for Soft and Living Matter Kickoff Meeting, University of Pennsylvania, Philadelphia, USA (Poster Presentation).
29. Jul. 29- Aug. 2, 2024: 8th International Soft Matter Conference (ISMC2024), Raleigh, North Carolina, USA (Poster Presentation).
30. Frequently delivered colloquia to high school students at various schools in Zanjan, Iran, aimed at introducing contemporary topics in physics, highlighting the significance of basic sciences, and encouraging students to pursue studies in these fields.

Articles in Proceedings

1. "A Model for Twist-Stretch Coupling in the DNA Molecule", M. Ghorbani, and F. Mohammad-Rafiee, Proceedings of the 15th IPM Physics Spring Conference, Institute for Research in Fundamental Sciences, Tehran, Iran, 2008.
2. "The Effect of External Torque on Nucleosome Dynamics", Sh. Rafatnia, L. Mollazadeh-Beidokhti, and F. Mohammad-Rafiee, Proceedings of the 15th IPM Physics Spring Conference, Institute for Research in Fundamental Sciences, Tehran, Iran, 2008.
3. "The Effect of Cross-Section Anisotropy on the Three-Dimensional Shape of Small DNA Rings", D. Norouzi, F. Mohammad-Rafiee, and R. Golestanian, Proceedings of 10th Condensed Matter Conference of Iranian Physics Society, Shiraz, Iran, 2009.
4. "Modeling the Movement of the Kinesin Protein Motor", H. Fatemi, L. Mollazadeh-Beidokhti, and F. Mohammad-Rafiee, Proceedings of 10th Condensed Matter Conference of Iranian Physics Society, Shiraz, Iran, 2009.
5. "Elastic Deformations of a Bilayer Membrane Due to the Adhesion of a Long Cylindrical Particle", S. M. Hashemi, and F. Mohammad-Rafiee, Proceedings of 10th Condensed Matter Conference of Iranian Physics Society, Shiraz, Iran, 2009.
6. "Deformation of an Elastic Surface Due to Gravitational Force", A. Amiri, M. Maleki, S. M. Hashemi, and F. Mohammad-Rafiee, Proceedings of 10th Condensed Matter Conference of Iranian Physics Society, Shiraz, Iran, 2009.
7. "Modeling Ribosome Translocation and Frameshifting", Bahareh Shakiba, Maryam Dayeri, and F. Mohammad-Rafiee, Proceedings of the 2nd IPM Conference on Soft Matter, Biological and Statistical Physics, Institute for Research in Fundamental Sciences, Tehran, Iran, 2013.
8. "The Mechanical Response of a Biological Membrane Due to the Binding of a Cylindrical Object Considering the Effects of the Cytoskeleton", S.M. Hashemi, F. Mohammad-Rafiee, and P. Sens, Proceedings of the 2nd IPM Conference on Soft Matter, Biological and Statistical Physics, Institute for Research in Fundamental Sciences, Tehran, Iran, 2013.
9. "Theoretical Study of RNA Polymerase Backtracking on Nucleosomal DNA", F. Shamsi, B. Shakiba, L. Mollazadeh-Beidokhti, F. Mohammad-Rafiee, Proceedings of the 2nd IPM Conference on Soft Matter, Biological and Statistical Physics, Institute for Research in Fundamental Sciences, Tehran, Iran, 2013.
10. "Modeling and Theoretical Study of Sequence-Dependent Nucleosome Sliding", Z. Alirezaei, P. Abazari, D. Norouzi, L. Mollazadeh-Beidokhti, F. Mohammad-Rafiee, Proceedings of the 2nd IPM Conference on Soft Matter, Biological and Statistical Physics, Institute for Research in Fundamental Sciences, Tehran, Iran, 2013.
11. "Change in Twist of Actin Filaments in Bundles in the Presence of Multivalent Salts", S. Dolatyari, and F. Mohammad-Rafiee, Proceedings of 20th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2014.
12. "Dynamics of Unwrapping and Rewrapping of a Di-nucleosome", F. Khodabandeh, H. Fatemi, and F. Mohammad-Rafiee, Proceedings of 20th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2014.

13. “Modeling Chemotaxis in Dictyostelium Amoeba: Biased Random Crawling”, Zahra Eidi, F. Mohammad-Rafiee, and M. Khorrami, Proceedings of the 6th IPS Conference on Statistical Physics, Soft Matter, and Complex Systems, University of Zanjan, Zanjan, Iran, 2014.
14. “Energy and Structure of Two-Nucleosomes”, Hashem Fatemi, Fatemeh Khodabandeh, and F. Mohammad-Rafiee, Proceedings of the 6th IPS Conference on Statistical Physics, Soft Matter, and Complex Systems, University of Zanjan, Zanjan, Iran, 2014.
15. “Dynamics of the Nuclear Membrane of Embryonic Stem Cells”, S. Ghanbarzadeh-Nodehi, Z. Eidi, L. Mollazadeh-Beidokhti, and F. Mohammad-Rafiee, Proceedings of the 8th IPS Conference on Statistical Physics, Soft Matter, and Complex Systems, Isfahan University of Technology, Isfahan, Iran, 2015.
16. “Elastic Behavior of DNA Molecules Immobilized on a Surface”, M.S. Alizadeh, H. Fatemi, and F. Mohammad-Rafiee, Proceedings of The 1st IPS Computational Physics Conference, Shahid Rajaei Teacher Training University, Tehran, Iran, 2016.
17. “Modeling of Deformation of the Cell’s Membrane Under Actin Forces”, Asal Atakhani, F. Mohammad-Rafiee, and A. Gholami, Proceedings of 22nd Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2016.
18. “Bendability of Short DNA Strands” M.S. Alizadeh, H. Fatemi, and F. Mohammad-Rafiee, Proceedings of 22nd Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2016.
19. “Theoretical Investigation of Nuclear Membrane Dynamics in Embryonic Stem Cells”, S. Ghanbarzadeh-Nodehi, Z. Eidi, L. Mollazadeh-Beidokhti, and F. Mohammad-Rafiee, Proceedings of 22nd Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2016.
20. “Modeling Deformation of the Cell’s Membrane Due to Pushing Forces by Actin Filaments”, A. Atakhani, F. Mohammad-Rafiee, and A. Gholami, Proceedings of 23rd Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2017.
21. “Study of Cell Membrane Elastic Deformations Due to Adhesion to a Cylindrical Nanowire”, A. Khosravanizadeh, and F. Mohammad-Rafiee, Proceedings of 23rd Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2017.
22. “A Coarse-Grained Model of the Cell Membrane in Two Dimensions: A Molecular Dynamics Simulation”, A. Khosravanizadeh, F. Mohammad-Rafiee, and P. Sens, Proceedings of 24th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2018.
23. “Investigating the Entropic Force Exerted by a Semi-Flexible Polymer on a Hard Wall Using Molecular Dynamics Simulation”, S. Rahbar, A. Khosravanizadeh, and F. Mohammad-Rafiee, Proceedings of 25th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2019.
24. “Exploring RNA Polymerase Dynamics in the Presence of Transcriptional Barriers”, R. Kor, and F. Mohammad-Rafiee, Proceedings of 25th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2019.
25. “Modeling and Theoretical Investigation of Programmed Ribosomal Frameshifting During Translation”, K. Mehrara, M. Chitsazha, and F. Mohammad-Rafiee, Proceedings of 28th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2023.
26. “Predicting Nucleosome Positioning and Nucleosome-Depleted Regions by Considering Sequence Effects and Remodelers”, M. Habibi, and F. Mohammad-Rafiee, Proceedings of 28th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2023.
27. “Modeling the Movement of Dictyostelium Discoideum in a cAMP Gradient”, S. Akbarloo, and F. Mohammad-Rafiee, Proceedings of 29th Annual IASBS Meeting on Condensed Matter Physics, IASBS, Zanjan, Iran, 2024.

Research Interests

I focus on theoretical problems in soft matter and living systems, encompassing:

- Nucleosome Structure and Dynamics
- Transcription and Translation Processes
- Active and Passive Membrane Deformations in processes such as phagocytosis
- Elastic and Electrostatic Properties of Biological Filaments
- Two-Dimensional Motion of Crawling Cells, such as *Dictyostelium discoideum*
- Growth and Self-Organization of Bacteria
- Global Epistasis and Physical Learning

Teaching Experiences

- Graduate course on “Advanced Classical Mechanics I”, IASBS, Zanjan (2005, 2020, 2022).
- Graduate course on “Advanced Classical Mechanics II”, IASBS, Zanjan (2006).
- Graduate course on “Biological Physics I”, IASBS, Zanjan (2006, 2011, 2018, 2020, 2021).
- Graduate course on “Advanced Electrodynamics I”, IASBS, Zanjan (2007, 2008, 2012, 2014, 2019, 2020, 2023).
- Graduate course on “Advanced Electrodynamics II”, IASBS, Zanjan (2008, 2009, 2015, 2018, 2019, 2021, 2023).
- Graduate course on “Molecular Biophysics” for Biophysics graduate students in the Department of Biological Sciences, IASBS, Zanjan (2009).
- Graduate course on “Cellular Biophysics” for Biophysics graduate students in the Department of Biological Sciences, IASBS, Zanjan (2009).
- Graduate course on “Soft Matter II”, IASBS, Zanjan (2009, 2014, 2022).
- Graduate course on “Biophysics of Molecular Motors and Nerve Conduction” for Biophysics graduate students in the Department of Biological Sciences, IASBS, Zanjan (2009).
- Graduate course on “Soft Matter I”, IASBS, Zanjan (2010, 2013, 2018, 2021, 2022).
- Graduate course on “Molecular Motors and Cytoskeleton Dynamics”, IASBS, Zanjan (2010).
- Graduate course on “Cell Motility” for Biophysics graduate students in the Department of Biological Sciences, IASBS, Zanjan (2011).
- Graduate course on “Biological Physics II”, IASBS, Zanjan (2011, 2014, 2018).
- Graduate course on “Advanced Statistical Mechanics I”, IASBS, Zanjan (2011).
- Undergraduate course on “Classical Mechanics I”, IASBS, Zanjan (2012, 2018).
- Undergraduate course on “Classical Mechanics II”, IASBS, Zanjan (2012, 2019).
- Undergraduate course on “Classical Mechanics III”, IASBS, Zanjan (2013, 2019).
- Undergraduate course on “Classical Mechanics IV”, IASBS, Zanjan (2013, 2019).
- Undergraduate course on “Thermodynamics I”, IASBS, Zanjan (2015).
- Undergraduate course on “Thermodynamics II”, IASBS, Zanjan (2015).
- Undergraduate course on “Thermodynamics III”, IASBS, Zanjan (2016).
- Undergraduate course on “Mathematical Physics I”, IASBS, Zanjan (2016).
- Undergraduate course on “Mathematical Physics II”, IASBS, Zanjan (2016).
- Undergraduate course on “Mathematical Physics III”, IASBS, Zanjan (2017).

- Undergraduate course on “Mathematical Physics IV”, IASBS, Zanjan (2017).
- Graduate course on “Statistical Physics of Fields”, IASBS, Zanjan (2017).
- Undergraduate course on “Physics of Fluids”, IASBS, Zanjan (2019).
- Undergraduate course on “Molecular Cell Biology”, IASBS, Zanjan (2020, 2021).
- Contributed to teaching three sessions on behalf of Prof. Andrea Liu in the graduate course on “Non-equilibrium Statistical Physics,” University of Pennsylvania, Philadelphia (2024).

Research Supervision

I have supervised **13 PhD** and **23 MSc** theses, and I have been an advisor for **1 PhD** and **4 MSc** theses listed below. At the moment, I have **2 PhD** and **1 MSc** students working under my supervision at IASBS. Additionally, I am mentoring **3 BSc** students at the University of Pennsylvania during the summer of 2024.

PhD Theses

1. Maryam Ghorbani, graduated September 2009,
Thesis Title: Study of the Microscopic Conformation of DNA Molecules under External Stress
2. Davood Norouzi, graduated September 2010,
Thesis Title: Nanomechanics of DNA: Modeling and Simulation
3. Laleh Mollazadeh-Beidokhti, graduated October 2010,
Thesis Title: Active Dynamics of Nucleosome
4. Tahmineh Godazgar, graduated in September 2011.
Thesis Title: Mapping the Potential Well of Optical Tweezers and Investigating DNA Elastic Properties
(supervisor: Nader Reihani, IASBS; I was advisor.)
5. S. Mahmoud Hashemi, graduated November 2014,
Thesis Title: Cell Membrane Deformation upon Extracellular Generalized Cylindrical Objects
6. Bahareh Shakiba, graduated December 2014,
Thesis Title: Modeling of the Ribosome and the RNA Polymerase Molecular Motors
7. S. Hashem Fatemi, graduated January 2017,
Thesis Title: Theoretical Modeling of di- and Four-Nucleosomes Structure in a Chromatin Fiber
8. Fatemeh Khodabandeh, graduated January 2017,
Thesis Title: Unwrapping Dynamics of a Dinucleosome in a Chromatin Fiber
9. Zahra Eidi, graduated October 2017,
Thesis Title: Modeling of Migration and Chemotaxis in Dictyostelium discoideum (co-supervisor: Mohammad Khorrami, Alzahra University)
10. Amir Rezaei-Dereshgi, graduated November 2018,
Thesis Title: Studying the Effect of Dielectric Inhomogeneity in Electrostatic Interactions in Cylindrical Geometry in Debye-Huckel Regime using the Green Function Method
11. Asal Atakhani, graduated December 2018,
Thesis Title: Modeling the Motility of Motile Cells (co-supervisor: Azam Gholami, Max-Planck Institute for Dynamics and Self-Organization)
12. Amir Khosravanizadeh, graduated July 2020,
Thesis Title: Elastic Deformations of a Cellular Membrane upon an External Object
13. Sedigheh Ghanbarzadeh Nodehi, graduated April 2021,
Thesis Title: The Mechanical and Nonequilibrium Characteristics of the Stem Cell Nucleus

14. Razieh Kor, graduated September 2022,
Thesis Title: Investigating RNA Polymerase Behavior in the Presence of Transcription Barriers
15. Mahshid Habibi, will graduate in 2024 or early 2025,
Thesis Title: Theoretical Study of Nucleosome Positioning and Nucleosome-Depleted Regions Considering the Effects of Sequence and Chromatin Remodeling Complexes
16. Meysam Chitsazha, will graduate in 2025,
Thesis Title: Modeling and Theoretical Investigation of Ribosome Dynamics in the Translation Process

MSc Theses

1. Amir Mohsen Pourmousa, graduated June 2007,
Thesis Title: Electrostatic Contributions to the Bending Rigidity of DNA
2. Bahareh Shakiba, graduated June 2008,
Thesis Title: Loop Formation Probability of Short DNA
3. Robabeh Moosavi, graduated September 2008,
Thesis Title: Elastic Deformations of a Bilayer Membrane upon Colloid Binding
4. Shervin Rafatnia, graduated December 2008,
Thesis Title: Nucleosome Dynamics under External Torque
5. Mohammad Hossein Yamani, graduated September 2009,
Thesis Title: Conformational Study of Deformed DNA using Numerical Methods and Monte Carlo Simulation
6. Amir Rezaei-Dereshgi, graduated September 2010,
Thesis Title: Sequence-Dependent Loop Formation Probability of Short DNA
7. Hashem Fatemi, graduated September 2010,
Thesis Title: Theoretical Study of the Kinesin Motor Protein Motion
8. Weria Pezeshkian, graduated June 2011,
Thesis Title: Dielectric Inhomogeneity in Electrostatic Interactions in Biological Systems (co-supervisor: Hossein Fazli, IASBS)
9. Aboutaleb Amiri, graduated June 2011,
Thesis Title: Deformation of Thin Elastic Sheets due to Gravitational Forces (supervisor: Maniya Maleki, IASBS; I was advisor.)
10. Parsa Pakzad, graduated July 2011,
Thesis Title: Pattern Formation in Drying Droplets Containing *E. coli* Bacteria (supervisor: Maniya Maleki, IASBS; I was advisor.)
11. Mehdi Bagherpour, graduated April 2013,
Thesis Title: DNA Mechanics in Protein-DNA Specific Interactions (supervisor: Davood Norouzi, IASBS; I was advisor.)
12. Saeed Najafi, graduated May 2013,
Thesis Title: Elastic Deformations of Polymers and Membranes Adhering to Surfaces
13. Zahra Alirezaei-Zanjani, graduated February 2014,
Thesis Title: Effect of 5s rDNA and CLN2 Genes on Nucleosome Core Particle Positioning (co-supervisor: Laleh Mollazadeh-Beidokhti, IASBS)
14. Farzaneh Shamdani, graduated March 2014,
Thesis Title: Sequence Dependence of DNA Elasticity in 2D
15. Maryam Dayeri, graduated March 2014,
Thesis Title: Quantitative Model of Ribosome Dynamics: The Ribosome as a Nanomachine

16. Hadise Talebi, graduated March 2014,
Thesis Title: Electrostatic Interactions in Nucleosome Structure
(supervisor: Davood Norouzi, IASBS; I was advisor.)
17. Saeedeh Dolatyari, graduated August 2014,
Thesis Title: Over-Twisting of Actin Filaments within Bundles in the Presence of Multivalent Salts
18. Fayeze Shamsi, graduated August 2014,
Thesis Title: Nucleosome Barrier Effects on Transcription Velocity and RNA Polymerase Backtracking
19. Parvin Abazari, graduated September 2014,
Thesis Title: Theoretical Modeling of Assembly and Disassembly of Histone Proteins in Nucleosome
(co-supervisor: Laleh Mollazadeh-Beidokhti, IASBS)
20. Seddigheh Borhani, graduated February 2015,
Thesis Title: ACF Remodeller Mechanism and Its Effect on Nucleosome Dynamics: Modeling and Theoretical Study
21. Maryam Shafie, graduated February 2015,
Thesis Title: DnaB Helicase Enzyme in Translation Process: Modeling and Theoretical Study
22. Mohammad Sadeq Alizadeh, graduated April 2015,
Thesis Title: Sequence Effects on Elasticity and Cyclization of Short DNA
23. Sedigheh Ghanbarzadeh Nodehi, graduated September 2015,
Thesis Title: Theoretical Investigation of Embryonic Stem Cell Nucleus Membrane Dynamics
24. Samaneh Rahbar, graduated March 2019,
Thesis Title: Molecular Dynamics Simulation of Entropic Force on a Flat Wall by a Semiflexible Polymer Chain
25. Sima Akbarloo, graduated March 2024,
Thesis Title: Modeling of *Dictyostelium discoideum* Movement in a cAMP Gradient
26. Morteza Ghazanfari, graduated September 2024,
Thesis Title: Theoretical Study of the Elastic Response of a Cell Under Compression Force
27. Fatemeh Khooshabi, graduated September 2024,
Thesis Title: Monte Carlo Simulation of the Effect of DNA Sequence on Nucleosome Bending Energy
28. Sarina Sharafflou, will graduate in 2025,
Thesis Title: Molecular Dynamics Simulation of 2D Diffusion of a Polymer Ring

Service to the Profession

- Referee for 43 PhD theses (33 at IASBS, 7 at Sharif University of Technology, and 3 at University of Zanjan).
- Referee for 68 MSc theses (59 at IASBS, 4 at Sharif University of Technology, and 5 at University of Zanjan).
- Editorial Board Member, "Physic-e-Rooz", the quarterly journal of the Physics Society of Iran, 2014-present.
- Reviewer for Journal of Statistical Mechanics: Theory and Experiment, 2009.
- Reviewer for Journal of Biological Physics, 2015.
- Reviewer for Heliyon, 2016.
- Reviewer for Scientific Reports, 2016.

- Reviewer for PLOS ONE, 2020.
- Reviewer for Soft Matter, 2022.
- Reviewer for Iranian scientific journals such as Scientia Iranica, 2010-present.
- Frequent Reviewer for Iran National Science Foundation, 2019-present.
- Frequent Reviewer for Iranian Journal of Physics Research, 2008-present.

Conference and School Organized

- Co-organizer and Chair of Local Organizing Committee, *IASBS-ICTP School on Active Matter and Chemotaxis*, IASBS, Zanjan, May 14-25, 2016.
- Co-organizer, *26th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, July 7-9, 2021.
- Co-organizer (Scientific Committee), *15th Physics Society of Iran Conference on Condensed Matter Physics*, Qom University of Technology, Qom, January 27-28, 2021.
- Co-organizer (Scientific Committee), *Annual Physics Society of Iran Conference*, University of Tabriz, Tabriz, August 26-29, 2019.
- Chair, *School on Soft Matter and Biological Physics*, IASBS, Zanjan, May 28, 2014.
- Co-organizer (Scientific Committee), *Annual Physics Society of Iran Conference*, University of Sistan and Baluchestan, Zahedan, September 8-11, 2014.
- Chair, *20th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 29-30, 2014.
- Co-organizer, *19th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 30-31, 2013.
- Co-organizer, *18th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 24-25, 2012.
- Co-organizer, *17th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 26-27, 2011.
- Co-organizer (Scientific Committee), *10th Physics Society of Iran Conference on Condensed Matter Physics*, Shiraz University, January 26-27, 2011.
- Co-organizer, *16th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 20-21, 2010.
- Co-organizer, *15th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 21-22, 2009.
- Co-organizer, *12th Annual IASBS Meeting on Condensed Matter Physics*, IASBS, Zanjan, May 25-26, 2006.

Internal Service

Institute for Advanced Studies in Basic Sciences

- Director, Research Council, IASBS, May 2014 – March 2016.
- Director, University-Industry Relations Council, IASBS, May 2014 – March 2016.
- Director, Institute's Library, IASBS, March 2009 – June 2013.
- Secretary, Specialized Commission of the IASBS Audit Board for Faculty Promotion Review, May 2014 – March 2020.
- Member, Select Committee for Faculty Promotion Review, IASBS, October 2019 – October 2022.

- Member, Screening Committee, Department of Biological Sciences, IASBS, September 2009 – October 2022.
- Member, Screening Committee, Department of Physics, IASBS, October 2010 – October 2022.
- Member, Board of Trustees, Sobouti-Khajehpour Award, IASBS, 2013-2022.
- Secretary, Search Committee for Sobouti-Khajehpour Award, 2014, 2016, 2018.
- Member, Council of University Directors, IASBS, May 2014 – March 2016.
- Member, Council of University Directors, IASBS, March 2009 – June 2013.
- Member and Department of Physics Representative, Research Council, IASBS, 2008 – 2012.
- Member, University Quality Assessment Committee, IASBS, September 2009-September 2011.
- Preparation and Compilation of Course Plans for the Biophysics MSc Program in the Newly Established Department of Biological Sciences, IASBS, September 2007 - September 2008.
- Member, Establishment Committee for the Department of Biological Sciences, IASBS, September 2007 – August 2009.

Department of Physics

- Director, Soft Matter and Biological Physics Group, Department of Physics, IASBS, 2018–2022.
- Academic Advisor for MSc Students Admitted in 2021, Department of Physics, IASBS, 2021–2022.
- Director, Soft Matter and Biological Physics Group, Department of Physics, IASBS, 2014–2015.
- Member, Revision and Planning Committee for MSc and PhD Courses, Department of Physics, IASBS, 2020.
- Co-Chair, Establishment of the "Biophysics Lab", Department of Physics, IASBS, 2016-2020.
- Member, Revision and Planning Committee for MSc and PhD Courses, Department of Physics, IASBS, 2015.
- Chair, Qualifying Exam Committee, Department of Physics, IASBS, 2012, and 2014.
- Member, Qualifying Exam Committee, Department of Physics, IASBS, 2008–2011.
- Co-Chair, Revision and Planning Committee for "Continuous Track Physics PhD Program", Department of Physics, IASBS, 2009–2010.
- Chair, Planning Committee for Establishment of Soft and Living Matter Group for MSc and PhD Programs, Department of Physics, IASBS, 2008.
- Chair, PhD Entrance Exam Committee, Department of Physics, IASBS, 2009.
- Member, PhD Entrance Exam Committee, Department of Physics, IASBS, 2005 and 2007–2010.
- Academic Advisor for Continuous Track Physics PhD Students, Department of Physics, IASBS, 2005 and 2007–2010.

Other Professional Activities

- Secretary, National Research Week Event, Zanjan Province, Iran, 2014 and 2015.
- Chair, University-Industry Committee, Zanjan Province, Iran, 2014 and 2015.
- Facilitated Collaboration Between University and Education Department for Schools in Zanjan Province and Zanjan City, Iran, 2014-2015.
- Member, Award Committee for Selection of Outstanding Applied Research, Zanjan Province, Iran, 2014 and 2015.

References

1. Professor Andrea Liu, *ajliu@physics.upenn.edu*
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3. Professor Pierre Sens, *pierre.sens@curie.fr*
Institut Curie, PSL Research University, CNRS UMR 168, Paris, France.
4. Professor Randall Kamien, *kamien@physics.upenn.edu*
Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, USA.
5. Professor Helmut Schiessel, *helmut.schiessel@tu-dresden.de*
Cluster of Excellence Physics of Life, TU Dresden, Dresden, Germany.