

# Varda Faghir Hagh

## Contact Information

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## ACADEMIC POSITIONS

### As a Member of Simons Collaboration on Cracking the Glass Problem

- **Postdoctoral Scholar, Soft Condensed Matter** Sep 2018- Present  
James Franck Institute, University of Chicago, Chicago, IL, USA.
- **Courtesy Research Associate, Soft Condensed Matter** Sep 2018- Present  
Department of Physics, University of Oregon, Eugene, OR, USA.

## EDUCATION

**Ph.D. in Physics, Soft Condensed Matter** July 2018  
Arizona State University, Department of Physics, Tempe, AZ, USA.

**Bachelor of Science, Physics** May 2011  
University of Tehran, Department of Physics, Tehran, Iran.

## RESEARCH INTERESTS

- *Quasistatic Training of Materials*: directing a disordered material towards a rare minimum with extraordinary properties and function on its complex energy landscape by introducing transient learning degrees of freedom to the system and evolving them such that the system learns the new property or behavior.
- *Dynamical Training of Materials*: following the dynamics of a glassy system and driving it at time scales that are comparable to the natural time scale of the dynamics.
- *Memory formation in Disordered Systems*: exploring the mechanisms under which soft spots in jammed packings of athermal particles lead to a memory of periodic deformations.
- *Higher-order Rigid Metamaterials*: studying second-order rigid metamaterials and tensegrity structures, where the shape of the material can be tuned using the null space of the network representation when there is no tension in the system.

## PUBLICATIONS

### Journal Papers

1. **Varda F. Hagh** and Mahdi Sadjadi *rigidPy: Rigidity Analysis in Python*, arXiv preprint arXiv:2108.07195 (2021).
2. **Varda F. Hagh**, Sidney R. Nagel, Andrea J. Liu, M. Lisa Manning, and Eric I. Corwin. *Free-then-freeze: transient learning degrees of freedom for introducing function in materials*, arXiv preprint arXiv:2105.10846 (2021).
3. Francesco Arceri, Eric I. Corwin, and **Varda F. Hagh**, *Marginal stability in memory training of jammed solids*, Physical Review E 104, no. 4 (2021): 044907.
4. Ojan Khatib Damavandi, **Varda F. Hagh**, Christian D. Santangelo, and M. Lisa Manning. *Energetic Rigidity: a Unifying Theory of Mechanical Stability*, arXiv preprint arXiv:2102.11310 (2021).
5. Ojan Khatib Damavandi, **Varda F. Hagh**, Christian D. Santangelo, and M. Lisa Manning. *Energetic rigidity II: Applications in examples of biological and underconstrained materials*, arXiv preprint arXiv:2107.06868 (2021).
6. Mahdi Sadjadi, **Varda F. Hagh**, Mingyu Kang, Meera Sitharam, Robert Connelly, Steven J. Gortler, Louis Theran, Miranda Holmes-Cerfon, and Michael F. Thorpe. *Realizations of Isostatic Material Frameworks*, physica status solidi (b) (2021): 2000555.
7. **Varda F. Hagh**, Eric I. Corwin, Kenneth Stephenson, and Michael Thorpe. *A Broader View on Jamming: From Spring Networks to Circle Packings*, Soft Matter (2019).
8. **Varda F. Hagh**, and M. F. Thorpe, *Disordered auxetic networks with no reentrant polygons*, Rapid Communication, Physical Review B 98, no. 10 (2018): 100101.
9. Wouter G. Ellenbroek, **Varda F. Hagh**, Avishek Kumar, M. F. Thorpe and Martin van Hecke, *Rigidity Loss in Disordered Systems: Three Scenarios*, Physical Review Letters 114, 135501 (Appeared on the cover).

### Work in Preparation

1. *Marginal Stability in 3D and Mean-Field Jammed Packings* (5 manuscript pages).
2. *Twin Dilemma: When Is a Jammed Packing Actually Not Jammed?* (4 manuscript pages).

### Scholarly Articles

Aghil Abed Zadeh, **Varda F. Hagh**, *Duke Research in Perspective: Trends of publications and interdisciplinarity of Duke's education and research*; Duke University Libraries. Click here to see the abstract.

### Books, Translated

1. *The Quantum World: Quantum Physics for Everyone*; Author: Kenneth W. Ford, Translated by: **Varda F. Hagh**, Tehran, Saray-e-Danesh (=House of Science) Publications, in press.
2. *Introducing Chaos*; Authors: Ziauddin Sardar and Iwona Abrams, Translated by: Mahdi Sadjadi and **Varda F. Hagh**, Tehran, Saray-e-Danesh (=House of Science) Publications, 2009.
3. *Physics in your kitchen lab*; Author: Isaac Konstantinovich Kikoin, Translated by: **Varda F. Hagh** and Ehsan Maghsudi, Tehran, Saray-e-Danesh (=House of Science) Publications, 2009.

### HONORS AND AWARDS

1. Outstanding Graduate Award, Arizona State University, Spring 2018.
2. Graduate College Completion Fellowship, Arizona State University, Fall 2017– Spring 2018.
3. Third Place, Scholars Data Visualization Challenge, Duke University, January 2018.
4. Recognized CLAS Student Leader 2017- 2018, Arizona State University, October 2018.
5. University Graduate Fellowship 2017, Arizona State University, June 2017.
6. CLAS Graduate Excellence Award 2016- 2017, Arizona State University, March 2017.
7. Recognized CLAS Student Leader 2016- 2017, Arizona State University, October 2016.
8. APS Distinguished Student Award, Forum on International Physics, American Physical Society, August 2016.
9. Physics Leadership Award, Sundial Program, Department of Physics, Arizona State University, August 2016.
10. University Graduate Fellowship 2016, Arizona State University, June 2016.
11. Teaching Excellence Award, Graduate and Professional Student Association at Arizona State University, April 2016.
12. Graduate Education Travel Award, Arizona State University, January 2016.
13. William J. and Carol M. Motil Scholarship, Arizona State University, May 2015.
14. ASU Outstanding Teaching Award 2014, Arizona State University, May 2014.
15. University Graduate Fellowship 2014, Arizona State University, June 2014.
16. University Graduate Fellowship 2013, Arizona State University, September 2013.

## PROFESSIONAL EXPERIENCE

### Research

1. “Simons Collaboration on Cracking the Glass Problem”; Under Supervision of Professor Sidney Nagel (University of Chicago), Professor Lisa Manning (Syracuse University), Professor Eric Corwin (University of Oregon), and Professor Andrea Liu (University of Pennsylvania) September 2018–Present.
2. “Rigidity of Disordered Materials”; Under Supervision of Professor Michael F. Thorpe, Department of Physics, Arizona State University, June 2014–June 2018.
3. “Towards Differentiating Information Transfer And Causation in Emergent Computation”, Research Rotation II; Under Supervision of Professor Sara Imari Walker, School of Earth and Space Exploration, Arizona State University, January 2014–May 2014.
4. “Finding Order in Disordered Proteins: Using Nanosecond Laser-Pump Spectroscopy To Study a New Class of Disease-Related Proteins”, Research Rotation I; Under Supervision of Professor Sara Vaiana, Arizona State University, August 2013–December 2013.
5. “Gravitomagnetic Monopoles and NUT Spacetime”; Under Supervision of Professor Mohammad Nouri Zonoz, University of Tehran, May 2012–June 2013.
6. “The Study of One Dimensional Photonic Crystals With Linear Inhomogeneous Layers”, Undergraduate Project; Under Supervision of Professor Mir Faez Miri, University of Tehran, June 2009–December 2009.

### Visiting Affiliations

1. Visiting Postdoctoral Researcher, University of Pennsylvania, January 2020.
2. Visiting Postdoctoral Researcher, Syracuse University, March– April, 2019.
3. Visiting Affiliate, The Rough High-Dimensional Landscape Problem, Kavli Institute For Theoretical Physics, February– March, 2019.

### Teaching

1. Foundation for Research Computing Boot Camp, Columbia University, New York, March 2019.
2. Workshop in Perception Technology, Co-teaching with 2004 Nobel Laureate Frank Wilczek, Arizona State University, Spring 2018.
3. Introduction to Scientific Computing, Software Carpentry Workshop, Annual Meeting of Society for Neuroscience, Washington DC, November 2017.
4. Introduction to Scientific Computing, Software Carpentry Workshop, Federal Reserve Board of Governors, Washington DC, April 2017.

5. Introduction to Scientific Computing, Software Carpentry Workshop, Allen Institute for Brain Science, Seattle, February 2017.
6. Introduction to Scientific Computing, Software Carpentry Workshop, Northeastern University, Boston, September 2016.
7. PHY 114 [Lab]: General Physics Laboratory, Arizona State University, Fall 2015 and Spring 2016.
8. PHY 113 [Online]: General Physics, Arizona State University, Summer 2015.
9. PHY 111 [Recitation]: General Physics I, Arizona State University, Spring 2015.
10. PHY 131 [Recitation]: Univ Physics II, Arizona State University, Fall 2014.
11. PHY 121 [Recitation]: Univ Physics I, Arizona State University, Spring and Summer 2014.
12. PHY 132 [Lab]: Univ Physics Lab II, Arizona State University, Fall 2013.

## Service

1. Program Chair of Local Organizing Committee, Conference for Undergraduate Women in Physics (CUWiP) 2018, Arizona State University, April 2017 – January 2018.
2. Diversity Chair, Sundial Program, Department of Physics, Arizona State University, September 2016- July 2018.
3. Volunteer Instructor at Software Carpentry Foundation, April 2016- Present.
4. Professional Development Chair, Sundial Program, Department of Physics, Arizona State University, 2015 – 2016.

## CONFERENCES AND TALKS

### Invited Talks

1. “Transient Degrees of Freedom and Stability”, Invited Talk at Syracuse University, Summer Soft and Living Matter Seminars, August 2021.
2. “The Twin Dilemma: When Is a Jammed Packing Not Actually Jammed?”, Mini-symposium on Materials and Periodicity, The Fields Institute for Research in Mathematical Sciences, March 2021.
3. “Degrees of Freedom and Stability”, Invited Talk at Centre Europeen de Calcul Atomique et Molculaire, January 2021.
4. “Making the Perfect Glass by Training the Proper Degrees of Freedom”, Invited Talk, North Carolina State University, February 2020.
5. “Pressure Training: An Algorithm to Generate Ultra-Stable Jammed Packings”, Invited Talk, California Institute of Technology, January 2020.

6. “Creating Ultra-Stable Jammed Packings by Training on Pressure”, Invited Talk, 2019 Soft Condensed Matter Physics Gordon Research Seminar, Colby Sawyer College, August 11, 2019.
7. “A New Perspective on Jamming: From Spring Networks to Disk Packings”, Invited Talk, 4th International Conference on Packing Problems, Yale University, June 6, 2019.
8. “Jamming in Perspective”, Invited Colloquium Talk at California Polytechnic State University, Department of Physics, February 14, 2019.

## **Presentations**

1. “Creating Ultra-Stable Jammed Packings by Training on Pressure”, Poster Presentation at 2019 Soft Condensed Matter Physics Gordon Research Conference, Colby-Sawyer College, August 2019.
2. “Marginality Gap, From Mean-Field to Lower Dimensions”, Poster Presentation at the Annual Meeting of Simons Collaboration on Cracking the Glass Problem, Simons Foundation, March 7, 2019.
3. “Tunneling States in Jamming and Glasses”, Poster Presentation at Boulder School 2017, University of Colorado at Boulder, July 15, 2017.
4. “Redundancy: A Bridge Between Rigidity and Connectivity Percolation Models”, Oral Presentation at APS March Meeting, New Orleans, March 13, 2017.
5. “Effects of Loops in Connectivity Percolation”, Oral Presentation at APS March Meeting, Baltimore, March 14, 2016.
6. “Rigidity Transition: From Random Networks to Jamming”, Oral Presentation at Annual Meeting of the APS Four Corners Section, Arizona State University, October 16, 2015.
7. “Rigidity Transition: From Random Networks to Jamming”, Poster Presentation at Boulder School 2015, University of Colorado at Boulder, July 9, 2015.

## **Attended**

1. APS March Meeting, Online Meeting, March 2021.
2. Soft Condensed Matter Physics Gordon Research Conference, Colby-Sawyer College, August 11–16, 2019.
3. 4th International Conference on Packing Problems, Yale University, June 3–7, 2019.
4. Annual Meeting of Simons Collaboration on Cracking the Glass Problem, Simons Foundation, New York, March 6–10, 2019.
5. APS March Meeting, Boston, March 4–6, 2019.
6. Rigidity Theory Annual Meeting, University of Florida, March 4–8, 2018.
7. Boulder School 2017: Frustrated and Disordered Systems, University of Colorado at Boulder, July 6–31, 2017.

8. APS March Meeting, New Orleans, March 13–17, 2017.
9. Rigidity Theory Annual Meeting, Phoenix, March 6– 9, 2017.
10. APS March Meeting, Baltimore, March 14–18, 2016.
11. Annual Meeting of the APS Four Corners Section, Arizona State University, October 16–17, 2015.
12. Boulder School 2015: Soft Matter In and Out of Equilibrium, University of Colorado at Boulder, July 6–31, 2015.
13. 5th Conference of Statistical Physics, University of Tehran & Physics Society of Iran, Iran, 2012.

## OUTREACH ACTIVITIES

### As an Instructor and Organizer

1. “Un-jam the jammed”; Outreach Talk, Sundial Science Conference, Arizona State University, Tempe, April 22, 2017.
2. Academic Facilitator at Sundial Summer Program 2016, Department of Physics, Arizona State University, August 2016.
3. “Rigid or Floppy? That Is the Question!”; Outreach Talk, Sundial Science Conference, Arizona State University, Tempe, April 23, 2016.
4. “Communicate Your Science”; Sundial Professional Development Workshop, Department of Physics, Arizona State University, April 2016.
5. “Software Carpentry Workshop”; Department of Physics, Arizona State University, January 7–8, 2016.
6. “Essay Writing”; Sundial Professional Development Workshop, Department of Physics, Arizona State University; November 2015.
7. “CV Writing”; Sundial Professional Development Workshop, Department of Physics, Arizona State University; November 2015.
8. “Scientific Conference Presentation Dos and Don’ts”; Sundial Professional Development Workshop, Department of Physics, Arizona State University; October 2015.

## PROFESSIONAL DEVELOPMENT

### Certificates

1. Instructor at Software Carpentry Foundation April 2016–Present

Software Carpentry is a non profit foundation that has been teaching researchers in science, engineering, medicine, and related disciplines since 1998, the computing skills they need to get more done in less time and with less pain.

## 2. Preparing Future Faculty (PFF)

Fall 2015–Spring 2016

The Preparing Future Faculty program is a year-long series of seminars, discussions and activities designed to expose graduate students and postdoctoral fellows more fully to the realities of research, teaching and service in higher education. The overarching goal of the program is to enable graduates to make the transition successfully to employment in the academic community equipped with a realistic knowledge of academic culture, behavioral expectations and career expectations.

**Computing Skills**

1. High Performance Computing (Batch Scripting, MPI)
2. Unix Shell
3. Python and PyData Stacks (Jupyter, Numpy, SciPy, Pandas, Scikit-Learn, Networkx, Matplotlib, Flask )
4. Octave, Supervised and Unsupervised Machine Learning Algorithms
5. Git Version Control
6. Mathematica

**PROFESSIONAL MEMBERSHIPS**

1. American Physical Society, Early Career Affiliate.
2. Physics Society of Iran, Researcher Affiliate.

**REFERENCES**

*Please feel free to contact any of my references*

1. Professor **Sidney Nagel**, James Franck Institute, University of Chicago, USA (email: srnagel@uchicago.edu)
2. Professor **Eric Corwin**, Department of Physics and Materials Science Institute, University of Oregon, USA (email: eric.corwin@gmail.com)
3. Professor **Lisa Manning**, Department of Physics, Syracuse University, USA (email: mmanning@syr.edu)
4. Professor **Michael F. Thorpe**, Department of Physics, Arizona State University, USA (email: Michael.Thorpe@asu.edu)