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Annie Stephenson

Education

2022	PhD in Applied Physics	Harvard University
2015	BS in Physics, *magna cum laude*	University of Notre Dame

Research

Collective Behavior / human social systems

2022-present **Postdoctoral Researcher, Princeton University** | Advisor: Prof. S. Levin

I study human collective behavior. In particular, I am interested in communities and organizations, and how individual behaviors bring about the emergence of large-scale societal patterns. I am currently using scaling theory, statistical physics models, machine learning, and network science to describe and model social systems.

2020 **Visiting Graduate Research Fellow, University of Oslo** | Advisor: Prof. İ. Gözen

In this fellowship funded by the NSF GROW program during my graduate studies, my primary focus was a project on building Bayesian hierarchical models to estimate the effectiveness of government interventions against COVID-19 spread.

Physics

2015-2022 **Graduate Researcher, Harvard University** | Advisor: Prof. V. Manoharan

I developed a Monte Carlo model to simulate light transport in structurally colored materials, predicting their reflectance, polarization, and phase. I also designed experimental techniques to fabricate these materials and measure their optical properties.

2014-2015 **Undergraduate Researcher, Rowland Institute at Harvard University** | Advisor: Prof. C. Hur

In this summer research internship that grew into a long-term project, I imaged microparticle flow through microfluidic channels and developed code to track and describe particle motion.

2013-2015 **Undergraduate Researcher, Stanford University** | Advisors: Prof. H. Manoharan and Prof. K. Gomes

Through this summer research internship, I modeled the electronic band structure of 2D materials, and I measured the electronic structure of these materials through analysis of scanning tunneling micrographs. This work grew into a long-term project that culminated in my senior thesis.

Undergraduate Researcher, University of Notre Dame

2012-2013 Imaged gallium arsenide nanowires and analyzed images to optimize growth | Advisor: Prof. J. Furdyna

2012 Simulated the flow of materials in a galactic filament | Advisor: Prof. Arielle Phillips

Scientific Contributions

Preprints **AB Stephenson**, G Falmagne, C Kempes, and S Levin, "Understanding Organizational Scaling using a Reddit Social Experiment"

G Falmagne*, **AB Stephenson***, and S Levin, "Identifying Early Warning Signals of Transitions in a Reddit Social Experiment using Machine Learning" *These authors contributed equally

AB Stephenson*, A von Raesfeld*, JA McGuire, V Hwang, S Barkley, and VN Manoharan, "How weak multiple scattering affects structural color in disordered nanoparticle assemblies and bird feathers." *These authors contributed equally

Publications

AB Stephenson, M Xiao, V Hwang, L Qu, PA Odorisio, M Burke, K Task, T Deisenroth, S Barkley, RH Darji, VN Manoharan, "Predicting the structural colors of films of disordered photonic balls," *ACS Photonics* Article ASAP, (2022)

M Xiao, **AB Stephenson**, A Neophytou, V Hwang, D Chakrabarti, VN Manoharan, "Investigating the trade-off between color saturation and angle-independence in photonic glasses," *Optics Express* 29 (14), 21212-21224 (2021)

V Hwang, **AB Stephenson**, S Barkley, S Brandt, M Xiao, J Aizenberg, VN Manoharan, "Designing angle-independent structural colors using Monte Carlo simulations of multiple scattering," *PNAS* 118 (4), e2015551118 (2021)

JM Brauner, S Mindermann, M Sharma, D Johnston, J Salvatier, T Gavenčiak, **AB Stephenson**, G Leech, G Altman, V Mikulik, AJ Norman, JT Monrad, T Besiroglu, H Ge, MA Hartwick, YW Teh, L Chindelevitch, Y Gal, J Kulveit. "Inferring the effectiveness of government interventions against COVID-19," *Science* 371 (6531), eabd9338 (2021)

V Hwang*, **AB Stephenson***, S Magkiriadou, JG Park, VN Manoharan. "Effects of multiple scattering on angle-independent structural color in disordered colloidal materials," *Physical Review E* 101 (1), 012614 (2020) *These authors contributed equally

Presentations

AB Stephenson, G Falmagne, C Kempes, S Levin. "Understanding the scaling of social organizations using Reddit" International Conference for Computational Social Science, Philadelphia, PA (2024)

AB Stephenson, G Falmagne, S Levin. "Understanding the scaling of social organizations using Reddit" American Physical Society March Meeting, Minneapolos, MN (2024)

Invited: **AB Stephenson**, G Falmagne, S Levin. "Understanding the emergence of organizations using Reddit" Condensed Matter Physics Seminar, University of Notre Dame, Notre Dame, IN (2023)

Invited: **AB Stephenson**, G Falmagne, S Levin. "Reddit's r/place social experiment: a testbed for understanding collective behavior of communities," Collective Adaptation in a Turbulent World Workshop, Santa Fe Institute, Santa Fe, NM (2023)

Invited: **AB Stephenson**, V Hwang, M. Xiao, S Barkley, VN Manoharan. "Measuring and modeling light scattering in disordered systems for applications in structural color," Physics Department Seminar, University of Fribourg, Fribourg, Switzerland (2022)

M Sharma, S Mindermann, JM Brauner, G Leech, **AB Stephenson**, T Gavenčiak, J Kulveit, YW Teh, L Chindelevitch, Y Gal. "On the robustness of effectiveness estimation of nonpharmaceutical interventions against COVID-19 transmission," NeurIPS (2020)

AB Stephenson, V Hwang, S Barkley, VN Manoharan, "The physical origin of the reflectance features of structurally colored colloidal glasses," American Physical Society March Meeting, Boston, MA (2019)

AB Stephenson, V Hwang, S Barkley, VN Manoharan, "Predicting Scattering in Structurally Colored Colloidal Glasses," Workshop on Correlated Disorder and Hyperuniformity in Photonics and Soft Matter, Paris, France (2018)

AB Stephenson, V Hwang, S Barkley, VN Manoharan, "Determining Degree of Scattering in Structurally-colored Colloidal Glasses," American Physical Society March Meeting, Los Angeles, CA (2018)

AB Stephenson, V Hwang, JG Park, VN Manoharan, "Coupling between absorption and scattering in disordered colloids," American Physical Society March Meeting, New Orleans, LA (2017)

AB Stephenson, KK Gomes, W Ko, W Mar, HC Manoharan, "Momentum-Space Imaging of the Dirac Band Structure in Molecular Graphene via Quasiparticle Interference," American Physical Society March Meeting, Denver, CO (2014)

Patents	RH Darji, J Newhouse, VN Manoharan, V Hwang, **AB Stephenson**, "Microspheres Comprising Polydisperse Polymer Nanospheres and Porous Metal Oxide Microspheres." US Patent App. 16/126346, filed 9/11/17, published 3/14/19
	RH Darji, J Newhouse, VN Manoharan, V Hwang, **AB Stephenson**, "Porous Metal Oxide Microspheres," US Patent App. 16/126,338, filed 9/11/17, published 3/14/19
	VN Manoharan, **AB Stephenson**, V Hwang, and M Xiao. "Methods and Systems for Selecting Parameters to Approximate Desired Properties of Structural Color," US Provisional Patent App. 62/984582, filed 3/03/20
	VN Manoharan, **AB Stephenson**V Hwang, and M Xiao. "Structural Colors with Short-Wavelength Response for Packaging Applications," US Provisional Patent App. 63/171345, filed 4/06/21
	VN Manoharan, V Hwang, J McGuire, **AB Stephenson**, and M Xiao "Ultraviolet Filtering Photonic Materials," US Provisional Patent App. 63/232478, filed 08/12/21

Computational Skills

Languages	Python, MATLAB, SQL, some experience with C++, Java, and Fortran 90
Certificates	Deep Learning Specialization, Coursera (offered by DeepLearning.AI), Instructor: Andrew Ng Topics covered: neural networks, CNNs, RNNs, machine learning optimization

Science Writing & Communication

2021	*Physics Today* Quick Study, invited piece "A field guide to angle-independent structural color"
2017-2020	Softbites Blog Co-founded soft matter physics blog; served as Managing Editor, Writer, and Reviewer Piece I wrote: "What is Soft Matter?"
2019	Communicating Science Convention (ComSciCon), UCSD Attended conference for science communication, with 700 applicants for 50 spots
2018-2019	Science Writing Workshop, Harvard University Led and designed workshop for 10 students in 2019 and co-led workshop in 2018

Awards, Fellowships, & Certificates

2023	Completion of the Complex Systems Summer School, Santa Fe Institute Intensitve 4-week course on complexity in mathematical, physical, and social systems
2023	2nd place, Poster competition at Collective Intelligence Symposium, Santa Fe Institute
2021	1st place, Datathon at the International Conference on Computational Social Science Competed with 17 teams to complete a data science project in 4 days
2020	NSF Graduate Research Opportunities Worldwide: Awarded to fund international research proposal
2015-2020	NSF Graduate Research Fellowship Program
2018	Outstanding Poster Award, BASF Research on Advanced Materials Conference
2015	Outstanding Physics Major Award, University of Notre Dame: Awarded to 2 physics students
2015	Dean's Research Award, University of Notre Dame: Awarded to 2 students in the College of Science

Teaching & Mentorship

2023	Presented at Junior Seminar at University of Notre Dame Dept. of Physics Invited talk on *What should I do with my career?*
2019	Undergraduate Mentoring Workshop, Harvard University: 11 hours of training
2016	Teaching Fellow, Applied Science 50a, Harvard University
2014	Teaching Assistant, Computational Methods in Physics, University of Notre Dame
2012	Teaching Assistant, Astronomy Lab, University of Notre Dame

Leadership & Service

Organizing

2020-2022	Applied Physics Steward, Harvard Graduate Student Union Elected officer to help students navigate union benefits and protections
2020	"Don't Kvetch, Organize," JOIN for Justice 8-week course on social justice and community organizing

Student Groups

2017-2019	Photonics Club, Harvard University Served as president in 2018 and outreach coordinator in 2017
2013-2015	Society of Physics Students, University of Notre Dame Served as president, vice president, and advisory board member