

Alex H. Barnett

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Born: 7th Dec, 1972
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RESEARCH AREAS

- Computational partial differential equations: fluid flow (Stokes), wave scattering (Helmholtz and time-domain), periodic geometries, optics, heat equation, high-frequency eigenvalue problems.
- Numerical analysis and software libraries: fast algorithms, signal/image processing, boundary integral equations, quadratures, spectral methods.
- Computational biology (spike sorting, cryo-electron microscopy), inverse imaging problems (phase retrieval), quantum physics, statistical methods (sampling, spatial regression).
- Mathematical physics: quantum chaos. Mathematics of music, acoustics.

EDUCATION

Harvard University. Ph. D. in Physics: *Dissipation in Deforming Chaotic Billiards* October 2000
Thesis advisor: Eric J. Heller

Cambridge University, England. B. A. (*First class*) in Theoretical Physics June 1994
Undergraduate thesis advisor: David J. C. MacKay

POSITIONS

Group Leader, Numerical Analysis. Center for Computational Mathematics, Flatiron Institute, Simons Foundation, New York, NY 2018–present

Group Leader, Numerical Algorithms. Center for Computational Biology, Flatiron Institute, Simons Foundation, New York, NY 2017–2018

Professor. 2017
Department of Mathematics, Dartmouth College, NH

Senior Research Scientist. November 2014–August 2015; January–March 2016; January–May 2017
Flatiron Institute (formerly SCDA), Simons Foundation, New York, NY

Adjunct Associate Professor. 2013–2017
Department of Physics and Astronomy, Dartmouth College, NH

Associate Professor. 2011–2017
Department of Mathematics, Dartmouth College, NH

Assistant Professor. 2005–2011
Department of Mathematics, Dartmouth College, NH

Courant Instructor / Assistant Professor. 2002–2005
Courant Institute of Mathematical Sciences, New York University, NY

Postdoctoral Research Fellow. February–August 2002
Photon Migration Imaging Laboratory, Dept. of Radiology, Harvard Medical School, Charlestown, MA

Consultant. November–December 2000
TrueWind Solutions LLC, Lowell, MA

Teaching Fellow / Head Teaching Fellow. 1995–2001
Department of Physics, Harvard University, Cambridge, MA

FELLOWSHIPS AND AWARDS

- *Best Paper Award, PDSEC21 (workshop of IPDPS)*, for “cuFINUFFT: a load-balanced GPU library for general-purpose nonuniform FFTs,” Y.-H. Shih, et al. 2021
- *C. Troy Shaver 1969 Fellow*, Dartmouth College 2017
- *Office of Naval Research, N00014-17S-B001*, award amount \$10,000 2017
Funding support for *Modern Advances in Computational and Applied Mathematics*, Yale
- *National Science Foundation, Grant DMS-1347163*, PI, award amount \$34,973 2014
Funding support for *CBMS Conference on Fast Direct Solvers for Elliptic PDEs*
- *Neukom Institute CompX Faculty Grant*, co-PI, award amount \$25,000 2013
“Efficient numerical solution of electromagnetic scattering from periodic arrays of cylindrically symmetric objects”
- *National Science Foundation, Grant DMS-1216656*, PI, award amount \$180,000 2012–2015
“Next-generation integral equation methods for wave scattering and propagation in periodic structures”
- *Elizabeth R. and Robert A. Jeffe 1972 Fellowship*, Dartmouth College 2011
- *Karen E. Wetterhahn Memorial Award for Distinguished Creative or Scholarly Achievement*, Dartmouth College 2011
- *Burke Initiation Award*, Dartmouth College 2011
- *National Science Foundation, Grant DMS-1005360*, co-PI, award amount \$42,355 2010
Funding support for *International Conference on Spectral Geometry*
- *The Class of 1962 Faculty Fellowship*, Dartmouth College 2010
- *National Science Foundation, Grant DMS-0811005*, PI, award amount \$310,517 2008–2011
“Efficient spectrally accurate global basis methods for high frequency wave scattering, eigenmodes, and photonics”
- *National Science Foundation, Grant DMS-0507614*, PI, award amount \$102,520 2005–2008
“High frequency cavity eigenmodes: rapid computation methods, applications and asymptotics”
- *Courant Instructorship*, New York University 2002–2005
- *Harvard University Certificate of Distinction in Teaching* Fall 1997, Spring 2001 and Fall 2001
- *Harold T White Prizes*, teaching introductory physics, Harvard Physics Department 1996 and 1997
- *Kennedy Scholarship*, Kennedy Memorial Trust, London 1994
- *Hockin Prize, Duchess of Somerset Scholarships*, St John’s College, Cambridge 1993 and 1994
- *XXI International Physics Olympiad, First Prize* of 155 entrants, Groningen, The Netherlands 1990

PUBLICATIONS

Journal publications:

- [69] “A fully adaptive, high-order, fast Poisson solver for complex two-dimensional geometries,” D. Fortunato, D. B. Stein, and A. H. Barnett, *in draft* (2024).
- [68] “A superfast direct inversion method for the nonuniform discrete Fourier transform,” H. Wilber, E. N. Epperley, and A. H. Barnett, *submitted, SIAM J. Sci. Comput.*, 26 pages (2024). `math.NA:2404.13223`
- [67] “Trapped acoustic waves and raindrops: high-order accurate integral equation method for localized excitation of a periodic staircase,” F. J. Agocs and A. H. Barnett, *submitted, J. Comput. Phys.*, 25 pages (2023). `math.NA:2310.12486`
- [66] “Efficient convergent boundary integral methods for slender bodies,” D. Malhotra and A. H. Barnett, *J. Comput. Phys.* **503**, 112855 (2024). (28 pages, `math.NA:2310.00889`)
- [65] “`riccati`: an adaptive, spectral solver for oscillatory ODEs,” F. J. Agocs and A. H. Barnett, *J. Open Source Softw.* **8**(86), 5430 (2023).
- [64] “Uniform approximation of common Gaussian process kernels using equispaced Fourier grids,” A. H. Barnett, P. R. Greengard, and M. Rachh, *in press, Appl. Comput. Harmonic Anal.* (2024). 21 pages, `math.NA:2305.11065`

- [63] “An adaptive spectral method for oscillatory second-order linear ODEs with frequency-independent cost,” F. J. Agocs and A. H. Barnett, *SIAM J. Numer. Anal.* **62**(1) 295–321 (2024).
- [62] “Ensemble reweighting using cryo-EM particle images,” W. S. Tang, D. Silva-Sánchez, J. Giraldo-Barreto, B. Carpenter, S. Hanson, A. H. Barnett, E. H. Thiede, and P. Cossio, *J. Phys. Chem. B* **127**(24) 5410–5421 (2023).
- [61] “Automatic, high-order, and adaptive algorithms for Brillouin zone integration,” J. Kaye, S. Beck, A. H. Barnett, L. Van Muñoz, and O. Parcollet, *SciPost Phys.* **15**(2), 062 (2023).
- [60] “Equispaced Fourier representations for efficient Gaussian process regression from a billion data points,” P. R. Greengard, M. Rachh, and A. H. Barnett, *submitted, SIAM/ASA J. Uncert. Quant.*, 27 pages (2023). [stat.CO:2210.10210](https://arxiv.org/abs/2210.10210)
- [59] “Eliminating artificial boundary conditions in time-dependent density functional theory using Fourier contour deformation,” J. Kaye, A. H. Barnett, L. Greengard, U. De Giovannini, and A. Rubio, *J. Chem. Theory Comput.*, **19**(5), 1409–1420 (2023). [arxiv:2209.11027](https://arxiv.org/abs/2209.11027)
- [58] “Delayed rejection Hamiltonian Monte Carlo for sampling multiscale distributions,” C. Modi, A. H. Barnett, and B. Carpenter. *in press, Bayesian Anal.* (28 pages), 2023. [arxiv:2110.00610](https://arxiv.org/abs/2110.00610).
- [57] “Quadrature by fundamental solutions: kernel-independent layer potential evaluation for large collections of simple objects,” D. B. Stein and A. H. Barnett. *Adv. Comput. Math.* **48**, article 60 (41 pages), 2022. [arxiv:2109.08802](https://arxiv.org/abs/2109.08802)
- [56] “A Bayesian approach for extracting free energy profiles from cryo-electron microscopy experiments using a path collective variable,” J. Giraldo-Barreto, S. Ortiz, E. H. Thiede, K. Palacio-Rodriguez, B. Carpenter, A. H. Barnett, and P. Cossio. *Sci. Rep.* **11**, 13657 (16 pages), 2021. [arxiv:2102.02077](https://arxiv.org/abs/2102.02077).
- [55] “cuFINUFFT: a load-balanced GPU library for general-purpose nonuniform FFTs,” Y.-H. Shih, G. Wright, J. Andén, J. Blaschke, and A. H. Barnett, *PDSEC2021*. (10 pages). [arxiv:2102.08463](https://arxiv.org/abs/2102.08463).
- [54] “Efficient high-order accurate Fresnel diffraction via areal quadrature and the nonuniform FFT,” A. H. Barnett, *J. Astron. Telesc. Instrum. Syst.* **7**(2), 021211 (21 pages), 2021. [arxiv:2010.05978](https://arxiv.org/abs/2010.05978)
- [53] “How exponentially ill-conditioned are contiguous submatrices of the Fourier matrix?”, A. H. Barnett, *SIAM Rev.* **64**(1), (24 pages), 2022. [arxiv:2004.09643](https://arxiv.org/abs/2004.09643)
- [52] “Recovering missing data in coherent diffraction imaging,” D. Barmherzig, A. H. Barnett, C. L. Epstein, L. F. Greengard, J. F. Magland, and M. Rachh, *SIAM J. Imaging Sci.* **14**(2), (18 pages), 2021. [arxiv:2002.02874](https://arxiv.org/abs/2002.02874)
- [51] “Aliasing error of the $\exp(\beta\sqrt{1-z^2})$ kernel in the nonuniform fast Fourier transform,” A. H. Barnett, *Appl. Comput. Harmon. Anal.* **51**, 1–16 (2021). [arxiv:2001.09405](https://arxiv.org/abs/2001.09405)
- [50] “A high-order integral equation-based solver for the time-dependent Schrödinger equation,” J. Kaye, A. H. Barnett, and L. Greengard, *Comm. Pure Appl. Math.* **75**(8), 1657–1712 (2022). [arxiv:2001.06113](https://arxiv.org/abs/2001.06113)
- [49] “SpikeForest: reproducible web-facing ground-truth validation of automated neural spike sorters,” J. F. Magland, J. J. Jun, E. Lovero, A. J. Morley, C. L. Hurwitz, A. P. Buccino, S. Garcia, and A. H. Barnett, *eLife*, 9:e55167 (2020). 23 pages.
- [48] “An integral equation method for the simulation of doubly-periodic suspensions of rigid bodies in a shearing viscous flow,” J. Wang, E. Nazockdast, and A. H. Barnett, *J. Comput. Phys.* **424**, 109809 (39 pages), 2021. [arxiv:1912.04501](https://arxiv.org/abs/1912.04501)
- [47] “Accurate quadrature of nearly singular line integrals in two and three dimensions by singularity swapping,” L. af Klinteberg and A. H. Barnett, *BIT Numer. Math.* **61**, 83–118 (2021). [arxiv:1910.09899](https://arxiv.org/abs/1910.09899)
- [46] “Solution of Stokes flow in complex nonsmooth 2D geometries via a linear-scaling high-order adaptive integral equation scheme,” B. Wu, H. Zhu, A. H. Barnett, and S. Veerapaneni, *J. Comput. Phys.* **410**, 109361 (2020). 25 pages. [arxiv:1909.00049](https://arxiv.org/abs/1909.00049)

- [45] “Factorization of the translation kernel for fast rigid image alignment,” A. Rangan, M. Spivak, J. Andén, and A. H. Barnett. *Inverse Problems* **36** (2), 024001 (2020). 30 pages. [arxiv:1905.12317](#)
- [44] “High-order discretization of a stable time-domain integral equation for 3D acoustic scattering,” A. H. Barnett, L. Greengard, and T. Hagstrom, *J. Comput. Phys.* **402**, 109047 (2020). 24 pages.
- [43] “Explicit unconditionally stable methods for the heat equation via potential theory,” A. H. Barnett, C. L. Epstein, L. Greengard, S. Jiang, and J. Wang, *Pure Appl. Anal.* **1**(4), 709–742, (2019).
- [42] “Geometry of the phase retrieval problem,” A. H. Barnett, C. L. Epstein, L. F. Greengard, and J. Magland, *Inverse Problems* **36**(9), 094003 (2020). [arxiv:1808.10747v2](#)
- [41] “A parallel non-uniform fast Fourier transform library based on an ‘exponential of semicircle’ kernel,” A. H. Barnett, J. Magland, and L. af Klinteberg. *SIAM J. Sci. Comput.* **41**(5), C479–C504 (2019).
- [40] “High-density, long-lasting, and multi-region electrophysiological recordings using polymer electrode arrays,” J. E. Chung, H. R. Joo, J. L. Fan, D. F. Liu, A. H. Barnett, S. Chen, S. Geaghan-Breiner, M. P. Karlsson, M. Karlsson, K. Y. Lee, H. Liang, J. F. Magland, A. C. Tooker, L. F. Greengard, V. M. Tolosa, L. M. Frank. *NEURON* **101**(1), 21-31.e5 (2019).
- [39] “A fully automated approach to spike sorting,” J. E. Chung, J. F. Magland, A. H. Barnett, V. M. Tolosa, A. C. Tooker, K. Y. Lee, K. G. Shah, S. H. Felix, L. M. Frank, L. F. Greengard. *NEURON* **95**(6) 1381–1394 (2017).
- [38] “A unified integral equation scheme for doubly-periodic Laplace and Stokes boundary value problems in two dimensions,” A. H. Barnett, G. Marple, S. Veerapaneni, and L. Zhao. *Comm. Pure Appl. Math.*, **71**(11), 2334–2380 (2018).
- [37] “Ubiquitous evaluation of layer potentials using quadrature by kernel-independent expansion,” A. Rahimian, A. H. Barnett, and D. Zorin. *BIT Numer. Math.*, **58**(2), 423–456 (2018).
- [36] “Rapid solution of the cryo-EM reconstruction problem by frequency marching,” A. H. Barnett, L. Greengard, A. Pataki, and M. Spivak. *SIAM J. Imaging Sci.*, **10**(3), 1170–1195 (2017).
- [35] “Comparable upper and lower bounds for boundary values of Neumann eigenfunctions and tight inclusion of eigenvalues,” A. H. Barnett, A. Hassell, and M. Tacy, *Duke Math. J.*, **167**(16), 3059–3114 (2018).
- [33] “A fast algorithm for simulating multiphase flows through periodic geometries of arbitrary shape,” G. Marple, A. H. Barnett, A. Gillman, and S. Veerapaneni, *SIAM J. Sci. Comput.*, **38**(5), B740–B772 (2016).
- [32] “Efficient numerical solution of acoustic scattering from doubly-periodic arrays of axisymmetric objects,” Y. Liu and A. H. Barnett, *J. Comput. Phys.*, **324**, 226–245 (2016).
- [31] “Validation of neural spike sorting algorithms without ground-truth information,” A. H. Barnett, J. F. Magland, and L. Greengard, *J. Neurosci. Meth.*, **264**, 65–77 (2016)
- [30] “A fast and robust solver for the scattering from a layered periodic structure containing multi-particle inclusions,” J. Lai, M. Kobayashi, and A. H. Barnett, *J. Comput. Phys.* **298**, 194–208 (2015)
- [29] “Spectrally-accurate quadratures for evaluation of layer potentials close to the boundary for the 2D Stokes and Laplace equations,” A. H. Barnett, B. Wu, and S. Veerapaneni, *SIAM J. Sci. Comput.* **37**(4), B519–B542 (2015)
- [28] “High-order boundary integral equation solution of high frequency wave scattering from obstacles in an unbounded linearly stratified medium,” A. H. Barnett, B. J. Nelson, and J. M. Mahoney, *J. Comput. Phys.* **297**, 407–426 (2015)
- [27] “Robust and efficient solution of the drum problem via Nyström approximation of the Fredholm determinant,” L. Zhao and A. H. Barnett, *SIAM J. Numer. Anal.* **53** (4), 1984–2007 (2015)
- [26] “Robust fast direct integral equation solver for quasi-periodic scattering problems with a large number of layers,” M. H. Cho and A. H. Barnett, *Optics Express* **23**(2), 1775–1799 (2015)

- [25] “A spectrally accurate direct solution technique for frequency-domain scattering problems with variable media,” A. Gillman, A. H. Barnett, and P.G. Martinsson, *BIT Numer. Math.* **55**(1), 141–170 (2015)
- [24] “Evaluation of layer potentials close to the boundary for Laplace and Helmholtz problems on analytic planar domains,” A. H. Barnett, 22 pages, *SIAM J. Sci. Comput.* **36**(2), A427–A451 (2014)
- [23] “High-order accurate Nyström discretization of integral equations with weakly singular kernels on smooth curves in the plane,” S. Hao, A. H. Barnett, P. G. Martinsson, and P. Young, *Adv. Comput. Math.* **40** (1) 245–272 (2014)
- [22] “Fast computation of high frequency Dirichlet eigenmodes via the spectral flow of the interior Neumann-Dirichlet map,” A. H. Barnett and A. Hassell, *Comm. Pure Appl. Math.* **67**(3), 351–407 (2014)
- [21] “A fast direct solver for quasiperiodic scattering problems,” A. Gillman and A. H. Barnett, *J. Comput. Phys.* **248**, 309–322 (2013)
- [20] “Quadrature by expansion: a new method for the evaluation of layer potentials,” A. Klöckner, A. H. Barnett, L. Greengard, and M. O’Neil, *J. Comput. Phys.* **252**, 332–349 (2013)
- [19] “Boundary quasi-orthogonality and sharp inclusion bounds for large Dirichlet eigenvalues,” A. H. Barnett and A. Hassell, *SIAM J. Numer. Anal.* **49**, 1046–1063 (2011)
- [18] “A new integral representation for quasi-periodic scattering problems in two dimensions,” A. H. Barnett and L. Greengard, *BIT Numer. Math.* **51**, 67–90 (2011)
- [17] “A few more words about James Tenney: dissonant counterpoint and statistical feedback,” L. Polansky, A. H. Barnett, and M. Winter, *J. Math. Music*, **5** (2), 63–82 (2011)
- [16] “A new integral representation for quasi-periodic fields and its application to two-dimensional band structure calculations,” A. H. Barnett and L. Greengard, *J. Comput. Phys.*, **229** (19), 6898–6914 (2010)
- [15] “An exponentially convergent nonpolynomial finite element method for time-harmonic scattering from polygons,” A. H. Barnett and T. Betcke, *SIAM J. Sci. Comput.* **32** (3), 1417–1441 (2010)
- [14] “Perturbative analysis of the Method of Particular Solutions for improved inclusion of high-lying Dirichlet eigenvalues,” A. H. Barnett, *SIAM J. Numer. Anal.* **47**, 1952–1970 (2009)
- [13] “Stability and convergence of the Method of Fundamental Solutions for Helmholtz problems on analytic domains,” A. H. Barnett and T. Betcke, *J. Comput. Phys.* **227** (14), 7003–7026 (2008)
- [12] “Analytic steady-state space use patterns and rapid computations in mechanistic home range analysis,” A. H. Barnett and P. R. Moorcroft, *J. Math. Biol.* **57** (1), 139–159 (2008)
- [11] “Quantum mushroom billiards,” A. H. Barnett and T. Betcke, *CHAOS* **17**, 043125, 13 pages (2007)
- [10] “Mechanistic home range models and resource selection analysis: a reconciliation and unification,” P. R. Moorcroft and A. H. Barnett, *Ecology* **89** (4), 1112–1119 (2008)
- [9] “Asymptotic rate of quantum ergodicity in chaotic Euclidean billiards,” A. H. Barnett, *Comm. Pure Appl. Math.* **59**, 1457–1488 (2006)
- [8] “Effective scattering coefficient of the cerebral spinal fluid in adult head models for Diffuse Optical Imaging”, A. Custo, W. M. Wells III, A. H. Barnett, E. M. C. Hillman, and D. A. Boas, *Applied Optics* **45**, 4747–55 (2006)
- [7] “A fast numerical method for time-resolved photon diffusion in general stratified turbid media,” A. H. Barnett, *J. Comput. Phys.* **201**, 771–797 (2004)
- [6] “Robust inference of baseline optical properties of the human head with 3D segmentation from magnetic resonance imaging,” A. H. Barnett, J. P. Culver, A. G. Sorensen, A. M. Dale, and D. A. Boas, *Applied Optics* **42**, 3095–3108 (2003)

- [5] “Parametric evolution for a deformed cavity,” D. Cohen, A. H. Barnett, and E. J. Heller, *Phys. Rev. E* **63**, 046207, 12 pages (2001)
- [4] “Mesoscopic scattering in the half-plane: squeezing conductance through a small hole,” A. H. Barnett, M. Blaauboer, A. Mody, and E. J. Heller, *Phys. Rev. B* **63**, 245312/1 (2001)
- [3] “Rate of energy absorption for a driven chaotic cavity,” A. H. Barnett, D. Cohen, and E. J. Heller, *J. Phys. A* **34**, 413–437 (2001)
- [2] “Deformations and dilations of chaotic billiards: dissipation rate, and quasi-orthogonality of the boundary wavefunctions,” A. H. Barnett, D. Cohen, and E. J. Heller, *Phys. Rev. Lett.* **85**, 1412–15 (2000)
- [1] “Substrate-based atom waveguide using guided two-color evanescent light fields,” A. H. Barnett, S. P. Smith, M. Olshanii, K. S. Johnson, A. W. Adams, M. Prentiss, *Phys. Rev. A* **61**, 023608, 11 pages (2000)

Conference proceedings, technical reports:

- [12] “Equispaced Fourier representations enable fast iterative Gaussian process regression,” A. H. Barnett, P. Greengard, and M. Rachh, *Yale technical report TR1562*, 29 pages (2022)
- [11] “Robust periodization of frequency-domain integral equation solvers,” A. H. Barnett, *Report for Oberwolfach Workshop*, 4 pages (2016)
- [10] “Unimodal clustering using isotonic regression: ISO-SPLIT,” J. F. Magland and A. H. Barnett, 23 pages (2015). [stat.ME/1508.04841v2](https://arxiv.org/abs/1508.04841v2)
- [9] “New tools for the high-order solution of frequency-domain wave scattering problems at high frequencies and in periodic geometries,” A. H. Barnett, *Report for Oberwolfach Workshop*, 4 pages (2013)
- [8] “Estimates on Neumann eigenfunctions at the boundary, and the ‘Method of Particular Solutions’ for computing them,” A. Hassell and A. H. Barnett, *Spectral Geometry* (P. S. P. M. proceedings of the International Conference on Spectral Geometry, July 2010, Dartmouth College), 195–210 (2012)
- [7] “Robust high-order numerical scattering from multi-layer dielectric gratings using a new integral representation for quasi-periodic fields,” A. H. Barnett and L. Greengard, *extended abstract*, WAVES2011 The 10th International Conference on Mathematical and Numerical Aspects of Wave Propagation (4 pages).
- [6] “Tensor product of kernel models,” O. de la Cruz, A. H. Barnett, H. Tang, and S. Holmes, *NIPS extended abstract*, 4 pages (2010).
- [5] “Accurate and robust computation of photonic crystal band structure using second-kind integral equations,” A. H. Barnett and L. Greengard, *extended abstract*, Proceedings of WAVES2009: The 9th International Conference on Mathematical and Numerical Aspects of Wave Propagation, 2 pages (2009).
- [4] “Quasi-orthogonality on the boundary for Euclidean Laplace eigenfunctions,” A. H. Barnett, *technical report*, [math-ph/0601006](https://arxiv.org/abs/math-ph/0601006), 21 pages (2004).
- [3] “Bayesian estimation of optical properties of the human head via 3D structural MRI,” A. H. Barnett, J. P. Culver, A. G. Sorensen, A. M. Dale, and D. A. Boas, *Proc. SPIE* **5138**, 9 pages (2003)
- [2] “Fast computation of the time domain diffusion forward model for optical tomography in the Born approximation,” J. J. Stott, Q. Zhang, and A. H. Barnett, 23 pages (2003).
- [1] “Bayesian Comparison of Models for Images,” A. H. Barnett and D. J. C. MacKay, in *Maximum Entropy and Bayesian Methods*, Proceedings of MAXENT94 (Kluwer, 1996), p. 239–248

Books:

Geometry of the Phase Retrieval Problem. A. H. Barnett, C. L. Epstein, L. F. Greengard, and J. F. Magland. (307 pages, Cambridge University Press, 2022).

Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition, W. H. K. Chun, with mathematical illustrations by A. H. Barnett. (318 pages, MIT Press, 2021). I contributed 17 hand-drawn tutorial pages on topics in statistics, machine learning, and physics.

Spectral Geometry (P. S. P. M. proceedings of the International Conference on Spectral Geometry, July 2010, Dartmouth College). Editors: A. H. Barnett, C. S. Gordon, P. A. Perry, and A. Uribe. 339 pages (2012).

Software:

FINUFFT. Parallel non-uniform fast Fourier transform (2018–) <http://finufft.readthedocs.io>

cuFINUFFT. GPU-based nonuniform FFT (2020–) <https://github.com/flatironinstitute/cufinufft>

SpikeForest / MountainSort. Spike-sorting software and validation website project. Lead developer: J. Magland. (2016–). <http://spikeforest.flatironinstitute.org>

MPSpack. A MATLAB toolbox to solve Helmholtz and scattering BVPs with particular solutions and integral equations (tutorial 45 pages, manual 38 pages); downloaded at least 10^3 times (2009–2016). <https://github.com/ahbarnett/mpspack>

Around twenty other software tools (of varying scope) at:

<https://github.com/ahbarnett>

<https://www.simonsfoundation.org/flatiron/software/?type=40178>

Outreach, cross-disciplinary work, education, press:

“Echoing Resynthesis,” by W. H. K. Chun and A. H. Barnett; article on algorithms of Florian Hecker for exhibition catalog, Equitable Vitruvian gallery, Los Angeles, CA (2023).

Figures of nodal surfaces of 3D random plane waves appearing in: “Topology of the nodal set of random equivariant spherical harmonics on S^3 ,” J. Jung and S. Zelditch, *Intl. Math. Res. Notices*, 2021 (11), 8521–8549; and “Filament structure of random waves,” M. Tacy, [arxiv:2105.11086](https://arxiv.org/abs/2105.11086) (2021).

“Making a computational tool even faster,” Simons Foundation 2019 Annual Report.

<https://annualreports.simonsfoundation.org/2019/making-a-fast-computational-tool-even-faster>

“Snapshots of modern mathematics from Oberwolfach: Fast solvers for highly oscillatory problems,” A. H. Barnett, 11 pages (2017). <https://publications.mfo.de/handle/mfo/1370>

“convolution: *son et lumière*,” A. H. Barnett, issue 01 of *Convolution. A journal for experimental criticism*, 4 pages (2011). <http://convolutionjournal.com/no-1>

Computed eigenmodes for integrable and chaotic billiards, appearing in: S. Dyatlov, “Quantum ergodicity in theorems and pictures”, *Notices AMS* (2023); S. Dyatlov, “Around quantum ergodicity”, *Ann. Math. Québec* **46** 11–26 (2022); S. Dyatlov, “Macroscopic limits of chaotic eigenfunctions”, *Proc. ICM 2022*; P. Sarnak, “Recent progress on the quantum unique ergodicity conjecture”, *Bull. AMS* **48**(2) 211–228 (2011); D. Mackenzie, *What’s Happening in the Mathematical Sciences, Volume 8* (AMS, 2011); S.-Y. Koyama, *From primes and zetas to arithmetic quantum chaos* (Nihon Hyoronsha, 2010); and S.-Y. Koyama, “Arithmetic quantum chaos and zeta functions”, *Suurikagaku*, **571** (2011)

Cover of *Notices of the American Mathematical Society*, January 2008. I created all images (modes 1, 10, 10^2 , 10^3 , 10^4 , 10^5 of a planar chaotic cavity), and eigenvalue data for article “Quantum Chaos” by Z. Rudnick.

Quantum chaos research featured in “A Decade of Science at Dartmouth”, W. Schpero and C. Chiang, *Dartmouth Undergraduate Journal of Science*, Spring 2008.

INVITED RESEARCH TALKS

[SIAM CSE 23, ICOSAHOM 23, and ICIAM 23: declined, to minimize CO₂ and travel]

Imperial/UCL Numerical Seminar, London, UK

April 2023

Applied Mathematics Seminar, Yale

March 2023

Analysis-Applied Math-Physics Seminar, Dalhousie University (online)

January 2023

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| Numerical Analysis and Scientific Computing seminar, NYU | November 2022 |
| Applied and Computational Mathematics Seminar, Dartmouth College | October 2022 |
| <i>Challenges in Computational Methods for Integral Equations</i> , Casa Matemática Oaxaca, Mexico | May 2022 |
| NJIT Applied Mathematics Colloquium, Newark, NJ | November 2021 |
| Panel discussant for book release of <i>Discriminating Data</i> (online) | November, December 2021 |
| SIAM Annual Meeting (online) | July 2021 |
| ICOSAHOM, Vienna (online) | July 2021 |
| CCM Seminar, Flatiron Institute (online) | March 2021 |
| Starshade Science and Industry Partnership (SIP) telecon, NASA/JPL (online) | March 2021 |
| PACM Colloquium, Princeton | February 2020 |
| Workshop on <i>Machine Learning of Organic Force Fields</i> , Flatiron Institute, NY | December 2019 |
| UC Berkeley/LBL Applied Mathematics Seminar | November 2019 |
| Widely Applied Mathematics seminar, SEAS, Harvard | October 2019 |
| <i>Mathematical Fluids, Materials and Biology</i> , U. Michigan | June 2019 |
| <i>High-Order Discretizations and Quadrature for Integral Eqn. Methods</i> , SIAM CSE, Spokane, WA | Feb 2019 |
| Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ | August 2018 |
| ICOSAHOM (two invited minisymposium talks), Imperial College, London, UK | July 2018 |
| Flatiron Friday Seminar, Simons Foundation, NY | June 2018 |
| Applied Mathematics Seminar, Yale | April 2018 |
| Aerospace & Mechanical Engineering Seminar, USC | April 2018 |
| <i>Fast Algs. for Generating Static and Dynamically Changing Point Configs.</i> , ICERM, Brown | March 2018 |
| Scientific Computing and Numerical Analysis (SCAN) seminar, Cornell | February 2018 |
| Flatiron Institute Board Meeting, Simons Foundation | January 2018 |
| Workshop on <i>Random geometries / Random topologies</i> , ETH Zurich | December 2017 |
| Scientific Computing Colloquium, FSU, Tallahassee | November 2017 |
| Flatiron Institute Lunch & Learn Seminar, NYC | November 2017 |
| SIAM Conference on Computational Science and Engineering, Atlanta | March 2017 |
| IMA workshop, <i>Mathematical and Numerical Modeling in Optics</i> , U. Minnesota | December 2016 |
| Math/ICES numerical analysis seminar, UT Austin | December 2016 |
| Oberwolfach Workshop on Fast Solvers for Highly Oscillatory Problems. MFO, Germany | November 2016 |
| SIAM Annual meeting, Boston | July 2016 |
| SIAM Conference on Computational Science and Engineering, Salt Lake City | March 2015 |
| PACM Colloquium, Princeton | February 2015 |
| SCDA Journal Club, Simons Foundation | November 2014 |
| CBMS-NSF Conference on Fast Direct Solvers for Elliptic PDE, Dartmouth College | June 2014 |
| Numerical Analysis and Scientific Computing Seminar, Courant Institute, NYU | March 2014 |
| <i>Integral Equations Methods: Fast Algorithms and Applications</i> , BIRS, Banff | December 2013 |
| Numerical analysis and PDE seminar, U. of Delaware | November 2013 |
| Colloquium, U. of Arizona, Tuscon, AZ | November 2013 |

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| Colloquium, Mathematics Dept, Tufts University | September 2013 |
| Physics Colloquium, UMass Boston | April 2013 |
| Middlebury College, VT | April 2013 |
| Applied Mathematics Seminar, NJIT, Newark, NJ | March 2013 |
| SIAM Conference on Computational Science and Engineering, Boston | February 2013 |
| Numerical Analysis and Scientific Computing Seminar, Courant Institute, NYU | February 2013 |
| Widely Applied Math Seminar, DEAS, Harvard | January 2013 |
| Oberwolfach Workshop on Computational Electromagnetism and Acoustics. MFO, Germany | January 2013 |
| Applied Math Colloquium, U. Michigan | November 2012 |
| Integrated Applied Mathematics Seminar, UNH. | November 2012 |
| <i>Applications of Integral Equation Methods</i> , minisymposium, SIAM Annual Meeting, Minneapolis | July 2012 |
| Workshop on <i>Geometry of eigenvalues and eigenfunctions</i> , CRM, Univ. de Montréal | June 2012 |
| <i>Challenges in Geometry, Analysis, and Computation</i> , Yale University (poster) | June 2012 |
| Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ | May 2012 |
| Analysis/PDE Seminar, UNC Chapel Hill | April 2012 |
| Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University | February 2012 |
| <i>Modern Numerical Methods for Waves: Periodic Geometries</i> , ICIAM, Vancouver | July 2011 |
| WAVES2011, Vancouver (contributed talk) | July 2011 |
| Applied and Computational Mathematics Seminar, Dartmouth | May 2011; January 2012; February 2012 |
| New England Numerical Analysis Day, UMass Dartmouth | April 2011 |
| CSC Seminar, Simon Fraser University, Vancouver, BC | March 2011 |
| Numerical Analysis and Scientific Computing Seminar, Courant Institute, NYU | January 2011 |
| Applied Mathematics and Computational Science Colloquium, U. Penn | January 2011 |
| Conference in honor of 65th birthday of Eric Heller, ITAMP, Harvard | October 2010 |
| <i>Integral Equation Methods, Fast Algorithms and Applications</i> , IMA workshop, Minnesota | August 2010 |
| Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ | May 2010 |
| <i>Numerical solution of the Painlevé equations</i> , ICMS, Edinburgh, UK | May 2010 |
| Applied Analysis Seminar, Louisiana State University | March 2009 |
| Dartmouth Mathematics Colloquium | November 2009 |
| MIT Applied Mathematics Colloquium | November 2009 |
| Computational Optical Sensing and Imaging Seminar, CU Boulder | September 2009 |
| <i>Topological Complexity of Random Sets</i> , AIM workshop, Palo Alto | August 2009 |
| WAVES2009, Pau, France (contributed talk) | June 2009 |
| Colloquium & PDE/Analysis Seminar (two separate talks), ANU, Canberra, Australia | February 2009 |
| <i>Laplacian Eigenvalues & Eigenfunctions: Theory, Computation, Application</i> , IPAM, UCLA | February 2009 |
| <i>Workshop on Numerical and Analytical Methods for Wave Scattering</i> , Manchester, UK | June 2008 |
| Workshop on quantum chaos, CRM (Univ. de Montréal) | June 2008 |
| Frontiers in Computational and Applied Mathematics, NJIT, Newark, NJ (contributed poster) | May 2008 |
| McGill Applied Mathematics Seminar, Montreal | March 2008 |

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| Applied Mathematics Seminar, U. Delaware | November 2007 |
| Numerical analysis seminar, Manchester, UK | July 2007 |
| Three separate mini-symposium talks, ICIAM, Zurich | July 2007 |
| PDE/Analysis Seminar, ANU, Canberra, Australia | February 2007 |
| Heller Group Seminar, Physics Department, Harvard | December 2006 |
| Applied Mathematics Seminar, UMass Amherst, MA | November 2006 |
| Dartmouth Physics Colloquium | October 2006 |
| SIAM Annual Meeting, Boston (contributed talk) | July 2006 |
| Joint MIT/Harvard Analysis Seminar | March 2006 |
| Computations in Science Seminar, U. Chicago | November 2005 |
| Institute of Sound and Vibration Research, Southampton University, UK | June 2005 |
| Computational Mathematics and Applications Seminar, Computing Laboratory, Oxford, UK | June 2005 |
| Numerical Analysis and Scientific Computing Seminar, Courant Institute, NYU | December 2004 |
| Applied Mathematics Colloquium, Columbia University | October 2004 |
| <i>Workshop on Semi-classical Theory of Eigenfunctions and PDEs</i> , CRM (Univ. de Montréal) | June 2004 |
| Applied Mathematics Seminar, Yale University | March 2004 |
| Applied Mathematics Laboratory Seminar, Courant Institute, NYU | February 2004 |
| European Conference on Biomedical Optics, Munich, Germany (contributed talk) | June 2003 |
| Theoretical & Computational Biology Seminar Series, Mount Sinai School of Medicine, NY | May 2003 |
| Applied Mathematics Seminar, Courant Institute, NYU | November 2002 |
| Photon Migration Imaging Seminar, Harvard Medical School | May 2002 |
| Applied Mathematics Laboratory Seminar, Courant Institute, NYU | December 2001 |
| Statistics Seminar, University of Toronto | September 2001 |
| Pan-American Advanced Study Institute on Quantum Chaos, Ushuaia, Argentina | October 2000 |
| <i>14th Maximum Entropy Workshop (MAXENT94)</i> , Cambridge, UK | June 1994 |

TEACHING

Flatiron Institute

- Nonuniform FFTs at Flatiron: lessons from developing a small numerical library, in *Flatiron-Wide Autumn Meeting* October 2023
- The GMRES method to solve square linear systems and its convergence rate, in *Scientific Computing and Concepts Seminar* October 2021
- The joys and pitfalls of numerical computing, in *Flatiron-Wide Algorithms and Mathematics III*, $F_\omega(\alpha+m)^3$ October 2021
- Writing good functions (2-hour workshop, co-presenter), *SciWare* November 2020
- Function approximation and differential equations, in *Flatiron-Wide Algorithms and Mathematics*, $F_\omega(\alpha+m)!$ October 2019

Dartmouth College *(the six new courses I created are shown by asterisks)*

- Math 5: The Mathematics of Music and Sound (non-majors)* Spring 2007, Fall 2008, 2010, 2011
- Math 11: Multivariable Calculus Fall 2010, 2015
- Math 22: Linear Algebra with Applications Summer 2006, Fall 2016, Summer 2017
- Math 23: Differential Equations Fall 2005, 2007
- Math 46: Introduction to Applied Mathematics (majors)* Spring 2007, 2008, 2009, 2011

- Math 50: Probability and Statistical Inference Winter 2006
- Math 53: Chaos! (dynamical systems, for majors)* Fall 2007, 2009, 2011, 2015
- Math 56: Computational and Experimental Mathematics (majors)* Spring 2013, 2014
- Math 116/126: Numerical PDEs & Waves* (graduate) Winter 2006, Fall 2008, Winter 2012
- Math 116: Great Papers in Numerical Computation* (graduate) Spring 2014
- Math 147: Graduate Teaching Seminar (with M. Groszek or R. Orellana) Summer 2012, 2013, 2014, 2017

New York University

- Business Calculus Fall 2004
- Mathematical Wave Dynamics (honors VIGRE course, with O. Bühler) Spring 2004
- Linear Algebra Fall 2003
- Multivariable Calculus Spring 2003
- Undergraduate Math Lab (honors VIGRE course, with P. Sarnak) Fall 2002

Harvard University

- TA / head TA, 8 semesters in physics; *Microteaching Facilitator* for Derek Bok Center 1995–2001

MENTORING

Postdoctoral advisees:

- Fruzsina Agocs (Flatiron Research Fellow, CCM, Flatiron Institute) October 2021–present
- Daniel Fortunato (Flatiron Research Fellow, CCM, Flatiron Institute) September 2020–2023
now: Associate Research Scientist, CCB/CCM, Flatiron Institute
- Jason Kaye (Flatiron Research Fellow, CCM, Flatiron Institute) September 2019–2022
now: Associate Research Scientist, CCQ/CCM, Flatiron Institute
- James Jun (Associate Research Scientist, CCM, Flatiron Institute) September 2018–May 2020
now: Research Scientist, Meta Reality Labs
- Jun Wang (Flatiron Research Fellow, CCB, Flatiron Institute) October 2017–August 2020
now: Tenure track, Tsinghua University
- Min Hyung Cho (IACM Instructor, Mathematics, Dartmouth College) July 2012–June 2015
now: Associate Professor, Mathematics & Statistics, UMASS Lowell
- Adrianna Gillman (JWY Instructor, Mathematics, Dartmouth College) July 2011–June 2014
now: Associate Professor, Applied Mathematics, CU Boulder

Graduate students:

- Yuxiang Larry Liu (Ph.D. '16; Physics. Now: Quantitative researcher, Citadel) January 2013–June 2016
The numerical solution of frequency-domain acoustic and electromagnetic periodic scattering problems
- Lin Zhao (Ph.D. '15. Now: Software engineer, Lacework, NYC) May 2012–June 2015
Boundary integral equations and their applications
- Matt Mahoney (Ph.D. '09; advised for one year) July 2006–July 2007
Global numerical methods for eigenmodes with gravity

Summer interns:

- Srinath Kailasa (CCM; co-mentored with M. Rachh) June–August 2022
- Tanya Wang (CCM; co-mentored with M. Rachh) July–August 2021
- Michael Doppelt (CCM) June–August 2020
- Andrea Malleo (CCM) June–August 2019
- Daniel Fortunato (CCM) June–August 2019

Yu-Hsuan Melody Shih (Numerical Algorithms Group, CCB) June–August 2018, July 2019
 Hannah Lawrence (Numerical Algorithms Group, CCB) June–August 2017

Undergraduate students:

Paula Chen '17 (senior thesis) Fall 2016–Spring 2017
Neural spike sorting algorithms for overlapping spikes

Luis Martinez '16 (Physics; senior thesis) Spring 2016
Bubbles in my scalar field soup: a study on oscillons in cosmology

Matthew Jin '17 (supported by \$4k from my NSF grant) June 2014–2016
Topological statistics of nodal surfaces of random waves

John Conley '15 (Presidential Scholar) September 2013–May 2014
Modeling optical waveguides and solar cells

James Brofos '15 (supported by \$4k from my NSF grant) June–August 2013
Behavior and solution of layer densities for close-to-touching curves

Ben Southworth '13 (supported by start-up; co-advisor Brenden Epps) June–July 2013
Stability of the SVD for measurement of eigenfunctions of a linear system

Bradley Nelson '13 (supported by \$4k Richter Memorial Fund; senior thesis) March 2012–May 2013
Integral equations for waves in variable-index media

Hahn Nguyen '14 (first-year WISP intern, Women in Science Program) January–June 2011
Accurate evaluation of layer potentials up to the boundary

Kyle Konrad '12 (senior thesis, Neukom Scholar) March 2011–June 2012
Nodal domain counts of chaotic eigenfunctions

Vipul Kakkad '13 (Presidential Scholar) January–March 2012
Optimization of tubular bell mode frequencies

Taylor Sipple '13 (Presidential Scholar) June–December 2011
Method of particular solutions for polygon and Dirichlet-Neumann eigenmodes

Kathleen Champion '11 (Presidential Scholar and senior thesis; co-supervisor Amy Gladfelter, Biology) January 2010–May 2011
Three-dimensional tracking of nuclear mitosis

Zoe Lawrence '10 (senior thesis, with 'high honors'; co-supervisor Dorothy Wallace) Spring 2010
The spatiotemporal dynamics of African Cassava Mosaic Disease

Emmanuel Mensah '09 (independent study) Spring 2009
The inverse source problem in medical imaging (published in DUJS, November 2009)

Yong Su '09 (senior thesis, with 'high honors'; Neukom Scholar) September 2008–March 2009
Computing the capacitance of the unit cube

Evan Tice '09 (computer science major; co-supervisor Amy Gladfelter, Biology) January 2008–June 2009
Automated image tracking of cell movement and division (awarded Kemeny Prize, 2008)

Chetan Mehta '08 (senior thesis, with 'high honors') June 2007–May 2008
Optimal optode location in Diffuse Optical Tomography

Chor Lam '08 (Presidential Scholar) January–June 2008
Chaos in billiards

Vissuta Jiwariyavej '09 (sophomore WISP intern, Women in Science Program) January–June 2007
A clap can chirp: waves and echoes in the racquetball court

William A. Webb (summer research student, Caltech; co-advisor Mason Porter) Summer 2006
A computational study of the quantization of billiards with mixed dynamics

External thesis committees:

Fredryk Fryklund (KTH, Ph.D 2021); as opponent I also gave a 30 min background talk.
Integral equations and function extension techniques for numerical solution of PDEs

Jason Kaye (NYU, Ph.D 2019)

Integral equation-based numerical methods for the time-dependent Schrödinger equation

Leonardo Andrés Zepeda-Núñez (MIT, Ph.D 2015)

Fast solvers for the Helmholtz equation

SERVICE AND OUTREACH

Seminar organizing:

Scientific Computing Seminar / Discussion Group, Flatiron Institute (31 meetings so far) 2020–
CCM Colloquium (formerly Numerical Analysis Seminar), Flatiron Institute (≥ 50 invited talks) 2017–2021
Applied and Computational Mathematics Seminar, Dartmouth College (≥ 90 invited talks) 2006–2016
Organizer (with J. Zhang), Applied Mathematics Laboratory Seminar, Courant Institute, NYU 2002–2003
Organizer, Creating Careers in Physics series, Harvard 1999–2000

Outreach and educational:

The Simons Sessions I: jazz and mathematics (with Stephon Alexander), Flatiron Institute October 2020
Research talk for Simons Foundation New Hire Workshop November 2019
Research talk for Simons Foundation Staff Meeting February 2019
Research talk for Flatiron Institute Board Meeting January 2018
Guest lecture, *Mathematics and Music*, Hanover High School, NH May 2016
Two-hour workshops on *Math and Music* for high-school teachers, Math for America January, March 2016
Co-supervisor, *Exploring Mathematics*, 2-week “camps” ages 11-17, Dartmouth Summer 2012–2014, 2017
Periods, Pitches and Pipes: middle-school music/math module (with Megan Martinez) June 2013
The Mathematical Overtones of Music, lecture, JHU Center for Talented Youth, Odyssey Series May 2011
Interactive Learning in the Sciences, session given for DCAL (teaching center) October 2007
Cross-disciplinary classroom visits by professional musicians to Math 5, 53 2007–2011
Guest lectures (1 week graduate level), Math 117, Dartmouth College Summer 2012, 2013
Affiliated faculty, Electro-Acoustic Music Program, Dartmouth 2007–2017
Research talks for Dartmouth Mathematics Society 2006, 2008, 2009, 2010, 2011
Judge, DMAX Makeathon May 2014
Research talk at Thugz Institute of Science, Dartmouth April 2014
Mathematical model building, Dartmouth Mathematics Society October 2006
Guest lecture, Music 3 (Music and Technology), Dartmouth November 2006

Flatiron Institute committees:

Organizing committee, *Flatiron-Wide Autumn Meeting* on software best practices 2023 SciWare Steering
Committee January 2021–April 2023

University committees & duties (Dartmouth College):

Chair, Committee on Organization and Policy (elected position) Fall 2015
Committee on Organization and Policy (elected position) 2013–2016
Committee on Student Life 2011–2013
Advisory Committee, Leslie Center for the Humanities Winter 2011–Spring 2013
Faculty Advisory Board, Dartmouth Undergraduate Journal of Science (DUJS) Fall 2007–2017
First-year advising Fall 2007, 2008, 2010, 2011

Department committees & duties (Dartmouth College):

Teaching Assistant Discussion Group Fall 2017
Faculty Advisor, Dartmouth SIAM Student Chapter March 2012–Nov 2015
Advisor to Graduate Students 2011–2013
Committee member, Applied Mathematics Qualifying Examination, Lin Zhao Spring 2012
Committee member, Applied Mathematics Qualifying Examination, Katherine Kinnaird Spring 2010
Graduate Program Committee 2006–2007, 2012–2014, 2015–2017
Graduate Admissions Committee 2005, 2006, 2011

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| Undergraduate Program Committee | 2005, 2008–2010 |
| Recruiting Committee | 2007–2008, 2010–2011, 2012–2013 |
| Computing Committee | 2005–2006, 2015–2016 |
| Equipment Committee | 2007–2008 |
| Mirkil Book Committee | 2006–2007 |
| Research talks for Dartmouth Graduate Recruiting Open House | 2006, 2007, 2009, 2011, 2013 |

OTHER PROFESSIONAL ACTIVITIES

Conference organizing:

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| Organizing committee, <i>Computational Tools for PDEs with Complicated Boundaries and Interfaces</i> , Flatiron Inst. | June 2024 |
| Organizing committee, <i>Flatiron-Wide Autumn Meeting</i> , Flatiron Inst. | October 2023 |
| Organizer (with 3 others), <i>Computational Methods for Multiple Scattering</i> workshop, Isaac Newton Inst., Cambridge, UK | April 2023 |
| Chair of committee, <i>Flatiron-Wide Algorithms and Mathematics</i> , $F_\omega(\alpha+m)!$, Flatiron Inst. | October 2019 |
| Organizing committee, <i>Frontiers in Applied and Computational Mathematics</i> , NJIT | August 2018 |
| Organizer (with 3 others), <i>Modern Advances in Computational and Applied Mathematics</i> , Yale | June 2017 |
| Organizer (with L. Zepeda-Núñez), two minisymposia on the high-frequency Helmholtz equation, SIAM Annual Meeting, Boston | July 2016 |
| Organizer (with 3 others), <i>CBMS-NSF Conference on Fast Direct Solvers for Elliptic PDE</i> , Dartmouth College | June 2014 |
| Organizer (with 4 others), <i>Integral Equations Methods: Fast Algorithms and Applications</i> , BIRS | December 2013 |
| Organizer (with L. Demanet), minisymposium on the high-frequency Helmholtz equation, SIAM CSE, Boston | February 2013 |
| Organizer (with L. Demanet), two minisymposia on numerical waves, ICIAM, Vancouver, BC | July 2011 |
| Organizer (with 3 others), <i>International Conference on Spectral Geometry</i> , Dartmouth College | July 2010 |
| Organizer (with 3 others), Boston Area Undergraduate Physics Competition | 1998–2001 |

Journals:

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| Editorial committee for AMS Mathematical Surveys and Monographs | 2023–2027 |
| Co-Editor in Chief, <i>Advances in Computational Mathematics (ACOM)</i> | 2017–present |
| Guest editorial board, Special Issue on <i>Advances in Computational Integral Equations</i> , ACOM | 2021 |
| Editorial board, <i>Advances in Computational Mathematics</i> | 2012–2017 |

Referee service:

SIAM Journal on Scientific Computing, SIAM Journal on Applied Mathematics, SIAM Journal on Numerical Analysis, Journal of Computational Physics, *Advances in Computational Mathematics*, Notices of the AMS, Journal of the AMS, *Communications in Mathematical Physics*, *Mathematics of Computation*, Journal of Mathematical Analysis and Applications, Journal of Differential Equations, *Inverse Problems*, Proceedings of the Royal Society of London A, Journal of Physics A, Journal of Scientific Computing, *Engineering Analysis with Boundary Elements*, *Numerical Functional Analysis and Optimization*, *Experimental Mathematics*, *Constructive Approximation*, *Applied Optics*, *Waves in Random and Complex Media*, *Wave Motion*, *NeuroImage*, *Journal of Electronic Imaging*, *Physics in Medicine and Biology*, *Transactions on Medical Imaging*, *Journal of the Optical Society of America A*, *Nonlinear Dynamics*, *Canadian Journal of Physics*, *New Journal of Physics*, *AMS Mathematical Reviews*, Johns Hopkins Press, SIAM book series, NSERC (Canada), Israel Science Foundation.

Review panels:

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| National Science Foundation | |
| Scientific Committee, <i>International Conference on Mathematical and Numerical Aspects of Wave Propagation (WAVES)</i> | 2011, 2013, 2015, 2017, 2019, 2022, 2024 |
| Scientific Committee, <i>International Association for Boundary Element Methods (IABEM)</i> | 2018 |
| Scientific Committee, <i>SIAM-NNP (New York-NJ-Penn regional SIAM group), Annual Meeting</i> | 2023 |

Member:

