Spencer H. Bryngelson

1 Basic information

Title: Assistant Professor, School of Computational Science & Engineering

Institution: Georgia Institute of Technology

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2 Education

- University of Illinois at Urbana–Champaign
  - (2017) Doctor of Philosophy, Theoretical & Applied Mechanics
  - (2015) Master of Science, Theoretical & Applied Mechanics
  - (2015) Graduate Certificate, Computational Science & Engineering
- University of Michigan–Dearborn
  - (2013) Bachelor of Science, Mechanical Engineering
  - (2013) Bachelor of Science, Engineering Mathematics

3 Positions held

- (2021–Present) Assistant Professor, School of Computational Science & Engineering, College of Computing, Georgia Institute of Technology
- (2022) Visiting Scholar, Stanford University, Center for Turbulence Research (Summer Program)
- (2018–21) Senior Postdoctoral Scholar, California Institute of Technology, with Tim Colonius
- (2019) Visiting Researcher, Massachusetts Institute of Technology, with Themis Sapsis
- (2017–18) Postdoctoral Researcher, XPACC (PSAAP II center), with Carlos Pantano, Dan Bodony, Jon Freund
- (2013–17) Graduate Research Fellow, University of Illinois at Urbana–Champaign, with Jon Freund
- (2015) Alumni Teaching Fellow, University of Illinois at Urbana–Champaign
- (2012–13) Undergraduate Research Assistant, University of Michigan–Dearborn, with Eric Ratts

4 Teaching

4.1 Georgia Institute of Technology

Semester	Number	Course Title	Students
Spring 2023	CSE6730	Modeling & Simulation	146
Fall 2022	VIP[2/3/4]60[1/2]	Team Phoenix Cluster Competition Team	17
Fall 2022	CX/MATH4640	Numerical Analysis I	36
Fall 2021	CX/MATH4640	Numerical Analysis I	43

4.2 Other Institutions

Semester	Number	Course Title	Students	Institute
Fall 2015	ME310	Fundamentals of Fluid Dynamics	82	UIllinois
Fall 2013	ME3601	Design and Analysis of Machine Elements	35	UMichigan
Spring 2012	ME364	Probability, Statistics, and Reliability in Design	32	UMichigan
Fall 2012	ME230	Statics and Mechanics of Materials	61	UMichigan

5 Students

5.1 Graduate

- Jesus Arias, Ph.D. student (CSE, co-advised with L. Sankar)
- Fatima Ezahra Chrit, Ph.D. student (ME and CSE, co-advised with A. Alexeev)
- Anand Radhakrishnan, Ph.D. student (CSE)
- Anshuman Sinha, M.S. student (CSE)
- Zhixin Song, Ph.D. Student (Physics)
- Benjamin Wilfong, Ph.D. student (CSE)
- Haocheng Yu, Ph.D. student (CSE, co-advised with K. Ahuja)

5.2 Undergraduate

- Ajay Bati (CS)
- Ansh Gupta (CS)
- Arjun Bhamra (CS)
- Sriharsha Kocherla (CS)
- Yash Kothari (CS)
- Henry Le Berre (CS)
- Qi Zeng (CS and Math, co-advised with F. Schäfer)

6 Awards

- (2022) Ralph E. Powe Junior Faculty Enhancement Award, Oak Ridge National Lab
- (2022–23) Georgia Tech Faculty Writing Scholar
- (2022–23) Class of 1969 Teaching Fellow, Georgia Institute of Technology
- (2017) Stanley Weiss Outstanding Dissertation Award, University of Illinois at Urbana–Champaign
- (2016) Hassan Aref Award (research in fluid mechanics), University of Illinois at Urbana–Champaign
- (2015) Alumni Teaching Fellowship, University of Illinois at Urbana–Champaign
- (2010–13) Dean's List, University of Michigan–Dearborn
- (2011) Pi Tau Sigma (honor society, member), University of Michigan–Dearborn

7 Research support

7.1 Pending grants

- (2023–28) PI: DOE Early Career Research Program "*Massively parallel mesh-free hyperbolic PDE solvers via adaptive radial-basis-function-based numerics*" ($750K)
- (2023–27) PI: DOD ARO "*Investigation and inference of soft material deformation mechanisms unlocked at large speeds, finite deformations, and many cycles*" ($550K)
- (2023–26) PI: NSF DARE "*Optimal computational model-based design of affordable wearable technology to monitor biomarkers in kids with enthesitis related arthritis*" ($450K)
- (2023–26) co-PI: DOD ONR "*Multi-scale simulations of combustion in a solid propellant ramjet with embedded reactive metal particles*" ($375K, PI S. Menon, GT Aerospace Engineering)
- (2023–24) PI: Google Research Scholar Program "*Solving partial differential equations on noisy quantum processors*" ($60K)
- (2023–24) PI: GT Seed Grant, Moving Teams Forward "*Quantum computing for next-generation engineering simulation*" ($100K)
- (2023–24) co-PI: NOAA SBIR "*Using bubbles to reduce underwater noise from shipping and ferries*"

($175K, SHB share: $24.5K, PI K. Seger, Applied Ocean Sciences)

7.2 Funded grants

- (2023) PI: DOE/Sandia National Laboratory (subcontract), "*Vibrated bubbly flow simulation*" ($65K)
- (2022–23) PI: DOE ORAU Powe, "*A methodologically coherent multi-scale model for multiphase flow*" ($10K)
- (2022–26) PI: DOD ONR N00014221251 9, "*Stochastic framework for cavitating flows: mesoscale modeling and acceleration*" ($560K)
- (2022–23) co-PI: GTRI IRAD, "*Quantum optimization for lattice Boltzmann simulation (QOLBS)*" ($40K), PI B. Gard (GTRI)
- (2022) PI: GT Seed Grant, Forming Teams "*Quantum computing for next-generation engineering simulation*" ($50K)
- (2022) PI: GTQA DE0001321 1, "*Quantum algorithms for lattice Boltzmann fluid flow simulation*" ($14.5K)

7.3 Miscellaneous grants

- (2023) PI: SIAM CSE Travel Award ($3.5K)
- (2023) PI: APS FECS Travel Grant ($350)
- (2022) PI: Stanford CTR Summer Program "*Fast macroscopic forcing for operator recovery via locality and causality with application to compressible and multiphase flow*" ($8K, with F. Schäfer, SHB share $4K)

7.4 Funded resource and hardware awards

- (2021–23) PI: Oak Ridge National Lab CFD154, Director's Discretionary, "*Accelerated sub-grid multi-component flow physics*" (20K node hours)
- (2022) PI: NVIDIA Academic Hardware Grant Program (4x BlueField-2 E-Series DPU, $12K value)
- (2022) PI: Georgia Tech Tech. Fee "*ARM HPC Dev Kits for next-generation supercomputing*" (10 NVIDIA ARM HPC Dev. Kits, $240K value)
- (2022) PI: AMD MI200-series GPU Server ($77K value)
- (2022) PI: NVIDIA Academic Hardware Grant Program (2x A100 80GB PCIe GPUs, $30K value)
- (2021–22) PI: XSEDE TG-PHY210084, "*High-fidelity simulation of high-speed flowing dispersions via a stochastic sub-grid model*" (200K Node Hours, $30K value)
- (2019–20) co-PI: XSEDE TG-CTS120005, "*Advanced immersed boundary and interface-capturing methods for simulations of complex flows*" (9M Node Hours, $1.35M value)

8 Professional activity

8.1 Appointments and memberships

- (2021–Present) NATO Science & Technology Organization, Technical Team Member
- (2015–Present) Society of Industrial and Applied Mathematics, Member
- (2014–Present) American Physical Society, Member

8.2 Referee

- AIAA Journal
- Fluids
- IEEE International Parallel & Distributed Processing Symposium
- International Journal of Multiphase Flow

- International Journal of Offshore and Polar Engineering
- Journal of Computational Physics
- Journal of Fluid Mechanics
- Physical Review E
- Physical Review Fluids
- PLOS Computational Biology
- SIAM Scientific Computing
- Symposium of Naval Hydrodynamics
- Theoretical and Computational Fluid Dynamics

9 Service and outreach

9.1 Georgia Tech

9.1.1 Institute-level

- (2021–Present) Georgia Tech *HPC Hackathon*, initiator and organizer, recruited sponsors Oak Ridge National Lab and NVIDIA
- (2022–Present) Georgia Tech *Scientific Software Engineering Center*, Advisory Board
- (2022–Present) PURA Award Reviewer
- (2022–Present) ORAU Powe Award Reviewer
- (2022) Faculty Search Panel, Professional Development Workshops, Georgia Tech Center for Teaching and Learning

9.1.2 CoC-level

- (2022–Present) VIP Team Phoenix–Cluster Competition Team, Faculty advisor
- (2022–Present) CSE communication committee
- (2021–Present) TSO advisory committee representative
- (2021–Present) Seminar series organizer (with F. Schäfer and R. Vuduc)
- (2023) CRNCH Summit Panel organizer and moderator (with R. Vuduc)
- (2022) Organizer, Georgia Scientific Computing Symposium (with E. Chow and X. Zhang)
- (2022) Judge, CS Junior Design Capstone Expo
- (2021–22) Graduate student admissions committee

9.1.3 Student examination committees

- (2023) M.S. Thesis Proposal; Felix Luo (CoE AE)
- (2023) Dissertation Proposal; Liana Hatoum (CoE BME)
- (2022) Ph.D. defense; Wangwei Lan (CoS Physics)
- (2022) Qualifying exam, Dissertation Proposal; Johnie Sublett (CoC CSE)
- (2022) Ph.D. defense; Achyut Panchal (CoE AE)
- (2021) Qualifying exam; Bradley Baker (CoC CSE)
- (2021) Qualifying exam; Conlain Kelly (CoC CSE)
- (2021) Qualifying exam; Sam Swanson (CoC CSE)

9.2 External

- (2021–Present) Mentor, GPU Hackathons (with Oak Ridge National Lab, NVIDIA, NASA)
- (2023) Session chair, 11th International Conference on Multiphase Flow

- (2022) Supercomputing (SC) Mentor (via Mentor–Protege program)
- (2022) Supercomputing (SC) Early Career Program
- (2022) Panel Referee, ACCESS Maximize
- (2022) Grant Panel Reviewer, National Science Foundation
- (2021, 2022) Session chair, American Physical Society, Division of Fluid Dynamics
- (2021–22) Research mentor, XSEDE EMPOWER (Expert Mentoring Producing Opportunities for Work, Education, and Research; program received HPCwire 2021 Editors' Choice Award in Workforce Diversity and Inclusion Leadership)
- (2021) Poster judge, American Physical Society, Division of Fluid Dynamics
- (2021) Mini-symposium organizer and session chair, "Machine learning for multiphase flows", IACM Conference on Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology (MMLDT-CSET)
- (2020) Research mentor, Schmidt Academy for Software Engineering
- (2019) Research mentor, WAVE undergraduate research program for under-represented students, Caltech
- (2015–16) Judge, Illinois State-wide Math Competition
- (2014) Organizer, Science Night, Illinois Middle Schools

10 Publications

10.1 Preprints

[U1] Firouznia, M., S. H. Bryngelson, and D. Saintillan (2022). "A spectral boundary integral method for simulating electrohydrodynamic flows in viscous drops". arXiv: 2210.04957.

10.2 Journal articles

[J17] Bryngelson, S. H., R. O. Fox, and T. Colonius (2023). "Conditional moment methods for polydisperse cavitating flows". *Journal of Computational Physics* **477**, 111917. DOI: 10.1016/j.jcp.2023.111917.

[J16] Panchal, A., S. H. Bryngelson, and S. Menon (2023). "A seven-equation diffused interface method for resolved multiphase flows". *Journal of Computational Physics* **475**, 111870. DOI: 10.1016/j.jcp.2022.111870.

[J15] Charalampopoulos, A., S. H. Bryngelson, T. Colonius, and T. P. Sapsis (2022). "Hybrid quadrature moment method for accurate and stable representation of non-Gaussian processes and their dynamics". *Philosophical Transactions of the Royal Society A* **380** 2229. DOI: 10.1098/rsta.2021.0209.

[J14] Bryngelson, S. H., K. Schmidmayer, V. Coralic, K. Maeda, J. Meng, and T. Colonius (2021). "MFC: An open-source high-order multi-component, multi-phase, and multi-scale compressible flow solver". *Computer Physics Communications* **266**, 107396. DOI: 10.1016/j.cpc.2020.107396.

[J13] Spratt, J.-S., M. Rodriguez, K. Schmidmayer, S. H. Bryngelson, J. Yang, C. Franck, and T. Colonius (2021). "Characterizing viscoelastic materials via ensemble-based data assimilation of bubble collapse observations". *Journal of the Mechanics and Physics of Solids* **152**, 104455. DOI: 10.1016/j.jmps.2021.104455.

[J12] Bryngelson, S. H., A. Charalampopoulos, T. P. Sapsis, and T. Colonius (2020). "A Gaussian moment method and its augmentation via LSTM recurrent neural networks for the statistics of cavitating bubble populations". *International Journal of Multiphase Flow* **127**, 103262. DOI: 10.1016/j.ijmultiphaseflow.2020.103262.

[J11] Bryngelson, S. H. and T. Colonius (2020). "Simulation of humpback whale bubble-net feeding models". *Journal of the Acoustical Society of America* **147** 2, 1126–1135. DOI: 10.1121/10.0000746.

[J10] Bryngelson, S. H., T. Colonius, and R. O. Fox (2020). "QBMMlib: A library of quadrature-based moment methods". *SoftwareX* **12**, 100615. DOI: 10.1016/j.softx.2020.100615.

[J9] Schmidmayer, K., S. H. Bryngelson, and T. Colonius (2020). "An assessment of multicomponent flow models and interface capturing schemes for spherical bubble dynamics". *Journal of Computational Physics* **402**, 109080. DOI: 10.1016/j.jcp.2019.109080.

[J8] Trummler, T., S. H. Bryngelson, K. Schmidmayer, S. J. Schmidt, T. Colonius, and N. A. Adams (2020). "Near-surface dynamics of a gas bubble collapsing above a crevice". *Journal of Fluid Mechanics* **899**, A16. DOI: 10.1017/jfm.2020.432.

[J7] Bryngelson, S. H. and J. B. Freund (2019). "Non-modal Floquet stability of a capsule in large amplitude oscillatory extension". *European Journal of Mechanics B/Fluids* **77**, 171–176. DOI: 10.1016/j.euromechflu.2019.04.012.

[J6] Bryngelson, S. H., F. Guéniat, and J. B. Freund (2019). "Irregular dynamics of cellular blood flow in a model microvessel". *Physical Review E* **100**, 012203. DOI: 10.1103/PhysRevE.100.012203.

[J5] Bryngelson, S. H., K. Schmidmayer, and T. Colonius (2019). "A quantitative comparison of phase-averaged models for bubbly, cavitating flows". *International Journal of Multiphase Flow* **115**, 137–143. DOI: 10.1016/j.ijmultiphaseflow.2019.03.028.

[J4] Bryngelson, S. H. and J. B. Freund (2018). "Floquet stability analysis of capsules in viscous shear flow". *Joural of Fluid Mechanics* **852**, 663–677. DOI: 10.1017/jfm.2018.574.

[J3] Bryngelson, S. H. and J. B. Freund (2018). "Global stability of flowing red blood cell trains". *Physical Review Fluids* **3** 7, 073101. DOI: 10.1103/PhysRevFluids.3.073101.

[J2] Bryngelson, S. H. and J. B. Freund (2016). "Buckling and its effect on the confined flow of a model capsule suspension". *Rheologica Acta* **55** 6, 451–464. DOI: 10.1007/s00397-015-0900-9.

[J1] Bryngelson, S. H. and J. B. Freund (2016). "Capsule-train stability". *Physical Review Fluids* **1** 3, 033201. DOI: 10.1103/PhysRevFluids.1.033201.

10.3 Refereed proceedings

[P17] Elwasif, W., S. Bastrakov, S. H. Bryngelson, M. Bussmann, S. Chandrasekaran, F. Ciorba, M. A. Clark, A. Debus, W. Godoy, N. Hagerty, J. Hammond, D. Hardy, J. A. Harris, O. Hernandez, B. Joo, S. Keller, P. Kent, H. Le Berre, D. Lebrun-Grandie, E. MacCarthy, V. G. Melesse Vergara, B. Messer, R. Miller, S. Oral, J.-G. Piccinali, A. Radhakrishnan, O. Simsek, F. Spiga, K. Steiniger, J. Stephan, J. E. Stone, C. Trott, R. Widera, and J. Young (2023). "Early application experiences on a modern GPU-accelerated Arm-based HPC platform". *HPC Asia '23*. International Workshop on Arm-based HPC: Practice and Experience (IWAHPCE). Singapore. DOI: 10.1145/3581576.3581621.

[P16] Le Berre, H. A., A. Radhakrishnan, and S. H. Bryngelson (2023). "Fast simulation of multiphase compressible flows thorugh GPU acceleration". *11th International Conference on Multiphase Flow*. Kobe, Japan.

[P15] Radhakrishnan, A., H. A. Le Berre, S. H. Bryngelson, J. Rodolfo Chreim, and T. Colonius (2023). "A stochastic computational method for bubbly flows with first steps towards representing inception". *11th International Conference on Multiphase Flow*. Kobe, Japan.

[P14] Zeng, Q., Y. Kothari, S. H. Bryngelson, and F. Schäfer (2023). "Competitive physics informed networks". *International Conference on Learning Representations (ICLR)*. Kigali, Rwanda.

[P13] Bryngelson, S. H., A. Charalampopoulos, T. P. Sapsis, R. O. Fox, and T. Colonius (2022). "Representing statistics of dispersions via moment methods and recurrent neural networks with application to cavitating bubbles". *34th Symposium on Naval Hydrodynamics*. Washington D.C., USA.

[P12] Bryngelson, S. H., F. Schäfer, J. Liu, and A. Mani (2022). "Fast Macroscopic Forcing Method". *Center for Turbulence Research, Proceedings of the Summer Program*. Stanford, CA, USA.

[P11] Radhakrishnan, A., H. Le Berre, and S. H. Bryngelson (2022). "Scalable GPU accelerated simulation of multiphase compressible flow". *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)*. Dallas, TX, USA.

[P10] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2022). "Bubble dynamics with phase change near a compliant object". *34th Symposium on Naval Hydrodynamics*. Washington D.C., USA.

[P9] Bryngelson, S. H. and T. Colonius (2021). "Closure of phase-averaged bubbly, cavitating flow models". *XXV International Congress of Theoretical and Applied Mechanics*. Milano, Italy. URL: https://vimeo.com/640932583/0ae772bf00.

[P8] Bryngelson, S. H., F. O'Meally, T. Colonius, and R. O. Fox (2021). "Conditional moment method for fully-coupled phase-averaged cavitation models". *11th International Symposium on Cavitation*. Daejeon, Korea. URL: https://vimeo.com/640931949/a6cd12fc05.

[P7] Rodriguez, M., S. H. Bryngelson, S. Cao, and T. Colonius (2021). "A unified Eulerian multiphase framework for fluid-structure interaction problems including cavitation". *XXV International Congress of Theoretical and Applied Mechanics*. Milano, Italy.

[P6] Rodriguez, M., S. H. Bryngelson, S. Cao, and T. Colonius (2021). "Acoustically-induced bubble growth and phase change dynamics near compliant surfaces". *11th International Symposium on Cavitation*. Daejeon, Korea.

[P5] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). "Eulerian framework for bubble-cloud-kidney stone interaction". *11th International Symposium on Cavitation*. Daejeon, Korea.

[P4] Bryngelson, S. H. and T. Colonius (2020). "Phase- and mixture-averaged techniques for general bubbly flows". *33rd Symposium on Naval Hydrodynamics*. Osaka, Japan. URL: https://vimeo.com/640930931/6e57ccfd89.

[P3] Bryngelson, S. H. and T. Colonius (2019). "A comparison of ensemble- and volume-averaged bubbly flow models". *10th International Conference on Multiphase Flow*. Rio de Janeiro, Brazil.

[P2] Bryngelson, S. H. and J. B. Freund (2016). "Buckling and the rheology of an elastic capsule suspension". *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.

[P1] Freund, J. B. and S. H. Bryngelson (2016). "The stability of flowing trains of confined red blood cells". *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.

10.4 Other publications

[O2] Bryngelson, S. H., C. Pantano, D. Bodony, and J. B. Freund (2018). *Adjoint-based sensitivity for flows with shocks*. Technical Report, XPACC.

[O1] Bryngelson, S. H. (2017). "Stability and transition of capsule-flow systems". Ph.D. Thesis. University of Illinois at Urbana–Champaign.

11 Talks

11.1 Invited talks

[I25] Lawrence Livermore National Laboratory, *Data-driven Physics Simulation Webinar* (2023). URL: https://www.youtube.com/watch?v=zm-iF1FtkLE.

[I24] Arizona State University, *Fluids Seminar* (2022).

[I23] Brown University, *Center for Fluid Mechanics, Applied Math and Engineering* (2022).

[I22] CRNCH Summit (2022). URL: https://mediaspace.gatech.edu/media/CRNCH+Summit+2022+-+Spencer+Bryngleson+-+Quantum+Computing+for+Continuum+Mechanics/1_23u8ou36.

[I21] Emory University, *Scientific Computing Seminar Series* (2022).

[I20] Georgia Institute of Technology, *Aerospace Engineering School Seminar* (2022). URL: https://vimeo.com/759713173/12ef9a0220.

[I19] Georgia Institute of Technology, *Applied and Computational Math Seminar Series* (2022).

[I18] Georgia Scientific Computing Symposium (2022).

[I17] Massachusetts Institute of Technology, *SAND Group* (2022).

[I16] Office of Naval Research, *Basic Research Challenge Guest Talks* (2022).

[I15] California Institute of Technology, *Mechanical and Civil Engineering Seminar Series* (2021).

[I14] OpenACC Annual Summit (2021). URL: https://youtu.be/DgX6ssX2yrg.

[I13] University of California, San Diego, *Fluid Mechanics, Combustion, & Engineering Physics Seminar Series* (2021). URL: https://vimeo.com/640930056/b1a6c0dc62.

[I12] Georgia Institute of Technology, *Computational Science & Engineering Seminar Series* (2020).

[I11] Massachusetts Institute of Technology, *SAND Group* (2019).

[I10] University of Michigan–Ann Arbor, *Mechanical Engineering Seminar Series* (2019).

[I9] University of Michigan–Dearborn, *Mechanical Engineering Seminar Series* (2019).

[I8] University of Utah, *Mechanical Engineering Seminar Series* (2019).

[I7] University of Vermont, *Mechanical Engineering Seminar Series* (2019).

[I6] University of Washington, *Mechanical Engineering Seminar Series* (2019).

[I5] California Institute of Technology, *Computational Flow Physics Group* (2018).

[I4] California Institute of Technology, *Flow Mechanics Research Conference* (2018).

[I3] ETH Zurich, *Computational Science & Engineering Lab* (2017).

[I2] University of Illinois at Urbana–Champaign, *Fluid Mechanics Seminar* (2017).

[I1] University of Illinois at Urbana–Champaign, *Biology Interest Group* (2015).

11.2 Conference presentations

[T42] Bryngelson, S. H., H. Le Berre, and A. Radhakrishnan (2023). "Compressible multiphase flow simulation at near-exascale via a scalable GPU implementation". *American Physical Society, March Meeting*.

[T41] Bryngelson, S. H., F. Schäfer, J. Liu, and A. Mani (2023). "Super-Spectral Operator Recovery via the Fast Macroscopic Forcing Method". *SIAM Computational Science and Engineering*.

[T40] Firouznia, M., S. H. Bryngelson, and D. Saintillan (2023). "A spectral boundary element method for interfacially driven flows". *8th Micro and Nano Flows Conference*.

[T39] Schäfer, F., A. Anandkumar, S. H. Bryngelson, Y. Kothari, H. Owhadi, Q. Zeng, and H. Zheng (2023). "Competitive Gradient Descent Algorithms". *SIAM Computational Science and Engineering*.

[T38] Arias, J. E. and S. H. Bryngelson (2022). "Radial-basis-function-based numerical methods for solving compressible flow equations at different Mach numbers". *American Physical Society*.

[T37] Bati, A. and S. H. Bryngelson (2022). "RoseNNa: A performant library for portable neural network inference with application to CFD". *American Physical Society*.

[T36] Bryngelson, S. H. (2022). "Fast integration methods for averaging bubble dynamics at sub-grid scales". *19th U.S. National Congress on Theoretical and Applied Mechanics*.

[T35] Bryngelson, S. H., F. Schäfer, J. Liu, and A. Mani (2022). "Fast Macroscopic Forcing: Exploiting locality for operator recovery". *American Physical Society*.

[T34] Chrit, F. E., S. Kocherla, A. Adams, J. Young, A. Alexeev, and S. H. Bryngelson (2022). "Quantum lattice algorithms for solving partial differential equations". *17th Conference on Theory of Quantum Computation, Communication, and Cryptography*.

[T33] Chrit, F. E., S. Kocherla, A. Alexeev, and S. H. Bryngelson (2022). "Quantum lattice gas algorithm for fluid flow simulations". *American Physical Society*.

[T32] Colonius, T. and S. H. Bryngelson (2022). "Hybrid quadrature moment methods for polydisperse cavitating flows". *1st European–American–Japanese Two-Phase Flow Group Meeting*.

[T31] Firouznia, M., S. H. Bryngelson, and D. Saintillan (2022). "A spectral boundary integral method for simulating electrohydrodynamic flows in liquid droplets". *American Physical Society*.

[T30] Panchal, A., A. Radhakrishnan, S. H. Bryngelson, and S. Menon (2022). "A numerical comparison of 5-, 6-, and 7-equation Baer-Nunziato-based diffuse interface methods". *American Physical Society*.

[T29] Radhakrishnan, A., H. Le Berre, and S. H. Bryngelson (2022). "Towards exascale multiphase compressible flow simulation via scalable interface capturing-based solvers and GPU acceleration". *American Physical Society*.

[T28] Rodriguez, M. and S. H. Bryngelson (2022). "Cavitation bubble growth near an elastic object". *American Physical Society*.

[T27] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2022). "Numerical simulations of cavitation near an elastic object". *ECCOMAS Congress*.

[T26] Rodriguez, M., J.-S. Spratt, S. H. Bryngelson, and T. Colonius (2022). "Numerical simulations of cavitation bubble growth and collapse near a viscoelastic object". *19th U.S. National Congress on Theoretical and Applied Mechanics*.

[T25] Spratt, J., M. Rodriguez, S. H. Bryngelson, and T. Colonius (2022). "Numerical simulations of ablation mechanisms during focused ultrasound therapies". *American Physical Society*.

[T24] Zeng, Q., S. H. Bryngelson, and F. Schäfer (2022). "Competitive physics informed networks". *ICLR workshop "Gamification and Multiagent Solutions"*.

[T23] Bryngelson, S. H., A. Charalampopoulos, R. O. Fox, T. Sapsis, and T. Colonius (2021). "Bypassing quadrature moment method instability via recurrent neural networks with application to cavitating bubble dispersions". *American Physical Society*. URL: https://vimeo.com/650700675/06006b48de.

[T22] Bryngelson, S. H., A. Charalampopoulos, T. Sapsis, and T. Colonius (2021). "Machine learned model for non-Gaussian cavitation statistics". *International Association for Computational Mechanics MMLDT-CSET*.

[T21] Bryngelson, S. H. and T. Colonius (2021). "Statistical model for cavitating polydisperse bubble clouds". *Journal of the Acoustical Society of America*. URL: https://vimeo.com/640933361/4f9d1469ce.

[T20] Bryngelson, S. H. and T. Colonius (2021). "Sub-grid population balance model for cavitating flows". *14th Southern California Flow Physics Symposium*.

[T19] Bryngelson, S. H., Q. Wang, E. Cisneros-Garibay, and T. Colonius (2021). "GPU-accelerated quadrature moment methods". *SIAM Annual Meeting*.

[T18] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2021). "Acoustically induced bubble growth with phase change". *14th Southern California Flow Physics Symposium*.

[T17] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2021). "Vapor and gas bubble growth with phase transition near a wall". *American Physical Society*.

[T16] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). "High fidelity single framework simulations of acoustic wave–bubble cloud–elastic solid interactions". *American Physical Society*.

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11.3 Software

Our software is located at github.com/comp-physics, below is an autogenerated listing:

Name (click for Github repo.)	**Description**
roseNNa	A fast and minimally-intrusive neural network inference library
awesome-modeling-simulation	Resources for learning about modeling and simulation
RBC3D	3D Spectral boundary integral solver for cell-scale blood flow
CPINN	Competitive Physics Informed Networks
hip-stencil-code	Stencil code for AMD GPUs
awesome-numerics	Resources for learning about numerical methods.
RBC2D	2D Spectral boundary integral solver for cell-scale blood flow
QBMMlib	Mathematica package for quadrature-based moment methods and population balance equations.
PyQBMMlib	PyQBMMlib is a Python extension of QBMMlib.
PyCav	Dynamics of cavitating bubble populations
bubble-dynamics-resnet	Integrate bubble dynamics faster!
tensor-modal-decomp	modal decomposition via high-order statistics for people
fvm-risc	Benchmarking FVMs on different hardware and under different optimizations
IMR	Inertial Microcavitation Rheometry
WENO-scalar	A WENO solver for 1D scalar PDEs
WENO-NN	A modified WENO method that improves interface sharpness via neural networks.
ECOGEN-CIT	A version of ECOGEN that was developed and used at Caltech
EnsAvg-1D-Tait	1D Ensemble-averaging solver for dilute cavitating bubbly flows. Finite volume with WENO/Riemann solvers.
1D-Shocks-Adjoint	A shock-capturing adjoint solver for the compressible flow equations
capillary-instability	A solver for the eigenmodes of an unstable viscoelastic jet
spherepack-doc	Additional documentation for SPHEREPACK

We maintain MFC, an exascale-ready multiphase CFD solver:

Name (click for Github repo.)	**Description**
MFC	Exascale-ready multiphase flow simulation
MFC-develop	Development repo. for MFC
MicroFC	A micro MFC and CFD mini-app

We also work on Inertial Microcaviation Rheometry (IMR) software:

Name (click for Github repo.)	**Description**
IMR-simple	MATLAB simple codes to numerically simulate laser/ultrasound-induced inertial cavitation bubble dynamics in soft materials
IMR-data-assimilation	IMR with Data Assimilation
IMR-v1	Vanilla IMR codebase
inca	InertialCav supported by J. Estrada's group