

Brett Tregoning, PhD

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Profile Summary

Highly qualified scientist with advanced statistical, computational, and analytical skills. Record of successful collaborations in a range of scientific problems with multi-cultural teams. Excellent interpersonal skills. Listens attentively, works to understand problems and tasks, and follows projects to completion diligently.

Skills

Scientific	📖 Statistical Methods, Machine Learning, Neural Networks, Decision Trees, Predictive Analytics, Numerical Optimization, Network Science, Data Science, Numerical Methods, Fluid Mechanics, Dynamical Systems, Topological Data Analysis
Coding	📖 Python, MATLAB, Latex, NumPy, Pandas, Scikit-Learn, Matplotlib, Seaborn, R, C, C++, SQL
Languages	📖 English (fluent), Spanish (comprehension)

Education

2016 – 2021	📖 Georgia Institute of Technology School of Physics. Thesis title: <i>Investigation of spatiotemporal chaos using persistent homology</i> Doctor of Philosophy-Physics , President's Fellow
2012 – 2016	📖 Vanderbilt University Bachelor of Arts-Physics with Highest Honors Thesis title: <i>Ps₂- in a magnetic field : structure and stability in the M=0 state.</i> Bachelor of Arts-Mathematics

Research Experience

Schatz Lab, Georgia Institute of Technology, School of Physics, Center for Non-linear Science

Advisors: Michael Schatz and Roman Grigoriev, 2016 –

- Performed statistical analysis, including hypothesis testing, on distributions of fluid flow pattern features
- Predicted the evolution of fluid flows using convolutional neural networks and reservoir computing for about 10 Lyapunov time units
- Developed a technique to detect a specific sequence of flow snapshots in a turbulent flow over hundreds of time steps
- Used persistent homology to detect topological signatures in in very large (10^5 time steps) time-series of flow patterns consisting of 10^6 pixels
- Designed an experiment to detect surface waves on a centimeter-wide fluid flow using a shadowgraph imaging technique

Varga Group, Vanderbilt University, Physics Department

Advisor: Kalman Varga, 2015

- Calculated stability of positron-electron systems of up to 10 particles using a variational method.

- Applied computational methods in Linux

United States Naval Observatory

Advisor: Susan G. Stewart, 2014

- Studied navigational astronomy.
- Quantified visual navigational error of binary star systems.
- Studied weather effects on sky visibility.

Bolotin Group, Vanderbilt University, Physics Department

Advisor: Kirill Bolotin, 2013 – 2014

- Studied experimental condensed matter physics.
- Gained experience exfoliating graphene.
- Gained clean-room training and experience.

Research Publications





Publications

- 1 **Tregoning, B.**, George-Kennedy, A., Miroslav, K., Grigoriev, R., & Schatz, M. F. (2022). Using persistent homology to detect shadowing of unstable solutions (in preparation).
- 2 **Tregoning, B.**, Mukherjee, S., Suri, B., Mischaikow, K., Paul, M. R., & Schatz, M. F. (2022). Quantifying plume statistics in spatiotemporally chaotic Rayleigh-Bénard convection using persistent homology (under review).
- 3 **Tregoning, B.**, & Stewart, S. G. (2014). Predicting navigational error of visual binary stars. *Naval Engineering Journal*, 126.4, 169–172.
https://my.vanderbilt.edu/susanstewart/files/2015/05/Stewart_DEC2014.pdf





Conference Proceedings and Talks

- 1 Schatz, M., **Tregoning, B.**, Barnett, J., Yoda, M., & Grigoriev, R. (2019). Experimental Study of Roll-Hydrothermal Wave Coexistence in Convection Driven by Buoyancy and Thermocapillarity, In *72nd Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2019)*, Seattle, Washington, USA.
<https://meetings.aps.org/Meeting/DFD19/Session/S08.3>
- 2 **Tregoning, B.**, Mukherjee, S., Levanger, R., Cyranka, J., Mischaikow, K., Paul, M., & Schatz, M. (2019). Characterizing Spatiotemporal Dynamics in Fluid Flows using Persistent Homology, In *Invited Seminar at Los Alamos National Labs*, Los Alamos, New Mexico, USA.
- 3 **Tregoning, B.**, Mukherjee, S., Levanger, R., Xu, M., Cyranka, J., Mischaikow, K., Paul, M., & Schatz, M. (2019). Using Persistent Homology to Compare Chaotic Dynamics Between Experiments on and Simulations of Rayleigh-Bénard Convection, In *72nd Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2019)*, Seattle, Washington, USA.
<https://meetings.aps.org/Meeting/DFD19/Session/G14.4>
- 4 **Tregoning, B.**, Levanger, R., Cyranka, J., Mukherjee, S., Paul, M., Mischaikow, K., & Schatz, M. (2018). Using topology to identify large Lyapunov vector magnitude in Rayleigh-Bénard convection, In *71st Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2018)*, Atlanta, Georgia, USA.
<http://meetings.aps.org/Meeting/DFD18/Session/G33.5>






Leadership Experience

- 2020 – 2021  **Diversity, Equity, and Inclusion Task Force**, Georgia Tech School of Physics
- 2015 – 2016  **Music Director**, WRVU Vanderbilt College Radio
- 2014 – 2016  **President**, Vanderbilt Quiz Bowl
- 2013 – 2015  **Secretary**, Vanderbilt Society of Physics Students

Awards and Honors

- 2016  **President's Fellow**, Georgia Institute of Technology.
-  **Highest Honors**, Vanderbilt University Physics Department.
- 2012, 2014, 2016  **Dean's List**, Vanderbilt University.
- 2014  **Sigma Pi Sigma Physics Honor Society**, Vanderbilt University Physics Department.

References

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| Prof. Michael F. Schatz | Interim Chair, School of Physics, Georgia Institute of Technology-Atlanta, GA.
 michael.schatz@physics.gatech.edu  +1 (404) 445-4435 |
| Dr. Rachel Levanger | Director of Data Science, Fidelity National Financial-Jacksonville, FL.
 rachel.levanger@gmail.com  +1 (904) 718-6842 |
| Prof. Susan Gessner Stewart | Astronomer, U.S. Naval Observatory-Washington, DC.
Adjoint Professor, Vanderbilt University-Nashville, TN.
 susan.g.stewart@vanderbilt.edu |