# Jane Pratt

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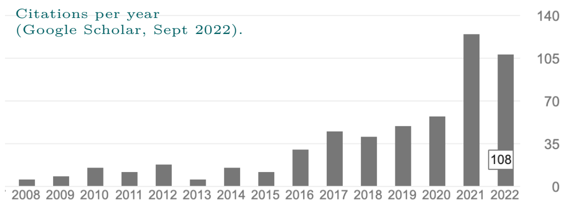
### Statistics (source: google scholar)

total number of publications: 46
h-index: 15
i10-index: 18
number of citations: 568




## Education

2004-2009 **Ph.D. Physics**, *University of Texas at Austin*, Institute for Fusion Studies.

2001-2004 **M.A.**, *Applied and Computational Mathematics*, Princeton University.

1997-2001 **B.S.**, *Mathematics, with distinction*, Harvey Mudd College.

1993-2007 **Diploma**, *Los Alamos High School*, GPA 4.2, graduated 4th in my class.

## Professional Credentials

2022–current **Research Scientist**, *Lawrence Livermore National Laboratory*, Astronomy & Astrophysics Analytics (AAA) Group, Physics Division (PLS) .

2022–current **Adjunct Professor**, *Georgia State University*, Dept. of Physics and Astronomy.

2017–2022 **Assistant Professor**, *Georgia State University*, Dept. of Physics and Astronomy.

2013–2017 **Post-doctoral fellow**, *Astrophysics Group*, University of Exeter, UK.

2012–2013 **Post-doctoral fellow**, *Dutch Institute for Fundamental Energy Research*, at the Netherlands Organisation for Scientific Research, Computational Plasma Physics – High Temperature Group.

2009–2011 **Post-doctoral fellow**, *Max-Planck-Institut für Plasmaphysik and Max-Planck-Institut für Sonnensystemforschung*, Garching bei München, Germany, Tokamak group.

1997–2001 **Student researcher**, *Theory Division*, Los Alamos National Laboratory, Computational Fluid Dynamics group/Plasma Physics group.

## Scholarship and Professional Development

### Grants Awarded (currently active)

2022 NSF CBET/Fluid Dynamics, "Formulating a theoretical scaling for dispersion in MHD turbulence." **$305,215 awarded.**

2019 NSF Astronomy and Astrophysics Grants, project "CDS&E: Feedback of energetic particles on plasma turbulence," **$396,783 awarded.**

2019 Thomas Jefferson Fund "Make Our Planet Great Again" Initiative from the FACE Foundation project Statistics of Turbulent Convection, **$10,000 awarded.**

2019 Co-PI on the HLRN continued project "Lagrangian Studies of Deeply Subsonic Turbulence" on the supercomputer system of the Norddeutscher Verbund zur F´orderung des Hoch- und H´ochstleistungsrechnens (HLRN) jointly located in Hannover and Berlin, Germany, **Large Project Allocation.**

## Proposals submitted

June 2022 LLNL WCI-Computational Physics Program, LEARN Award, "Astrophysical Applications of the High-Order Multi-Physics Code MARBL." 1 years, 0.4 FTE requested. **(under review).**

March 2022 DOE LDRD-ER, "Astrophysical Applications of the High-Order Multi-Physics Code MARBL." $359k/year, for 3 years, requested.

Jan 2022 HLRN new project proposal "Lagrangian Studies of Deeply Subsonic Turbulence" on the supercomputer system of the Norddeutscher Verbund zur Förderung des Hoch- und Höchstleistungsrechnens (HLRN) jointly located in Hannover and Berlin, Germany, **600 kNPL requested successful.**

Dec 2021 NSF CBET/Fluid Dynamics, "Formulating a theoretical scaling for dispersion in MHD turbulence." **$305,215 awarded successful.**

Nov 2021 NSF AAG, "CDS&E: Structure of rotating young stars." $406,867 requested.

Jan 2021 HLRN new project proposal "Lagrangian Studies of Deeply Subsonic Turbulence" on the supercomputer system of the Norddeutscher Verbund zur Förderung des Hoch- und Höchstleistungsrechnens (HLRN) jointly located in Hannover and Berlin, Germany, **530 kNPL requested successful.**

Nov 2020 NSF AAG, "Ages and Stellar Jitter Values of Nearby Open Clusters" **I was the Co-I on this proposal, written with PI Russel White, $527,754 requested.**

August 2020 NSF REU Program, "Astronomy and Physics at Georgia State University: From the Largest to Smallest Scales in the Universe" **Contributed along with other Faculty in Physics and Astronomy on this proposal.**

June 2019 NASA Astrophysical Theory Program, "Deep mixing in post-main-sequence red giant evolution"

June 2019 NASA Heliophysics DRIVE center proposal "Coupling Simulations and Machine Learning in Heliophysics"

May 2019 NASA Heliophysics Living with a star, "Living with a Star: Modeling surface variability due to dynamo action in the solar interior"

March 2019 Thomas Jefferson Fund "Make Our Planet Great Again" Initiative from the FACE Foundation proposal *Statistics of Turbulent Convection* **successful, $10,000 awarded.**

March 2019 Blue Waters proposal *Convection in Low-Mass Stars* (continuation proposal) **successful.**

Jan 2019 Research Initiation Grant from Georgia State University Research Services & Administration proposal *Modernization of an advanced parallel code for high-resolution simulation of astrophysical turbulence* **successful, $6,850 awarded.**

Jan 2019 Co-PI on the HLRN continued project proposal *Lagrangian Studies of Deeply Subsonic Turbulence* **successful.**

Jan 2019 XSEDE start-up proposal *Heat transport in fully convective young stars using MUSIC* **successful, 1600 core-hours awarded.**

Nov 2018 NSF AAG "Chemical peculiarity of binary stars from multi-dimensional fluid simulation"

Nov 2018 NSF AAG "Feedback of energetic particles on plasma turbulence" **successful, $396,783 awarded.**

Sept 2018 NASA Heliophysics Supporting Research "Realistic dynamics of coronal jets from magnetohydrodynamic large-eddy simulations"

July 2018 NSF CAREER "Next generation of binary star evolution models from multi-dimensional fluid simulation"

March 2018 Blue Waters proposal *Convection in Low-Mass Stars* **successful, 6.4 million core hours core hours awarded.**

Jan 2018 Co-PI on the HLRN continued project proposal *Lagrangian Studies of Deeply Subsonic Turbulence* **successful, $6 \cdot 10^6$ core-hours awarded.**

July 2018 GSU internal grant: Faculty International Partnership Engagement (FIPE) grant *Theoretical asteroseismology of solar-like stars* **successful, $3500 awarded.**

Nov 2017 XSEDE start-up proposal *ECCD evolution during suppression of neoclassical tearing modes using JOREK* **successful, $5 \cdot 10^4$ core-hours awarded (estimated monetary value $2,414.00).**

Oct 2017 J&J WiSTEM2D Scholars Award Program: "Feedback of energetic particles on astrophysical turbulence"

## Honors and Awards

2012–2013 **Postdoctoral fellowship from the Dutch Foundation for Fundamental Research on Matter (FOM/Netherlands Organization for Scientific Research)**.

2009–2011 **Postdoctoral fellowship from the Max Planck Society Inter-institutional Research Initiative**.

2001 **Presidential fellowship from Princeton Graduate School**.

2000–2001 **Harvey Mudd College Deans List**, *4 semesters (maximum possible)*.

1997–2001 **Seely G. Mudd Fellowship**, *for 4 years of Undergraduate Study at Harvey Mudd College*.

1997–2001 **Robert C. Byrd Honors Scholarship for Undergraduate Study**, *renewed for 4 years, from the State of New Mexico*.

1997 **J. Robert Oppenheimer Scholarship for Undergraduate Study**, *from the city of Los Alamos*.

## Language Skills

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|---|---|---|
| English | **native language** | |
| German | **fluent (C1)** | *reading, writing, and speaking* |
| Dutch/Frisian | **beginning (A2)** | *basic skills* |
| Norwegian | **beginning (A1)** | *basic skills* |

## Computing and Programming Proficiency

Extensive experience with physical and numerical methods in computational fluid dynamics, based on both hands-on research and teaching:

- numerical methods for solving partial differential equations: pseudo-spectral methods, finite-element methods, finite-volume methods
- fluid simulation frameworks: direct numerical simulations, large-eddy simulations
- explicit time integration methods: Leapfrog, Crank-Nicolson, Runge–Kutta, low-storage SSP methods
- implicit time integration methods: BDF1, BDF2, Crank-Nicolson, GMRES, inexact Newton methods, Jacobian Free Newton Krylov methods

Extensive experience with high-performance computing:

- Operating Systems used in the last 10 years: Unix (Linux clusters, AIX), Centos7, OpenSuse, Ubuntu, Crouton for Chromebooks (personal computers), Mac.
- Platforms used in the last 10 years: IBM Power 6 (VIP at RZG), Dell (Lonestar at TACC), Sun (Ranger at TACC), Intel Xeon (HPC-FF at Jülich, Comet cluster at the San Diego Supercomputer Center, and DiRAC Complexity Cluster at the University of Leicester), Bullx B510 Xeon (Helios at the IFERC-CSC), IBM iDataPlex (Hydra at RZG), Cray XC30/XC40 (HLRN-III at the HLRN, ARCHER), IBM SP (Seaborg at NERSC), IBM Power5 (Bassi at NERSC), Sun visualization system (Maverick at TACC), Bullx SMP cluster (Cartesius at Surfsara), and Intel Skylake (DiRAC DIaL (Data Intensive at Leicester) Cluster at the University

of Leicester), Lenovo NeXtScale (Marconi at CINECA), HLRN-IV Intel Skylake Gold system at the Georg-August-Universität Göttingen, Stampede2 Intel Skylake Gold system at TACC.

Design/purchase/administration of high-performance computing cluster Harlow at Georgia State University:

- 30 Intel Skylake Silver nodes, Mellanox FDR connection, Centos 7 operating system.
- Configured and adjusted SLURM software as necessary.
- Installed and maintained module environment containing necessary modules for code development: trilinos, petc, fftw, p3dfft, mkl, netcdf, hdf5, blas, lapack, scalapack, mumps, scotch, pastix, mesa, etc.

Experience with Programming Languages:

- Fortran 77/90/95, MPI , OpenMP (extensive experience)
- C++, Java, Cuda (moderate experience)

Experience with High-Level/Scripting Languages:

- R (The R Project for Statistical Computing) (extensive experience)
- Julia (professional experience, used for demonstrations in Computational Physics classes)
- IDL, Python, Mathematica, MatLab, Asymptote , gnuplot (moderate experience)

Experience with Visualization Software:

- VisIt
- Vapor
- ParaView
- Writing output in NetCDF, VTK, HDF5.

Experience with Version Control Software:

- git: used for MHDT, CSMHD, MUSIC, and JOREK simulations, more than 10 years experience
- SVN (Apache Subversion): used for JOREK simulation, 8 years experience

## Refereed Full Papers

34. D.G. Vlaykov, I. Baraffe, T. Constantino, T. Goffrey, T. Guillet, A. Le Saux, A. Morrison, **J. Pratt**. "Impact of radial truncation on global 2D hydrodynamical simulations for a Sun-like model" Monthly Notices of the Royal Astronomical Society 514.1 (2022): 715-727. https://doi.org/10.1093/mnras/stac1278

    This paper is the work of a post-doc, Dimitar Vlaykov, studying solar convection with the MUSIC code. As part of the MUSIC developers group, I collaborated and provided suggestions on the work and the paper.

33. **J. Pratt**, A. Busse, W.-C. Müller. "Reynolds number dependence of Lagrangian dispersion in direct numerical simulations of anisotropic magnetohydrodynamic turbulence" Journal of Fluid Mechanics, 944, A36. doi:10.1017/jfm.2022.434.

    This work uses Lagrangian tracer particles to explore dispersion in a the situation where turbulence is anisotropic due to a weak magnetic field. We quantify how dispersion changes for higher Reynolds number.

32. A. Le Saux, T. Guillet, I. Baraffe, D. Vlaykov, T. Constantino, **J. Pratt**, T. Goffrey, M. Sylvain, V. Reville, A. S. Brun. "Two-dimensional simulations of solar-like models with artificially enhanced luminosity. II. Impact on internal gravity waves" Astronomy & Astrophysics 660 (2022): A51. https://doi.org/10.1051/0004-6361/202142569

    This paper is the work of a PhD student, Arthur Le Saux, who examined internal gravity waves in global simulations of realistic stars produced with the MUSIC code. As part of the MUSIC developers group, I collaborated and provided suggestions on the work and the paper.

31. R. Andrassy, J. Higl, ...**J. Pratt** (author 18 of 21) et al. "Dynamics in a stellar convective layer and at its boundary: Comparison of five 3D hydrodynamics codes" Astronomy & Astrophysics (accepted, in press) https://doi.org/10.1051/0004-6361/202142557.

    This paper is a benchmarking effort between five codes that have been used to investigate stellar interiors. I collaborated with this benchmarking project as part of the developers group for the MUSIC code.

30. I. Baraffe, T. Constantino, J. Clarke, A. Le Saux, T. Goffrey, T. Guillet, **J. Pratt**, D. G. Vlaykov. "Local heating due to convective overshooting and the solar modelling problem." Astronomy & Astrophysics, 659, A53 (2022). https://doi.org/10.1051/0004-6361/202142666

    This letter proposed a stellar evolution model for modification of the temperature gradient due to convective penetration.

29. T. Constantino, I. Baraffe, T. Goffrey, **J. Pratt**, T. Guillet, D. G. Vlaykov, and L. Amard "Suppression of lithium depletion in young low-mass stars from fast rotation" Astronomy & Astrophysics 654 (2021): A146.

    This is a paper that uses the MONSTAR stellar evolution code to examine adjustments to stellar mixing length theory (MLT) models for convection in the presence of fast rotation. Evolutionary tracks for low-mass pre-main sequence and main sequence stars are compared to understand how these models affect the rate of lithium depletion. This work is mainly due to the efforts of Isabelle Baraffe and her post-doc Tom Constantino. I provided advice and editing during the project.

28. I. Baraffe, **J. Pratt**, D. Vlaykov, T. Guillet, T. Goffrey, A. Le Saux, T. Constantino. "Two-dimensional simulations of solar like models with artificially enhanced luminosity - I. impact on convective penetration" Astronomy & Astrophysics 654 (2021): A126.

    This paper systematically examines the effect of increasing the luminosity above the luminosity that is correct for a stellar model. The practice has been common over the last 20 years in simulations of the stellar interior, because a higher luminosity results in faster convection, and thus more data for less computational effort. However, changing the luminosity also potentially changes the stellar structure. The idea for this paper originated in conversations between the first author (Isabelle Baraffe), me, and other post-docs. Isabelle Baraffe produced the stellar structures and hydrodynamic simulations for this investigation. I contributed ideas for analyzing the data in this paper.

27. M. Hoelzl, G.T.A. Huijsmans, ...**J. Pratt** (author 40 of 53) et al. "The JOREK non-linear extended MHD code and applications to large-scale instabilities and their control in magnetically confined fusion plasmas" Nuclear Fusion (2021) 61(6), 065001. arXiv:2011.09120 .

    This paper is a large review article discussing the accomplishments and capabilities of the JOREK code. I contributed to the JOREK code, by programming a model for ECCD in the code. I used this model to examine the suppression of tearing instabilities, a type of instability that had not been previously studied using JOREK. This article summarizes those achievements and puts them in the context of the development of the JOREK code (at ITER) and the theory of tokamak fusion plasmas.

26. **J. Pratt**, A. Busse, W.-C. Müller. "Lagrangian Statistics for Dispersion in Magnetohydrodynamic Turbulence" Journal of Geophysical Research: Space Physics 125.11 (2020): e2020JA028245.

    This paper is a follow-up to paper 20 below entitled "Extreme-value statistics from Lagrangian convex hull analysis for homogeneous turbulent Boussinesq convection and MHD convection." Here we apply the convex hull analysis of dispersion to anisotropic MHD turbulence, which is relevant to the solar wind, the magntosphere, and the heliosphere in general. This work was performed by me; all simulations were run by me, the data was analyzed by me, and I wrote the discussion of it.

25. **J. Pratt**, A. Busse, W.-C. Müller "Lagrangian Statistics of Heat Transfer in Homogeneous Turbulence Driven by Boussinesq Convection." Fluids 2020, 5, 127.

    This paper was invited for a special issue on "Lagrangian Transport in Geophysical Fluid Flows". The paper develops a new statistic, the Lagrangian heat structure, to examine heat transport for different Prandtl number, and different Rayleigh number convectively driven turbulence.

24. **J. Pratt**, I. Baraffe, T. Goffrey, C. Geroux, T. Constantino, D. Folini, R. Walder. "Comparison of 2D and 3D compressible convection in a pre-main sequence star." Astronomy & Astrophysics 638 (2020): A15.

This paper examines statistical differences between two-dimensional and three-dimensional global simulations of stars. Two-dimensional models are often used to model dynamics in global simulations of stars. Here we examine statistics of convection in these models, and compare them to identical simulations that are fully three-dimensional. This work was performed by me; all simulations were run by me, the data was analyzed by me, and I wrote the discussion of it.

23. M. V. Popov, R. Walder, D. Folini, T. Goffrey, I. Baraffe, T. Constantino, C. Geroux, **J. Pratt**, M. Viallet, and R. Käppeli. "A well-balanced scheme for the simulation tool-kit A-MaZe : implementation, tests, and first applications to stellar structure." Astronomy & Astrophysics, 2019.

    This paper represents the effort to produce global simulations of stars in a different numerical framework from the MUSIC code, using a well-balanced scheme in the A-MaZe code. I acted as a collaborator, providing suggestions for the A-MaZe code and data from the MUSIC code for comparison during this work.

22. I. Baraffe, **J. Pratt**, T. Goffrey, et al. "Lithium depletion in solar-like stars." Astrophysical Journal Letters, 845(1), 2017.

    This work is a brief follow-up on the paper below entitled "Extreme value statistics for two-dimensional convective penetration in a young low-mass star." It applies the new model outlined in that work to the problem of lithium depletion in solar-like stars, demonstrating the utility of my new model for interpreting observational data. The stellar evolution calculations for this paper were carried out by Isabelle Baraffe using the Lyon stellar evolution code. However the basis for this paper was my work.

21. **J. Pratt**, I. Baraffe, T. Goffrey, et al. "Extreme value statistics for two-dimensional convective penetration in a young low-mass star." Astronomy & Astrophysics, 604(A125), 2017.

    This work represents a large statistical study of penetrative convection in the interior of a young low-mass star. Penetrative convection defines a boundary layer between the convection zone and a radiative zone. Because intermittent convective motions erode the star's radial structure in temperature and density, the mixing and transport in this boundary layer are critical to stellar evolution. In the high Péclet number regime realistic to the interior of a star, this boundary layer has not previously been studied. This work applies extreme value theory to model the depth and frequency of convective penetration, and develops a new stellar evolution model of convection-enhanced diffusion. The analysis performed here is entirely my work. The raw data that is analyzed was entirely produced by me, and I was one of the original developers of the MUSIC code used in this study; my coauthors provided helpful discussions, feedback, and advice throughout the project.

20. **J. Pratt**, A. Busse, W.-C. Müller, S.C. Chapman, N.W. Watkins. "Extreme-value statistics from Lagrangian convex hull analysis for homogeneous turbulent Boussinesq convection and MHD convection." New Journal of Physics, Focus on Turbulence in Astrophysical and Laboratory Plasmas, 19(6), 2017.

    This work is the leading paper in a project to form a new approach toward statistics calculated from the motion of many tracer particles. The goal is to reveal the underlying character of MHD convection and the dynamo, an area where Lagrangian statistics have not previously been explored. In this work, we present a new method that allows for extreme value statistics related to dispersion and anisotropy of turbulent MHD convection to be examined. This method utilizes the convex hull of many tracer particles, a tool that also allows for comparison with mathematical models such as continuous time random walks. The analysis performed here is entirely my work. The bulk of the raw data that is analyzed was produced by me; my coauthors provided additional raw particle data that forms a comparison with homogeneous neutral fluid turbulence, and helpful discussions, feedback, and advice throughout the project.

19. T. Goffrey, **J. Pratt**, M. Viallet, I. Baraffe, et al. "Benchmarking the Multi-dimensional Stellar Implicit Code MUSIC." Astronomy & Astrophysics, 600(A7), 2017.

The paper analyzes standard benchmarking problems for compressible fluid dynamics, demonstrating the correct and reasonable results provided by the MUSIC code. The idea to write this paper originated with me, and I am an original developer of the MUSIC code. I collaborated with and supervised a junior post-doc (Tom Goffrey) to formulate the tests; he then performed the results and analyzed them. I contributed to the write-up of those results.

18. **J. Pratt**, G.T.A Huismans, E. Westerhof. "Early evolution of electron cyclotron driven current during suppression of tearing modes in a circular tokamak." Physics of Plasmas, 23(10), 2016.

    This work is the cap-stone paper in a project to explore magnetic reconnection and stabilization of the tearing mode using the JOREK code, a large nonlinear compressible MHD code developed at ITER to simulate MHD instabilities in an accurate tokamak geometry. We exploit a new fluid model for the electron cyclotron current that we developed in Westerhof and Pratt, Physics of Plasmas, 2014. Using high resolution simulations performed on world-class computer systems, we explore the topology of the electron cyclotron current during its early evolution, which our model captures more accurately than previous models. In this work we develop a measure based on the standard deviation of the current along surfaces of constant magnetic flux, which quantifies how evenly the current spreads inside the magnetic islands. We evaluate the impact of the electron cyclotron current on the early period of suppression of magnetic islands, setting the ground-work for an expansive study and comparison with the generalized Rutherford equation, which has been used to predict performance in operational tokamaks and for ITER.

17. J.W. Haverkort, H.J. de Blank, G.T.A. Huysmans, **J. Pratt**, B. Koren. "Implementation of the full viscoresistive magnetohydrodynamic equations in a nonlinear finite element code." Journal of Computational Physics 316, 2016.

    This paper is part of the PhD Thesis of Willem Haverkort, a PhD student whom I collaborated with at the Dutch Institute for Fundamental Energy Research. I helped to devise tests of the code he was writing, and provided tearing mode simulations from the JOREK code using a reduced MHD model. I also provided suggestions and feedback on the write-up of this paper.

16. **J. Pratt**, I. Baraffe, T. Goffrey, et al. "Spherical-shell boundaries for two-dimensional compressible convection in a star." Astronomy & Astrophysics, 593(A121), 2016.

    This work summarizes the effects of simulation boundaries and boundary conditions on compressible convection in the interior of a young low-mass star. These effects are quantified using statistics from simulations of stellar convection over hundreds of convective turnover times. Because of the innovative implicit time integration scheme we utilize in the MUSIC code, we are able to cover longer times more efficiently than previous studies, and thus acquire data for detailed statistical analysis. This study is a vital preliminary step to a work targeting convective overshooting and penetration (see paper 21 above). The analysis performed here is entirely my work. The raw data that is analyzed was produced by me; my coauthors provided helpful discussions, feedback, and advice throughout the project.

15. C. Geroux, I. Baraffe, M. Viallet, T. Goffrey, **J. Pratt**, et al. "Multi-dimensional structure of accreting young stars." Astronomy & Astrophysics 588(A85), 2016.

    This paper was an early application of the MUSIC code, of which I am an original developer. In this work, the mixing of material accreted onto the surface of the star is analyzed for its effect on convection. I provided suggestions and feedback on the set-up of the simulations, the analysis of the data, and the write-up of this paper.

14. M. Viallet, T. Goffrey, I. Baraffe, D. Folini, C. Geroux, M. V. Popov, **J. Pratt**, and R.Walder. "A Jacobian-free Newton-Krylov method for time-implicit multidimensional hydrodynamics." Astronomy & Astrophysics 586(A153), 2016.

    This paper provided a first look at the implicit time integration method used in the MUSIC code. I provided suggestions on the write-up of this paper.

13. E. Westerhof, H.J. de Blank, **J. Pratt**. "New insights into the generalized Rutherford equation for nonlinear neoclassical tearing mode growth from 2D reduced MHD simulations." Nuclear Fusion, 56(3), 2016.

This paper analytically examines the equation that forms the basis for tearing mode reconnection. I provided input and suggestions on the analysis and write-up in this paper.

12. E. Westerhof and **J. Pratt**. "Closure of the single fluid magnetohydrodynamic equations in presence of electron cyclotron current drive." Physics of Plasmas, 21(10), 2014.

    This paper uses closure theory to develop a new set of equations that includes the effect of radio frequency heating on a fusion plasma. This was the idea of my post-doctoral supervisor Egbert Westerhof, but I worked out the equations and contributed to the write-up. This analytical work forms the basis for my in-depth study of the tearing mode using the JOREK code (see paper 18 above).

11. **J. Pratt**, A. Busse, W.-C. Müller. "Fluctuation dynamo amplified by intermittent shear bursts in convectively driven magnetohydrodynamic turbulence." Astronomy & Astrophysics 557(A76), 2013.

    This work centers on the interaction of dynamics and energetics in the turbulent dynamo. We present a new insight into the mechanism of the turbulent fluctuation dynamo, which is expressed in intense periods, "shear-bursts", that intermittently produce magnetic energy at an elevated level. Lagrangian statistics, calculated from the movement of millions of tracer particles, were used to understand the development of large-scale structures in the flow, through the calculation of Lagrangian Coherent Structures. This paper represents several years of advanced computational work into the turbulent fluctuation dynamo from my postdoctoral appointment jointly at the Max-Planck Institut f́ur Plasmaphysik in Garching and the Max-Planck Institut f́ur Sonnensystemforschung. This paper is my work; my coauthors provided helpful discussions and advice throughout the project.

10. H. L. Berk and **J. Pratt**. "Trapped Particle Stability for the Kinetic Stabilizer." Nuclear Fusion, 51(8), 2011.

    This work analyzes the instability that forms when a hot plasma interacts with a group of particles trapped in a region of plasma where there is unstable magnetic-field line curvature. This is a situation that happens frequently when a magnetic mirror field, a magnetic field shaped to reflect particles, is present. Such field configurations happen naturally in many astrophysical situations. In the case examined in this paper, the unstable curvature is the result of a kinetic stabilizer, a machine design intended to stabilize MHD instabilities. In fusion devices, the trapped particle instability can grow very quickly, ultimately damaging the machine. In this work I evaluate a proposed scheme for stabilizing a simple axially-symmetric tandem mirror machine, to determine whether it can stabilize the trapped particle instability. This paper represents the culmination of my doctoral work on the stability in tandem mirror plasmas, awarded by the University of Texas at Austin. This paper is my work and includes a natural, small extension of that PhD work. My coauthor provided supervision and advice throughout the PhD project.

9. R. Moll, J. Pietarila-Graham, **J. Pratt**, R.H. Cameron, W.-C. Müller, and M. Sch́ussler. "Universality of the Small-Scale Dynamo Mechanism." Astrophysical Journal, 736(1), 2011.

    This work is the product of a large collaboration between my group and the MURaM group at the Max-Planck Institut f́ur Sonnensystemforschung during the first year of my postdoctoral appointment in Garching. This study compares the nature of the dynamo mechanism in several complex dynamo simulations, including realistic compressible large-eddy-simulations of the near-surface layers of the Sun. My contributions to this wide-ranging survey of energy production and transfer were direct numerical simulations and energetic analysis of homogeneous turbulent Boussinesq MHD convection.

8. **J. Pratt**, H. L. Berk, W. Horton. "Drift-Wave Eigenmodes and Spectral Gaps in Tandem Mirrors." Fusion Science and Technology, 55(2T), 2009.

    This paper is my work, and my coauthors provided supervision and advice throughout the project, which formed part of my PhD thesis. Energetic ions can cause plasma instabilities that propagate with discrete frequencies in the gaps in the Alfvén wave spectrum, ultimately causing large losses of energetic ions from a fusion machine. This work provides a theoretical and computational analysis of one feedback relationship between a hot plasma and energetic particles in fusion machines with magnetic mirror fields. Realistic machine set-ups are treated, including a model GAMMA-10 experiment (the large tandem mirror machine built and maintained by the Japanese government), a model of the LAPD experimental set-up with a periodic magnetic field (the fusion device built and maintained at the University of California at Los Angeles), and an ideal infinitely-repeating magnetic-mirror machine.

7. W. Horton, P. J. Morrison, X. R. Fu, **J. Pratt**. "Transport with Reversed Er in the GAMMA-10 Tandem Mirror." Fusion Science and Technology, 55(2T), 2009.

   This paper was a collaborative effort in the group that I worked in as a graduate student. I performed related model calculations and provided feedback on the write-up of this paper.

6. T. Cho, V.P. Pastukhov, W. Horton, T. Numakura, M. Hirata, J. Kohagura, N. V. Chudin, and **J. Pratt.** "Active control of internal transport barrier formation due to off-axis electron-cyclotron heating in GAMMA 10 experiments." Physics of Plasmas 15(1), 2008.

   This paper was produced by the GAMMA-10 group in Tsukuba, that I collaborated with during my PhD thesis work. I performed related model calculations and provided feedback on the write-up of this paper.

5. **J. Pratt**, W. Horton. "Global Energy Confinement scaling predictions for the kinetically stabilized tandem mirror." Physics of Plasmas. 13(4), 2006.

   This paper was entirely my work, and was the first first-author paper I completed as a graduate student. I did the calculations described, and I wrote the paper with feedback from my thesis supervisor, Wendell Horton.

4. W. Horton, H.V. Wong, P.J. Morrison, A. Wurm, J.H. Kim, J.C. Perez, **J. Pratt**, G.T. Hoang, B.P. LeBlanc and R. Ball. "Temperature gradient driven electron transport in NSTX and Tore Supra." Nuclear Fusion 45(8), 2005.

   This paper was a collaborative effort in the group where I worked as a graduate student. I performed related calculations, produced graphs, and provided feedback on the write-up of this paper.

3. H. Vernon Wong, B.-Y. Xu, W. Horton, **J. Pratt**, and J. W. Van Dam. "Nonlinear evolution of the firehose instability in a magnetic dipole geotail geometry." Physics of Plasmas 12(5), 2005.

   This paper was produced by Vernon Wong, a researcher in my department that I collaborated with during my PhD thesis work. I performed related calculations, produced graphs, and provided feedback on the write-up of this paper.

2. L. Turner and **J. Pratt**. "Eddy-Damped Quasinormal Markovian Closure: A Closure for Magnetohydrodynamic Turbulence?" LA-UR 01-3507. J. Phys.A:Math.Gen. 35(3), 2002.

   This paper was the result of 4 years of my work as an undergraduate student in the Theory Division of Los Alamos National Laboratory. The core of this paper formed my undergraduate thesis work at Harvey Mudd College. I performed the analysis and contributed to the write-up of this paper.

1. L. Turner and **J. Pratt**. "Does a Falling Pencil Levitate? When the Normal Becomes Abnormal." Quantum, New York: Springer-Verlag, March/April, 1998.

   This paper was the result of my first summer of work as an undergraduate student in the Theory Division of Los Alamos National Laboratory. The idea for this work was contributed by Leaf Turner, but I solved the analytical problem myself, and contributed to the write-up of this paper.

## Refereed Conference Publications

8. **J. Pratt**, A. Busse, W.-C. Müller. "Intermittency of many-particle dispersion in anisotropic magnetohydrodynamic turbulence." Journal of Physics: Conference Series. Institute of Physics Publishing Ltd, vol. 1620, 2020.

This is a refereed conference paper associated with the 19th Annual International Astrophysics Conference: Conference Proceedings Information, held in Santa Fe NM in March 2020. This paper explores the time periods where flows converge, sending a group of dispersing particles back toward each other. This is a curious topic that can be linked to dynamo action. The simulations and data analysis were performed by me, and the paper was written by me. My co-authors provided advice and discussions throughout the work.

7. **J. Pratt**. "Interior dynamics of young stars revealed by 3D hydrodynamic simulations." Blue Waters (NCSA, Illinois) Project Book. 2019.

6. **J. Pratt**, A. Busse, W.-C. Müller. "A Lagrangian Perspective on Anisotropy in Turbulent Flows." HLRN (Northern German Computing Alliance) Project Book. 2015.

5. E. Westerhof, **J. Pratt**, B. Ayten. "Closure of the single fluid magnetohydrodynamic equations in presence of electron cyclotron current drive." Proceedings of the 18th Joint Workshop on Electron Cyclotron Emission and Electron Cyclotron Resonance Heating. Nara, Japan, 22–25 April 2014. EDP Sciences.

   This paper includes a PhD student, B. Ayten, with whom I collaborated.

4. E. Westerhof, **J. Pratt**. "Expression of electron cyclotron current drive in plasma fluid models." Proceedings of the 40th EPS Conference on Plasma Physics. Espoo, Finland, 1–5 July 2013.

3. **J. Pratt**, E. Westerhof. "Toward 3D MHD modeling of neoclassical tearing mode suppression by ECCD." Proceedings of the 17th Joint Workshop on Electron Cyclotron Emission and Electron Cyclotron Resonance Heating. European Physical Journal Web of Conferences. 2012.

2. W. Horton, **J. Pratt**, H.L. Berk. "Energy Confinement Predictions for the Stabilized Tandem Mirror and GAMMA-10." (invited talk and proceedings paper) Innovative Confinement Concepts Workshop, University of Maryland. February 12-14, 2007.

1. W. Horton, **J. Pratt**, H.L. Berk, M. Hirata. "Energy Confinement Scaling Predictions for the Kinetically Stabilized Tandem Mirror." (invited talk and proceedings paper) Open Magnetic Systems For Plasma Confinement Conference Tsukuba, Japan. July 17-21, 2006.

## Conference Papers

4. **J. Pratt**, M. Viallet, I. Baraffe, C. Geroux, T. Goffrey, M.V. Popov, D. Folini, R. Walder. "Multi-dimensional models of the interior of stars." Proceedings of the 22nd UK Conference of the Association for Computational Mechanics in Engineering. 2 – 4 April 2014, University of Exeter, Exeter, UK.

3. **J. Pratt**, A. Busse, W.-C. Müller, S.C. Chapman, N.W. Watkins. "Anomalous dispersion of Lagrangian particles in local regions of turbulent flows revealed by convex hull analysis" arXiv:1408.5706 [physics.flu-dyn]. 2014.

2. J. Heres, **J. Pratt**, E. Westerhof. "Nonlinear growth of tearing modes validating the generalized Rutherford equation." 41th EPS Conference on Plasma Physics, 2014/06/23, Berlin, Germany, P2.045

   This is a paper produced by a master's student, Jacco Heres, that I collaborated with and officially supervised.

1. E. Westerhof, **J. Pratt**. "Expression of electron cyclotron current drive in plasma fluid models." Proceedings of the 40th EPS Conference on Plasma Physics. Espoo, Finland, July 1st – 5th 2013.

## Books, Book Chapters, and Dissertations

2. **J. Pratt.** "Drift Wave Stability and Transport in Tandem Mirrors." PhD Thesis. University of Texas at Austin, May 2009. http://repositories.lib.utexas.edu/handle/2152/18380/.

1. **J. Pratt**. “Adapting a closure scheme typically used in Turbulence Theory for use with the Magnetohydrodynamic Equations.” Undergraduate Thesis, Harvey Mudd College, May 2001.

## Invited Talks at Conferences

7. J. Pratt. “Heat transport at the convective boundary of a pre-main sequence star” Stellar Hydro Days, Exeter, UK, June 24, 2019.

6. J. Pratt. “Cosmic Ray Feedback on Astrophysical Systems” Workshop on Applications of Cosmic Ray Measurements Atlanta, GA, USA, October 5, 2019.

5. J. Pratt. “Magnetic islands under the influence of heating and current” UKMHD Meeting. Durham, UK, 20 April 2017. https://doi.org/10.6084/m9.figshare.4906460.v1.

4. J. Pratt. “Current evolution during suppression of tearing modes with ECCD” JOREK General Meeting. Garching, Germany, 27 May 2015. https://dx.doi.org/10.6084/m9.figshare.2750659.v1

3. J. Pratt. “Fluctuation dynamo amplified by intermittent shear bursts.” Dynamics Days Europe, Mini-symposium on Nonlinear Problems in Plasma Astrophysics, Bayreuth, Germany, 8-12 September 2014. https://doi.org/10.6084/m9.figshare.2749897.v2.

2. J. Pratt. “Tutorial: Incorporating kinetic aspects of RF current drive in MHD simulation with a focus on ECCD stabilization of tearing modes.” Lorentz Workshop: Modeling Kinetic Aspects of Global MHD Modes, Leiden, Netherlands, 4 Dec 2013. https://doi.org/10.6084/m9.figshare.2750392.v2.

1. J. Pratt, W. Horton, H.L. Berk “GAMMA-10 Simulation Results and Implications for a Tandem Mirror Effort.” Fusion Power Associates Symposium, Lawrence Livermore National Laboratory. Livermore California, USA. December 3-4, 2008.

## Invited Seminars

9. J. Pratt. “Diffusion and dispersion in anisotropic magnetohydrodynamic turbulence.” University of Wisconsin, Madison, Feb 12, 2020.

8. J. Pratt. “Convective penetration in a pre-main sequence star.” Georgia Tech, Atlanta, USA, Sept 13, 2018.

7. J. Pratt. “Convective penetration: toward a new generation of stellar structure models.” Mullard Space Science Laboratory, University College London, May 11 2017.

6. J. Pratt. “Instability, Convection, and Turbulence in Plasmas.” UC San Diego, March 13, 2017.

5. J. Pratt. “MHD modeling of solar wind turbulence and convection in sunspots.” AstroChat Astrophysics Seminar at the University of Glasgow, November 5, 2015.

4. J. Pratt. “Time-implicit compressible simulations of deep convection in a young sun.” Astrophysics Seminar, Georg-August-Universit´at G´ottingen, Germany, 5 Feb 2015.

3. J. Pratt, E. Westerhof. “Current flow inside magnetic islands during suppression of tearing modes in tokamak plasmas” JOREK developers group Seminar, Garching, Germany. June, 11 2014.

2. J. Pratt. “Anomalous local dispersion in simulations of turbulent flows.” Geophysical and Astrophysical Fluid Dynamics Seminar. University of Exeter. Oct 30, 2013.

1. J. Pratt. “Solar Dynamo Action: Lagrangian statistics and other characteristics of 3D MHD convection.” Institute for Fusion Studies VIP Seminar. University of Texas at Austin, Austin Texas, USA. Dec. 2010.

# Teaching

Spring 2021 **proposed new course ASTR 8160/PHYS 8160** *Special Topics in Space Physics* I formally proposed this new class, and it was accepted by the departmental curriculum committee and the department. It was proposed as is a setting where the faculty can teach classes in core areas like magnetospheres, ionospheres, space physics, and generally heliospheric physics that otherwise would not be taught. The class I taught in Spring 2020 "Magnetism in Astronomy" could be taught again in this setting.

## Courses Taught

Spring 2021 **ASTR 1010** *Astronomy of the Solar System* I have worked on the development team for the Online Master Class for this class since June 2020, and taught the class online during the pandemic.

Spring 2020 **ASTR 8710** *Research Topics in Astronomy: Magnetism in Astronomy* This is a new class, designed by me, to teach astronomy graduate students about basic magnetism. It focuses on magnetic reconnection and the background and development of the generalized Rutherford equation. It was taught for the first time in the spring of 2020 as an independent study class.

Spring 2020, Spring 2021, Spring 2022 **PHYS 3560** *Mathematical Methods and Computational Physics II.* This is the newly re-designed second half of the computational physics track. It focuses on probability, statistics, stochastic modeling of physical processes, and stochastic simulation methods. It was taught for the first time in the spring of 2020. In spring 2021 I revised the description of this class, and that description was accepted by the curriculum committee and department.

Fall 2019, Fall 2020, Fall 2021 **PHYS 3550** *Mathematical Methods and Computational Physics I.* This is the newly re-designed first half of the computational physics track. It focuses on using using deterministic methods for data analysis and solving physical equations (linear, non-linear, and differential equations). The course uses a hands-on approach to computing, with lectures to present the mathematical methods, examples in code, and assignments to apply those mathematical methods. It was first taught in the fall of 2019. In spring 2021 I revised the official description of the class, and that description was accepted by the curriculum committee and department. The number of students in the class has grown more rapidly than predicted, roughly doubling each time the class was taught.

Fall 2018, Fall 2020, Spring 2022 **ASTR/PHYS 4130/8130** *Introduction to Fluid Dynamics with Astrophysical Applications.* This is a new class that was designed by me to train students in theoretical astrophysics and fluid dynamics. It was first taught in the fall of 2018 as a special topics class. It was then formally proposed and accepted in the university catalog in 2019. It appeared for the first time in the catalog in the fall of 2020, with the idea that it will be taught biennially thereafter. During the Spring of 2022, it will be taught as an independent study class.

Fall 2017, Spring 2018, Spring 2019 **PHYS 2212** *Principles of Physics II,* topic: electricity and magnetism and waves. I have taught this class twice as a regular class and twice as an Honors class. This is a large service class and it is team-taught class in the sense that there are different sections taught by different professors and lecturers. In my section, I emphasize the mathematical and computational aspects of the subject, to make the physics more interesting and understandable to computer science majors. I have innovated the standard format of the course to introduce a project. This project asks students to invest in an application of the physics that they are learning, and write a textbook section about that application, complete with suggested physics problems and solutions. I have taught this class 4 times, twice as honors sections.

## Supervision of Research

2019–current **Graduate (PhD) research student**, *Mary Geer Dethero*, GSU.
Mary Geer Dethero began working with me in July of 2019, ahead of enrolling at GSU as a graduate student. She has begun to learn about computational astrophysics, and has learned to run the Modules for Experiments in Stellar Astrophysics (MESA) stellar evolution code, the ESTER stellar structure code, the Rayleigh solar/stellar MHD code, and the MUSIC code. The results of her first project presented at the American Astronomical Society meeting in January 2020. For her doctoral thesis, Mary Geer will develop diagnostics for the interior dynamics of red giants, rapid rotators, and binary stars. She will work with and run the MUlti-dimensional Stellar Implicit Code (MUSIC) and collaborate with the Astrophysics group at the University of Exeter.

2021-2022 **Graduate (PhD) research student**, *Zach Way*, GSU.
Zach Way began working with me in August of 2021 on stellar evolution modeling, upon enrolling at GSU as a graduate student. He continued to work with me through the spring of 2022. He has since moved on to work with Prof. Sebastien Lepine.

2021–2022 **Undergraduate research student**, *Michael Duffee*, GSU.
Michael Duffee has worked with me in the summer and fall of 2021, as well as the spring of 2022 in the context of the PHYS 4900 class. He worked to develop and run the stellar structure code ESTER, and produce optimal stellar structures for the star Alderamin (Alpha Cephei).

2021 **Undergraduate research student**, *Will Jones*, GSU.
Will Jones worked with me in the summer and fall of 2021 to adapt a large MHD simulation code PIERNIK for isotropic homogeneous turbulence simulations.

2020–2021 **Undergraduate research student**, *Emily Sommer*, Georgia Tech.
Emily Sommer worked with from the fall semester of 2020 through the summer of 2021 to study stars on the AGB. She learned to work with MESA and identified different burning periods.

2019–2020 **Undergraduate research student**, *Christopher Powell*, GSU.
Christopher Powell completed a directed reading course with me during the summer of 2019, and has continued to work on fluid dynamics and computational physics intermittently following that. He completed PHYS 4900 in Fall 2020 and graduated.

2020 **Undergraduate research student**, *Emily Knutson*, GSU.
Emily Knutson worked with me in the spring semester of 2020. Having taken my computational physics class, she began a research project in computational physics concerning fast Fourier transform (FFT) algorithms and libraries. This work was interrupted by the pandemic.

2018–2020 **Undergraduate research student**, *Kara Gartner*, GSU.
Kara Gartner began working with me in May 2018 and continued to work with me until her graduation in May 2020, a period that included two summers as an astronomy department summer intern, as well as two academic years of research. During the summer of 2019, Kara held the Raghaven fellowship for academic achievement in astronomy. Kara has learned to work effectively on Linux systems, use emacs, program in bash, R, and fortran. She has run and developed input files for the MESA stellar evolution code to produce a range of red giants. Kara has presented the results of our simulations at several departmental and university events, as well as at a the Stellar Hydro Days conference in Exeter (UK) during the summer. Kara has completed the research experience class (PHYS 4900) based on this research. Kara graduated from GSU in May 2020, and has applied to graduate schools in astronomy.

2019–2020 **Undergraduate research student**, *Diksha Holla*, GSU.
Diksha Holla began working with me in September of 2019 through the Honors College University Assistant Program, a position that continued into the spring semester. As a freshman, she learned a lot of new concepts and skills.

2018–2019 **Graduate (PhD) research student**, *Sumanth Rotti*, GSU.
Sumanth Rotti worked with me from March 2018 to May 2019. Sumanth was recruited on the basis of his Master's degree in fluid dynamics engineering and stated interest in astrophysical hydrodynamics. He has since moved on to work with Prof. Piet Martens.

2018 **PHYS 4900 project student**, *Austin Gibbs*, GSU.
Austin Gibbs worked with me in spring 2018 in the context of the PHYS 4900 course that gives undergraduates a research experience. Austin examined several correlations in simulation data. He has since graduated.

2017 **PHYS 4900 project student**, *Chris Toben*, GSU.
Chris Toben worked with me in fall 2017 in the context of the PHYS 4900 course that gives undergraduates a research experience. Chris performed an analysis of simulation data in two and three dimensions. He has since graduated.

2014–2017 **PhD student**, *Oliver Henze*, at the Zentrum für Astronomie und Astrophysik, TU Berlin, (joint-supervision).
Oliver contributed to the development of a compressible MHD code for turbulence, including working with Lagrangian tracer particles. He has since graduated.

2013–2016 **Guidance/supervision of junior post-docs**, *Dr. Chris Geroux, Dr. Tom Goffrey, Dr. Thomas Constantino, Dr. Misha Popov*, University of Exeter.

2014 **Masters student intern (joint-supervision)**, *Michał Marcinkiewicz*, University of Exeter.

2012–2013 **Masters student (official joint-supervision)**, *Jacco Heres*, Dutch Institute for Fundamental Energy Research (a NWO/FOM institute) and the University of Utrecht, graduated August 2013.
This supervision included writing a final summary of his research project and taking part in grading his thesis and final defense presentation.

# Service

## Service to the Department and University

2018–2022 **Co-chair of Colloquium Committee**, *In Fall 2020, our new online format for the departmental colloquia received many positive comments. Astronomers associated with the CHARA array, but not necessarily GSU, asked to be able to attend. The undergraduate majors in Physics were also included in this new format.*

2018–2022 **Faculty advisor for Astropals (Astronomy Peer Advising Leaders)**, *Astropals is a peer-mentoring club organized by the graduate students in Astronomy. It provides information and encouragement to new graduate students. http://www.astro.gsu.edu/AstroPAL/.*

2018–2022 **member of the Graduate Admissions Committee**.

2018–2022 **member of the Undergraduate Research Committee**.

2021 **member of FY22 IIT Tech Fee Voting Committee**.

Dec 7, 2020 **Staffed a virtual table at the AAS/SPD Graduate School Fair (grad student recruitment)**.

Nov 10, 2020 **Attended the University of Texas Women in STEM Virtual Networking Event (grad student recruitment)**.

Sept 26, 2020 **Staffed a virtual table at the APS-DPP Graduate School Fair (grad student recruitment)**.

August 30, 2020 **Lecture “Plasma Physics of the Sun and Stars.” for the PHYS 1000 Gateway to Physics class**.

2020 **Program committee for 6th Solar & Stellar Astronomy Big Data SABiD Workshop (Rafal Angryk)**, *I reviewed two submitted papers for this workshop.*

2019–2020 **member of Faculty Search Committee for Nuclear Theory tenure track assistant professor**, *This search was successful..*

2019–2020 **member of Faculty Search Committee for Astroinformatics tenure track assistant professor**, *This search was successful..*

2018–2020 **Design, purchase, and management of the parallel HPC cluster "Harlow"**, *The Harlow system is a parallel supercomputer consisting of 30 Intel Skylake Silver compute nodes, threaded with 16 tasks, connected with high-speed infiniband. Harlow serves the new Astroinformatics Group in the department of Physics and Astronomy. Harlow has been funded by (1) start-up funds and (2) federal research funds.*

2020 **Thesis committee for graduate student Katie Lester**.

March 13, 2019 **Lecture "Plasma Physics of the Sun and Stars." for the PHYS 1000 Gateway to Physics class**.

2018–2019 **Revision of curriculum requirements and Learning Outcomes for the Astronomy PhD program**.

Oct 8, 2018 **Lecture "Plasma Physics of the Sun and Stars." for the PHYS 1000 Gateway to Physics class**.

Feb 14, 2018 **Lecture "Plasma Physics of the Sun and Stars." for the PHYS 1000 Gateway to Physics class**.

2018 **member of Faculty Search Committee for visiting professor in astroinformatics**.

2018 **Prospectus committee for graduate student Beena Meena**.

Oct 10, 2017 **Lecture "Plasma Physics of the Sun and Stars." for the PHYS 1000 Gateway to Physics class**.

2017 **Prospectus committee for graduate student Katie Lester**.

## Service to the Community

June 2021 **Referee for Astronomy & Astrophysics**.

May 2021 **Referee for Physics of Fluids**.

May 2021 **Referee for Fluids (MDPI)**.

June 2021 **Participated in International Combustion Institute Summer School on Near-Wall Reactive Flows**.

April 2021 **Served on NSF astronomy panel**.

March 2021 **Organized and Hosted Topical Interest Room on "Solar/Stellar Hydrodynamics/MHD simulation" at Cool Stars 20.5 Workshop**.

Oct 2020 **Local Program Committee/Reviewer 6th Solar & Stellar Astronomy Big Data SABiD Workshop**.

Dec 2020 **Referee for The Astrophysical Journal**.

Nov 2020 **Provided expert reviews for NASA postdoctoral program (NPP)**.

Sept 2020 **Referee for Fluids (second paper)**.

Sept 2020 **Referee for Astronomy and Astrophysics**.

Sept 2020 **Served as session chair at Astronomische Gesellschaft annual meeting**.

August 2020 **Referee for Taylor and Francis book proposal**.

June 2020 **Referee for Fluids (MDPI Journal)**.

Feb 2020 **Served on NSF plasma physics panel**.

Jan 2020 **Served as session chair at AAS January meeting**.

Jan 2020 **Served as Chambliss Judge at AAS January meeting**.

Dec 2019 **Referee for Monthly Notices of the Royal Astronomical Society (MNRAS)**.

Dec 2019 **Invited to participate in Kavli Institute for Theoretical Physics (KITP) Program on "Probes of Transport in Stars"**.

Oct 2019 **Provided expert reviews for NASA postdoctoral program (NPP)**.

Jan 2019 **Served on NSF postdoctoral panel**.

2018 **Provided expert reviews for Polish National Science Center**.

2018 **Provided expert reviews for UK Distributed Research using Advanced Computing (DIRAC)**.

2018 **Referee for journal: Hydrology**.

2018 **Referee for journal: Plasma Science and Technology**.

## Outreach Activities

Sept 2022 **Participation in Maria Mitchell Women of Science Symposium**.
Participants devise strategies to encourage and keep girls in STEM and support women in STEM at the beginning, middle, and late career stages.

2020-2022 **Participation in "Science. Art. Wonder"**.
This is an Atlanta-based club of artists and researchers that has the goal of creating art based on scientific research for exhibition in the Atlanta Science Festival. I have participated twice.

Oct 2, 2020 **Participation in Maria Mitchell Women of Science Symposium**.
Participants devise strategies to encourage and keep girls in STEM and support women in STEM at the beginning, middle, and late career stages.

Nov 20, 2019 **J Pratt. "Visualizing Astrophysical Flows." seminar for the Graduate Seminar course in the Ernest G. Welch School of Art and Design**.
This talk is linked to the larger effort to organize a summer school and art show around astrophysical visualization and artist renderings.

Feb 16, 2019 **J. Pratt "Simulating the stars." Public talk at the Buckhead Public Library, Atlanta, GA**.

August 2017 **Participation in departmental "Great American Eclipse" outreach activity**.

2019–2020 **Research mentorship of high-school research student, who was accepted at Georgia Tech** , *Siwoo Kim*.

## Activities Prevented/Additional work caused by COVID-19 pandemic

** During the pre-tenure workshop (fall 2021) we were asked to keep track of these things.

2021-2022 **Course Releases**.
In January 2020, the college promised two course releases for high ratings on my 3rd year dossier. Due to budget cuts, these have not yet materialized, and the effort of starting up my research group has been damaged.

2020-2021 **Additional Teaching**.
During the 2020-2021 academic year, I have taught 4 courses. Additional work was caused by adapting those classes to be taught online. This is also an additional class beyond my usual load of 3 classes.

June 2021 **Cool Stars Workshop**.
The rescheduled Cool Stars meeting in Toulouse, France was cancelled. A shorter online event is now scheduled in March

June 2021 **2021 MIAPP Program "Stellar Astrophysics in the Era of Gaia, Spectroscopic and Asteroseismic Surveys"**.
I was invited to attend this program in Germany for two weeks (and offered support to do so). It is now seems likely to be held online.

Oct–Dec 2021 **Kavli Institute for Theoretical Physics, Program: Probes of Transport in Stars**.
I was invited to attend this program in Santa Barbara for three weeks. I was unable to participate in a full fashion, and instead had a limited virtual experience.

March 2021 **Graduate student recruitment**.
Due to departmental budgets, we did not accept new graduate students this year, and I could not attract a second graduate student.

Fall 2020 **Co-Chairing the Colloquium Committee**.
Organizing an online Colloquium series required a larger effort this fall. Because faculty were less engaged with the department, fewer professors volunteered to host speakers. To fill the schedule, I invited and hosted 3 speakers this semester, rather than the usual single speaker. I also set-up an iCollege page to better advertise and communicate with the department about colloquia.

June 2020 – May 2021 **Development of the ASTR 1010 Master Class**.
I volunteer to work as part of a small team to produce this Online Master Class, which has meant several hours of work each week.

August, 2020 **Mastering Online Teaching**.
The requirement to work through this training course absorbed approximately 9 hours each week that would otherwise have been dedicated to research.

Jan 11-15, 2021 **Participation in annual AAS meeting**.
I have usually participated in this meeting, and had planned to travel along with my PhD student to the AAS this year. The meeting was made virtual, and the costs were high, so that neither of us participated.

November 9–13, 2020 **APS-Division of Plasma Physics annual meeting**.
I had planned to attend this meeting. It was moved online without any substantial discount, and my teaching load was higher, so I did not attend.

June, 2020 **Invited Seminar/research visit at the ENS de Lyon**.
I was invited to give a seminar and visit for a week at the ENS de Lyon. This trip was cancelled, hampering a new collaboration, and the execution of my grant from the Thomas Jefferson Fund.

June 2020 **Research visit at the University of Exeter**.
I was invited to visit for two weeks at the University of Exeter. This trip was cancelled.

June 2020 **Cool Stars Workshop 2020**.
I submitted two abstracts to the Cool Stars meeting in Toulouse, France. This meeting was cancelled.

April 2020 **Invited Seminar at UC Boulder**.
I was invited to give a seminar, which had to be cancelled in the early phase of the pandemic.