Drummond B. Fielding

Curriculum Vitae

Assistant Professor
Department of Astronomy, Cornell University,
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Education

PhD 2018, MA 2014, Astrophysics, University of California, Berkeley. *Advisor: Eliot Quataert*
BS, BA 2012, Physics, Mathematics, Johns Hopkins University.

Professional Appointments

Assistant Professor, Cornell University, Department of Astronomy	2024-
Visiting Assistant Professor, Cornell University, Department of Astronomy	2023-2024
Flatiron Research Fellow, CCA	2018-2024
Visiting Scholar, Indian Institute of Science	2016
NSF & Berkeley Graduate Research Fellow, U.C., Berkeley	2012-2018

Active Research Interests

fluid dynamics	cosmic ray transport	magnetized turbulence	magnetic reconnection
galaxy formation	galactic winds	multiphase flows	geom. measure theory
plasma physics	circumgalactic medium	stellar+BH feedback	machine learning

Grant Support

Current

PI, NSF AAG, *Illuminating the Interplay of Multiphase Galactic Winds and the CGM*
—Graduate student funding and 1.5 months of summer funding per year

Co-PI, Legacy HST-AR, STScI, *Mocking Galactic Winds: A new approach to constraining feedback by modeling the UV spectra of galaxies*, 2025-2027
—Graduate student funding and one month of summer funding per year

Co-PI, Legacy HST-AR, STScI, *Galactic Winds Unveiled: Leveraging Cloud Simulations with Radiative Transfer to Constrain Feedback*, 2024-2026
—Graduate student funding and one month of summer funding per year

PI, multi-year INCITE, DOE, *Pushing the* Frontier *of Cosmic Ray Transport in Interstellar Turbulence*, 2025-2027
—First year: 4.8 Million GPU hours on *Frontier* & 1.6 Million GPU hours on *Aurora*

PI, INCITE, DOE, *Resolving Cosmic Ray Transport by pushing the* Frontier *of MHD Turbulence*, INCITE, PI, 2024
—7.2 Million GPU hours on *Frontier* the world's first exascale supercomputer.

Co-PI, EURO HPC, *Resolving Turbulent Multiphase Gas Dynamics*, 2023-2025
—7.2 Million GPU hours on *Lumi-G*.

Co-I, Support for Open-Source Tools, Frameworks, and Libraries, NASA, *AthenaK: a Performance Portable Simulation Infrastructure for Computational Astrophysics*, 2025-2027

Past

Co-I, KCWI, *DUVET: Mapping Outflows and the Inner CGM in Starbursting Disks*, 2020-
PI, APS-IUSSTF, *Visiting scholar grant to work Indian Institute of Science with Prof. Prateek Sharma*, 2016
Co-I, HST AR, *Towards an Understanding of the Origin of OVI in the Circumgalactic Medium*, 2017
Co-I, NSF XSEDE, *The Physics of Supernova Feedback: Global 3D Simulations of Galactic Disks*, 2016-2018
Co-I, NSF XSEDE, *Conduction, Convection, and Thermal Instability in Hot Halos*, 2016-2017

Student advising

Current

Brent Tan — Postdoc — Cornell University
Yongqi Zhang — Graduate Student — Cornell University
Bodong Liu — Undergraduate Student — Cornell University

Past

Iryna Butsky — Graduate Student — UW + CCA predoctoral fellow → Hubble Fellow at Stanford
Viraj Pandya — Graduate Student — UC Santa Cruz + CCA predoctoral fellow → Hubble Fellow at Columbia
Matthew Abruzzo — Graduate Student — Columbia → Postdoc at UPitt
Anthony Chow — Graduate Student — Columbia
Zirui Chen — Undergraduate Student — Columbia → Postdoc at UCSB
Brent Tan — Graduate Student — UC Santa Barbara + CCA predoctoral fellow → Postdoc at CCA
Minami Roy — Graduate Student — Raman Research Institute + CCA predoctoral fellow → Postdoc at OSU
Mitali Damle — Graduate Student — University of Potsdam

Public outreach

Founder and leader of *The Astro Club*. Monthly meetings 2020–2023. Democracy Prep Charter Middle School, Harlem, NY.

Astronomy career day, Democracy Prep Charter Middle School, Harlem, NY 2019

Taught a month-long series of astronomy classes to 2nd and 3rd grade students. 2017. North Oakland Community Charter School, Oakland, CA

Undergrad mentor UC Berkeley Astronomy, 2016-2017

UC Berkeley Astronomy Department Public Liaison, 2015

East Bay Astronomical Society Public Lecture, 2014, Chabot Space and Science Center

The Berkeley Compass Project Summer Evening Instructor, 2013

Professional services & community engagement

Founder and organizer of the **New York Area Fluid Dynamics Meeting**, a cross-disciplinary monthly meeting of local fluid dynamicists, 2020

Research Mentor, **Simons-National Society of Black Physicists** Scholars Program 2023

Flatiron Pre-Doctoral Program graduate student mentor, 2019–2024

Referee: MNRAS, ApJ, ApJL

NSF proposal evaluation panelist, 2020

NASA proposal evaluation panelist, 2024

Summer research mentor for the Cornell *Nexus Scholars Program* 2024–

Publications — *ADS search* — *ORCID*

total: 64 — citations: 2752 — h-index: 27 (*30 Nov 2024*) — * indicates ≥100 citations

First Author

8 **Fielding, D. B.**; Ripperda, B.; Philippov, A. A., *Plasmoid Instability in the Multiphase Interstellar Medium*, ApJ, 949, 2023 (arXiv:2211.06434) [21 citations]

⋆7 **Fielding, D. B.**; Bryan, G. L., *The Structure of Multiphase Galactic Winds*, ApJ, 924, 82, 2022 (arXiv:2108.05355) [**108** citations]

6 **Fielding, D. B.**; Tonnesen, S.; DeFelippis, D.; Li, M. *et al.*, *First Results from SMAUG: Uncovering the Origin of the Multiphase Circumgalactic Medium with a Comparative Analysis of Idealized and Cosmological Simulations*, ApJ, 903, 32, 2020 (arXiv:2006.16316) [75 citations]

⋆5 **Fielding, D. B.**; Ostriker, E. C.; Bryan, G. L.; Jermyn, A. S., *Multiphase Gas and the Fractal Nature of Radiative Turbulent Mixing Layers*, ApJ, 894, 2020 (arXiv:2003.08390) [**155** citations]

⋆4 **Fielding, D. B.**; Quataert, E.; Martizzi, D., *Clustered supernovae drive powerful galactic winds after superbubble breakout*, MNRAS, 481, 3325, 2018 (arXiv:1807.08758) [**183** citations]

⋆3 **Fielding, D. B.**; Quataert, E.; Martizzi, D.; Faucher-Giguère, C., *How supernovae launch galactic winds*, MNRAS, 470, 2017 (arXiv:1704.01579) [**106** citations]

⋆2 **Fielding, D. B.**; Quataert, E.; McCourt, M.; Thompson, T. A., *The impact of star formation feedback on the circumgalactic medium*, MNRAS, 466, 3810, 2017 (arXiv:1606.06734) [**191** citations]

⋆1 **Fielding, D. B.**; McKee, C. F.; Socrates, A.; Cunningham, A. J. *et al.*, *The turbulent origin of spin-orbit misalignment in planetary systems*, MNRAS, 450, 3306, 2015 (arXiv:1409.5148) [**100** citations]

Second Author (‡=mentor for student led project)

17 Smith, M. C.; **Fielding, D. B.**; Bryan, G. L.; Bennett, J. S. *et al.*, *Arkenstone - II. A model for unresolved cool clouds entrained in galactic winds in cosmological simulations*, MNRAS(arXiv:2408.15321) [3 citations]

‡16 Abruzzo, M. W.; **Fielding, D. B.**; Bryan, G. L., *Taming the TuRMoiL: The Temperature Dependence of Turbulence in Cloud–Wind Interactions*, ApJ, 966, 181 (arXiv:2210.15679) [19 citations]

15 Stern, J.; **Fielding, D. B.**; Hafen, Z.; Su, K. *et al.*, *Accretion onto disc galaxies via hot and rotating CGM inflows*, MNRAS, 530, 1711 (arXiv:2306.00092) [27 citations]

‡14 Tan, B.; **Fielding, D. B.**, *Cloud atlas: navigating the multiphase landscape of tempestuous galactic winds*, MNRAS, 527, 9683 (arXiv:2305.14424) [26 citations]

13 Smith, M. C.; **Fielding, D. B.**; Bryan, G. L.; Kim, C. *et al.*, *ARKENSTONE - I. A novel method for robustly capturing high specific energy outflows in cosmological simulations*, MNRAS, 527, 1216 (arXiv:2301.07116) [21 citations]

12 Kempski, P.; **Fielding, D. B.**; Quataert, E.; Galishnikova, A. K. *et al.*, *Cosmic ray transport in large-amplitude turbulence with small-scale field reversals*, MNRAS, 525, 4985 (arXiv:2304.12335) [25 citations]

‡11 Pandya, V.; **Fielding, D. B.**; Bryan, G. L.; Carr, C. *et al.*, *A Unified Model for the Coevolution of Galaxies and Their Circumgalactic Medium: The Relative Roles of Turbulence and Atomic Cooling Physics*, ApJ, 956, 118 (arXiv:2211.09755) [23 citations]

‡10 Abruzzo, M. W.; **Fielding, D. B.**; Bryan, G. L., *TuRMoiL of Survival: A Unified Survival Criterion for Cloud-Wind Interactions* (arXiv:2307.03228) [11 citations]

‡9 Chen, Z.; **Fielding, D. B.**; Bryan, G. L., *The Anatomy of a Turbulent Radiative Mixing Layer: Insights from an Analytic Model with Turbulent Conduction and Viscosity*, ApJ, 950, 91 (arXiv:2211.01395) [9 citations]

‡8 Orr, M. E.; **Fielding, D. B.**; Hayward, C. C.; Burkhart, B., *Bursting Bubbles: Feedback from Clustered Supernovae and the Trade-off Between Turbulence and Outflows*, ApJ, 932, 88 (arXiv:2109.14656) [39 citations]

‡7 Orr, M. E.; **Fielding, D. B.**; Hayward, C. C.; Burkhart, B., *Bursting Bubbles: Clustered Supernova Feedback in Local and High-redshift Galaxies*, ApJ, 924 (arXiv:2109.14626) [16 citations]

6 Stachenfeld, K.; **Fielding, D. B.**; Kochkov, D.; Cranmer, M. *et al.*, *Learned Coarse Models for Efficient Turbulence Simulation* (arXiv:2112.15275) [75 citations]

⋆‡5 Pandya, V.; **Fielding, D. B.**; Anglés-Alcázar, D.; Somerville, R. S. *et al.*, *Characterizing mass, momentum, energy,*

and metal outflow rates of multiphase galactic winds in the FIRE-2 cosmological simulations, MNRAS, 508, 2979 (arXiv:2103.06891) [117 citations]

‡4 Butsky, I. S.; **Fielding, D. B.**; Hayward, C. C.; Hummels, C. B. *et al.*, *The Impact of Cosmic Rays on Thermal Instability in the Circumgalactic Medium*, ApJ, 903, 77 (arXiv:2008.04915) [93 citations]

3 Stern, J.; **Fielding, D. B.**; Faucher-Giguère, C.; Quataert, E., *The maximum accretion rate of hot gas in dark matter haloes*, MNRAS, 492, 6042 (arXiv:1909.07402) [76 citations]

⋆2 Stern, J.; **Fielding, D. B.**; Faucher-Giguère, C.; Quataert, E., *Cooling flow solutions for the circumgalactic medium*, MNRAS, 488, 2549 (arXiv:1906.07737) [104 citations]

⋆1 Martizzi, D.; **Fielding, D. B.**; Faucher-Giguère, C.; Quataert, E., *Supernova feedback in a local vertically stratified medium: interstellar turbulence and galactic winds*, MNRAS, 459, 2311 (arXiv:1601.03399) [131 citations]

Co-author

39 Voit, G. M.; Carr, C.; **Fielding, D. B.** *et al.*, *Equilibrium States of Galactic Atmospheres. II. Interpretation and Implications*, ApJ, 976, 151 (arXiv:2406.07632) [3 citations]

38 Voit, G. M.; Pandya, V.; **Fielding, D. B.** *et al.*, *Equilibrium States of Galactic Atmospheres. I. The Flip Side of Mass Loading*, ApJ, 976, 150 (arXiv:2406.07631) [3 citations]

37 Perrotta, S. *et al.* (incl. **DBF**), *The Outflowing [O II] Nebulae of Compact Starburst Galaxies at $z \sim 0.5$*, ApJ, 975, 263 (arXiv:2409.10013)

36 Hassan, S. *et al.* (incl. **DBF**), *Toward Implementation of the Pressure-regulated, Feedback-modulated Model of Star Formation in Cosmological Simulations: Methods and Application to TNG*, ApJ, 975, 151 (arXiv:2409.09121)

35 Bennett, J. S.; Smith, M. C.; **Fielding, D. B.** *et al.*, *Prevention is better than cure? Feedback from high specific energy winds in cosmological simulations with Arkenstone* (arXiv:2410.12909)

34 Choi, B. *et al.* (incl. **DBF**), *The Metallicity Mapping of the Ionized Diffuse Gas at the Milky Way Disk-halo Interface* (arXiv:2410.06286)

33 Stone, J. M.; Mullen, P. D.; **Fielding, D. B.** *et al.*, *AthenaK: A Performance-Portable Version of the Athena++ AMR Framework* (arXiv:2409.16053) [7 citations]

32 Hummels, C. B.; Rubin, K. H. R.; Schneider, E. E.; **Fielding, D. B.**, *CLOUDFLEX: A Flexible Parametric Model for the Small-scale Structure of the Circumgalactic Medium*, ApJ, 972, 148 (arXiv:2311.05691) [6 citations]

31 Kim, C. *et al.* (incl. **DBF**), *Metallicity Dependence of Pressure-regulated Feedback-modulated Star Formation in the TIGRESS-NCR Simulation Suite*, ApJ, 972, 67 (arXiv:2405.19227) [7 citations]

30 Su, K. *et al.* (incl. **DBF**), *Unravelling jet quenching criteria across L^* galaxies and massive cluster ellipticals*, MNRAS, 532, 2724 (arXiv:2310.17692) [9 citations]

29 Steinwandel, U. P.; Rennehan, D.; Orr, M. E.; **Fielding, D. B.** *et al.*, *Pumping Iron: How turbulent metal diffusion impacts multiphase galactic outflows* (arXiv:2407.14599) [5 citations]

‡28 Ramesh, R.; Nelson, D.; **Fielding, D. B.** *et al.*, *Zooming in on the Circumgalactic Medium with GIBLE: Tracing the Origin and Evolution of Cold Clouds* (arXiv:2407.00172) [4 citations]

27 Hamel-Bravo, M. J. *et al.* (incl. **DBF**), *DUVET: Resolved direct metallicity measurements in the outflow of starburst galaxy NGC 1569*, MNRAS, 530, 3855 (arXiv:2404.04600)

26 Fisher, D. B.; Bolatto, A. D.; Chisholm, J.; **Fielding, D.** *et al.*, *JWST Observations of Starbursts: Cold Clouds and Plumes Launching in the M82 Outflow* (arXiv:2405.03686) [2 citations]

‡25 Ramesh, R.; Nelson, D.; **Fielding, D. B.** *et al.*, *Zooming in on the circumgalactic medium with GIBLE. The topology and draping of magnetic fields around cold clouds*, A&A, 684 (arXiv:2404.01370) [3 citations]

24 Reichardt Chu, B. *et al.* (incl. **DBF**), *DUVET: sub-kiloparsec resolved star formation driven outflows in a sample of local starbursting disk galaxies* (arXiv:2402.17830) [5 citations]

23 Coil, A. L. *et al.* (incl. **DBF**), *Ionized gas extends over 40 kpc in an odd radio circle host galaxy*, Nature, 625, 459 (arXiv:2310.15162) [9 citations]

22 Steinwandel, U. P. *et al.* (incl. **DBF**), *The Structure and Composition of Multiphase Galactic Winds in a Large Magellanic Cloud Mass Simulated Galaxy*, ApJ, 960, 100 (arXiv:2212.03898) [30 citations]

21 Roy, M.; Su, K.; Tonnesen, S.; **Fielding, D. B.** *et al.*, *Seeding the CGM: how satellites populate the cold phase of milky*

way haloes, MNRAS, 527, 265 (arXiv:2310.04404) [8 citations]

20 Qutob, N. *et al.* (incl. **DBF**), *Observational Signatures of AGN Feedback in the Morphology and the Ionization States of Milky Way-like Galaxies* (arXiv:2312.14809) [2 citations]

19 McPherson, D. K. *et al.* (incl. **DBF**), *DUVET survey: mapping outflows in the metal-poor starburst Mrk 1486*, MNRAS, 525, 6170 (arXiv:2308.06918) [9 citations]

‡18 Carr, C.; Bryan, G. L.; **Fielding, D. B.** *et al.*, *Regulation of Star Formation by a Hot Circumgalactic Medium*, ApJ, 949, 21 (arXiv:2211.05115) [19 citations]

17 Reichardt Chu, B. *et al.* (incl. **DBF**), *DUVET: Spatially Resolved Observations of Star Formation Regulation via Galactic Outflows in a Starbursting Disk Galaxy*, ApJ, 941, 163 (arXiv:2211.02063) [12 citations]

16 Butsky, I. S.; Werk, J. K.; Tchernyshyov, K.; **Fielding, D. B.** *et al.*, *The Impact of Cosmic Rays on the Kinematics of the Circumgalactic Medium*, ApJ, 935, 69 (arXiv:2106.14889) [20 citations]

15 Hafen, Z. *et al.* (incl. **DBF**), *Hot-mode accretion and the physics of thin-disc galaxy formation*, MNRAS, 514, 5056 (arXiv:2201.07235) [73 citations]

‡14 Abruzzo, M. W.; Bryan, G. L.; **Fielding, D. B.**, *A Simple Model for Mixing and Cooling in Cloud-Wind Interactions*, ApJ, 925, 199 (arXiv:2101.10344) [42 citations]

13 Stern, J. *et al.* (incl. **DBF**), *Neutral CGM as damped Ly α absorbers at high redshift*, MNRAS, 507, 2869 (arXiv:2105.06489) [28 citations]

⋆12 Stern, J.; Faucher-Giguère, C.; **Fielding, D. B.** *et al.*, *Virialization of the Inner CGM in the FIRE Simulations and Implications for Galaxy Disks, Star Formation, and Feedback*, ApJ, 911, 88 (arXiv:2006.13976) [109 citations]

11 Cranmer, M.; Cui, C.; **Fielding, D. B.**; Sanchez-Gonzalez, A. *et al.*, *Interpretable Deep Learning for Computational Fluid Dynamics*, APS Division of Fluid Dynamics Meeting Abstracts, 2021

10 Pandya, V. *et al.* (incl. **DBF**), *First Results from SMAUG: The Need for Preventative Stellar Feedback and Improved Baryon Cycling in Semianalytic Models of Galaxy Formation*, ApJ, 905, 4 (arXiv:2006.16317) [45 citations]

9 Burkhart, B. *et al.* (incl. **DBF**), *The Catalogue for Astrophysical Turbulence Simulations (CATS)*, ApJ, 905, 14 (arXiv:2010.11227) [22 citations]

8 Kim, C.; Ostriker, E. C.; **Fielding, D. B.** *et al.*, *A Framework for Multiphase Galactic Wind Launching Using TIGRESS*, ApJ, 903 (arXiv:2010.09090) [49 citations]

⋆7 Kim, C. *et al.* (incl. **DBF**), *First Results from SMAUG: Characterization of Multiphase Galactic Outflows from a Suite of Local Star-forming Galactic Disk Simulations*, ApJ, 900, 61 (arXiv:2006.16315) [120 citations]

6 Lochhaas, C. *et al.* (incl. **DBF**), *Properties of the simulated circumgalactic medium*, MNRAS, 493, 1461 (arXiv:1908.00021) [43 citations]

5 Voit, G. M.; Babul, A.; Babyk, I. *et al.*, *Circumgalactic Gas and the Precipitation Limit* (arXiv:1903.11212)

4 Martizzi, D.; Quataert, E.; Faucher-Giguère, C.; **Fielding, D.**, *Simulations of jet heating in galaxy clusters: successes and challenges*, MNRAS, 483, 2465 (arXiv:1805.06461) [57 citations]

3 Stern, J. *et al.* (incl. **DBF**), *Does Circumgalactic O VI Trace Low-pressure Gas Beyond the Accretion Shock? Clues from H I and Low-ion Absorption, Line Kinematics, and Dust Extinction*, ApJ, 865, 91 (arXiv:1803.05446) [61 citations]

⋆2 Offner, S. S. R. *et al.* (incl. **DBF**), *The Turbulent Origin of Outflow and Spin Misalignment in Multiple Star Systems*, ApJ, 827 (arXiv:1606.08445) [122 citations]

1 Schlieder, J. E. *et al.* (incl. **DBF**), *The Na 8200 Å Doublet as an Age Indicator in Low-mass Stars*, AJ, 143, 114 (arXiv:1202.4191) [65 citations]

Honors and awards

Outstanding Graduate Student Instructor Award	2014
NSF Graduate Research Fellowship	2014–2017
Berkeley Graduate Fellowship	2012–2014
Donald E. Kerr Award for Outstanding Physics Undergraduate	2012

Selected recent invited presentations

Endowed Colloquium, Niels Bohr Lecture, Niels Bohr Institute, Copenhagen (10/2024)
Seminar, Institute for Advanced Studies, Princeton (10/2024)
Colloquium, Flatiron Institute, Center for Computational Astrophysics (2/2024)
Invited Review, *New simulations for new problems in galaxy formation*, conference, Paris (12/2023)
Invited Talk, Salpeter Workshop on the Interstellar Medium, Cornell (12/2023)
Seminar, Computational Research in Boston and Beyond (CRIBB), MIT (12/2023)
Colloquium, Johns Hopkins University, Physics and Astronomy Department (11/2023)
Colloquium, Columbia University, Astronomy Department (10/2023)
Invited talk, *Interfaces and Mixing in Fluids, Plasmas, and Materials*, conference, KITP (9/2023)
Colloquium, Michigan State University, Physics and Astronomy Department (10/2023)
Invited Review, *MIST2023: Cosmic turbulence and Magnetic fields: physics of baryonic matter across time and scales*, conference (9/2023)
Invited talk, *CGM@ND*, conference (9/2023)
Invited talk, *New Views on Feedback & the Baryon Cycle in Galaxies*, conference (8/2023)
Invited talk, *Modeling multiphase astrophysical systems*, conference (5/2023)
Invited talk, *Jim's Fest/Athena++*, conference (5/2023)
Colloquium, Yale University, Astronomy Department (2/2023)
Colloquium, Cornell University, Astronomy Department (1/2023)
Astrophysics Seminar, UIUC (11/2022)
Joint Astrophysics Colloquium, Pitt-CMU (10/2022)
Invited talk, *What Matter(s) Around Galaxies*, conference (9/2022)
Invited talk, *Ringberg Computational Galaxy Formation 2022*, conference (4/2022)
Invited talk, *Wolfe Symposium*, conference (3/2022)
Theoretical AstroPhysics Including Relativity & Cosmology seminar, Caltech (12/2021)
Astronomy Department seminar, The Racah Institute of Physics, Hebrew University of Jerusalem (12/2021)
Invited Talk, *Baltimore Wind Workshop*, Johns Hopkins University (8/2021)
Astrophysics Colloquium, UCSD-SDSU (4/2021)
Keynote speaker, KITP workshop *Fundamentals of Gaseous Halos* (1/2021)
Invited talk, KITP conference *On the Origin, Nature, and Mixing of Multiphase Gas in Astrophysics* (10/2020)
Gaggle Seminar, Carnegie Institution for Science (8/2020)
Invited talk, CLEARNESS conference IAP (6/2020)
CGI Colloquium, U.C. Santa Cruz (4/2020)
Contributed Talk, Universality of Turbulence Conference, Flatiron Institute, NY (12/2019)
SFIR Seminar, Princeton University (11/2019)
Astro Seminar, NYU CCPP, New York NY (10/2019)
Invited Talk, CGM conference, Berlin Germany (10/2019)
Invited seminar, Turbulence workshop, Aspen Center for Physics (6/2019)
Invited Talk, *athena++* conference, Las Vegas NV (3/2019)
Invited Talk, CGM conference, Northwestern, Chicago IL (8/2018)
Invited Talk, CGM/DLA conference, Big Sur CA (3/2018)
TAPIR Seminar, Caltech, Pasadena CA (11/2017)
Astronomy Colloquium, Raman Research Institute (12/2016)
Astronomy Department Colloquium, Indian Institute of Science (10/2016)