

Evan McDonough

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Research Interests

Connections between high energy theoretical physics and cosmology, astrophysics, gravitational waves, dark matter, and dark energy.

Academic Appointments

2020 - :	University of Chicago Kavli Fellow , Enrico Fermi Fellow Faculty contact: Wayne Hu, Rocky Kolb
2020:	Massachusetts Institute of Technology Banting Fellow Faculty contact: Alan Guth, David Kaiser
2017-2020:	Brown University Post-Doctoral Research Associate, Presidential Scholar Post-doctoral Researcher Faculty contact: Stephon Alexander, Jim Gates

Education

2012-2017:	McGill University Ph.D. Physics
2008-2012:	McGill University Hon. B.Sc. Physics

Publications

Summary statistics: h -index:17, 774 total citations, 27 published papers, 31 papers & preprints.

Student collaborators under my supervision are underlined>.

2021:

31. E. W. Kolb, A. J. Long, and E. McDonough *Catastrophic Production of Slow Gravitinos*. Preprint available at [[arXiv:2102.10113](https://arxiv.org/abs/2102.10113)].

2020:

30. S. Alexander, E. McDonough, and David N. Spergel, *Strongly-Interacting Ultralight Millicharged Particle (STUMP) Neutron Stars as Dark Matter Halos*. Preprint available at [[arXiv:2011.06589](https://arxiv.org/abs/2011.06589)].
29. S. Alexander, L. Jenks and E. McDonough, *Higher Spin Dark Matter*. Preprint available at [[arXiv:2010.15125](https://arxiv.org/abs/2010.15125)].
28. E. McDonough, A. H. Guth, D. I. Kaiser, *Nonminimal Couplings and the Forgotten Field of Axion Inflation*. Preprint available at [[arXiv:2010.04179](https://arxiv.org/abs/2010.04179)].
27. M. M. Ivanov, E. McDonough, J. C. Hill, M. Simonović, M. W. Toomey, S. Alexander, and M. Zaldarriaga, *Constraining Early Dark Energy with Large-Scale Structure*. Phys. Rev. D 102 (2020) 103502 . [[arXiv:2006.11235](https://arxiv.org/abs/2006.11235)].
26. J. C. Hill, E. McDonough, M. W. Toomey and S. Alexander, *Early Dark Energy Does Not Restore Cosmological Concordance*. Editors suggestion, Phys. Rev. D 102 (2020) 4, 043507 . [[arXiv:2003.07355](https://arxiv.org/abs/2003.07355)].
25. S. Alexander, G. Herczeg, J. Liu and E. McDonough, *Chiral Symmetry and the Cosmological Constant*. Phys. Rev. D 102 (2020) 8, 083526. [[arXiv:2003.08416](https://arxiv.org/abs/2003.08416)].
24. E. McDonough, *The Cosmological Heavy Ion Collider: Fast Thermalization after Cosmic Inflation*. Phys. Lett. B 809 (2020) 135755. [[arXiv:2001.03633](https://arxiv.org/abs/2001.03633)].

2019:

23. S. Alexander, E. McDonough, A. Pullen and B. Shapiro, *Physics Beyond The Standard Model with Circular Polarization in the CMB and CMB-21cm Cross-Correlation*. JCAP **2001**, no. 01, 032 (2020) [[arXiv:1911.01418](https://arxiv.org/abs/1911.01418)].
22. S. Alexander, S. Gleyzer, E. McDonough, M. W. Toomey and E. Usai, *Deep Learning the Morphology of Dark Matter Substructure*. Ap. J. **15** **893** (2020) [[arXiv:1909.07346](https://arxiv.org/abs/1909.07346)].
21. S. Alexander, S. J. Gates Jr. , L. Jenks, K. Koutrolikos, and E. McDonough, *Higher Spin Supersymmetry at the Cosmological Collider: Sculpting SUSY Rilles in the CMB*. JHEP **1910**, 156 (2019) [[arXiv:1907.05829](https://arxiv.org/abs/1907.05829)].

20. S. Alexander and E. McDonough, *Axion-Dilaton Destabilization and the Hubble Tension*. Phys. Lett. B797 (2019) [[arXiv:1904.08912](#)].
19. R. Kallosh, A. Linde, E. McDonough, and M. Scalisi, *dS vacua and the Swampland*. JHEP 1903 (2019) 134 [[arXiv:1901.02022](#)].
18. S. Alexander, J. Bramberger, and E. McDonough, *Dark Disk Substructure and Superfluid Dark Matter*. Phys. Lett. B797 (2019) [[arXiv:1901.03694](#)].

2018:

17. S. Alexander and E. McDonough, *Primordial Circular Polarization in the Cosmic Microwave Background*. Phys. Lett. B 0370 (2018) 2693 [[arXiv:1811.05953](#)].
16. R. Kallosh, A. Linde, E. McDonough and M. Scalisi, *4d models of dS uplift in KKLT*. Phys.Rev. D99 (2019) no.4, 046006 [[arXiv:1809.09018](#)].
15. S. Alexander, E. McDonough, R. Sims and N. Yunes, *Hidden-Sector Modifications to Gravitational Waves From Binary Inspirals*, Class. Quant. Grav. 35, no. 23, 235012 (2018) [[arXiv:1808.05286](#)]
14. R. Kallosh, A. Linde, E. McDonough and M. Scalisi, *de Sitter Vacua with a Nilpotent Superfield*. Fortschr. Phys. 2018, 1800068 [[arXiv:1808.09428](#)].
13. K. Dasgupta, M. Emelin, E. McDonough, and R. Tatar, *Quantum Corrections and the de Sitter Swampland Conjecture*. JHEP **1901**, 145 (2019) [[arXiv:1808.07498](#)].
12. S. Alexander and E. McDonough, *Observable Chiral Gravitational Waves from Inflation in String Theory*. JCAP 1811, no. 11, 030 (2018) [[arXiv:1806.05684](#)].
11. S. Alexander, E. McDonough, and D. N. Spergel, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, JCAP 1805, no. 05, 003 (2018) [[arXiv:1801.07255](#)].

2013-2017:

10. H. Bazrafshan Moghaddam, E. McDonough, R. Namba, and R. H. Brandenberger, *Inflationary magneto-(non)genesis, increasing kinetic couplings, and the strong coupling problem*, Class. Quant. Grav. 35, no. 10, 105015 (2018) [[arXiv:1707.05820](#)].
9. S. Alexander, E. McDonough, and R. Sims, *V-mode Polarization in Axion Inflation and Preheating*, Phys. Rev. D 96, no. 6, 063506 (2017) [[arXiv:1704.00838](#)].
8. E. McDonough and M. Scalisi, *Inflation from Nilpotent Kähler Corrections*, JCAP 1611, no. 11, 028 (2016) [[arXiv:1609.00364](#)].
7. K. Dasgupta, M. Emelin, and E. McDonough, *Fermions on the Anti-Brane: Higher Order Interactions and Spontaneously Broken Supersymmetry*, Phys. Rev. D 95, 026003 [[arXiv:1601.03409](#)].
6. E. McDonough, H. B. Moghaddam, and R. H. Brandenberger, *Preheating and Entropy Perturbations in Axion Monodromy Inflation*, JCAP 1605 (2016) 012 [[arXiv:1601.07749](#)].

5. K. Dasgupta, M. Emelin, and E. McDonough, *Non-Kahler Resolved Conifold, Localized Fluxes in M-Theory and Supersymmetry*, JHEP 1502 (2015) 179 [[arXiv:1412.3123](#)].
4. L. P. Levasseur and E. McDonough, *Backreaction and Stochastic Effects in Single Field Inflation*, Phys.Rev. D91 (2015) 063513 [[arXiv:1409.7399](#)].
3. K. Dasgupta, R. Gwyn, E. McDonough, M. Mia, and R. Tatar. *de Sitter Vacua in Type IIB String Theory: Classical Solutions and Quantum Corrections*, JHEP 1407, 054 (2014) [[arXiv:1402.5112](#)].
2. Y. -F. Cai, E. McDonough, F. Duplessis and R. H. Brandenberger, *Two Field Matter Bounce Cosmology*, JCAP 1310, 024 (2013) [[arXiv:1305.5259](#)].
1. E. McDonough and R. H. Brandenberger, *Searching for Signatures of Cosmic String Wakes in 21cm Redshift Surveys using Minkowski Functionals*, JCAP 1302, 045 (2013) [[arXiv:1109.2627](#)].

Student Mentoring and Research Supervision

Density Perturbations Group, MIT

Mentor and research supervisor to five (5) undergraduate students in the Density Perturbations Group (DPG) at the MIT, led by Alan Guth and David Kaiser.

Presidential Scholars Program, Brown University

Mentor, tutor, and advisor to undergraduate [Presidential Scholars](#) at Brown University.

Graduate Research Supervision:

8. Jinglong Lui, 2019-2020.
Master's research, *Baryogenesis and The Cosmological Constant Problem*. Published paper under my supervision.
7. Shuangpeng Lin, 2019-2020.
Master's research, *Higher-Spin Fermions at the Cosmological Collider*.
6. Michael Toomey, 2018 - 2019.
Master's research thesis, *Machine Learning Dark Matter Substructure*. Accepted to Brown University PhD program. Published paper under my supervision.
5. Bradley Shapiro, 2017 - 2019.
Master's research thesis, *The Circular Polarization of the Cosmic Microwave Background*. Accepted to Dartmouth College PhD program. Published paper under my supervision.
4. Leah Jenks, 2017-
Doctoral research, *Cosmological Collider Physics*. Published paper under my supervision.
3. Robert Sims, 2017-2018.
Doctoral research, *New Probes of Dark Matter*. Published two papers under my supervision.

2. Athira Sanal, 2017-2019 .
Master's research, *On Superfluid Cores Of Dark Matter Halos*. Research presented at APS April meeting 2019. Accepted to Dartmouth College PhD program.
1. Xiao Zhou, 2018 - 2019.
Master's research, *An Ultra-Light Dark Disk Universe*. Accepted to Northwestern University PhD program.

Undergraduate Research Supervision:

7. **MIT Density Perturbations Group:** Vedang Lad, Michelle Xu, Kiriakos Hilbert, Sami Kaya, Ellen Lee. Undergraduate research, *Primordial Black Holes from First Principles*
6. Kaushik Srinivasan Harith, 2020.
Undergraduate research project, *Tensions in CMB Data*.
5. Sarah Bawabe, 2019.
Undergraduate research project, *Reheating in Orbital Inflation*. Research presented at the MIT Eighth Annual Undergraduate Cosmology Workshop.
4. Griffin Edwards, 2019.
Undergraduate research project, *Reheating in Orbital Inflation*. Research presented at the MIT Eighth Annual Undergraduate Cosmology Workshop.
3. Dante Sanchez, 2019.
Undergraduate research project, *Numerical Simulations of Fuzzy Dark Matter Solitons*.
2. Kairy Herrera, 2018.
Undergraduate research thesis, *Investigations on Superfluid Dark Matter*.
1. Stellen Bechtel, 2019.
Summer reading course, *Early Universe Cosmology*.

Selected Awards and Honours

Selected awards and prizes totaling \$311,000 .

Banting Fellowship, Government of Canada.

2020. \$140,000. *National Prize Postdoctoral Fellowship*

Post-Doctoral Fellowship (PDF), Natural Sciences and Engineering Research Council (NSERC)

2017-2019, \$90,000. *National Award*.

P. R. Wallace Thesis Prize, Canadian Association of Physicists,

2019. *National award for best Doctoral thesis*.

Prix Meilleur Etudiant, Centre de Recherches Mathematiques (CRM)

2017, \$1,000. *National award for Doctoral research*.

Post-Graduate Scholar Doctoral fellowship (PGS D), Natural Sciences and Engineering Research Council (NSERC).

2014-2017, \$63,000. National award.

Lorne Trottier Science Accelerator Fellowship, McGill University

2014, \$5,000. Award from McGill University.

Wolfe Fellowship in Scientific and Technological Literacy, McGill University

1/2015 - 4/1015, \$12,000. Award funded from the WOCO foundation (and administered by McGill University), awarded on the basis of high academic standing, community involvement, and athletic activities.

Teaching

Guest Lecturer

PHYS 0150: The Jazz of Physics
Fall 2017, Fall 2018, Fall 2019. Brown University
Enrollment: 40 students.

Designed and gave 6 lectures per term.

Course Co-Instructor

PHYS 743: Very Early Universe
Fall 2016, McGill University
Enrollment: 11 students.

Designed and organized the course, gave four lectures, and assessed student performance. Utilized the 'just in time' teaching method.

Course Organizer

PHYS 731: Mathematical Methods of High Energy Physics (Special Topics Course)
Winter 2013, McGill University
Enrollment: 4 students.

Organized and led a reading course on mathematical aspects of higher energy physics, for graduate students at McGill University.

Lecturer:

Summer Lectures on Topological Defects and Cosmology
May-June 2012, McGill University.

Lecture series (8 lectures) on topological defects (e.g. cosmic strings, monopoles) and their observational signatures to undergraduate and graduate students at McGill University.

Tutoring:

Volunteer physics tutor, Medlife McGill fundraiser for children in developing nations (Fall 2012). Calculus tutor for MATH 140-141 (May-June 2012) . Physics tutor for McGill Physics Helpdesk (Fall 2011 - Winter 2012).

Professional Service and Activities

Diversity and Inclusion Committee: Serving member and post-doc representative on the Departmental Diversity and Inclusion Action Plan (DDIAP) committee, Brown University Physics department.

Referee for journals: Referee for *Physical Review Letters*, *Journal of High Energy Physics*, *Physical Review D*, and *European Physics Journal C*.

Conference Co-organizer: *String Theory and Cosmology*, June 15 - 16, 2019. Gordon Research Seminar, Barcelona, Spain.

Workshop Co-organizer: *Northeast Cosmology Workshop*, March 16-18, 2018. Workshop at McGill University.

Seminar Series Organizer: *Brown Physics Post-Doc Journal Club*, 2018-2019, Brown University.

Session Chair: "Quantum Gravity and Gravitational Waves", *Theory Canada 13* June 7-10, 2018. National conference at St. Francis-Xavier University.

Seminar Series Organizer: *High Energy Theory Journal Club*, 2015-2017, McGill University.

Webmaster for the High Energy Physics Seminars Listing Website: Fall 2015 - 2017.

Seminars and Invited Talks

31. Invited talk at the Massachusetts Institute of Technology, Joint MIT/Tufts cosmology seminar, *Constraining Early Dark Energy with Large Scale Structure*. Oct. 20, 2020.
30. Invited talk at MPA Garching, *Constraining Early Dark Energy with Large Scale Structure*. Oct. 20, 2020.
29. Invited talk at PACMAN (Particle Astro/Cosmo Meeting Around NYC) seminar, *Ultra-light Fermionic Dark Matter: Halo Cores as Dark Neutron Stars*. Oct. 13, 2020.
28. Invited talk at Copernicus Webinar Series, *Constraining Early Dark Energy with Large Scale Structure*. July 23, 2020.
27. Invited talk at the Theoretical Cosmology, Gravity and Fields Workshop, Dartmouth College. *Constraining Early Dark Energy with Large Scale Structure*. July 21, 2020.
26. Invited talk at University of Illinois Urbana-Champaign, *Gravitational Lamp Posts for Dark Matter Physics*. Dec. 6, 2019.

25. Invited talk at Northeastern University, *The Chirality of Primordial Gravitational Waves*. Sept. 30, 2019.
24. Invited talk at Theory Canada 14, *New (Old) Gravitational Probes of Dark Matter*. May 31, 2019.
23. Invited Lecture at Atlantic General Relativity 2019, *Primordial Cosmology and High Energy Physics*. May 27, 2019.
22. Seminar at the Flatiron Institute, Center for Computational Astrophysics, *Strong Gravity Probes of Dark Matter*. May 1, 2019
21. Seminar at the ETH Zurich, *The Chirality of Primordial Gravitational Waves*. March 22, 2019
20. Seminar at the Max Planck Institute for Astrophysics (MPA) Garching, *The Chirality of Primordial Gravitational Waves*. March 19, 2019
19. Seminar at the Syracuse University, *The Chirality of Primordial Gravitational Waves*, Dec 11, 2018.
18. Seminar at the Massachusetts Institute of Technology, *The Chirality of Primordial Gravitational Waves*, Dec 11, 2018.
17. Invited Speaker at [Canadian Association of Physicists \(CAP\) Congress 2018](#), June 11-15, 2018. Dalhousie University, Halifax, Nova Scotia.
16. Session Chair and contributed talk at the [Theory Canada 13](#), June 7-9, 2018. St. Francis Xavier University, Antigonish, Nova Scotia.
15. Invited speaker at conference [New England Cosmology Workshop](#), October 13-14, 2018. Massachusetts Institute of Technology.
14. Seminar at the Dartmouth College, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, May 2, 2018.
13. Seminar at the University of Pennsylvania, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, April 26, 2018.
12. Seminar at the New York University, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, April 17, 2018.
11. Seminar at the Institute for Advance Study, Princeton, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, March 12, 2018.
10. Seminar at Harvard University, Dvorkin-Finkbeiner-Kovacs journal club, *Chiral Gravitational Waves and Baryon Superfluid Dark Matter*, February 20, 2018.
9. Seminar at Tufts University, *Anti-Brane Induced Inflation*, November 14, 2017.
8. Invited speaker at conference [String Theory and Cosmology: Cosmic Origin and Cosmic Fate, From Big Bang to Dark Energy](#) May 27-28, 2017, Italy.

7. Seminar at Brown University, *Primordial Black Holes and Preheating in Axion Inflation*, April 26, 2016.
6. Contributed talk, *Fermions on the Antibrane*, at the workshop [Northeast Gravity Workshop](#), April 22-24, 2016, hosted by UMass Amherst.
5. Seminar at the Massachusetts Institute of Technology, *Preheating in Axion Inflation Models*, April 12, 2016.
4. Seminar at the University of California at Berkeley, *Fermions on the Anti-Brane: Higher Order Interactions and Spontaneously Broken Supersymmetry*, March 1, 2016.
3. Seminar at the University of Chicago, *de Sitter in String Theory: A story of branes, planes, and quantum corrections*, June 12, 2014.
2. Seminar at Ecole Physique Les Houches, *Pour some SUGRA on me: Supergravity and Superconformal Gauge Theory*, while attending summer school *Post-Planck Cosmology*, July 3 - August 3, 2013.
1. Contributed talk, *Two Field Matter Bounce Cosmology*, at the conference [Theory Canada 8](#), May 24-26, 2013, hosted by Bishop's University.