

Jonathan Bain

Department of Technology, Culture and Society
Tandon School of Engineering, New York University
6 Metrotech Center, Brooklyn, NY 11201

+1.646.997.3688
jon.bain@nyu.edu
faculty.poly.edu/~jbain

EDUCATION

1998 **Ph.D.** History and Philosophy of Science, University of Pittsburgh, Pittsburgh, PA.

Thesis: 'Representations of Spacetime: Formalism and Ontological Commitment'

Committee: John Earman (co-chair; HPS), John D. Norton (co-chair; HPS), Kenneth Manders (Philosophy), George A. J. Sparling (Mathematics).

1996 **M.S.** Physics, University of Pittsburgh.

1992 **M.A.** History and Philosophy of Science, University of Pittsburgh.

1989 **B.S.** Applied Mathematics/Physics, University of the Pacific, Stockton, CA. **Minor**, Philosophy.

AREA OF SPECIALIZATION

philosophy/foundations of physics; history & philosophy of science.

AREAS OF COMPETENCE

logic, social philosophy, epistemology, philosophy of mathematics, Whitehead, science and technology studies.

EMPLOYMENT

2017–present **Professor of Philosophy of Science**, Department of Technology, Culture and Society; Tandon School of Engineering, New York University (NYU-Tandon).

2013–present **Affiliated Faculty**, Program in History of Science and Science Studies, NYU.

2010–present **Affiliated Faculty**, Department of Philosophy, NYU.

2005–2017 **Associate Professor**, Department of Technology, Culture and Society, NYU-Tandon.

1999–2005 **Assistant Professor**, Department of Humanities and Social Sciences, Polytechnic University.[†]

1998–1999 **Visiting Assistant Professor**, Department of Philosophy, University of California-Riverside.

PUBLICATIONS

Book:

CPT Invariance and the Spin-Statistics Connection, Oxford University Press (2016).

Refereed Articles:

25. 'The RT Formula and its Discontents: Spacetime and Entanglement', *Synthese* (2020),

<https://doi.org/10.1007/s11229-020-02836-4>.

24. 'Spacetime as a Quantum Error-Correcting Code?', *Studies in History and Philosophy of Modern Physics* 71 (2020), 26–36.

23. 'Why be Natural?', *Foundations of Physics* 49 (2019), 898–914.

[†] Polytechnic University became The Polytechnic Institute of New York University (NYU-Poly) in 2008. NYU-Poly became The Tandon School of Engineering, New York University (NYU-Tandon) in 2015.

22. 'Non-Locality in Intrinsic Topologically Ordered Systems', *Studies in History and Philosophy of Modern Physics* 66 (2019), 24–33.
21. 'Topological Order and Emergence', *Philosophica* 92 (2017), 77–112.
20. 'Emergence and Mechanism in the Fractional Quantum Hall Effect', *Studies in History and Philosophy of Modern Physics* 56 (2016), 27–38.
19. 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theories', in U. Mäki, et al. (eds.) *Recent Developments in the Philosophy of Science: EPSA13 Helsinki*, Springer (2015), 227–42.
18. 'Three Principles of Quantum Gravity in the Condensed Matter Approach', *Studies in History and Philosophy of Modern Physics* 46 (2014), 154–63.
17. 'Emergence in Effective Field Theories', *European Journal for Philosophy of Science* 3 (2013), 257–273.
16. 'CPT Invariance, the Spin-Statistics Connection, and the Ontology of Relativistic Quantum Field Theories', *Erkenntnis* 78 (2013), 797–821.
15. 'The Emergence of Spacetime in Condensed Matter Approaches to Quantum Gravity', *Studies in History and Philosophy of Modern Physics* 44 (2013), 338–45.
14. 'Category-Theoretic Structure and Radical Ontic Structural Realism', *Synthese* 190 (2013), 1621–35.
13. 'Effective Field Theories', in Batterman, B. (ed.) *The Oxford Handbook of Philosophy of Physics*, Oxford University Press (2013), 224–54.
12. 'Quantum Field Theories in Classical Spacetimes and Particles', *Studies in History and Philosophy of Modern Physics* 42 (2011), 98–106.
11. 'Relativity and Quantum Field Theory', in Petkov, V. (ed.) *Space, Time, and Spacetime - Physical and Philosophical Implications of Minkowski's Unification of Space and Time*, Springer (2010), 129–46.
10. 'Condensed Matter Physics and the Nature of Spacetime', in Dieks, D. (ed.) *The Ontology of Spacetime, Vol. 1*, Elsevier (2008), 301–29.
9. 'Spacetime Structuralism', in Dieks, D. (ed.) *The Ontology of Spacetime, Vol. 1*, Elsevier (2006), 37–66.
8. Essay review: Hättich, F., *Quantum Processes: A Whiteheadian Interpretation of Quantum Field Theory*, in *Studies in History and Philosophy of Modern Physics* 36 (2005), 680–90.
7. 'Theories of Newtonian Gravity and Empirical Indistinguishability', *Studies in History and Philosophy of Modern Physics* 35 (2004), 345–76.
6. 'Einstein Algebras and the Hole Argument', *Philosophy of Science* 70 (2003), 1073–85.
5. 'What Should Philosophers of Science Learn from the History of the Electron?', (with J. D. Norton) in Buchwald, J. & A. Warwick (eds.), *Histories of the Electron*, MIT Press (2001), 451–65.
4. 'Against Particle/Field Duality: Asymptotic Particle States and Interpolating Fields in Interacting QFT (or: Who's Afraid of Haag's Theorem?)', *Erkenntnis* 53 (2000), 375–406.
3. 'The Coordinate-Independent 2-component Spinor Formalism and the Conventionality of Simultaneity', *Studies in History and Philosophy of Modern Physics* 31 (2000), 201–26.
2. 'Weinberg on QFT: Demonstrative Induction and Underdetermination', *Synthese* 117 (1998), 1–30.
1. 'Whitehead's Theory of Gravity', *Studies in History and Philosophy of Modern Physics* 29 (1998), 547–74.

Invited Reviews (not refereed):

6. French, S. and J. Saatsi (ed.) *Scientific Realism and the Quantum*, in *Metascience* (2020), <https://doi.org/10.1007/s11016-020-00568-2>.
5. Rickles, D. (ed.) *The Ashgate Companion to the Philosophy of Physics*, in *Metascience* 18 (2009), 485–9.
4. Healey, R. *Gauging What's Real: The Conceptual Foundations of Contemporary Gauge Theories*, in *Philosophy of Science* 75 (2008), 479–85.
3. Arabatzis, T. *Representing Electrons*, in *International Studies in Philosophy of Science* 20 (2006), 352–4.
2. Pesic, P., *Seeing Double: Shared Identities in Physics, Philosophy, and Literature*, in *ISIS* 93 (2002), 670–1.
1. Jammer, M., *Concepts of Mass in Contemporary Physics and Philosophy*, in *Physics Today* 53 (2000), 67–8.

ERDOS NUMBER: 5

Jonathan Bain → John D. Norton → Alexander Pruss → Richard Bradley Jr. → Svante Janson → Paul Erdos

INVITED (*) AND REFEREED PRESENTATIONS

2019

- 'Spacetime as a Quantum Error-Correcting Code?', *European Philosophy of Science Association*, University of Geneva, Geneva, Switzerland, Sept. 11–14.

2018

- 'Why be Natural?', *Philosophy of Science Association*, Seattle, WA, Nov. 1–4.
- Commentary, *Norton For Everyone?*, University of Pittsburgh, Pittsburgh, PA, Oct. 26–28.*
- 'Non-Locality in Intrinsic Topologically Ordered Systems', *American Philosophical Association-Pacific Division*, San Diego, CA, March 28–April 1.
- 'Why be Natural?', *Naturalness, Hierarchy, and Fine-Tuning*, RTWH Aachen University, Aachen, Germany, Feb. 28–March 1.*

2017

- 'Non-Locality in Intrinsic Topologically Ordered Systems', *European Philosophy of Science Association*, University of Exeter, Exeter, U.K., Sept. 6–9. (Accepted for presentation but could not attend.)
- 'Category–Theoretic Radical Ontic Structural Realism', *Rutgers Workshop on Structural Realism and Metaphysics of Science*, Rutgers University, New Brunswick, NJ, May 18–19.*

2016

- 'What Explains the Spin–Statistics Connection?', *Metro-Area Philosophy of Science Group*, New York University, New York, NY, Dec. 9.*
- 'Emergence and Mechanism in the Fractional Quantum Hall Effect', *18th U.K. and European Meeting on the Foundations of Physics*, London School of Economics, London, U.K., July 16–18.
- 'Emergence and Mechanism in the Fractional Quantum Hall Effect', *British Society for Philosophy of Science Annual Conference*, Cardiff University, Cardiff, U.K., July 7–8.
- 'What Explains the Spin–Statistics Connection?', *Society for Exact Philosophy*, University of Miami, Coral Gables, FL, May 6–8.
- 'What Explains the Spin–Statistics Connection?', *American Philosophical Association-Pacific Division*, San Francisco, CA, March 30–April 3.

2015

- 'What Explains the Spin–Statistics Connection?', *European Philosophy of Science Association*, Heinrich Heine University, Dusseldorf, Germany, Sept. 23–26.
- Comments on Kerry McKenzie's 'Fundamentality as Structuralist Resource', *First Annual Conference of the Society for the Metaphysics of Science*, Rutgers University, Newark, NJ, Sept. 17–18.*

2014

- 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theory', *Philosophy of Science Association*, Chicago, IL, Nov. 6–9.
- 'What Explains the Spin–Statistics Connection?', *British Society for Philosophy of Science Annual Conference*, University of Cambridge, Cambridge, U.K., July 10–11.
- 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theory', *Society for Exact Philosophy*, California Institute of Technology, Pasadena, CA, June 22–24.

2013

- 'Three Principles of Quantum Gravity in the Condensed Matter Approach', *Beyond Spacetime*, University of Illinois, Chicago, IL, September 27–29.
- 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theory', *European Philosophy of Science Association Conference*, University of Helsinki, Helsinki, Finland, August 28–31.
- 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theory', *17th U.K. and European Meeting on the Foundations of Physics*, Ludwig-Maximilians University, Munich, Germany, July 29–31.
- 'Pragmatists and Purists on CPT Invariance in Relativistic Quantum Field Theory', *British Society for Philosophy of Science Annual Conference*, University of Exeter, Exeter, U.K., July 4–5.

2012

- 'The Emergence of Spacetime in Condensed Matter Approaches to Quantum Gravity', *Reflections on Space, Time & Their Quantum Nature*, Max Planck Institute for Gravitational Physics, Potsdam, Germany, Nov. 26–28.*
- 'Emergence in Effective Field Theories', *Philosophy of Science Association*, San Diego, CA, Nov. 15–17.
- 'Emergence in Effective Field Theories', *Society for Exact Philosophy*, Ohio State, Columbus, OH, Oct. 11–15.
- 'Principles of Quantum Gravity in the Condensed Matter Approach', *British Society for Philosophy of Science Annual Conference*, University of Stirling, Stirling, U.K., July 5–6.

2011

- 'Concepts of Emergence Appropriate for Effective Field Theories', *Emergence and Effective Field Theories*, Perimeter Institute for Theoretical Physics, Waterloo, Canada, Oct. 26–28.*
- 'CPT Invariance, the Spin-Statistics Connection, and the Ontology of Relativistic Quantum Field Theories', *European Philosophy of Science Association Conference*, Athens, Greece, Oct. 5–8.
- 'CPT Invariance, the Spin-Statistics Connection, and the Ontology of Relativistic Quantum Field Theories', *27th Boulder Conference on the History & Philosophy of Science*, University of Colorado, Boulder, CO, Sept. 23–25.
- 'CPT Invariance, the Spin-Statistics Connection, and the Ontology of Relativistic Quantum Field Theories', *British Society for Philosophy of Science Annual Conference*, University of Sussex, Brighton, U.K., July 7–8. (Accepted for presentation but could not attend.)

2010

- 'Category-Theoretic Structure and Radical Ontic Structural Realism', *Structure and Identity*, University of Bristol, Bristol, UK, July 23–25.
- 'Interpreting Effective Field Theories', *British Society for Philosophy of Science Annual Conference*, University of Dublin, Dublin, Ireland, July 8–9.
- 'Interpreting Effective Field Theories', *16th U.K. and European Meeting on the Foundations of Physics*, University of Aberdeen, Aberdeen, UK, July 5–7.

2009

- 'Motivating Structural Realist Interpretations of Spacetime', *Metaphysics of Science*, University of Melbourne, Melbourne, Australia, July 2–5.
- 'Intertheoretic Implications of Non-Relativistic Quantum Field Theories', *Workshop on the Philosophy of Quantum Field Theory*, University of Western Ontario, London, Canada, April 24–26.*

2008

- 'Motivating Structural Realist Interpretations of Spacetime', *Studia Logica International Conference: Logic and the Foundations of Physics (Trends6)*, Brussels, Belgium, Dec. 11–12.
- 'Quantum Field Theories in Classical Spacetimes and Particles', *Philosophy of Science Association 2008*, Pittsburgh, PA, Nov. 6–8.
- 'The Spin-Statistics Theorem and Non-Relativistic Quantum Field Theories', *Theoretical and Experimental Aspects of the Spin-Statistics Connection and Related Symmetries (Spin-Stat2008)*, Istituto Nazionale di Fisica Nucleare Sezione di Trieste, Trieste, Italy, Oct. 21–25. (Accepted for presentation but could not attend.)
- 'Quantum Field Theories in Classical Spacetimes and Particles', *British Society for Philosophy of Science Annual Conference*, University of St. Andrews, St. Andrews, UK, July 10–11.

- 'Relativity and Quantum Field Theory', *3rd International Conference on the Ontology of Spacetime*, Concordia University, Montreal, Canada, June 13–15.

2007

- 'Condensed Matter Physics, Emergent Spacetime, and Structural Realism', *15th U.K. and European Meeting on the Foundations of Physics*, University of Leeds, Leeds, UK, March 29–31.

2006

- 'Condensed Matter Physics and the Nature of Spacetime', *2nd International Conference on the Ontology of Spacetime*, Concordia University, Montreal, Canada, June 9–11.
- 'Emergent Spacetime and Structural Realism', *Society for Exact Philosophy*, UCSD, La Jolla, CA, May 18–21.

2005

- 'Reductionism and Emergentism in Contemporary Physics', Othmer Institute for Interdisciplinary Studies, Polytechnic University, Brooklyn, NY, Oct.*
- 'Conceptual Foundations of Quantum Information Theory', Othmer Institute for Interdisciplinary Studies, Polytechnic University, Brooklyn, NY, Feb.*

2004

- 'Spacetime Structuralism', *1st International Conference on the Ontology of Spacetime*, Concordia University, Montreal, Canada, May 11–14.

2003

- 'How to be a Semantic Realist With Respect to Yang-Mills Gauge Theories', Department of Philosophy, University of Minnesota, Minneapolis, MN, Feb.*

2002

- 'Einstein Algebras and the Hole Argument', *Philosophy of Science Association*, Milwaukee, WI, Nov. 7–9.
- 'How to be a Semantic Realist With Respect to Yang-Mills Gauge Theories', *Probing the Boundaries of Mathematics and Physics*, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, Oct.*
- 'Philosophy and Physics: Tachyons, Causality, and Special Relativity', Interdisciplinary Physics Group, Polytechnic University, Brooklyn, NY, March.*

1999

- 'Weinberg on QFT: Demonstrative Induction and Underdetermination', Department of Humanities and Social Sciences, Polytechnic University, Brooklyn, NY, March.*

REFEREEING AND REVIEWING

- External reviewer, PhD thesis, Department of Philosophy, University of Sydney, January 2014.
- Journal referee for: *Philosophy of Science*; *Studies in History and Philosophy of Modern Physics*; *British Journal for Philosophy of Science*; *European Journal for Philosophy of Science*; *European Philosophy of Science Association Proceedings*; *Erkenntnis*; *Synthese*; *International Studies in the Philosophy of Science*; *HOPOS: The Journal of the International Society for the History of Philosophy of Science*; *Foundations of Physics*; *Journal for General Philosophy of Science*; *Philosophy Compass*; *Nous*.
- Referee (book chapter) for Wiley & Sons; Elsevier Press.
- Grant reviewer for National Science Foundation (NSF); Social Sciences and Humanities Research Council of Canada (SSHRC); French National Research Agency (ANR); Fonds de recherche du Québec (FRQ).
- Book proposal reviewer for Cambridge University Press; Oxford University Press; Bloomsbury Publishing; Longman Publishers; Imperial College Press.
- Book manuscript reviewer for Oxford University Press; Elsevier Press; SUNY Press.
- Article reviewer for *Mathematical Reviews*.

AWARDS AND FELLOWSHIPS

- Othmer Junior Faculty Fellowship, Othmer Institute for Interdisciplinary Studies, Polytechnic University, 2004–2006 (\$10,000).

UNIVERSITY SERVICE

- Tenure and Promotion Committee, NYU-Tandon, 2019-present.
- Steering Committee, Cross-School Minor in Science and Society, NYU, 2014–present.
- Search Committee, Dibner Chair in History & Philosophy of Technology & Science, NYU-Tandon, 2018-2019.
- Search Committee, Industry Assistant Professor of Ethics & Engineering, NYU-Tandon, 2018-19.
- Search Committee, Industry Assistant Professor of Science & Technology Studies, NYU-Tandon, 2016–17.
- Executive Committee, Dept. of Technology, Culture & Society, NYU-Tandon, 2010–17.
- Undergraduate Curriculum and Standards Committee, NYU-Tandon, 2008–17.
- Strategic Planning Committee, Dept. of Technology, Culture & Society, NYU-Tandon, 2015.
- Co-Director, Science and Technology Studies program, NYU-Tandon, 2010–15.
- Development Committee, Cross-School Minor in Science and Society, NYU, 2010–12.
- Middle States Accreditation Working Group II, NYU-Tandon, 2010–12.
- TCS Curriculum Committee, NYU-Tandon, 2006–11.
- Advisor, Undergraduate Program in Science & Technology Studies, NYU-Tandon, 2008–09.
- Non-Engineering Freshman Curriculum Committee, NYU-Tandon, 2008.
- Graduate Curriculum and Standards Committee, Polytechnic Univ./NYU-Tandon, 2002–08.
- Development Committee, Undergrad Program in Science & Technology Studies, Polytechnic Univ., 2006–07.
- Search Committee, Dibner Chair in History & Philosophy of Technology & Science, Polytechnic Univ., 2005–07.
- Chair, Institutional Review Board, Polytechnic Univ., 2001–07.
- Honors College mentor, Polytechnic Univ., 2004–06.
- Development Committee, Polytechnic Nanotechnology Initiative, Polytechnic Univ., 2004.
- Quality Learning Environment Team, Polytechnic Univ., 2001–04.
- Development Committee, Undergraduate Program in Interdisciplinary Physics, Polytechnic Univ., 2001.
- Development Committee, Undergraduate Program in Liberal Studies-Philosophy, Polytechnic Univ., 1999–01.
- Professional Review Development Committee, Dept. of Humanities & Social Sciences, Polytechnic Univ., 2000.
- Search Committee, Assistant Professor of Psychology, Polytechnic Univ., 1999–00.

MENTORING AND ADVISING

NYU-Tandon

- *Faculty Mentor*, Science and Technology Studies, 2010–present.
- *Supervisor (*)/External Reader (†)*, Science and Technology Studies Senior Capstone:
 - Spr. 2019. Sindhu Avuthu (STS, biomolecular science concentration) "Embodying Inequality: Effects on Race and Epigenetics on Public Health Disparities".†
 - Summer 2018. San Wong You (STS, EE concentration), "Wind Farms and Environmental Impact in Palm Springs, California".*
 - Spr. 2015. Diego Tasso (STS, physics concentration), "Theory, Practice, and Scientific Progress: An Analysis of late 19th Century Electrical Theory versus Practice Debates".*
 - F. 2013. Deniss Vinogradov (STS, physics concentration), "The Quantum Hypothesis and Physics of Principle".*
 - F. 2010. Sirazum Islam (STS), "Social Constructivism in the Diagnosis and Treatment of Schizophrenia".*

- Spr. 2010. Ricardo Davis (STS, chemistry concentration), "Mathematics Education in the U.S. in the 20th Century and Tacit Knowledge".*
- Spr. 2010. Volkan Turgut (STS, physics concentration), "Technological Determinism".*
- Spr. 2008. David Darling (STS, ME concentration), "Defining and Demarcating Unscientific Principles for the Purpose of Advancing Scientific Understanding".*
- Supervisor, Undergraduate Summer Research Program:
 - 2020. "ER=EPR? Topology and Quantum Entanglement". Nigel Shen (STS, NYU-Tandon; Physics, NYU).
 - 2019. "Spacetime and Entanglement". Gabriela Avila (Applied Physics, NYU-Tandon); Sam Granade (Physics & Math, NYU-Tandon).
 - 2018. "Holographic Spacetime and Quantum Error Correction Codes". Mengmeng Li (Honors Math, NYU-Shanghai); Edison Murairi (Physics, NYU-Abu Dhabi).
 - 2017. "Non-Locality in Intrinsic Topologically Ordered Systems". Avedis Baghdasarian (ME, NYU-Tandon).
 - 2016. "Topological Order and Emergence". Song-Chen Xia (Applied Physics/STS, NYU-Tandon).
 - 2015. "Emergence in the Fractional Quantum Hall Effect". Louis Ramirez (STS, NYU-Poly); Wells Santos (CE/CS, NYU-Poly).
 - 2015. "What Explains the Spin-Statistics Connection?" Hind Al-Tantawi (ME, NYU-Abu Dhabi); Shearyar Khan (Applied Physics, NYU-Poly).
 - 2014. "The Explanatory Power of 19th Century Mechanical Models of the Electromagnetic Aether". Yikal Abe (EE, NYU-Abu Dhabi); Felipe Pereira (EE, NYU-Poly); Wells Santos (CE/CS, NYU-Poly).

NYU-Gallatin

- Supervisor, Senior Project:
 - Spr. 2018. Melody Xu (History of Science concentration, Science and Society minor), "History of Artificial Intelligence: A Historical Analysis of Newell and Simon's Physical Symbol System Approach to AI in the 1950s-1960s". Honors distinction.
- Committee member, Undergraduate Colloquium:
 - F. 2017. Melody Xu "The History and Philosophy of Intelligence Studies".
 - Spr. 2011. Zhipan Ren "The Mind-Body Problem and the Problem of Physical Determinism".

TEACHING

Undergraduate Courses Taught at NYU-Tandon

Intro

Science, Technology, and Society (history & philosophy of science; science & technology studies)

Space and Spacetime (history and philosophy of space)

Social Philosophy

Science and Psuedoscience

Symbolic Logic

Conceptual Mathematics: Intro to Category Theory (mathematics course)

Intro to 20th Century Physics (physics course)

Intermediate

Relativity and Spacetime (philosophy of special and general relativity)

Quantum Mechanics and Information (philosophy of quantum mechanics)

From Heat Engines to Black Holes (history & philosophy of thermodynamics)

Magic, Medicine and Science (history & philosophy of science)

Advanced

History of Light (history & philosophy of electrodynamics)
Physics, Information, and Computation (philosophy of physics)
Philosophy of Science
Philosophy of Mathematics
Metalogic
Seminar in Science and Technology Studies
Senior Capstone, Science and Technology Studies

Guided Study

Category Theory
Minds and Machines (philosophy of mind)
Whitehead

CURRENT RESEARCH

1. 'Motivating ER=EPR', in preparation.