

December 2019

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## CURRENT ACADEMIC POSITION

- Visiting Scholar, *Max-Planck-Institut für Wissenschaftsgeschichte*, December 2019–November 2022.
- Professor, Program in the History of Science, Technology, and Medicine & School of Physics and Astronomy, University of Minnesota.

## EDUCATION

- Ph.D., 1995. History and Philosophy of Science, University of Pittsburgh. Dissertation: *A Comparison between Lorentz's Ether Theory and Einstein's Special Theory of Relativity in the Light of the Experiments of Trouton and Noble*.
- Doctoraal ( $\approx$ M.S.), 1988 Theoretical physics, cum laude, Universiteit van Amsterdam. Thesis: Part 1: *Construction of a Symplectic Form on a Manifold of Field Configurations*. Part 2: *H. A. Lorentz's Attempt to Give a Coordinate Free Formulation of Einstein's General Theory of Relativity*.
- Kandidaats ( $\approx$ B.S.), 1983. Physics, Universiteit van Amsterdam.
- Kandidaats ( $\approx$ B.A.), 1982. Philosophy, cum laude, Universiteit van Amsterdam.

## PAST ACADEMIC POSITIONS

- Visiting Scholar, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, Spring 2016; academic year 2008–2009; summers 1994–1995, 1998–2007, 2015–2018.
- Resident Fellow, Minnesota Center for Philosophy of Science, University of Minnesota, 2000–2018.
- Affiliated Faculty Member, Department of Philosophy, University of Minnesota, 2011–2018.
- Visiting Fellow, Center for Philosophy of Science, University of Pittsburgh, Fall 2015.
- Associate Professor, Program in the History of Science, Technology, and Medicine & School of Physics and Astronomy, University of Minnesota, 2005–2013 (Assistant Professor, 2000–2005).
- Assistant Professor, Department of Philosophy, Boston University, 1997–2000 (Adjunct Assistant Professor, 1995–1997; Associate Director, Center for Einstein Studies, 1997–2000).
- Co-Editor, Einstein Papers Project, Princeton University Press, 1998–1999 (Associate Editor, 1995–1998; Contributing Editor, Summers 1991–1992, Fall 1999).

## AWARDS & HONORS

- Humboldt Research Award, The Alexander von Humboldt Foundation, 2016
- Corresponding Member, International Academy of the History of Science (elected 2015).
- Fellow, American Physical Society (elected 2010).
- George W. Taylor Career Development Award, Institute of Technology, University of Minnesota, 2005.
- John Clarke Slater Fellowship, American Philosophical Society, 1994–1995.
- Andrew Mellon Predoctoral Fellowship, 1993–1994.
- Fulbright Grant (Graduate Student Category), 1989–1990.

## PUBLICATIONS

### BOOKS AND EDITED VOLUMES

- *Putting Probabilities First. How Hilbert Space Generates and Constrains Them.* With Michael Janas and Michael E. Cuffaro. To be published as a *SpringerBrief*. Expected Fall 2020.
- *How Einstein Found His Field Equations. A Source Book.* With Jürgen Renn. New York: Springer. Expected Fall 2020.
- *Constructing Quantum Mechanics.* Vol. 1. *The Scaffold, 1900–1923.* Vol. 2. *The Arch, 1923–1927.* With Anthony Duncan. Oxford: Oxford University Press. Vol. 1 (2019), Vol. 2 (expected 2022).
- *The Collected Papers of Albert Einstein.* Vol. 15. *The Berlin Years: Writings & Correspondence, June 1925–May 1927.* Princeton: Princeton University Press, 2018. Contributing editor. Editors: Diana Kormos Buchwald et al.
- “Making the History of Physics Dirtier: Solid State Physics in the Twentieth Century.” Special issue of *Historical Studies in the Natural Sciences* 45 (2015): 631–804. Co-edited with Joseph D. Martin
  - “Beyond the Crystal Maze: Twentieth-Century Physics from the Vantage Point of Solid State Physics.” With Joseph D. Martin. Pp. 631–640.
- *The Cambridge Companion to Einstein.* Co-edited with Christoph Lehner. Cambridge: Cambridge University Press, 2014.
  - “Introduction.” Pp. 1–37. Janssen, Lehner.
  - “‘No Success Like Failure ...’: Einstein’s Quest for General Relativity, 1907–1920.” Pp. 167–227.
  - “Appendix: Special Relativity.” Pp. 455–506.
- *Einstein’s Zurich Notebook.* Vol. 1, *Introduction and Source,* and Vol. 2, *Commentary and Essays.* Dordrecht: Springer, 2007. Co-authored with John D. Norton, Jürgen Renn, Tilman Sauer, and John Stachel.
  - “Introduction to Volumes 1 and 2: The Zurich Notebook and the Genesis of General Relativity.” Pp. 6–20. Janssen, Norton, Renn, Sauer, Stachel.
  - “A Commentary on the Notes on Gravity in the Zurich Notebook.” Pp. 489–714. Janssen, Renn, Sauer, Norton, Stachel.
  - “What Did Einstein Know and When Did He Know It? A Besso Memo Dated August 1913.” Pp. 785–837. Janssen.

- “Untying the Knot: How Einstein Found His Way Back to Field Equations Discarded in the Zurich Notebook.” Pp. 839–925. Janssen, Renn.
- “2005: The Centenary of Einstein’s Annus Mirabilis.” Special issue of *Studies in History and Philosophy of Modern Physics* 37 (2006): 1–242. Guest Editor.
  - “Introduction.” Pp. 1–4.
- *The Collected Papers of Albert Einstein*. Vol. 7. *The Berlin Years: Writings, 1918–1921*. Princeton: Princeton University Press, 2002. Lead editor. Other editors: Robert Schulmann, József Illy, Christoph Lehner, and Diana Kormos Buchwald.
- *The Collected Papers of Albert Einstein*. Vol. 8. *The Berlin Years: Correspondence, 1914–1918*. Princeton: Princeton University Press, 1998. Co-edited with Robert Schulmann, A. J. Kox, and József Illy.
- *The Collected Papers of Albert Einstein*. Vol. 4. *The Swiss Years: Writings, 1912–1914*. Princeton: Princeton University Press, 1995. Contributing editor. Editor: Martin J. Klein et al.
- *Einstein Studies*. Vol. 5. *The Attraction of Gravitation. New Studies in the History of General Relativity*. Boston: Birkhäuser, 1993. Co-edited with John Earman and John D. Norton.

#### ARTICLES AND CHAPTERS IN EDITED VOLUMES<sup>1</sup>

- “Sleeping Beauty on Monty Hall.” With Sergio Pernice. Preprint (2019).
- “How did Lorentz find his theorem of corresponding states?” *Studies in History and Philosophy of Modern Physics* 67 (2019): 167–175.\*
- “Arches and Scaffolds: Bridging Continuity and Discontinuity in Theory Change.” Pp. 95–199 in: Alan C. Love and William C. Wimsatt (eds.), *Beyond the Meme. Development and Structure in Cultural Evolution*. Minneapolis: University of Minnesota Press, 2019.\*
- “Ce que l’on doit aux mathématiques.” With Jürgen Renn. *La Recherche* 16 (2015): 18–21.
- “Einstein was no lone genius.” With Jürgen Renn. *Nature* 527, 298–300 (19 November 2015).
- “Arch and scaffold: How Einstein found his field equations.” With Jürgen Renn. *Physics Today*, November 2015, pp. 30–36\*
  - Japanese translation: *Parity* 2017 (10): 21–30.
- “Von verbotenen Räumen und krummen Zeiten.” With Jürgen Renn. *Kultur & Technik*, 2015, No. 4, pp. 10–15.
- “Einsteins Weg zur allgemeinen Relativitätstheorie.” With Jürgen Renn. *Spektrum der Wissenschaften*, October 2015, pp. 48–55.
- “The Stark Effect in the Bohr-Sommerfeld Theory and in Schrödinger’s Wave Mechanics.” With Anthony Duncan. Pp. 217–271 in Finn Aaserud and Helge Kragh (Eds.), *One Hundred Years of the Bohr Atom. Proceedings from a Conference. (Scientia Danica. Series M, Mathematica et Physica, Vol. 1)*. Copenhagen: Det Kongelige Danske Videnskabernes Selskab, 2015.\*
- “The Trouble with Orbits: The Stark effect in the Old and the New Quantum Theory.” With Anthony Duncan. *Studies in History and Philosophy of Modern Physics* 48 (2014): 68–83.\*
- “Kuhn Losses Regained: Van Vleck from Spectra to Susceptibilities.” With Charles Midwinter. Pp. 137–205 in: Massimiliano Badino and Jaume Navarro, Eds., *Research and Pedagogy: A History of Early Quantum Physics through its Textbooks*. Berlin: Edition Open Access, 2013.\*

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<sup>1</sup> Refereed articles are marked with an asterisk.

- “(Never) Mind your  $p$ 's and  $q$ 's: Von Neumann versus Jordan on the Foundations of Quantum Theory.” With Anthony Duncan. *The European Physical Journal H—Historical Perspectives on Contemporary Physics* 38 (2013): 175–259.\*
- “The Twins and the Bucket: How Einstein Made Gravity rather than Motion Relative in General Relativity.” *Studies in History and Philosophy of Modern Physics* 43 (2012): 159–175.\*
- “Lorentz als wegbereider voor de speciale relativiteitstheorie.” With Anne J. Kox. *Nederlands Tijdschrift voor Natuurkunde* 77 (2011): 344–347.
- “From Canonical Transformations to Transformation Theory, 1926–1927: The Road to Jordan's Neue Begründung.” With Anthony Duncan. *Studies in History and Philosophy of Modern Physics* 40 (2009): 352–362.\*
- “Drawing the Line between Kinematics and Dynamics in Special Relativity.” *Studies in History and Philosophy of Modern Physics* 40 (2009) 26–52.\*
  - Expanded version of sec. 2 reprinted as: “The Drag Coefficient from Fresnel to Laue.” Pp. 47–60 in: Ad Maas and Henriëtte Schatz, Eds., *Physics as a Calling. Science for Society. Studies in Honour of A. J. Kox*. Leiden: Leiden University Press, 2013.
- “Pascual Jordan's Resolution of the Conundrum of the Wave-Particle Duality of Light.” With Anthony Duncan. *Studies in History and Philosophy of Modern Physics* 39 (2008): 634–666.\*
- “Lorentz, Hendrik Antoon (Postscript).” With Anne J. Kox. Pp. 333–336 in: Noretta Koertge (ed.), *Complete Dictionary of Scientific Biography*. Vol. 22. Detroit: Charles Scribner's Sons, 2008.
- “On the Verge of Umdeutung in Minnesota: Van Vleck and the Correspondence Principle.” 2 Pts. With Anthony Duncan. *Archive for History of Exact Sciences* 61 (2007): 553–624, 625–671.\*
- “From Classical to Relativistic Mechanics: Electromagnetic Models of the Electron.” With Matthew Mecklenburg. Pp. 65–134 in: V. F. Hendricks, K. F. Jørgensen, J. Lützen, and S. A. Pedersen (eds.), *Interactions: Mathematics, Physics and Philosophy, 1860–1930*. Berlin: Springer, 2007.\*
- “Of Pots and Holes: Einstein's Bumpy Road to General Relativity.” *Annalen der Physik* 14, Supplement (2005): 58–85.\*
- “Relativity.” Pp. 2039–2047 in: Maryanne Cline Horowitz et al. (eds.), *New Dictionary of the History of Ideas*. New York: Charles Scribner's Sons, 2004.
- “L'Optica e l'elettrodinamica dei corpi in movimento.” With John Stachel. Pp. 363–379 in: Sandro Petruccioli et al. (eds.), *Storia Della Scienza*, Vol. 8. Rome: Istituto della Enciclopedia Italiana, 2004.
  - English original, “Optics and Electrodynamics in Moving Bodies,” to appear in: John Stachel, *Going Critical*. Dordrecht: Springer.
- “Local Sidemen Go Back to the Tracks: Unsung Heroes of a Dylan Masterpiece Restage Seward Sessions.” *Seward Profile* 34 (2004) No. 12, pp. 1, 5.
- “A Glimpse Behind the Curtain of the Wizard/Un coup d'œil derrière le rideau du magicien.” In: *The Einstein-Besso Manuscript: From Special Relativity to General Relativity/Le manuscrit Einstein-Besso: De la Relativité Restreinte à la Relativité Générale*. Paris: Scriptura and Aristophile, 2003.
  - Reprint and translation of: “Einstein Manuscripts on Relativity.” In: *The History of Quantum Mechanics and the Theory of Relativity* (Christie's Auction Catalog), 2002. Pp. 99–113, pp. 119–122.
  - Earlier version: “The Einstein-Besso Manuscript, the Perihelion Motion of Mercury, and the Genesis of the General Theory of Relativity.” In: *The Einstein-Besso Working Manuscript* (Christie's Auction Catalog), 1996.

- “Albert Einstein.” Pp. 205–208 in: John S. Rigden (ed.), *Building Blocks of Matter: A Supplement to the Macmillan Encyclopedia of Physics*. New York: Macmillan, 2003.
- “Presentism and Relativity.” With Yuri Balashov. *The British Journal for the Philosophy of Science* 54 (2003): 327–346.
  - Reprinted in: L. Nathan Oaklander (ed.), *The Philosophy of Time: Time and Physics*. Vol. 4. London: Routledge, 2008.\*
- “The Trouton Experiment,  $E = mc^2$ , and a Slice of Minkowski Space-Time.” Pp. 27–54 in: Abhay Ashtekar et al. (ed.), *Revisiting the Foundations of Relativistic Physics: Festschrift in Honor of John Stachel*. Dordrecht: Kluwer, 2003.
- “COI Stories: Explanation and Evidence in the History of Science.” *Perspectives on Science* 10 (2002): 457–522.\*
- “Reconsidering a Scientific Revolution: the Case of Lorentz versus Einstein.” *Physics in Perspective* 4 (2002): 421–446.\*
  - Earlier version: Pp. 153–167 in: Peter Galison, Michael Gordin, and David Kaiser (Eds.). *Science and Society. The History of Modern Physical Science in the Twentieth Century*. Vol. 1. *Making Special Relativity*. New York, Routledge, 2001.
- “Rotation as the Nemesis of Einstein’s Entwurf Theory.” Pp. 127–157 in: Hubert Goenner et al. (eds.), *Einstein Studies*. Vol. 7. *The Expanding Worlds of General Relativity*. Boston: Birkhäuser, 1999.\*
- \* “On the Dating of a Recently Published Einstein Manuscript: Could These Be the Calculations that Gave Einstein Heart Palpitations?” With Robert Schulmann. *Foundations of Physics Letters* 11 (1998): 379–389.\*
- “Einstein’s Explanation of the Motion of Mercury’s Perihelion.” With John Earman. Pp. 129–172 in: John Earman et al. (eds.), *Einstein Studies*. Vol. 5. *The Attraction of Gravitation. New Studies in the History of General Relativity*. Boston: Birkhäuser, 1993.
- “H. A. Lorentz’s Attempt to Give a Coordinate-Free Formulation of the General Theory of Relativity.” Pp. 344–363 in: J. Eisenstaedt and A.J. Kox (eds.), *Einstein Studies*. Vol. 3. *Studies in the History of General Relativity*. Boston: Birkhäuser, 1992.
- “Honderd jaar ‘Michelson and Morley’.” *Nederlands Tijdschrift voor Natuurkunde* A54(1) 1988: 8–11.
- “De tweelingparadox en relativiteit van gelijktijdigheid.” *Stroom* 2 (10) 1988: 13–25.

## BOOK REVIEWS

- Helge Kragh, *Niels Bohr and the Quantum Atom. The Bohr model of Atomic Structure, 1913–1925* (Oxford: Oxford University Press, 2012). In: *Isis* 108 (2017): 219–220.
- Jeroen van Dongen, *Einstein’s Unification* (Cambridge: Cambridge University Press, 2010). In: *Science*, March 6, 2015, Vol. 347, Issue 6226, p. 1078.
- Robert E. Kennedy, *A Student’s Guide to Einstein’s Major Papers* (Oxford: Oxford University Press, 2012). In: *Classical and Quantum Gravity* 30 (2013) 239001.
- Hans C. Ohanian, *Einstein’s Mistakes. The Human Failings of Genius* (New York: Norton, 2008). In: *Physics Today*, June 2009.

## TALKS

- Drawing the Line Between Kinematics and Dynamics in Special Relativity and in Quantum Mechanics.
  - Keynote lecture. Second Chilean Conference on the Philosophy of Physics, Santiago, Chile, December 5, 2019.
  - Quantum Workshop. *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, January 9, 2020.
- From Discreteness to Non-Commutativity: Quantum Conditions, 1900–1927.
  - Keynote lecture. IX Conference on Quantum Foundations, Córdoba, Argentina, November 29, 2019
- Putting Probabilities First. How Hilbert Space Generates and Constrains Them.
  - With Michael Janas and Michael E. Cuffaro. New Directions in the Foundations of Physics, Viterbo, Italy, May 25, 2019
  - Seminar, Final Theory Program Research Group, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, June 5, 2019
- Einstein and the Genesis of General Relativity, 1907–1920.
  - Black Hole Initiative, Harvard University, Cambridge, MA, April 23, 2019
- The Trouble with the I in IBE.
  - Symposium Norton for Everyone? University of Pittsburgh, October 27, 2018.
- Einstein: The Old Sage versus the Young Turk.
  - History of Science and Technology, University of Minnesota, November 15, 2002.
  - Center for Philosophy of Science, University of Pittsburgh, March 21, 2003.
  - *Geschiedenis en grondslagen natuurkunde*, *Universiteit Utrecht*, Utrecht, February 6, 2004.
  - *Einstein und wie man der Natur ihre Geheimnisse ablauscht. Vortragsreihe Der andere Einstein*, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, November 4, 2004.
  - St. John’s University, Collegeville, MN, March 29, 2005.
  - Pacific Northwest Association of College Physics (PNACP), Portland, Oregon, April 15, 2005.
  - Seven Pines IX, Stillwater, Minnesota, May 7, 2005.
  - Department of Physics, University of Maryland, September 12, 2005.
  - Department of Physics, University of Pittsburgh, October 24, 2005.
  - University of Wisconsin–Barron County, October 6, 2006.
  - Committee on the History and Philosophy of Science, Distinguished Speaker Series, University of Colorado at Boulder, February 26, 2007.
  - Bar Hillel Lecture Series, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, October 28, 2013.
  - Bard College, Annandale-on-Hudson, NY, April 6, 2018.
- Dirac, Jordan, and von Neumann: Hilbert Space and Transformation Theory.
  - Colloquium, Department of Physics, University of Colorado Boulder, February 7, 2018.
  - Colloquium, Department of Physics, Georgia Tech, April 2, 2018
- Mermin in Bananaworld: Bub on Quantum Mechanics.

- Colloquium, Department of Physics and Astronomy, Minnesota State University Mankato, September 28, 2017.
- Lunchtime talk, Center for Philosophy of Science, University of Pittsburgh, March 13, 2018.
- Wave Mechanics versus Matrix Mechanics.
  - Invited talk, American Physical Society March Meeting (Session: The Author in Dialogue: A. Douglas Stone’s *Einstein and the Quantum*), Los Angeles, March 6, 2018.
- Einstein from Field Equations to Gravitational Waves (1912–1918).
  - Keynote lecture. 32nd Boulder Conference on HPS, *Gravity: Its History and Philosophy*. University of Colorado at Boulder, October 28–30, 2016.
- From Common Origin Inference to Common Origin Idea.
  - Center for Philosophy of Science, University of Pittsburgh, September 18, 2015.
  - HSTM colloquium, University of Minnesota, September 9, 2016
- Arches and Scaffolds: Bridging Continuity and Discontinuity in Theory Change.
  - *Séminaire d’histoire et philosophie de la physique de l’UMR SPHere, Université Paris VII Denis Diderot*, Paris, March 15, 2016.
  - *Forschungskolloquium zur Wissenschaftsgeschichte, Institut für Philosophie, Literatur-, Wissenschafts- und Technikgeschichte, Technische Universität*, Berlin, May 25, 2016.
- *Het Einstein-De Sitter debat (1916–18): Het start schot voor de moderne kosmologie*.
  - *Lezingenserie “Einstein & Friends,” Museum Boerhaave*, Leyden, January 26, 2016.
- Arch and Scaffold. How Einstein Found His Field Equations.
  - Colloquium, Department of Physics and Astronomy, University of Pittsburgh, November 3, 2015.
  - Conference, *General Relativity at 100*, Institute for Advanced Study, Princeton, November 5, 2015.
  - Joint Colloquium, Departments of Physics and Philosophy, Macalester College, November 23, 2015.
- $\frac{1}{2} + \frac{1}{2} = 1$ . The Accidental Success of the Old Quantum Theory.
  - With Anthony Duncan. HQ4, conference on the history of quantum physics, San Sebastián, Spain, July 16, 2015.
- Minkowskian Pedagogy: Explanation in Special Relativity.
  - Harveyfest, University of Oxford, July 14, 2015.
- Einstein’s 1913 Vienna Lecture: Modeling Gravitational Theory on Electrodynamics.
  - With Jürgen Renn. Session Einstein and the relation between physics and mathematics. History of Science Society, Chicago, November 6, 2014.
  - Colloquium, School of Physics and Astronomy, University of Minnesota, February 18, 2015.
  - Symposium, *100th Anniversary of General Relativity*, Center for Philosophy and History of Science & Center for Einstein Studies, Boston University, March 27, 2015.
- ‘No Success Like Failure ...’: Einstein’s Quest for General Relativity, 1907–1920.
  - *Außerordentliches Seminar in Theoretischer Physik, Eidgenössische Technische Hochschule*, Zurich, June 25, 1998.
  - Einstein Papers Project, Caltech, Pasadena, California, April 25, 2002.
  - Gravity Theory Seminar, Department of Physics, University of Maryland, April 28, 2010.

- Senior Seminar, Physics & Astronomy / Joint Colloquium, Physics & Astronomy and Philosophy, Macalester College, St. Paul, February 18, 2011.
- Colloquium, Astrophysics Group, Michigan State University, East Lansing, MI, April 7, 2011.
- Symposium, *100th Anniversary of General Relativity*, Center for Philosophy and History of Science & Center for Einstein Studies, Boston University, March 27, 2015.
- From the Einstein-De Sitter Debate to the Expanding Universe.
  - Colloquium, Department of Physics, Swenson College of Science and Engineering, University of Minnesota Duluth, March 5, 2015.
- Arches and Scaffoldings in the Construction of Relativity and Quantum Theory.
  - Keynote lecture, Conference *Continuity and Discontinuity in the Physical Sciences Since the Enlightenment*. Center for History of Physics, American Institute of Physics. Washington, DC, July 30, 2011.
  - HSTM colloquium/Kuhnfest Keynote lecture, University of Minnesota, November 30, 2012.
  - Annual Alumni Lecture, Department of History and Philosophy of Science, University of Pittsburgh, March 21, 2013.
  - *Mara Beller Memorial Lecture*, Van Leer Institute, Jerusalem, October 30, 2013.
  - Third International Interdisciplinary Summer School on History and Philosophy of Science, Forum Scientiarum, Eberhard Karls Universität Tübingen, August 4–8, 2014 [five sessions].
  - Workshop *Beyond the Meme: Articulating Dynamic Structures in Cultural Evolution* Minnesota Center for Philosophy of Science, University of Minnesota, October 17, 2014.
- Kuhn Losses Regained: Van Vleck from Spectra to Susceptibilities
  - Session *Research and Pedagogy: A History of Quantum Physics through the Textbooks*. (II) *Quantum Books in a Time of Fast Change*, History of Science Society (HSS), Phoenix, AZ, November 21, 2009.
  - With Charles Midwinter. Session: *J. H. Van Vleck: Quantum Theory and Magnetism*. American Physical Society, March Meeting, Dallas, TX, March 22, 2011.
  - Physics and Astronomy Colloquium, University of Minnesota, October 31, 2012.
  - Science Studies Colloquium, University of California at San Diego, February 11, 2013.
  - Session *Historical Perspectives on Teaching Physics*, American Association of Physics Teachers (AAPT), Minneapolis, MN, July 28, 2014.
- “Building Castles in the Sky ...”: Why Einstein Introduced the Cosmological Constant.
  - Symposium *Einstein in Berlin: the First Ten Years*. The Boston Colloquium for the Philosophy and History of Science, March 3, 1997.
  - *Geschiedenis en grondslagen natuurkunde*, Universiteit Utrecht, Utrecht, June 19, 1998.
  - Department of Physics, University of Minnesota, January 23, 2002.
  - Department of Physics, University of Pittsburgh, March 15, 2002.
  - Department of Physics, Universiteit van Amsterdam, June 20, 2002.
  - Society for History of the Exact Sciences and Niels Bohr Archive, Copenhagen, October 1, 2002.
  - *Einstein en De Sitter aan de wieg van de relativistische kosmologie*. *Studium Generale*, Universiteit van Leiden, Leyden March 16, 2005.
  - Astrophysics Colloquium, University of Minnesota, October 20, 2006.
  - Seven Pines XII, Stillwater, Minnesota, May 8, 2008.



- Cosmology Lunchtime Seminar, School of Physics and Astronomy, University of Minnesota, March 10, 2014.
- Stark Contrasts Between the Old and the New Quantum Theory.
  - With Anthony Duncan. Conference, *One hundred years of the Bohr atom*, Copenhagen, June 11, 2013.
- How to Make Judicious Use of Current Physics in Reconstructing its History.
  - Pais Prize Session for Roger Stuewer, American Physical Society, April Meeting, Denver, CO, April 15, 2013.
- Pascual Jordan's Resolution of the Conundrum of the Wave-Particle Duality of Light.
  - With Anthony Duncan. HQ1, conference on the history of quantum physics, Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, July 2–6, 2007
  - Philosophy of Physics Research Seminar, University of Oxford, October 23, 2008.
  - Colloquium History of Science and Technology, University of Minnesota, October 30, 2009.
  - Physics and Astronomy Colloquium, University of Minnesota, February 17, 2010.
  - Maryland Center for Fundamental Physics Colloquium, University of Maryland, April 29, 2010.
  - Physics & Philosophy Seminar, Macalester College, November 8, 2012.
- Einstein's Most Revolutionary Work: The Young Turk's Contributions to Early Quantum Theory.
  - Colloquium, Chemistry Department Seminar, Carleton College, January 20, 2012.
- (Never) Mind your  $p$ 's and  $q$ 's: von Neumann versus Jordan on the Foundations of Quantum Theory.
  - With Anthony Duncan. New Directions in the Foundations of Physics, Washington, DC, April 30, 2010.
  - With Anthony Duncan. HQ3, conference on the history of quantum physics, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, July 3, 2010.
- Van Vleck and Slater: Two Americans on the Road to Matrix Mechanics.
  - Seven Pines VIII, Stillwater, Minnesota, May 6, 2004.
  - New Directions in Foundations of Physics, Washington, DC, April 29, 2005.
  - Session *The Practices of Quantum Mechanics*, History of Science Society (HSS), Minneapolis, November 5, 2005.
  - With Anthony Duncan. HQ0, workshop on history of quantum physics, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, June 14 and July 6, 2006.
  - Physics & Astronomy Colloquium, University of Minnesota, September 13, 2006.
  - Lectures on Quantum Phenomena, Public Lecture Series of Pacific Institute of Theoretical Physics (PITP), University of British Columbia, Vancouver, January 10, 2007.
  - Physics and Astronomy Colloquium, Minnesota State University Mankato, March 29, 2007.
  - Department of History and Philosophy of Science, Indiana University, October 5, 2007.
  - Session 80 Years of Quantum Mechanics, American Physical Society, St. Louis, Missouri, April 14, 2008.
  - Mack Lecture, Department of Physics, University of Wisconsin–Madison, September 18, 2009.
  - Physics Colloquium, St. Olaf College, Northfield, MN, October 7, 2009.
- Transformation Theory from the *Dreimännerarbeit* to Jordan's *Neue Begründung*.

- With Anthony Duncan. HQ2, conference on the history of quantum physics, Institute for History and Foundations of Science, Universiteit Utrecht, July 14, 2008.
- How to Draw the Line between Kinematics and Dynamics.
  - Symposium *Time and Relativity*, Institute for Advanced Study, University of Minnesota, October 26, 2007.
  - Colloquium Foundations of Physics, University of Maryland, November 5, 2007.
  - Boston Colloquium for Philosophy of Science, Boston University, March 17, 2008.
- How Einstein Found His Field Equations.
  - Department of Mathematics, University of Minnesota, February 22, 2005.
  - With Jürgen Renn. Seventh International Conference on the History of General Relativity (HGR7), Tenerife, Spain, March 11, 2005
  - Department of Physics, University of Maryland, September 12, 2005.
  - With Jürgen Renn. 11th Marcel Grossmann Meeting on General Relativity, Freie Universität, Berlin, July 27, 2006.
- Common Origin Inferences.
  - *Wissenschaftstheorie und Wissenschaftsgeschichte Kolloquium*, University of Berne, Berne, June 16, 2000.
  - University of British Columbia, Vancouver, September 27, 2001.
  - History of Science Society (HSS), Denver, Colorado, November 11, 2001.
  - Conference *Assessing Evidence in Physics*, Department of Philosophy, University of Western Ontario, London, Ontario, May 13, 2005.
  - Department of Philosophy, Johns Hopkins University, September 14, 2005.
- The Trouton Experiment and  $E = mc^2$ .
  - Workshop *Space-time, Quantum Entanglement, and Critical Epistemology*, Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, June 6, 1998.
  - Minnesota American Association of Physics Teachers (MAAPT), Augsburg College, St. Paul, October 25, 2003.
  - Session *Einstein in Historical and Philosophical Perspective*, American Association for the Advancement of Science (AAAS), Washington, DC, February 20, 2005.
  - Symposium *Heuristics, Discovery and Innovation Culture: Einstein's Annus Mirabilis*. Berne, Switzerland, July 8, 2005.
- The Einstein-Besso Manuscript: The Problem of Mercury's Perihelion and the Problem of Rotation.
  - The Boston Colloquium for the Philosophy and History of Science, Boston University, May 5, 1998.
  - Department of Physics, University of Minnesota, December 2, 1999.
  - Session *Einstein and Friends*, American Physical Society (APS), Tampa, Florida, April 17, 2005.
  - Symposium *Heuristics, Discovery and Innovation Culture: Einstein's Annus Mirabilis*. Berne, Switzerland, July 7, 2005.
- Emergence and Interpretation of Lorentz Invariance.
  - Seven Pines VI, Stillwater, Minnesota, May 16, 2002.
  - American Physical Society (APS), Division of Atomic, Molecular, and Optical Physics (DAMOP), Lincoln, Nebraska, May 21, 2005.

- Einstein: From Unification to Relativity and Back Again.
  - Plenary lecture, American Association of Physics Teachers (AAPT), Albuquerque, NM, January 11, 2005.
- The Electromagnetic View of Nature and the Transition from Classical Particle Mechanics to Relativistic Field Mechanics.
  - Sixth International Conference on the History of General Relativity (HGR6), Universiteit van Amsterdam, June 26, 2002.
  - Conference *The interaction between Mathematics, Physics and Philosophy from 1850 to 1940*, Copenhagen, September 28, 2002.
  - Department of Physics, University of Minnesota, February 19, 2003.
  - *Oberseminar Geschichte der Mathematik, Johannes Gutenberg-Universität, Mainz*, November 9, 2004.
- Dogs, Fleas, and Tree Trunks: Marking the Territory of Boltzmann's  $H$ -Theorem.
  - History of Science Society (HSS), Milwaukee, Wisconsin, November 8, 2002.
  - Center for Austrian Studies, University of Minnesota, February 13, 2003.
- Einstein, Hilbert, and Klein: The Background to Noether's Theorems.
  - With Tilman Sauer. Seven Pines VI, Stillwater, Minnesota, May 17, 2002.
- What Did Einstein Know and When Did He Know It? A Besso Memo Dated August 1913.
  - Fifth International Conference on History and Foundations of General Relativity (HGR5), University of Notre Dame, July 10, 1999.
  - Department of Physics, University of British Columbia, Vancouver, British Columbia, Canada, September 27, 2001.
- Planck's Derivation of His Black-Body Radiation Law Revisited.
  - Symposium *Max Planck and the Quantum*. The Boston Colloquium for the Philosophy and History of Science, Boston University, May 3, 2000.
- Einstein's Zurich Notebook: Coordinate Restrictions and the Search for Gravitational Field Equations.
  - Mark M. Horblit Colloquia in the History of Science, Harvard University, February 29, 2000.
- The Twin Paradox and an Unorthodox Solution to the Problem of Absolute Space.
  - The Boston Colloquium for the Philosophy and History of Science, Boston University, January 25, 1999.
- The Trouton-Noble Experiment: Making a Better Case for Special Relativity.
  - Colloquium Max-Planck-Institut für Bildungsforschung, Berlin, 1994.
  - *Geschiedenis en grondslagen natuurkunde, Universiteit Utrecht*, Utrecht, 1995.
  - Department of Philosophy, Boston University, 1996.
  - Department of Philosophy, University of Notre Dame, January 22, 1999.
- What Einstein Got Right and What he Got Wrong in his First Paper on Gravitational Waves.
  - With Dan Kennefick. Symposium *Einstein in Berlin: the First Ten Years*. The Boston Colloquium for the Philosophy and History of Science, March 3, 1997.
- Rotation as the Nemesis of Einstein's Entwurf theory.
  - Fourth International Conference on History and Foundations of General Relativity (HGR4), Berlin, 1995.
- The Hole Argument: A Cloud over Absolute Space-Time?
  - *Geschiedenis en grondslagen natuurkunde, Universiteit Utrecht*, Utrecht, 1993.

- H. A. Lorentz and the Special Theory of Relativity.
  - Symposium on History and Philosophy of Physics, Nederlandse Natuurkundige Vereniging (NNV), Utrecht, 1989.
- Lorentz's Geometrical Approach to General Relativity.
  - Second International Conference on History of General Relativity (HGR2), Luminy, France, 1988.

## SERVICE

### PROGRAM IN THE HISTORY OF SCIENCE, TECHNOLOGY (& MEDICINE), UNIVERSITY OF MINNESOTA

- Director of Graduate Admissions (2017–2019)
- Director of Graduate Studies, 2010–2014.
- Chair of Search Committee, tenure-track position (in the School of Physics and Astronomy) in the history of the physical sciences pre-1800, 2011–2012.
- Chair of Search Committee, tenure-track position (in the Department of Earth Sciences) in the history of the environmental and earth sciences, 2017–2018.
- Director of Undergraduate Studies, 2002–2008.

### UNIVERSITY OF MINNESOTA

- Coordinator, Physics Interest Group (PIG), Minnesota Center for Philosophy of Science, 2007–2017 (with the exception of the academic years 2008–2009 and 2015–2016).
- Member of search committee, tenure-track position in philosophy of science, Department of Philosophy, 2001–2002, 2002–2003.

### THE HISTORY AND PHILOSOPHY OF SCIENCE PROFESSION

- Member of the selection committee for the Abraham Pais Prize for history of physics of the American Physical Society (2017–2019)
- Member of the Editorial Advisory Board for Einstein Studies book series (since March 2017)
- Member of International Advisory Board, Vossius Center for History of Humanities and Sciences, University of Amsterdam (since 2016).
- Member of the Committee for Integrated History and Philosophy of Science (since December 2015).
- Member of Wissenschaftlicher Beirat for the 2005 exhibit, Albert Einstein—Ingenieur des Universums, Max-Planck-Institut für Wissenschaftsgeschichte, Berlin (2003–2005).
- Member of Wissenschaftlicher Beraterkreis of Arbeitsstelle Albert Einstein, Max-Planck-Institut für Wissenschaftsgeschichte, Berlin (1994–1997).

### CONFERENCE ORGANIZATION

- Quantum Workshop, *Max-Planck-Institut für Wissenschaftsgeschichte*, Berlin, January 9–10, 2020. With Jürgen Jost and Jürgen Renn.
- Chair of the Advisory Board for The Seven Pines Symposium. 2007–2012 (Vice-chair 2005–2007).

- Member of Organizing Committee for series of international conferences on History of Quantum Physics (Utrecht 2008 [HQ2], Berlin 2007 [HQ1], Berlin 2006 [HQ0]).
- Co-organizer (with Antigone Nounou) of Symposium, Time and Relativity, Institute for Advanced Study, University of Minnesota, October 25–27, 2007
- Program director (with Jeremy Butterfield) of Conference, 2005: The Centenary of Einstein’s Annus Mirabilis 1905, British Academy, London, March 4–5, 2005.
- Member of Organizing Committee for the series of international conferences on History and Foundations of General Relativity (Tenerife 2005 [HGR7], Amsterdam 2002 [HGR6], Notre Dame 1999 [HGR5], Berlin 1995 [HGR4], Johnstown 1991 [HGR3]).

## EDITORIAL WORK

- Member of Editorial Advisory Board of *Physics in Perspective* (since spring 2008), *Studies in History and Philosophy of Modern Physics* (since fall 2001), and *The European Physical Journal H—Historical Perspectives on Contemporary Physics* (2009–2014).
- Referee for *American Journal of Physics*, *The British Journal for the Philosophy of Science*, *Canadian Journal of Physics*, *Endeavour*, *European Physical Journal H—Historical Perspectives on Contemporary Physics*, *Historical Studies in the Natural Sciences*, *Isis*, *Philosophy of Science*, *Physics in Perspective*, *Science*, *Studies in History and Philosophy of Modern Physics*, *Synthese*.

## REVIEWING & CONSULTING

- Reviewing book manuscripts for Harvard University Press, Houghton Mifflin, Oxford University Press, Princeton University Press, University of Pittsburgh Press.
- Reviewing grant proposals for National Science Foundation (NSF), Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO), The Leverhulme Trust.
- Consulting and on-camera interview for BBC Horizon special on Einstein, 2005.
- Consulting and on-camera interview for History Channel program on Einstein, 2014.
- Consulting for The 19th Century Shop (rare book and manuscript dealer) on Einstein material, 2005.
- Consulting for Christie’s on auction of Einstein manuscripts, 1996, 2002.

## OUTREACH

- *Tangled Up In Yellow: Quantum Foundations Banana-Flavored.*
  - Public lecture. Second Chilean Conference on the Philosophy of Physics, Santiago, Chile, December 3, 2019.
  - City College New York, March 16, 2020.
- *Quantum mechanics à la Bananaworld.* Co-taught with Peter Grul and Michael Janas. Washburn High School, Minneapolis, May 23, 24, and 25, 2018.
- *The Age of Entanglement: Ten Years Later* (with Louisa Gilder). Co-organized with David Russell and Brian Woodcock. Target Performance Hall, Openbook, Minneapolis, April 12, 2018.
- *Einstein and Judaism.* Beth El Synagogue, St. Louis Park, October 17, 2017.
- *Einstein: A Stage Portrait.* Q&A. Matchbox Theater, Minneapolis, Three shows. September–October 2017.

- Einstein and the Eclipse of 1919. Bell Museum of Natural History, Pre-Eclipse Block Party, August 13, 2017
- Einstein: The Old Sage versus the Young Turk. Café Scientifique, Bryant-Lake Bowl & Bell Museum of Natural History, University of Minnesota, October 21, 2014.
- Does God play dice or does He just not make up His mind? Washburn High School, Minneapolis, May 29, 2014.
- Relativity. Washburn High School, Minneapolis, February 6, 2014.
- Science of Klein gallery talk. With Eric Crosby. Exhibit: Yves Klein: with the void, full powers. Walker Art Center, January 13, 2011.
- Einstein in Exile. John F. Kennedy School in Berlin-Zehlendorf, German department, for about 150 students, grades 11 and 12, January 23, 2009.
- Dinosaurs: how do we know what they looked like? Marcy Open Elementary School. Class of 2nd & 3rd graders, Minneapolis, March 2004.
- Quantum Mechanics, Squirrels, and Quarterbacks. Elders Learning Institute, University of Minnesota, January 24, 2002.
- Foundations of Special Relativity. Symposium Fysica of metafysica. Studium Generale, Landbouwhogeschool Wageningen. 1988.