Advanced Philosophy of Physics Reading List

James Read
james.read@philosophy.ox.ac.uk

This is James Read's reading list for the Finals paper, Advanced Philosophy of Physics. If you have any questions, comments, or suggestions, please email me at the above address.

1 The philosophy of symmetries

What is a symmetry of a physical theory? When should symmetry-related models of a theory be interpreted as being physically equivalent? How is one to articulate the content of symmetry-related models?

Definitions of symmetry transformations

1. Gordon Belot, "Symmetry and Equivalence", in R. Batterman (ed.), *The Oxford Handbook of Philosophy of Physics*, Oxford: Oxford University Press, pp. 318-339, 2013.
2. Shamik Dasgupta, "Symmetry as an Epistemic Notion (Twice Over)", British Journal for the Philosophy of Science 67(3), pp. 837-878, 2016.
3. James Read and Thomas Møller-Nielsen, "Redundant Epistemic Symmetries", Studies in History and Philosophy of Modern Physics 70, pp. 88-97, 2020.

Approaches to interpretation

1. Neil Dewar, "Symmetries and the Philosophy of Language", Studies in the History and Philosophy of Modern Physics 52, pp. 317-327, 2015.
2. Thomas Møller-Nielsen, "Invariance, Interpretation, and Motivation", Philosophy of Science 84, pp. 1253-1264, 2018.
3. James Read and Thomas Møller-Nielsen, "Motivating Dualities", Synthese 197, pp. 263-291, 2020.
4. Joana Luc, "Motivationalism vs. Interpretationalism about Symmetries: Some Options Overlooked in the Debate About the Relationship Between Symmetries and Physical Equivalence", European Journal for Philosophy of Science 13(3), pp. 1-33, 2023.

The content of symmetry-related models

1. Neil Dewar, "Sophistication About Symmetries", British Journal for the Philosophy of Science 70(2), pp. 485-521, 2019.
2. Niels Martens and James Read, "Sophistry About Symmetries?", Synthese, 2020.
3. Clara Bradley, "The Representational Role of Sophisticated Theories", Philosophy of Science, 2023.

Further reading

1. Katherine Brading and Elena Castellani (eds.), *Symmetries in Physics: Philosophical Reflections*, Cambridge: Cambridge University Press, 2003.

2. Katherine Brading and Nicholas J. Teh, "Symmetry and Symmetry Breaking", in E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*, 2017.

3. Jenann Ismael and Bas van Fraassen, "Symmetry as a Guide to Superfluous Theoretical Structure", in K. Brading and E. Castellani (eds.), *Symmetries in Physics: Philosophical Reflections*, Cambridge: Cambridge University Press, pp. 371-392, 2003.

4. Robert Nozick, *Invariances: The Structure of the Objective World*, Cambridge, MA: Harvard University Press, 2001.

5. Adam Caulton, "The Role of Symmetry in the Interpretation of Physical Theories", Studies in History and Philosophy of Modern Physics 52, pp. 153-162, 2015.

6. Gordon Belot, "Fifty Million Elvis Fans Can't be Wrong", Noûs 52(4), pp. 946-981, 2018.

2 The hole argument

What is the hole argument of general relativity? How is it best resolved? Does it rest on a mathematical mistake?

Background

1. John Norton, Oliver Pooley and James Read, "The Hole Argument", in E. N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy*, 2023.
2. John Earman and John Norton, "What Price Spacetime Substantivalism? The Hole Story", British Journal for the Philosophy of Science 38(4), pp. 515-525, 1987.

Some classic responses

1. Tim Maudlin, "The Essence of Space-Time", Proceedings of the Biennial Meeting of the Philosophy of Science Association, pp. 82-91, 1988. (Metric essentialism.)
2. Jeremy Butterfield, "The Hole Truth", British Journal for the Philosophy of Science 40 pp. 1-28, 1989. (Counterpart theory.)
3. Oliver Pooley, "Substantivalist and Relationist Approaches to Spacetime", in R. Batterman (ed.), *The Oxford Handbook of the Philosophy of Physics*, Oxford: Oxford University Press, pp. 522-586, 2013. §7. (Sophisticated substantivalism.)
4. Trevor Teitel, "Holes in Spacetime: Some Neglected Essentials", Journal of Philosophy 116, pp. 353-389, 2019. (More on metric essentialism.)

Mathematical representation

1. James Owen Weatherall, "Regarding the 'Hole Argument'", British Journal for the Philosophy of Science 69, pp. 329-350, 2018.
2. Samuel C. Fletcher, "On Representational Capacities, with an Application to General Relativity", Foundations of Physics 50, pp. 228-249, 2020.
3. Oliver Pooley and James Read, "On the Mathematics and Metaphysics of the Hole Argument", 2020.

Further reading

1. John Stachel, "The Meaning of General Covariance; The Hole Story", in J. Earman, A. Janis and G. Massey (eds.), *Philosophical Problems of the Internal and External Worlds: Essays on the Philosophy of Adolph Grünbaum*, Pittsburgh: University of Pittsburgh Press, pp. 129-60, 1993.

3 The identification/measurement of absolute motions

In what ways, if any, can I identify/measure my absolute position/velocity?

Indexical identification

1. Tim Maudlin, "Buckets of Water and Waves of Space: Why Spacetime is Probably a Substance", Philosophy of Science 60(2), pp. 183-203, 1993.
2. Shamik Dasgupta, "Inexpressible Ignorance", Philosophical Review 124(4), pp. 441-480, 2015.
3. Bryan Cheng and James Read, "Shifts and Reference", in A. Vassallo (ed.), *Foundations of Spacetime Physics: Philosophical Perspectives*, London: Routledge, 2021.

Measuring absolute velocities

1. Sebastián Murgueitio Ramírez and Ben Middleton, "Measuring Absolute Velocity", Australasian Journal of Philosophy 99(4), pp. 806-816, 2021.
2. Caspar Jacobs, "Absolute Velocities Are Unmeasurable: Response to Middleton and Murgueitio Ramírez", Australasian Journal of Philosophy 100, 2022.
3. Joana Luc, "The Unmeasurability of Absolute Velocities from the Point of View of Epistemological Internalism", Erkenntnis, 2023.

4 Background independence

Is there any special feature which sets general relativity apart from other spacetime theories? If so, what is that feature?

Core reading

1. Oliver Pooley, "Background Independence, Diffeomorphism Invariance, and the Meaning of Coordinates", in D. Lehmkuhl, G. Schiemann and E. Scholz (eds.), *Towards a Theory of Spacetime Theories*, Birkhäuser, 2017.
2. James Read, *Background Independence in Classical and Quantum Gravity*, Oxford: Oxford University Press, 2023. **Ch. 3**.
3. Gordon Belot, "Background-Independence", General Relativity and Gravitation 43, pp. 2865-2884, 2011.
4. J. Brian Pitts, "Absolute Objects and Counterexamples: Jones-Geroch Dust, Torretti Constant Curvature, Tetrad-Spinor, and Scalar Density", Studies in History and Philosophy of Modern Physics 37(2), pp. 347-371, 2006.

Further reading

1. John Norton, "General Covariance and the Foundations of General Relativity: Eight Decades of Dispute", Reports on Progress in Physics 56, pp. 791-858, 1993.
2. Oliver Pooley, "Substantive General Covariance: Another Decade of Dispute", in M. Suàrez *et al*. (eds.), *EPSA Philosophical Issues in the Sciences: Launch of the European Philosophy of Science Association*, Berlin: Springer, 2010.
3. Trevor Teitel, "Background Independence: Lessons for Further Decades of Dispute", Studies in History and Philosophy of Modern Physics 65, pp. 41-54, 2019.

5 The local validity of special relativity in general relativity

In what sense, if any, is special relativity locally valid in general relativity?

1. Dennis Lehmkuhl, "The Equivalence Principle(s)", in E. Knox and A. Wilson (eds.), *The Routledge Companion to Philosophy of Physics*, London: Routledge, 2021.
2. James Read, Harvey R. Brown and Dennis Lehmkuhl, "Two Miracles of General Relativity", Studies in History and Philosophy of Modern Physics 64, pp. 14-25, 2018.
3. James Owen Weatherall, "Two Dogmas of Dynamicism", Synthese, 2020.
4. Samuel C. Fletcher, "Approximate Local Poincaré Spacetime Symmetry in General Relativity", in Claus Beisbart, Tilman Sauer, Christian Wüthrich (eds), *Thinking About Space and Time: 100 Years of Applying and Interpreting General Relativity*, Basel: Birkhäuser, 2020.
5. Samuel C. Fletcher and James Owen Weatherall, "The Local Validity of Special Relativity, Part 1: Geometry", Philosophy of Physics 1(1), 2023.
6. Samuel C. Fletcher and James Owen Weatherall, "The Local Validity of Special Relativity, Part 1: Matter Dynamics", Philosophy of Physics 1(1), 2023.
7. Niels Linnemann, James Read and Nicholas J. Teh, "The Local Validity of Special Relativity from a Scale-relative Perspective", 2023.

6 The past hypothesis

Is a postulate about the initial state of the universe necessary in order to explain observed time-asymmetric behaviour? If so, what should that postulate look like?

Core reading

1. David Albert, *Time and Chance*, Cambridge, MA: Harvard University Press, 2000.
2. David Wallace, "The Logic of the Past Hypothesis", in B. Loewer, E. Winsberg and B. Weslake (eds.), *The Probability Map of the Universe: Essays on David Albert's Time and Chance*, Cambridge, MA: Harvard University Press, pp. 76-109, 2023.
3. Harvey R. Brown, "Once and For All: The Curious Role of Probability in the Past Hypothesis", in D. Bedingham, O. Maroney and C. Timpson (eds.), *The Quantum Foundations of Statistical Mechanics*, Oxford University Press, 2017.
4. John Earman, "The 'Past Hypothesis': Not Even False", Studies in the History and Philosophy of Modern Physics 37, pp. 399-430, 2006.
5. David Wallace, "The Local Quantum Vacuum as the Past Hypothesis", 2023.
6. Sean Gryb, "New Difficulties for the Past Hypothesis", Philosophy of Science 88, pp. 511–532, 2021.

Further reading

1. Eric Winsberg, "Can Conditioning on the "Past Hypothesis" Militate Against the Reversibility Objections?", Philosophy of Science 71, pp. 489–504, 2004.