

The Philosophy of Space and Time after Einstein

Fergus Horan

fhoran3@jh.edu

8:30 AM - 10:30 AM

Course Description

What are space and time? What can physics tell us? And how does this bear on the metaphysics of space and time? This course introduces two revolutions in physics, the classical and relativistic, and their impacts on how we understand space and time. What appears on the surface to be simple physics will unravel into philosophical puzzles that we will spend the course discussing. The class is divided into three parts: 1) Classical Physics, 2) The Metaphysics of Time, and 3) Special Relativity and Philosophy. During the course, we will begin by unpacking the basics of the physics, from Newton's Laws to Special Relativity, with no prior experience in physics required, before turning to questions of what these theories can tell us about the nature of space, time, and metaphysics.

Course Aims

- Provide an introduction to two of the greatest achievements of natural science, classical mechanics and special relativity
- Introduce the methodology of the philosophy of science, by which theories in physics can be assessed
- Develop close reading skills in historically significant texts
- Develop critical thinking skills in assessing major conflicts in the history of science
- Explore the relation of physics and philosophy, and thus the sciences and humanities more broadly

Syllabus

Part I: The Classical World

1) Newton and Classical Mechanics

1. Chapter 7: Newton Nick Huggett, *Space from Zeno to Einstein – Classic Readings with a Contemporary Commentary*, Illustrated edition (Cambridge, Mass: MIT Press, 1999), 107–42.

2) Substantivalism and Relationalism

1. Chapter 8: Leibniz and Clarke *ibid.*, 143–68.
2. Shamik Dasgupta, 'Substantivalism vs Relationalism About Space in Classical Physics', *Philosophy Compass* 10, no. 9 (2015): 601–24, doi:10.1111/phc3.12219.

Part II: The Metaphysics of Time

1) Does time flow?

1. J. Ellis McTaggart, 'The Unreality of Time', *Mind* 17, no. 68 (1908): 457–74.

2. Heather Dyke, 'Time, Metaphysics Of', in *Routledge Encyclopedia of Philosophy*, 1st ed. (London: Routledge, 2016), doi:10.4324/9780415249126-N123-2.
<https://www.rep.routledge.com/articles/thematic/time-metaphysics-of/v-2>

2) What exists beyond the present?

1. Kristie Miller, 'Presentism, Eternalism, and the Growing Block', in *A Companion to the Philosophy of Time* (John Wiley & Sons, Ltd, 2013), 345-351, 354-364 (SKIPPING SECTION ON SPECIAL RELATIVITY "TENSIONS WITH OUR BEST SCIENCE"), doi:10.1002/9781118522097.ch21.

Part III: Special Relativity and Philosophy

1) What is Special Relativity?

1. Chapter 2-6 John D. Norton, *Einstein for Everyone*, n.d.,
https://sites.pitt.edu/~jdnorton/teaching/HPS_0410/chapters/index.html.

2) Energy-Mass Equivalence

1. Marc Lange, 'The Most Famous Equation', *The Journal of Philosophy* 98, no. 5 (2001): 219-38, doi:10.2307/2678382.

3) The Conventionality of Simultaneity

1. Chapter 17 Norton, *Einstein for Everyone*.
https://sites.pitt.edu/~jdnorton/teaching/HPS_0410/chapters/significance_conv_sim/index.html
2. David Malament, 'Causal Theories of Time and the Conventionality of Simultaneity', *Noûs* 11, no. 3 (September 1977): 293, doi:10.2307/2214766.

4) Presentism after Relativity

1. Hilary Putnam, 'Time and Physical Geometry', *The Journal of Philosophy* 64, no. 8 (1967): 240-47, doi:10.2307/2024493.
2. Mark Hinchliff, 'A Defense of Presentism in a Relativistic Setting', *Philosophy of Science* 67 (2000): S575-86.

5) Time Travel

1. David K. Lewis, 'The Paradoxes of Time Travel', *American Philosophical Quarterly* 13, no. 2 (1976): 145-52.
2. Frank Arntzenius, 'Time Travel: Double Your Fun', *Philosophy Compass* 1, no. 6 (2006): 599-616, doi:10.1111/j.1747-9991.2006.00045.x.

Readings

All readings can be found here <https://fhoran.info/Einstein-Readings> with password "minkowski".