

Philosophy of Time

John Dougherty

SoSe 2022

Meeting:	Fridays, 14:00–16:00 (s.t.) Ludwigstr. 31, Room 021
Office Hours:	Thursdays, 14:00–16:00 (c.t.) Ludwigstr. 31, Room 126
Email:	john.dougherty@lrz.uni-muenchen.de

Overview

Description This course is an introduction to philosophical issues arising from the representation of time and change in modern physics. It is organized around four major questions:

1. What must we assume about time in order to proceed with our physical theorizing, and how far do these assumptions go beyond empirical justification?
2. How should we conceive of time in light of the general theory of relativity, where space and time appear to be more intimately related than previously thought? Is there time at all?
3. How are change and the direction of time represented in physics? In particular, what would it mean to reverse the direction of time, and how does this interact with change and causation?
4. Does the general theory of relativity allow for change at all?

The required math and physics will be covered in class. The level of technical difficulty will be that of a general philosophy of science journal (say, *Philosophy of Science* or *The British Journal of Philosophy of Science*), rather than that of a specialist journal (say, *Studies in History and Philosophy of Modern Physics* or *Foundations of Physics*).

Objectives By the end of the course, you should be able to (i) formulate one or more philosophical problems that arise from the representation of time and change in physics and (ii) assess one or more strategies for solving these problems. Exhibiting ability (i) means giving a statement, in academic writing, of a question—or inconsistency, paradox, puzzle, or similar—along with an explanation of why it poses a problem for some particular philosophical tradition. Exhibiting ability (ii) means describing, again in academic writing, a new or existing attempt to answer this question and explaining why this is or is not a plausible answer.

Assessment

The evaluation for this course will be by means of a term paper submitted at the end of the semester. If you would like to submit a term paper, you must register through LSF during the registration period (04.07.2022–15.07.2022) and submit it to me by email by the term paper deadline (TBA). Please note that extensions of this deadline are not up to me; if you need an extension, please contact Fabian Widerna (f.widerna@lmu.de) at the Prüfungsamt für Geistes- und Sozialwissenschaften (PAGS).

Your paper should be on a topic related to the relationship between mathematics and the natural world. I will distribute a list of suggested questions and grading criteria before the registration period. You may write your paper on topic not on that list; if you do, then I recommend speaking to me before writing the paper, so that I can advise on the topic and scope of your planned alternative. The term paper should be 3000 words for BA students and 6000 words for MA students. In either case, it should be written in 12pt font, with 1.5 spacing, 3cm margins on the left and right, and a standard academic typeface (e.g., Computer Modern, Palatino, Times New Roman, Calibri, etc.)

Resources

Questions about the administration of philosophy teaching at LMU should be directed to Thomas Wyrwich (thomas.wyrwich@lrz.uni-muenchen.de). The Erasmus coordinator for philosophy at LMU is Peter Adamson (office.peter.adamson@lrz.uni-muenchen.de). The list of women's representatives (Frauenbeauftragte) for the Philosophy Faculty can be found on the Faculty's webpage (<https://www.philosophie.uni-muenchen.de/fakultaet/frauenbeauftragte/index.html>); the representative for the MCMP is

Silvia Jonas. Issues regarding the economic, social, and cultural aspects of student life—including studying with a child or studying with a disability—are the responsibility of the Munich Student Union (<https://www.studentenwerk-muenchen.de>).

Schedule and readings

Please see the reading list for secondary readings and further bibliographic information. The starred weeks will be rescheduled based on participants' availabilities.

April 29: Introduction and Newton

- Scholium to the Definitions from Newton, I. (1999). *The Principia: Mathematical Principles of Natural Philosophy*. University of California Press. Trans. I. Bernard Cohen and Anne Whitman

May 6: Newton, continued

- Schliesser, E. (2021b). Newton's philosophy of time. In Schliesser (2021a), pages 172–187
- Brading, K. (2017). Time for empiricist metaphysics. In Slater, M. and Yudell, Z., editors, *Metaphysics in the Philosophy of Science*. Oxford University Press
- Schliesser, E. (2021c). Postscript to chapter 7. In Schliesser (2021a), pages 188–197

May 13: Mach

- Thébault, K. P. Y. (2021). On Mach on time. *Studies in History and Philosophy of Science*, 89:84–102

May 20: Simultaneity

- Salmon, W. C. (1977). The philosophical significance of the one-way speed of light. *Noûs*, 11(3):253–292

May 27: General relativity

- Reading will be explained in class

June 3: Philosophy of spacetime

- Earman, J. (1970). Space-time, or how to solve philosophical problems and dissolve philosophical muddles without really trying. *The Journal of Philosophy*, 67(9):259–277

June 10: Time reversal

- Albert, D. Z. (2000). Time-reversal invariance. In *Time and Chance*, pages 1–21. Harvard University Press
- Allori, V. (2015). Maxwell's paradox: the metaphysics of classical electrodynamics and its time-reversal invariance. *analytica*, pages 1–19

June 17: Time reversal (Quantum)

- Callender, C. (2000). Is time 'handed' in a quantum world? *Proceedings of the Aristotelian Society*, 100(1):247–269
- Roberts, B. W. (2021). Time reversal. In Knox, E. and Wilson, A., editors, *The Routledge Companion to Philosophy of Physics*, pages 605–619. Routledge

June 24: Time reversal and causation

- Farr, M. (2020). Causation and time reversal. *British Journal for the Philosophy of Science*, 71(1):177–204
- Williams, P. (2022). The fate of causal structure under time reversal. Forthcoming in *Theoria*

July 8: The common cause principle

- Hofer-Szabó, G., Rédei, M., and Szabó, L. E. (2002). Common-causes are not common common-causes. *Philosophy of Science*, 69(4):623–636

July 14: Hole argument

- Earman, J. and Norton, J. (1987). What price spacetime substantivalism? The hole story. *The British Journal for the Philosophy of Science*, 38(4):515–525
- Greaves, H. (2011). In search of (spacetime) structuralism. *Philosophical Perspectives*, 25:189–204

July 15: Hole argument 2

- Brighouse, C. (2020). Confessions of a (cheap) sophisticated substantivalist. *Foundations of Physics*, 50(4):348–359
- Halvorson, H. and Manchak, J. B. (2022). Closing the hole argument. Forthcoming in *The British Journal for the Philosophy of Science*

July 22: Background independence

- Teitel, T. (2019). Background independence: Lessons for further decades of dispute. *Studies in History and Philosophy of Modern Physics*, 65:41–54

July 25: The problem of time in GR

- Earman, J. (2002). Thoroughly modern McTaggart: Or, what McTaggart would have said if he had read the general theory of relativity. *Philosopher's Imprint*, 2(3)
- Maudlin, T. (2002). Thoroughly muddled McTaggart: Or, how to abuse gauge freedom to create metaphysical monstrosities. *Philosopher's Imprint*, 2(4)