

# Philosophy of Quantum Theory

John Dougherty

SoSe 2024

---

Meeting:	Tuesdays, 14:00–16:00 (s.t.) Ludwigstr. 31, Room 021
Office Hours:	Thursdays, 14:00–16:00 (c.t.) Ludwigstr. 31, Room 126
Email:	<a href="mailto:john.dougherty@lrz.uni-muenchen.de">john.dougherty@lrz.uni-muenchen.de</a>

---

## Overview

**Description** The development of quantum mechanics in the early twentieth century challenged many philosophical theses about the natural world and our scientific knowledge of it. In this course, we will investigate the problems quantum theory poses for traditional philosophical understandings of objectivity. The first part of the course introduces some philosophical background on objectivity in science and some of the mathematical basics of quantum theory. No previous knowledge of quantum mechanics is required. The second part of the course concerns the interpretation of these mathematical basics, including how they relate to experiment and how (and whether) they can give an objective picture of the world. The third and last part of the course focuses on one aspect of this picture—namely, the nature of quantitative features of the world from the point of view of quantum theory.

**Objectives** By the end of the course, you should be able to (i) formulate one or more philosophical problems that arise from quantum mechanics 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 view. 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.

## Materials

The syllabus, reading list, readings, and handouts for this course are available in the following dropbox:

[http://bit.ly/24s\\_qt](http://bit.ly/24s_qt)

## 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 (24.06–05.07) and submit it to me by email by the term paper deadline (23.09.2024). 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](mailto:f.widerna@lmu.de)) at the Prüfungsamt für Geistes- und Sozialwissenschaften (PAGS).

Your paper should be on a topic related to philosophical issues in quantum theory. Near the end of the semester I will distribute a list of suggested questions and grading criteria. 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, Times New Roman, Palatino, Calibri, etc.)

## Resources

Questions about the administration of philosophy teaching at LMU should be directed to Thomas Wyrwich ([thomas.wyrwich@lrz.uni-muenchen.de](mailto:thomas.wyrwich@lrz.uni-muenchen.de)). The Erasmus coordinator for philosophy at LMU is Peter Adamson ([office.peter.adamson@lrz.uni-muenchen.de](mailto: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 Vanessa Carr. 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

### I. Background

#### 16.4 Causality and determinism

- Anscombe, *Causality and Determinism*

#### 23.4 Causality and probability

- Salmon, Causal forks and common causes

#### 30.4 Basics of quantum theory

- Albert, excerpts from *Quantum Mechanics and Experience*

### II. Interpreting the formalism

#### 7.5 Equivalence of theories

- Perović, Why were matrix mechanics and wave mechanics considered equivalent?

#### 14.5 Measurement problem I

- Maudlin, Collapse theories and the problem of local beables

#### 21.5 NO MEETING (Whit Tuesday)

- Maudlin, Pilot wave theories

#### 28.5 Measurement problem (cont.)

- Maudlin, Many worlds

#### 4.6 Hidden variables

- Hermann, Natural-philosophical foundations of quantum mechanics

#### 11.6\* (CANCELLED)

#### 18.6 Bell's theorem

- Jarrett, Bell's theorem: a guide to the implications

#### 25.6 Absoluteness

- Adlam, What does '(non)-absoluteness of observed events' mean?

### III. Quantities in quantum theory

#### 2.7 Symmetry breaking

- Ruetsche, Johnny's so long at the ferromagnet

#### 9.7\* (CANCELLED)

#### 16.7 Identical particles

- Huggett and Norton, Weak discernibility for quanta, the right way