Philosophy 4542: Philosophy of Space and Time
Syllabus

PHI 4542; Section 29122
Fall 2024
Tuesdays 1:55 - 2:45 pm
Thursdays 1:55 - 3:50 pm
Matherly 0051

Instructor Information

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Office Hours: Tuesdays 3:00pm - 4:00pm; Wednesdays 1:00pm - 2:00pm
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Course Description

This course will explore a variety of philosophical questions about the nature of space and time from the perspective of contemporary physics. No prior background with the relevant physical theories will be expected, but students should be prepared to learn some of the fundamentals of these theories as part of the course. Emphasis will be placed on gaining an intuitive understanding of the theories, while requiring only a minimal amount of mathematics.

Our approach to this material will be to focus on the conceptual foundations of physical theories such as Newtonian mechanics, Lagrangian mechanics, Hamiltonian mechanics, Special Relativity, and General Relativity. We will be guided in this regard by Sean Carroll's *The Biggest Ideas in the Universe: Space, Time, and Motion*, which will serve as our textbook for the course. The book aims to explain the conceptual foundations of those physical theories while also exploring some philosophical issues that they give rise to. We will supplement the text with additional, more overtly philosophical readings along the way. These supplemental readings will cover a variety of topics, including: the metaphysics of laws of nature, the metaphysics of time, the nature of instantaneous velocity, conservation laws, the arrow of time, and the implications of Special and General Relativity for the metaphysics of time.

Learning Objectives

At the end of this course, students will be able to:

- Construct spacetime diagrams to answer questions about various physical situations
- Explain various positions about the metaphysics of time, and articulate to what extent that are compatible with contemporary physics
- Describe how statistical mechanics relates to the arrow of time, as well as what motivates the postulation of the Past Hypothesis
- Answer various conceptual questions related to Newtonian mechanics, special relativity, general relativity, and statistical mechanics
- Articulate and defend informed positions about various philosophical debates about the nature of space and time

Academic Honesty

UF students are bound by The Honor Pledge, which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.” On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor. **Plagiarism on any assignment will automatically result in a grade of zero for the assignment.** Plagiarism is defined in the University of Florida's Student Honor Code as follows: "A student shall not represent as the student’s own work all or any portion of the work of another. Plagiarism includes (but is not limited to): a. Quoting oral or written materials, whether published or unpublished, without proper attribution. b. Submitting a document or assignment which in whole or in part is identical or substantially identical to a document or assignment not authored by the student." Students found guilty of academic misconduct will be prosecuted in accordance with the procedures specified in the UF honesty policy.

ChatGPT/AI

Use of AIs such as ChatGPT to compose the text of all or part of the assignments for this course is strictly prohibited.

Attendance and Classroom Policies

Students are expected to attend class and to have done all assigned reading in advance. Failure to do so will adversely affect students' ability to perform well in this course. The use of smart phones during class is not permitted. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

Canvas e-Learning Environment

This course is supplemented by online content in the e-Learning environment known as "Canvas." To login to the e-Learning site for this course, go to https://lss.at.ufl.edu/, click the **e-Learning in Canvas** button, and on the next page enter your Gatorlink username and password. You can then access the course e-Learning environment by selecting PHI 4542 from the **Courses** pull-down menu at the top of the page. If you encounter any difficulties logging in or accessing any of the course content, contact the UF Computing Help Desk at (352) 392-4537. Please do not contact the course instructor regarding computer issues.

Online Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of

instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Accommodation for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. *Students with disabilities should follow this procedure as early as possible in the semester.*

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

COVID-19 Recommendations

In response to COVID-19, the following recommendations are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available and have been demonstrated to be safe and effective against the COVID-19 virus. Visit one.uf for screening/testing and vaccination opportunities.
- If you are sick, stay home. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 to be evaluated.
- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

Campus Resources

Health and Wellness

- *U Matter, We Care*: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit the U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress
- *Counseling and Wellness Center*: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.
- *Student Health Care Center*: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.
- *University Police Department*: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).
- *UF Health Shands Emergency Room / Trauma Center*: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.
- *GatorWell Health Promotion Services*: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the GatorWell website or call 352-273-4450.

Academic Resources

- *E-learning technical support*: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.
- *Career Connections Center*: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- *Library Support*: Various ways to receive assistance with respect to using the libraries or finding resources.
- *Teaching Center*: Broward Hall, 352-392-2010 or to make an appointment 352-392-6420. General study skills and tutoring.
- *Writing Studio*: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- *Student Complaints On-Campus*: Visit the Student Honor Code and Student Conduct Code webpage for more information.
- *On-Line Students Complaints:* View the Distance Learning Student Complaint Process.

Required Text:

- *The Biggest Ideas in the Universe: Space, Time, and Motion*, by Sean Carroll. 2022, Dutton (Penguin Random House). ISBN: 978-0593186589.

Please note that there are two books by Sean Carroll in this series. We are using the first one, focused on "Space, Time, and Motion" (not the second one, focused on "Quanta and Fields"). Other readings will be provided on Canvas.

Course Requirements
In-Class Assignments: 15%
Canvas Quizzes: 15%
Take-Home Exam 1: 20%
Take-Home Exam 2: 20%
Final Paper: 30%

In-Class Assignments
There will be frequent in-class work during the course of the semester. These assignments will typically be small-group discussions where I will pose a question for you to discuss together in small groups, arrive at an answer, and submit it as a group. These will be graded for thoughtfulness and effort. You will need to be present in class to be able to receive a grade on these assignments. If you miss an in-class assignment because of an unexcused absence, you will not be able to make it up. If you will miss a reading quiz for excused absences such as a religious holiday, official university activity, doctor's office visit, or prolonged illness, you must notify me as soon as the situation arises; in-class assignments missed for these reasons will not count against your course grade if you notify me in a timely manner.

Canvas Quizzes
Throughout the semester there will be 3 quizzes to be completed on Canvas. These will be available on Monday and due by Friday at 11:59pm. Each quiz will consist of a variety of conceptual questions about the physical theories that we are discussing. These quizzes are designed to help ensure that you are doing the work to understand the physics behind the philosophy that we'll be engaging with. They should be done on your own (i.e. not as a group), and on your own time (i.e. not in class).

Take-Home Exams
There will be two take-home exams designed to test your grasp of both (i) the conceptual foundations of the physical theories we are working with, and (ii) their philosophical implications. (So, compared to the Canvas Quizzes, the Take-Home Exams will have more of a focus on the philosophy papers that we are discussing.) The exams will consist of a set of prompts; you will choose a subset of these prompts and provide a short answer to each. Exams will be due on Sundays at 11:59pm (see the Course Schedule for dates), and the prompts will be provided at least one week before the due date. *These exams will be open-note, but* ***you may not collaborate with other students on the preparation of your answers.*** If you have questions about the prompts, you should ask me directly (I'm happy to help!) rather than going to other students.

Take-Home Exams will lose ⅓ of a letter grade for each day that they are late. For example, if the exam was due on Friday and it would have earned a B+, but you submit it on Saturday, it will earn a B.

Final Paper

As a final assignment for the course, you will be asked to write a substantial paper, of at least 3000 words, that takes a stand on some philosophical question, issue, or debate that we have discussed in class this semester. This paper should be a significant work of philosophy that requires independent research on your part. In principle your paper can be on anything that we have covered, though it is prudent to select one that has a philosophical literature with which you can engage. I am happy to help discuss potential paper topics as we get closer to the end of the semester.

Extensions

Extensions without penalty may be granted in extenuating circumstances, provided that communication about these circumstances is clear and timely. Please don't hesitate to reach out to discuss options with me.

Grading

The following grade scale will be used to assign final letter grades for the course. See UF grading policies for assigning grade points at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Grade Scale	Grade Value
100-93=A	A=4.0
92-90=A-	A-=3.67
89-87=B+	B+=3.33
86-83=B	B=3.00
82-80=B-	B-=2.67
79-77=C+	C+=2.33
76-73=C	C=2.00
72-70=C-	C-=1.67
69-67=D+	D+=1.33
66-63=D	D=1.00
62-60=D-	D-=0.67

59-0=E	E=0.00

Course Schedule and Readings

The following is a tentative schedule for the course. Any official changes to the schedule will be announced on Canvas. The syllabus is divided into weeks; the items listed for a given week are to be read before classes that week. Note: "BIITU" stands for *The Biggest Ideas in the Universe*, the course textbook written by Sean Carroll, listed above.

Week 1: August 22

- BIITU Introduction (pp. 1-6)

Week 2: August 27, 29

- BIITU Chapter 1: Conservation (pp. 7-28)
- "Laws of Nature", John Roberts (provided on Canvas)

Week 3: September 3, 5

- "There Sweep Great General Principles which All the Laws Seem to Follow", Marc Lange (provided on Canvas)

Week 4: September 10, 12

- BIITU Chapter 2: Change (pp. 29-54)
- "Are There Really Instantaneous Velocities?", Frank Arntzenius (provided on Canvas)

Week 5: September 17, 19

- "How Can Instantaneous Velocity Fulfill its Causal Role?", Marc Lange (provided on Canvas)

Canvas Quiz 1 Due Friday, September 20 at 11:59pm

Week 6: September 24, 26

- BIITU Chapter 3: Dynamics
- *The Metaphysics within Physics* Chapter 1, Tim Maudlin (provided on Canvas)
- "Minimal Primitivism about Laws of Nature", Eddy Chen (provided on Canvas)

Take-Home Exam 1 Due Sunday, September 29 at 11:59pm (submit on Canvas)

Week 7: October 1, 3

- BIITU Chapter 4: Space
- "The 'Structure' of Physics", Jill North (provided on Canvas)

Week 8: October 8, 10

- BIITU Chapter 5: Time

- “On the Passage of Time,” Tim Maudlin (provided on Canvas)

Week 9: October 15, 17
- “Two Accounts of Laws and Time”, Barry Loewer (provided on Canvas)

Canvas Quiz 2 Due Friday, October 18 at 11:59pm

Week 10: October 22, 24
- BIITU Chapter 6: Spacetime
- “Time and Physical Geometry,” Hilary Putnam (provided on Canvas)

Week 11: October 29, 31
- “Presentism and the Space-Time Manifold”, Dean Zimmerman (provided on Canvas)

Take-Home Exam 2 Due Sunday, November 3 at 11:59pm (submit on Canvas)

Week 12: November 5, 7
- BIITU Chapter 7: Geometry
- “Productive Laws in Relativistic Spacetimes”, Chris Dorst (provided on Canvas)

Week 13: November 12, 14
- BIITU Chapter 8: Gravity
- “Tearing Spacetime Asunder”, Craig Callender (provided on Canvas)

Week 14: November 19, 21
- BIITU Chapter 9: Black Holes
- “Trouble on the Horizon for Presentism,” Sam Baron and Baptiste Le Bihan (provided on Canvas)

Canvas Quiz 3 Due Friday, November 22 at 11:59pm

Week 15: December 3
- Make-up Day/Course Recap

Final Paper Due Sunday December 8 at 11:59pm (submit on Canvas)