

Space, Time, and Matter

PHYS 419/420 and PHIL 419/420¹

Spring 2022

Time: Every Monday, Wednesday, Friday 12:00pm (noon) to 12:50pm²

Location: Loomis Laboratory 136

Professor: Dr. [Christopher Gregory Weaver](#), Assistant Professor of Philosophy and Affiliate Assistant Professor of Physics, UIUC

E-mail: wgcave9@illinois.edu (I prefer to be contacted through email. Please see my email correspondence policy below.)

Office Hours and Location: Monday morning 8:30am to 9:30am Office #409B in Gregory Hall

Prerequisites: The prerequisites for either PHIL/PHYS 419 or PHIL/PHYS 420 are: PHIL 101 and (either PHYS 101 or PHYS 211).

Credits: PHYS/PHIL 419 is worth 3 credits and satisfies the general education criteria for advanced composition. PHYS/PHIL 420 is worth 2 credits and does *not* satisfy the general education criteria for advanced composition.

Course Compass 2g Webpage: Go to <https://compass2g.illinois.edu> and sign in.

Instructor Assisting with Grading for Course: Instructor Charles A. Byrne³

Email: bcharles@illinois.edu

Office Hours: By appointment; Instructor Byrne will conduct office hours by means of Zoom. Please email Instructor Byrne for the necessary information and to schedule an office hours meeting.

Teaching Assistant #1: Dmitry Manning-Coe (Condensed Matter Physics and Foundations of Physics)

Email: dmitry2@illinois.edu

Office Hours: Monday 4:00pm to 5:00pm in ICMT Office Engineering Sciences Building Office 4117

Teaching Assistant #2: Nikhil Kunapuli (Complex Systems and Biophysics)

Email: nikhilk7@illinois.edu

Office Hours: Tuesday 10:00am to 11:00am in Loomis Laboratory Office 390Q

I. Course Description

Space, Time, and Matter is an advanced and intensive history and philosophy of physics course that aims to: (a) introduce students to the history of both theoretical and experimental physics (more specifically, we will travel from scientific thought before Aristotle all the way to the development of the standard model of particle physics), (b) briefly introduce students to the basic formulae and accompanying (sometimes competing) interpretations of classical Newtonian mechanics, classical electrodynamics, early kinetic theory, thermodynamics, (classical) Boltzmannian statistical mechanics, special relativity, general relativity, the standard Λ -CDM cosmological model, and both non-relativistic and relativistic quantum mechanics, (c)

¹ Graduate students taking the graduate version of the course should speak with Professor Weaver outside of class regarding their responsibilities and assignments.

² All listed times are local Urbana-Champaign times.

³ Instructor Byrne is a non-local Instructor. He will therefore not have office hours although one can reach him via email.

introduce students to debates in the foundations of physics, and (d) give special attention to philosophical debates concerning scientific realism and anti-realism, the relationship between the manifest and scientific images, and the nature of matter, space, time, and spacetime.

II. Learning Objectives

1. All students will be introduced to the topics mentioned in the course description.
2. All students will acquire substantive knowledge of the history of physics and natural philosophy before the 20th century.
3. All students will acquire substantive knowledge of the development of *modern* physics and its philosophy.
4. Students will be provided with a preliminary—though still substantive—picture of the scientific images of matter, space, time, and spacetime supplied by our best physical theories. They will be introduced to debates about the ontologies and interpretations of those physical theories as well.
5. All students will develop the skill of analyzing and synthesizing historical, scientific, and philosophical information for the purpose of generating new insights about physics, and the history and philosophy of physics.
6. Students enrolled in PHYS/PHIL 419 will develop and further hone their communication skills by writing an argumentative research paper defending a specific thesis on a topic peculiar to physics *and* (the history of physics or the philosophy of physics).

III. General Approach

Every Monday and Wednesday class period will begin with a lecture on new material. On Fridays, class will begin with the administration of an in-class five-point quiz (see the Things to Do section below). Every class period, attendance will be taken by means of a “sign-in sheet”. Lectures will sometimes be supported by videos, lecture slides, and other teaching supports. Most lectures will include supporting handouts made available at the beginning of class. These handouts will *not* be made available outside of class. If you miss class for an unexcused reason, you may want to consult with another student about obtaining a copy. Lecture slides will *not* be made available outside of class.

Given UIUC’s Spring 2022 COVID-19 policies, our first week of in-person instruction will begin Monday, January 24th, 2022. This means that our first two class periods (the first on Wednesday, January 19th, the second on Friday, January 21st) will be conducted via Zoom. These two class meetings (*i.e.*, those on January 19th and January 21st) will be conducted at our normal class time, *viz.*, 12:00pm to 12:50pm. The class Zoom information will be provided through a Compass2g announcement so that it is accessible only to those who are registered for the course. Please do not share this Zoom information with anyone.

IV. Textbooks

The required textbooks for this course are:

1. Bruce J. Hunt, *Pursuing Power and Light: Technology and Physics from James Watt to Albert Einstein*. (Baltimore, MD: Johns Hopkins University Press, 2010). ISBN: 978-0801893599
2. Roger Penrose, *The Road to Reality: A Complete Guide to the Laws of the Universe*. (New York, NY: Vintage Books, 2007). ISBN: 978-0679776314
3. Helge Kragh, *Quantum Generations: A History of Physics in the Twentieth Century*. (Princeton, NJ: Princeton University Press, 1999). 978-0-691-09552-3

V. Things to Do

1. Assignments – (For students enrolled in PHIL 419 or PHYS 419, the assignments portion of the course is worth 15% of your course grade. For students enrolled in PHIL 420 or PHYS 420, the assignments portion of the course is worth 30% of your course grade.)
 - a) Students will need to complete five-point quizzes administered in class every Friday. These weekly in-class quizzes will be supplemented with a weekly essay question (worth five points). So, every week one has to complete a 10-point quiz, five points of which can be earned in class by responding correctly to the questions/problems/challenges provided, and another five points of which can be earned by responding accurately/correctly to an essay question provided via Compass. All essay portions of the weekly quizzes will be open book and open note since the essay questions will be made available through Compass on **Wednesdays by 11:00pm. Responses to the essay questions should be provided in Compass by the immediately following Friday at 12:00pm (noon)**. Be sure to follow the instructions provided. Students are not allowed to work with each other.
2. Midterm – 30% (For All Students)
 - a) Students will be required to take a midterm exam that will consist of four essay questions. The midterm will be made available on Compass and will be open book and open note. Students are not allowed to work with each other. The midterm will be made available on **March 28th at 10:00pm and will be due on April 1st at 10:00pm.**
 - b) Special instructions for the midterm will be provided on the midterm exam itself (*e.g.*, word limits, *etc.*).
3. Final Paper – 30% (For Students Enrolled in PHIL 419 or PHYS 419 **Only**)
 - a) Directions
 - Your final paper should be on a topic covered in class or in one of the textbooks. Please have your final paper topic approved by Professor Weaver by **April 2nd**. To acquire approval of your topic, please email me with the subject heading “Final Paper Topic for Approval”, then in the body of your email state the thesis you intend

to argue for. Your thesis should be a completion of the following phrase: “I will argue that...”.

- The document should be single spaced, the text should be in a justified format, and in Times New Roman font, size 12, with one-inch margins. Please do not include a title page. Please do not include course information.
- Please paginate your papers.
- Please document your paper in the Chicago Manual of Style.⁴ It should include a bibliography.
- All drafts of final papers are due in PDF format via Compass.
- A late (required final draft) paper will receive a one-point reduction every hour it is late (*e.g.*, if your paper is 70 minutes late, your final paper will receive a one-point reduction).

b) Drafts

- Students enrolled in PHIL 419 or PHYS 419 are required to submit both a rough and final draft of their final paper assignment.
- Rough drafts are due **April 22nd at 11:00am (morning)**.
- Comments on rough drafts will be returned via compass by **May 3rd**.
- All students who submit a rough draft will receive comments on their rough drafts and will be expected to make revisions in light of those comments. The revised version of your paper constitutes the final draft.
- Final drafts are due on **May 12th at 6:00pm**.
- The rough *and* final drafts of your paper should have a word count between 3,000 and 5,000 words.
- *Failing to turn in a rough draft on time (or at all) can negatively affect the final draft grade.*

4. Final Exam – (For students enrolled in PHIL 419 or PHYS 419, the final exam portion of the course is worth 15% of your course grade; For students enrolled in PHIL 420 or PHYS 420, the final exam portion of the course is worth 30% of your course grade.)

a) All students are required to take the final examination on your scheduled final exam date (**Thursday, May 12th: 7:00pm to 10:00pm** in Loomis Laboratory 136).

- The final exam will feature four essay questions.

5. Class Participation – 10% (For all students)

a) Class participation points include a possible 100 points in all. However, class participation grades are only worth 10% of your final grade. Class participation grades can be negatively affected if disrespect is shown to others. Also, class participation grades can be negatively affected by accumulating absences (see the table below):

⁴ See https://www.chicagomanualofstyle.org/tools_citationguide/citation-guide-2.html

<u>Absence Amount</u>	<u>Penalty</u>
4 unexcused absences	The student's class participation grade is reduced by half (50/100 points)
5 unexcused absences	The student's class participation grade is reduced by 75% (25/100 points)
6 unexcused absences	The student's class participation grade is reduced to a zero (0/100 points)
7 or more unexcused absences	Excessive unexcused absences numbering seven or more in amount can result in further consequences as allowed by the Student Code and the appropriate UIUC policies
Between 6 and 8 excused absences	An incomplete grade and makeup work after the semester ends (pending UIUC administrative approval)
8 or more excused absences	Dr. Weaver seeks advice from the appropriate office of the Dean to discuss how to proceed

VII. Academic Integrity

“The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.”

“Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <https://studentcode.illinois.edu/article1/part4/1-401/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.”⁵

Students are not allowed to work with anyone else on quizzes, assignments, or exams.

VIII. Emergency Response Recommendations

“Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/>.”⁶

⁵ Quotations in this section were taken from: <https://wiki.illinois.edu/wiki/display/ugadvise/Syllabus+Statements>

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IX. Email Correspondence Policy

All email correspondence with your instructor must be done using your academic (usually the one provided for you by the University of Illinois at Urbana-Champaign) email address (that's an email address ending with .edu). Email correspondence received from non-academic email addresses will be ignored. Email correspondence sent to any other email address besides wgceave9@illinois.edu in an attempt to communicate with me will be ignored. All email correspondence with Professor Weaver should include one's first and last name. Professor Weaver does not open email attachments from students that include scans, JPEGs, or pictures.

Students can expect to receive a reply to their emails within 24 hours on weekdays. If your email is sent after 3:00pm on Friday, or during the weekend you can expect a reply by 5:00pm the following Monday.

X. COVID-19 and Class Participation

“Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols.”

“Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.”

“Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and [will be] reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.”

“All students, faculty, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and [is] expected in this class. Please refer to the University of Illinois Urbana-Champaign's COVID-19 website for [further information on face coverings](#). Thank you for respecting all of our well-being so we can learn and interact together productively.”

“In order to implement COVID-19 guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access Status in the Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Illinois app or the Boarding Pass. If the Building Access Status says ‘Granted,’ that means the individual is compliant with the university's COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students.”

“Students are required to show only the Building Access Screen, which shows compliance without specifying whether it was through COVID-19 vaccination or regular on-campus testing. To protect personal health information, this screen does not say if a person is vaccinated or not. Students are not required to show anyone the screen that displays their vaccination status. No university official, including faculty members, may ask students why they are not vaccinated or any other questions seeking personal health information.”⁷

XI. Sexual Misconduct Reporting Obligation

“The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University’s Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.”

“A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.”⁸

You can retrieve additional information about resources and reporting here: wecare.illinois.edu.

XII. Religious Observances

“Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes.”⁹

XIII. Disability-Related Accommodations

“To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to <https://www.disability.illinois.edu>. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnose a previously undiagnosed disability. You may access these by visiting the DRES website and selecting ‘Request an Academic

⁷ Quotations in this section were taken from: <https://covid19.illinois.edu/on-campus/on-campus-instructors/>

⁸ Quotations in this section are taken from: <https://wiki.illinois.edu/wiki/display/ugadvise/Syllabus+Statements>

⁹ Quotations in this section are taken from: <https://wiki.illinois.edu/wiki/display/ugadvise/Syllabus+Statements>

Screening’ at the bottom of the page.”¹⁰

XIV. Family Educational Rights and Privacy Act (FERPA)

“Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.”¹¹

XV. Grading Scale

The grading scale for this course is as follows:

A+	97.0% to 100%	C+	77% to 79.9%
A	93% to 96.9%	C	73% to 76.9%
A-	90% to 92.9%	C-	70% to 72.9%
B+	87% to 89.9%	D+	67% to 69.9%
B	83% to 86.9%	D	63% to 66.9%
B-	80% to 82.9%	D-	60% to 62.9%

Any grade percentage below 60% is an F.

¹⁰ Quotations in this section are taken from:
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