

Philosophy of Physics

Christopher Arledge

UMBC Spring 2024

Course Details

Email: carledge@umbc.edu
Course Number: PHIL 395
Time: TTh 5:30-6:45 p.m.
Room: PAHB 234
Office Hours: By appointment
Office: PAHB 465

Course Description

The course serves as an introduction to philosophical aspects of classical and modern physics. Topics will include the nature of space and time in special and general relativity, interpretations of quantum mechanics, the quantum measurement problem, and quantum non-locality. Towards the end of the course we will also look at some cutting edge topics in the philosophy of quantum mechanics including quantum information theory, quantum computation and quantum cryptography.

University Requirements Satisfied by the Course

General Education Program - Arts and Humanities (AH)

General Functional Requirements - Arts and Humanities

Learning Outcomes

By the end of this course students should:

1. Have a basic grasp of modern physical theory, including non-relativistic quantum mechanics and special relativity.
2. Be able to explain the interrelation between physics and philosophy.
3. Be able to articulate some of the main philosophical problems facing modern physics.
4. Have the ability to pursue future research in philosophy of physics, should they desire to.

Readings

Required Texts

Albert, David. (1994) *Quantum Mechanics and Experience*. Cambridge:Harvard University Press.

Earman, John. (1992) *World Enough and Space-Time: Absolute versus Relational Theories of Space and Time*. Bradford Books.

Methods of Evaluation

Participation (5%) - Students are expected to attend class and participate. Participation involves doing the readings and contributing to the discussions. Students who don't say anything the entire class will have points deducted from the grade.

Exams (60%) - Students will be given 3 in-class exams worth 20% each.

Exam 1: Thursday March 7

Exam 2: Thursday April 11

Exam 3: Tuesday May 14

Research Paper Proposal (5%) - Students will be required to submit a short research proposal. This proposal should include the topic you are researching and a tentative list of sources you are using. The template for this proposal will be handed out in class and students are expected to adhere to the template.

Due Date: Thursday April 4

Research Paper (30%) - Students will be required to submit a 7-10 page research paper on a topic of their choosing. The paper should use external sources in addition to the sources we cover in class. More details on how to write a good research paper will be given in class.

Due Date: Monday May 20

Classroom Policies

Attendance - I won't take attendance but attendance is still expected. To do well in the course you need to do the readings and attend the sessions. Students who do not attend the class regularly usually receive at least a letter grade lower than the class average.

Technology - The use of laptops and tablets is permitted on the condition that they are used for class purposes. Using a device for a non-class related purpose will distract you, and those around you, so please don't be rude and wait until after class to browse.

Schedule

This is a rough schedule and specific topics for each course will depend on class progress

1. Classical Space and Time from Plato to Einstein (Month 1)
2. Special and General Relativity (Month 2)
3. Quantum Physics (Month 3)
4. Quantum Information and Computation (Last few sessions)

From the University

UMBC Statement of Values for Academic Integrity

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, or the Office of Undergraduate Education.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination

UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at **titleixcoordinator@umbc.edu** or **410-455-1717**. You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited. Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations.

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.

Center for Counseling and Well-Being (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) Online Appointment Request Form

Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; **i3b@umbc.edu**; Monday – Friday 8:00 a.m. – 10:00 p.m.

Other Resources: Women's Center (open to students of all genders): 410-455-2714; **women-scenter@umbc.edu**; Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m. Shady Grove Student Resources, Maryland Resources, National Resources.

Child Abuse and Neglect

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

Accessibility and Disability Accommodations, Guidance and Resources

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities. If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu

SDS phone: 410-455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.