



2023 Pre-College Program Course Performance Report

Student Name: Zara Andhyarujina

Course Title: Quantum Mechanics: The Intersection of Physics and Philosophy

Instructor Name(s): Jiwoo Seo

Program: Summer@Brown

Course Description: Today, almost all university quantum mechanics courses present the topic through the lens of the "Copenhagen interpretation" and then swiftly move on to mathematics and calculating wavefunctions. However, they barely (if at all) discuss the metaphysical reality of what's really going on under the mathematical formulation, and either ignore the many other interpretations of quantum mechanics or briefly mention a few as side notes.

However, when physicists first developed quantum mechanics, arguments about the bizarre metaphysical and philosophical implications took the front stage among physicists, with a famous example being the series of debates between Einstein and Bohr. As time passed, physicists shied away from spending effort into understanding the bewildering reality of quantum mechanics and instead into using the theory to calculate results, summarized as the "shut up and calculate" mentality.

In this course, we aim to introduce quantum mechanics in the spirit of the founders of quantum mechanics, where we openly discuss various interpretations and are never afraid to dive deeply into the counterintuitive and mind-bending consequences of accepting quantum mechanics as reality. How can something be both a particle and a wave? Can a cat be alive and dead at the same time? Does free will exist according to quantum mechanics? These are just a few of the questions that we will be discussing in class, where each student will have a chance to speak their mind and comment on each other's thoughts. By studying these philosophical issues, you will find yourself able to appreciate the beauty and intrigue beneath the surface of mathematical formalism.

This course will be a combination of discussions where the students lead the class through speaking and listening to each other on their opinions and more traditional lectures where the instructor introduces the concepts and mathematics of quantum mechanics.

In this course, you will:

- explore the intersection between philosophy and quantum mechanics
- argue the difference between science and pseudoscience
- discuss the various interpretations of quantum mechanics, and debate which is your favorite
- gain a basic intuition for the mathematics of quantum mechanics: linear algebra
- prove Einstein wrong by going through some calculations of quantum entanglement(!)
- learn about determinism in the context of quantum mechanics and debate the existence of one's own free will

For the following statements, instructors reflected on this student's performance using the following scale: Never, Rarely, Sometimes, Most of the time, Always, N/A. Please review your instructor's responses to each question and then read the narrative student evaluation below.

This student completed assignments on time.: Always

This student submitted quality work.: Always

This student productively collaborated with their peers.: Always

This student displayed strong engagement with the course and course materials.: Always

This student constructively contributed to the course content or classroom environment.: Always

This student was responsive to feedback.: Always

Student Evaluation:

Zara was easily one of the most engaged and hard-working students in the class. She came to class eager to learn and actively participated perhaps more than any other student. Zara showed much effort in fully understanding all the topics and frequently asked valuable questions to do so, helping not only herself but also her classmates to learn more effectively. Zara was a very rare example of a student who excelled in both group and individual settings. She quickly made friends with her colleagues, cooperated excellently with her peers during group projects, put herself in the middle of discussions by speaking up, and proficiently presented her final project to the class. Simultaneously, she demonstrated her profound thoughts in physics and philosophy through eloquent writing in her assignments. Zara's final project on the topic of free will from the point of view of physicists and philosophers was a unique and well-research work on the common topic and I enjoyed reading through it.

It was my great pleasure to teach Zara and I thank her for her active engagement in class, which has helped me to teach and connect with the students more effectively. I have no doubt Zara will excel in whatever she does in the future thanks to her passionately inquisitive and friendly attitude.

BROWN UNIVERSITY

PRE-COLLEGE PROGRAMS

CERTIFICATE OF COMPLETION

Zara Andhparujina

Quantum Mechanics: The Intersection of Physics and

Philosophy

Pre-College Course

June 26th - July 7th, 2023



BROWN

Adrienne Marcus

ADRIENNE MARCUS, DEAN