

CHAPMAN UNIVERSITY
University Honors Program
One University Drive
Orange, CA 92866

HON 382
Spring 2022
The Fabric of the Universe: Space, Time, and Reality

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Catalog Description:

Prerequisite: acceptance to the University Honors Program, or consent of instructor.

Did you ever wonder what is the arena of our physical Reality, what is the Shape of the Universe, or what is the Arrow of Time? Through concrete examples and engaging exercises that teach mind-expanding ideas in an intuitive and informal way, we will learn connections between Geometry and recent developments in Cosmology.

Required Text:

1. *Fabric of the Cosmos: Space, Time, and the Texture of Reality*, by Brian Greene, Publisher: Vintage, 2005; ISBN-13: 978-0375727207.

Course Learning Outcomes:

- ↯ Students will understand the information presented in quantitative form (e.g. equations, logical formulas, graphs, diagrams, algorithms) and have the ability to convert relevant information into this form.
- ↯ Students will understand mathematics and physics concepts in the context of the material presented in class and they will be able to analyze and apply the notions and techniques learned by making relevant assumptions and supporting intermediate steps and solutions in written form.

Honors Program Learning Outcomes:

Upon completing a course in the University Honors Program students will have:

- a. Obtained a starting point for integrative exploration of the development of cultures and intellectual achievements through a variety of disciplinary and interdisciplinary perspectives;
- b. Sharpened their ability to critically analyze and synthesize a broad range of knowledge through the study of primary texts and through engagement in active learning with fellow students, faculty, and texts (broadly understood);
- c. Understood how to apply more integrative and interdisciplinary forms of understanding in the advancement of knowledge and in addressing complex challenges shaping the world;
- d. Developed effective communication skills, specifically in the areas of written and oral exposition and analysis.

Content:

The course introduces students to rigorous concepts and notions of Geometry, Topology, Cosmology, and Physics in the context of understanding Reality. Our own existence takes place in a region of Space and during an interval of Time, yet Science is still struggling to understand what Space and Time actually are.

We start by investigating the Space: notions of surfaces and three-dimensional manifolds are introduced, along with a study of their Topology and Geometry. We construct and study concrete examples of surfaces, and then study several Geometries that these carry, e.g. Euclidean and Hyperbolic.

The second part of the course deals with the notion of Time, setting and answering several questions such as: does Time has a beginning, is there an arrow of Time, can we manipulate Space and Time? In this part students learn notions of Relativity, Cosmology, and Quantum Physics, which are the main players in the search for definition and study of Time and Time measurements.

The Mathematics and Physics of Space and Time are crucial in understanding the Reality and the structure of the Universe. There is a general misconception that this study is meant only for specialists in these fields. This course is designed to break down this barrier and make these “cosmic” questions accessible to undergraduate students.

Instructional strategies:

The lectures are based on the material in the required textbook, complemented by several articles and book chapters which will be provided by the teacher. In class participation is mandatory, as many lectures will be organized in a self-discovery fashion. Students are required to read the material assigned each class time, as there will be follow-up discussions during the next lecture. In addition, students are required to write weekly assignments, which are based on the material taught in class, and on the textbooks. One midterm take-home written project and one take-home written final project will be assigned.

Methods of Evaluation: Total of 600 points

1. Student performance will be evaluated weekly in the form of in-class participation, written assignments, which will assess knowledge acquisition, critical analysis, integration, and creative synthesis of the material. (100 points)
2. There will be one written midterm exam (200 points) and one written final exam (200 points) assigned, consisting in theoretical material and problem solving exercises.
3. In addition, students will be required to complete and present projects related to the material of study. Presentations will occur during class time followed by whole class discussions and peer evaluations (100 points).

Tentative scale:

Score of at least (%)	93	90	87	83	80	77	73	70	67	63	60
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-

Equity and Diversity Statement

Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman’s Harassment and Discrimination Policy. Any violations of this policy should be discussed with the professor, the Dean of Students and/or otherwise reported in accordance with this policy.

Chapman University Academic Integrity Policy

Chapman University is a community of scholars which emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work, and academic dishonesty of any kind will not be tolerated anywhere in the university. At their discretion the faculty may submit work to plagiarism detection software, such as www.turnitin.com for review.

Chapman University's Students with Disabilities Policy

In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Office of Disability Services. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516-4520 if you have questions regarding this procedure, or for information and to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and cannot jeopardize the academic standards or integrity of the course.

Student Support at Chapman University

Over the course of the semester, you may experience a range of challenges that interfere with your learning, such as problems with friend, family, and or significant other relationships; substance use; concerns about personal adequacy; feeling overwhelmed; or feeling sad or anxious without knowing why. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. You can learn more about the resources available through Chapman University's Student Psychological Counseling Services here:

<https://www.chapman.edu/students/health-and-safety/psychological-counseling/>

Fostering a community of care that supports the success of students is essential to the values of Chapman University. Occasionally, you may come across a student whose personal behavior concerns or worries you, either for the student's well-being or yours. In these instances, you are encouraged to contact the Chapman University Student Concern Intervention Team who can respond to these concerns and offer assistance:

<https://www.chapman.edu/students/health-and-safety/student-concern/index.aspx>

While it is preferred that you include your contact information so this team can follow up with you, you can submit a report anonymously. 24-hour emergency help is also available through Public Safety at 714-997-6763.

Course Accommodations: If you need course adaptations or accommodations because of a disability please make an appointment to discuss this with the instructor as soon as possible. No course adaptations, accommodations, or special treatment will be given without written justification from the Chapman University Disability Services. Their office is located inside Student Psychological Counseling Services.

Safety Protocols for On-Campus Instruction

In response to the current COVID-19 pandemic, Chapman University has developed the CU Safely Back program (CUSBP) and mandatory safety measures (<https://news.chapman.edu/coronavirus/>). The University's mandatory safety measures may be stricter than local, state or federal guidelines and may be subject to change at any time. Students are expected to adhere to the University's safety measures while attending classes, including when entering and exiting classrooms, laboratories, or other instructional areas. Safety precautions and procedures may change in response to emerging findings and the recommendations of scientific experts and authorities. Refusal to abide by the University's mandatory safety measures or to the safety requirements specific to this course will result in your being asked to leave the area immediately and may result in an administrative dismissal from this course. The COVID-19 pandemic requires all of us to accept the possibility that changes in how this course is taught may be required and that some changes may occur with little or no notice. For example, some or all of the in person classes might be shifted to a remote-instruction or a hybrid modality. If this occurs, you will be given clear instructions as to how to proceed. The uncertainty of the situation is not ideal for any of us. We must all try to approach this situation with good-will, flexibility, and mutual understanding.

Collaboration and Academic Honesty: Collaboration on homework is encouraged. Group discussions and study sessions can be useful tools for learning. However, outright copying is unacceptable. A good rule of thumb is that it is fine to talk together about how to do a problem, but then go do it and write it up yourself, possibly comparing answers afterwards if you are unsure. Exams and quizzes must be an individual effort. Therefore, no collaboration is permitted on exams, which includes discussing an exam with any student taking it at a different time. In addition to these specific examples, [Chapman University's academic honesty policy](#) applies to this course. If you are unsure whether an activity would constitute a violation of the academic honesty policy, ask the instructor.

Some Useful Campus Resources

Most of these are on campus. However, you should feel free to reach out through email or phone even when we are having online classes.

Tutoring Center: Mon-Thurs, 1pm-5pm, Davis Community Center

Libraries: Leatherby Libraries: <https://www.chapman.edu/library/index.aspx>

Veteran Resource Center: 526 N. Shaffer, va@chapman.edu 714-516-5776

Student Psychological Counseling Services: spcs@chapman.edu

Health Services: Walk in: Mon-Fri 8:30am – 12pm (12-5pm is by appointment)
402 N. Glassell

LGBTQIA+: <https://www.chapman.edu/diversity/resources/queer-pages.aspx> (you can find events and clubs at this website)

Fish Interfaith Center: <https://www.chapman.edu/about/fish-interfaith-center/index.aspx>
(use the events tab to find an event that suits you)

Expectations: I expect that everyone will maintain a classroom conducive to learning. I like an informal atmosphere, but it must be orderly. Thus, everyone is expected to behave with basic politeness, civility, and respect for others. In particular, talking in class is OK if it's part of a class discussion or with me. Neither are reading extraneous materials, using electronic equipment, or sleeping. Suggestions for

improvement are welcome at any time. Any concern about the course should be brought first to my attention.

Keeping On Track Even with Missed Classes/Assignments: During the semester, you may need to miss a class or a few. This semester may be unusual with COVID illnesses or quarantining from exposure where you would miss some classes. To accommodate for this, some class sessions will be recorded to allow you to view them after class. From the 2nd week of class and onward (or when we return to in-person classes), there will be no “live” Zoom meetings during class time, but a recording may be available after the class. If you do miss any number of classes, please do the following:

1. Inform me, the instructor, so I am aware you will be out of class.
2. Check the course Canvas site for detailed information on the lectures/assignments you missed.
3. Do not hesitate to contact me with any questions or concerns you may have with the class or material.

Prepared by: Adrian Vajiac
Last revised: 01/31/2022