

# PHIL 236g: Issues in Space and Time

Andrew Bacon

This course introduces students to philosophical issues related to space and time. Our subjective experience of space and time is often very different from the ways that scientists talk about space and time. This course aims to expose students to the latter way of thinking about space and time and familiarize them to the surrounding philosophical issues. In the first half of this course we investigate Newton's theory of space and time and in the second half we the special and general theory of relativity.

**COURSE OBJECTIVES:** Students taking this course will acquire a qualitative understanding of several historically significant theories of space and time and will be familiar with the philosophical issues surrounding them.

**PREREQUISITES:** There are no prerequisites for this course. Note that this course is not a mathematical course: prior knowledge of mathematics or physics will not be assumed, and we will tend to focus on the purely qualitative aspects of the subject matter.

## 1 Course Details

**CLASSES:** Tuesdays and Thursdays 2:00-3:15pm, THH 102

**OFFICE HOURS:** 12-2 Thursdays, 224 Stonier Hall

**WEBSITE:** Blackboard will be used.

**PHONES AND LAPTOPS:** Phones must be on silent and out of sight during class. Special permission must be sought to use laptops.

**TEXTS:** We will be working primarily from

‘Philosophy of Physics: Space and Time’ by Tim Maudlin.

Everyone will need a copy of this book. A slightly more advanced book is ‘General Relativity: From A to B’ by Robert Geroch. Students wishing to obtain a firmer understanding of the material in this course might also wish to consult this book.

Texts will be selected every week or so and must be read before the corresponding class. You will most likely need to read each text more than once so leave plenty of time.

**GRADING:** You will be assessed on the basis of weekly reading questions (marked on a scale of 0 to 4), two writing assignments and section participation. The writing assignments will consist of short papers (around 2000 words each.)

Grading. Papers: First paper 30%, second paper 35%, weekly questions 25%, participation 10%.

#### STATEMENT ON ACADEMIC CONDUCT AND SUPPORT SYSTEMS

##### Academic Conduct

Plagiarism presenting someone else's ideas as your own, either verbatim or recast in your own words is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity <http://equity.usc.edu/> or to the Department of Public Safety <http://capsnet.usc.edu/departments/departments-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community such as a friend, classmate, advisor, or faculty member can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage [sarc@usc.edu](mailto:sarc@usc.edu) describes reporting options and other resources.

##### SUPPORT SYSTEMS

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

## 2 Preliminary Schedule

This is a *preliminary* schedule – the topics listed here are subject to change (some of these topics will extend over more than one week).

1. Euclid's 'Elements'
2. Relationism and Substantivalism: Handedness (Reading: Jim Van Cleve, 'Left, Right, and the Fourth Dimension')
3. Relationism and Substantivalism: Newton's theory of space and time. (Reading: Maudlin chapter 1.)

4. Relationism and Substantivalism: Relationism and the Bucket argument. (Reading: Maudlin chapter 2.)
5. Relationism and Substantivalism: Absolute velocity and Gallilean space-time. (Reading: Maudlin chapter 3.)
6. Space-time geometry: types of geometric structure.
7. Space-time geometry: Geometry without numbers. (Reading: Selection from Hartry Field's "Science without Numbers". Tarski: "Foundations of the Geometry of Solids".)
8. Space-time geometry: Relationism and space-time geometry. (Readings. Field: "Can we dispense with space-time?", Bacon "Relative locations"
9. Special relativity: Puzzles in classical electromagnetism.
10. Special relativity: Geometry. (Reading: Maudlin chapter 4 and 5.)
11. General relativity: Differential geometry.
12. General relativity: Curved space-time (Maudlin chapter 6.)