MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Physics

Introduction to Special Relativity (8.20) — IAP 2013

Welcome to 8.20

Einstein's special theory of relativity is one of the most stunning achievements of physics, comparable only to Newton's *Principia* and the development of quantum theory. You will learn how relativity emerged from a conflict between optics experiments and intuitive notions of space and time. You will retrain your intuition and learn to make relativistic calculations involving Lorentz transformations, length contraction and time dilation, relativistic energy and momentum, and spacetime diagrams. You will use these concepts to unify the seemingly separate phenomena of electricity and magnetism.

This class is intended for freshmen and sophomores. It cannot be used as a restricted elective by physics majors. Credit cannot be received for 8.20 if credit for 8.033 is or has been received in the same or prior terms.

Prerequisites

Newtonian mechanics (8.01) and single-variable calculus (18.01).
Prior study of electricity & magnetism (8.02) would be helpful but is not required.

People

Lecturer	Prof. Joshua Winn	37-664b, `jwinn@mit.edu`
Graduate Teaching Assistant	Mr. John Barrett	26-650c, `barrettj@mit.edu`
Course Manager	Ms. Nancy Boyce	4-315, `nboyce@mit.edu`

Schedule

- Lectures: Weekdays from 9:30-11 am, in 34-101.
- Recitations: Tuesdays and Thursdays, either 2-3 or 3-4 pm, in 4-145.
- Prof. Winn's office hours: Wednesdays and Fridays from 1-3 pm, in 37-664b.
- There will be 5 problem sets, due at intervals of a few days (see the schedule on the next page).
- The midterm exam is on Friday, January 18, and the final exam is on Friday, February 1. Both are from 9:30-11 am in 34-101.

Required textbook

Special Relativity by A. P. French (W. W. Norton, 1968)

Grades

Your grade will be based on the problem sets (35%), midterm (25%), and final exam (40%). Small grade adjustments may be made to reward class participation.

Other Policies

- Announcements, problem sets and solution sets, and other materials will be distributed using the course web site:

  `http://stellar.mit.edu/S/course/8/ia13/8.20`

- Each lecture has a corresponding reading assignment (see the schedule below). Please read the assigned material before the lecture, or immediately afterward.

- We encourage you to work together on problem sets. You should wrestle with a problem yourself, then discuss it with your friends, and then write up the solution by yourself. You may *not* consult solution sets from previous years.

- Late problem sets will not be accepted.

Schedule

Date	Reading	Topic
Mon Jan 07	Chap. 1	Departures from Newtonian dynamics
Tue Jan 08	Chap. 2	Perplexities in the propagation of light
Wed Jan 09	Chap. 3	Einstein and the Lorentz-Einstein transformations
Thu Jan 10	Chap. 3	Einstein and the Lorentz-Einstein transformations — **pset 1 due**
Fri Jan 11	Chap. 3	Einstein and the Lorentz-Einstein transformations
Mon Jan 14	Chap. 4	Relativity and the measurement of lengths and time intervals — **pset 2 due**
Tue Jan 15	Chap. 4	Relativity and the measurement of lengths and time intervals
Wed Jan 16	Chap. 5	Relativistic kinematics — **pset 3 due**
Thu Jan 17	Chap. 5	Relativistic kinematics
Fri Jan 18		**Midterm exam**
Mon Jan 21		**No class (MLK Day)**
Tue Jan 22	Chap. 6	Relativistic dynamics — collisions and conservation laws
Wed Jan 23	Chap. 6	Relativistic dynamics — collisions and conservation laws
Thu Jan 24	Chap. 7	More about relativistic dynamics — **pset 4 due**
Fri Jan 25	Chap. 7	More about relativistic dynamics
Mon Jan 28	Chap. 7	Relativity and electricity
Tue Jan 29	Chap. 8	Relativity and electricity
Wed Jan 30	Chap. 8	Relativity and electricity — **pset 5 due**
Thu Jan 31	Chap. 8	Relativity and electricity
Fri Feb 01		**Final Exam**