INTRODUCTION TO RELATIVITY

course schedule

January 11 Predrag Cvitanović? Just SAY IT!
1. Atlanta snowmageddon
NOTE: classes cancelled due to icy conditions
January 13
2. Atlanta snowmageddon II
NOTE: classes cancelled due to icy conditions

Reading: Chapter 1 - Gravitational Physics
Please read this chapter yourself. It will not be covered in the class.
[emergency help]
[assigned viewing]
January 17
Martin Luther King Day
January 18
3. Geometry as Physics

Reading: Chapter 2 - Geometry as Physics
January 20 Predrag Cvitanović? Just SAY IT!
3. Newtonian Physics

Reading: Chapter 2 - Geometry as Physics
Sect. 2.6 and Box 2.3.
Reading: Chapter 3 - Newtonian Physics
Sects. 3.1 - 3.4.

homework #1: Chapter 2, problem 2, optional 10. Chapter 3, problem 2, optional 5. - due in class, Thu Jan 27. Democracy has been saved by Brendan Sullivan! Hartle and Cvitanović are wrong, everybody in the class is right, Earth trumps Sun in problem 2.2. Will adjust grades accordingly.
[solutions to homework #1: 2.2, 2.10, 3.5]
January 25
4. Variational principle

Reading: Chapter 3 - Newtonian Physics
Sect. 3.5: Variational principle
January 27
5. Principles of Special Relativity

Reading: Chapter 4 - Principles of Special Relativity
February 1

6. Principles of Special Relativity
February 3
7. E = m c square

Reading: Chapter 5 - Special Relativistic Mechanics
Sects. 5.1 - 5.4

homework #2:
[solutions to homework #2]
How is this course graded?

February 8
8. Variational principle

Reading: Chapter 5 - Special Relativistic Mechanics
Sects. 5.4 - 5.6

February 10
9. Doppler shift

Doppler Shift and Moving beyond a Non-Accelerating frame.

homework #3:
[solutions to homework #3]

February 15
10. Curved Spacetime

Reading: Chapter 7 - Description of Curved Spacetime
Sect. 7.1.

February 17
11. Curved Spacetime

Sects. 7.2 to 7.5.

homework #4:
[solutions to homework #4]

February 22
12. Curved Spacetime

Sects. 7.5 to 7.6.

February 24
13. Curved Spacetime

Sects. 7.7 to 7.9.

homework #5:
[solutions to homework #5]
[solutions to homework #5, example 7.2]

March 1
14. The Global Positioning System

Sects. 6.2 to 6.6.

March 3

15. Wormholes

Sects. 7.7. Seek alternative sources of enlightment concerning covariant vs contravariant indices: vectors vs forms, etc.. Let me know it you found something insightful.

homework #6:

Note: this homework due March 17. Problem 8.1 added March 10.

[solutions to homework #6]

March 8

16. Geodesics

Reading: Chapter 8 - Geodesics

The most important chapter. Wormholes are fun.

March 10

9:35-10:55am Howey S204: midterm exam

What does midterm cover: All the assigned reading up to March 3. The problems will be much like the assigned exercises. Scores: from 8 to 29, out of 30 max.

[overview of material covered]

[solutions to the midterm exam]

March 15

Midterm review

Please study the midterm solutions; they are very detailed, I will answer only questions that are not in the solutions provided. My advice: (1) Do work through the assigned problems, there is no other way to learn theoretical physics. (2) Do come to lectures, they can help you sort out what is important and what is not. (3) Seize the opportunities of the small class, participate and discuss unclear points. (4) Do stop by my office if you do not understand something off the bat.

March 17

17. Geodesics

homework #7:

Note: this homework due April 7.

[solutions to homework #7]

March 21-25

spring break

March 29

18. Geodesics

Worked out Christoffel symbol in polar coordinates.

March 31

19. Geodesics

Symmetries, Killing vectors, freely falling frames.

April 5

20. Geometry Outside of a Spherical Star

Reading: Chapter 9 - The Geometry Outside a Spherical Star

Timelike particle orbits in Schwarzschild geometry. Redshift and particle orbits.

April 7
21. Orbits in Schwarzschild geometry
homework #7 due

Reading: Chapter 9 - The Geometry Outside a Spherical Star
The geometry outside a spherical star. Lightlike orbits in Schwarzschild. Time delay of light.

homework #8:
[solutions to homework #8]
April 12
22. Getting ready to meet Albert

Reading: Chapter 20 - A Little More Math
A hard jump.
[Max's solution: Her covariant derivatives blow my mind"]
April 14
23. More Math
April 19
24. Einstein Equation

Reading: Chapter 21 - Curvature and the Einstein equation
Read sects. 21.1 and 21.2

homework #9:
NOTE: due Tue April 26 2011
[solutions to homework #9]
April 21
25. Einstein Equation: Schwarzschild solution

Reading: Chapter 21 - Curvature and the Einstein equation
Read sects. 21.3 and 21.4
[Einstein equation: the battle plan]
April 26
26. Stress-energy tensor
Read sects. 22.1 and 22.2

Reading: Lautrup Chapter 6 - Stress
Optional reading from B. Lautrup, Physics of Continuous Matter, if you would like to understand the classical stress tensor.
For the full story, take "Introduction to Continuum Physics".
April 28
27. Einstein equation
Read sect. 22.3
April 29
GT classes end

Final exam syllabus: An overview of material covered by the final exam

Thursday May 5

final exam 8:00am - 10:50am

closed book, closed lecture notes, no calculator.

solutions to the final exam, version of May 8

until May ?

course opinion survey

Instructor's opinion: Show this class a few indices, and it's like deer in a floodlight. Democracy does not work - nobody is going to try to explain the Einstein field equation in the first undergraduate relativity course again. I never got so many white hairs as in this course...

CETL web link

May 7

the future looks bright - have good holidays!

May 9  the rest has yet to be worked out ...