April 2013

Physics 317 – Special Theory of Relativity (3)
Course Outline

Prerequisites for PHYS 317: PHYS 211. Primarily serves as an upper division elective for physics and astronomy minors.

Learning Objectives and Criteria:
Upon completion of the course the student is expected to:

1. Understanding of the postulates of Einstein's special theory of relativity, the theoretical consequences of these postulates, and how they affect the core covariant theoretical framework of physical law.
2. Solve advanced kinematics problems and apply special relativity to such fields as nuclear physics, particle physics, geodesy, astrogation, astrophysics, and astronomy.
3. Know the advanced mathematics of relativity including tensor manipulation Einstein summation notation, non-Euclidian (flat) metrics in Minkowski space, and invariance in Minkowski space.
4. Appreciate the connection between special relativity and Maxwell's equations, the theoretical foundations of electricity and magnetism.
5. Be prepared for an introductory course in general relativity.
6. Know and appreciate of some of the established ideas underpinning modern physics.

Text and References:
1. T. M. Helliwell, Special Relativity, 1st edition, University Science Books, 2010. (text)
2. D. J. Griffiths, Introduction to Electrodynamics (primarily chapter 12), 3rd edition, Pearson/Addison Wesley, 1999. (Suggested reference)
3. A. P. French, Special Relativity, W. W. Norton and Co., 1968. (Suggested reference)
4. N. D. Mermin, Space and Time in Special Relativity, Waveland Pr. Inc., 1989. (Suggested reference)
5. Taylor and Wheeler, Spacetime Physics, 2nd edition, W. H. Freeman, 1992. (Suggested reference)

Content and Method:

Method: Physics 317 is offered in a traditional lecture format. The course is intended as a mathematical, quantitative study of the predictions of special relativity based on the two basic postulates as originally proposed by Einstein. It meets a total of 3 hours per week (3 hours of lecture).

Content: Physics 317 will adhere to the following topics:

1. Postulates of relativity with historical context
2. Simultaneity
3. Length and time measurements
4. Discussion of classic "paradoxes" and their resolutions

5. Lorentz coordinate transformations
6. Relativistic kinematics including energy and momentum conservation
7. Four-Vectors and invariance (spacetime interval, mass, etc.)
8. Space-time diagrams
9. Relativity and electromagnetism

Methods of Assessment:

Lecture Sections: The methods of assessment will be in the form of homework and exams.