# Math 651B

# Spring Semester 2005 Topic:

# Mathematics of Relativity and Gravitation

**Instructor** David Klein
**Meeting Times** Tuesday & Thursday, 5:30 to 6:45 p.m.
**Room** JR 215
**Prerequisites** Math 462 and Math 350, or permission of the instructor

**Textbook** *The Geometry of Spacetime: An Introduction to Special and General Relativity*, by James J. Callahan, Springer-Verlag Undergraduate Texts in Mathematics, copyright 2000, ISBN 0-387-98641-3

**Course Description**

Einstein's theory of relativity is a theory of great beauty as well as predictive power. It is a centerpiece of modern physics and astronomy, and it continues to attract researchers in both mathematics and physics.

This course is an introduction to special and general relativity for beginning math graduate students. Background in physics will not be assumed, and any results from physics needed for the course will be developed in class or identified as assumptions.

We will begin with the special theory of relativity, a theory that explains how time and space measurements depend on an observer's inertial frame of reference. The main mathematical ingredient for this part of the course will be linear algebra, and the focus will be on Lorentz transformations and Minkowski geometry. Following that we will develop the rudiments of differential geometry needed for an introduction to general relativity, and then proceed to general relativity itself. General relativity is a theory of gravity. It explains gravity in terms of the geometry of spacetime. The unifying theme will be geometry in the context of both flat and curved spacetimes.

Topics for the course include Galilean and Lorentz transformations, Minkowski geometry, accelerated motion, rudiments of semi-Riemannian geometry (geodesics, parallel transport, curvature), De Sitter Spacetime, tidal forces, and the gravitational field equations, as time permits.

For further information contact David Klein: david.klein@csun.edu