Topics in Geometry
Mathematics 995
Fall 1996

Instructor: Louis Crane (will be coordinated with Larry Weaver in Physics)

The development of theoretical physics over the last 20 years has led to a curious result: the forces and equations of physics correspond almost perfectly to the cast of characters of differential geometry in its fiber bundle formulation. This is the result of the great success of gauge theories, which are conceptually similar to general relativity. This state of affairs is still not well known either among mathematicians or physicists.

The purpose of this course is to explore this correspondence. The main goal will be to understand general relativity in the Ashtekar variables. In the course of understanding the geometry of the Ashtekar variables, we will learn about fiber bundles and spin bundles. This will make it easy to understand the other fundamental equations of theoretical physics in the same context.

We will try to approach the subject by understanding examples, and to be accessible to physics students.