EXPRESIÓN DE INTERÉS SO-INTRO: INTRODUCTION TO MODULI SPACES

OSCAR GARCÍA-PRADA

Moduli spaces arise naturally in classification problems in geometry. Typically, one has a collection of objects and an equivalence relation, and the problem is to describe the set of equivalence classes. Usually, there are discrete invariants that partition this set in a countable number of subsets. In most cases there exist continuous families of objects, and one would like to give the set of equivalence classes some geometric structure to reflect this fact. This is the object of the theory of moduli spaces. The word moduli is due to Riemann, who used it as a synonym for parameters when showing that the space of equivalence classes of Riemann surfaces of a given genus $g > 1$ depends on $3g - 3$ complex numbers. After this, the concept of moduli has been used in geometry in a rather loose sense to measure variations of geometric structures of one kind or another, but it has not been however until the 1960s that one has been able to formulate moduli problems in precise terms and in some cases to obtain solutions to them.

In this project we will be concerned with moduli spaces of vector bundles and Higgs bundles over a Riemann surface, as well as related structures, like connections and representations of the fundamental group of the surface. These moduli spaces play a very prominent role in algebraic geometry, differential geometry, topology and theoretical physics. The goal of the project is to introduce the student in this important subject. During his stay the student will benefit of the activity of the Hitchin–Ngo Laboratory at ICMAT with Professors Nigel Hitchin (University of Oxford, Shaw Prize in Mathematics) and Ngo Bao Chau (University of Chicago, Fields Medal), and other top researchers in the field giving courses and talks. This will provide a unique opportunity for a student interested in this area of research.

The supervisor of this work has a large experience in supervising Master, PhD and postdoctoral students, having supervised more than 14 PhD theses, in addition to several JAE Intro students over the years.

Instituto de Ciencias Matemáticas, CSIC, Nicolás Cabrera, 13–15, 28049 Madrid, Spain

Email address: oscar.garcia-prada@icmat.es

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