

1. PROJECT SUMMARY

Understanding the *topology and geometry of the moduli space of Riemann surfaces and the corresponding mapping class groups* has been a goal of central importance in mathematics for many years. Over the last 15 years there have been several new perspectives on moduli spaces that have not only increased our understanding of these important objects, but have fundamentally affected major research directions in several areas of geometry and topology, including Hyperbolic Geometry and Geometric Group Theory, Algebraic Geometry, and most recently, Algebraic Topology. Important developments were occurring at the same time in Symplectic Geometry and Mathematical Physics. The introduction by M. Gromov of the *method of J-holomorphic curves* in Symplectic geometry and the development of the mathematical theory of Mirror Symmetry brought into the spotlight the *Gromov-Witten theory*: the study of moduli spaces of holomorphic curves in algebraic and symplectic manifolds. During the last five years there have been several further startling advances in all these areas and new, deep and unexpected links were discovered between seemingly unrelated areas of mathematics.

This proposal is for the funding of a major three year, January 2007–January 2010, emphasis program in the geometry and topology and geometry of moduli spaces and related topics, to be organized by the Mathematics Research Center (MRC) of Stanford University and the American Institute of Mathematics (AIM). Each year of the program will focus on one of the big areas associated to the project: *Algebraic and Symplectic Geometry of Moduli Spaces and Applications*, *Algebraic Topology of Moduli Spaces and String Topology*, and *Hyperbolic Geometry and Geometric Group Theory*. In turn, each thematic year will be structured as two inter-related and parallel subprograms focused on specific problems.

Broader Impacts. One basic impact of this project is the cross discipline communication between mathematicians studying moduli spaces from the perspectives of different fields. These will benefit greatly all very active subfields represented in these programs. There is also the related educational impact of this program. Graduate students and postdoctoral researchers entering these fields will be exposed and learn techniques from a wide variety of subfields. The program organizers will also particularly encourage the participation of women and minority mathematicians at every stage of career development. This will include women graduate students and postdocs, as well as having senior female mathematicians give plenary talks, lecture series, and mini-courses. The proposed project has applications beyond Geometry and Topology, e.g. in Mathematical Physics.