Complex Manifolds (L24)

Dr. Maxim Jeffs

This course will be a first introduction to complex manifolds: smooth manifolds that are equipped with an atlas of holomorphic charts. Such manifolds arise naturally in algebraic geometry, representation theory, and certain aspects of mathematical physics. When equipped with a kind of compatible Riemannian metric, called a *Kähler metric*, complex manifolds have a rich geometric structure. This 'Kähler package', which shall be our focus for the second half of the course, has inspired significant developments over many different fields of mathematics.

The course will cover a selection of topics including:

- Analysis of several complex variables;
- Divisors, line bundles, and Chern classes;
- Complex algebraic curves and projective varieties;
- Kähler metrics and Hodge theory;
- The Ricci form and Calabi-Yau manifolds.

Prerequisites

Familiarity with complex analysis, smooth manifolds, and de Rham cohomology will be essential. Differential geometry and algebraic topology from Part III (or equivalent) are strongly recommended.

Literature

1. D. Huybrechts. *Complex geometry: An introduction*, Springer 2005.
2. D. Arapura. *Algebraic Geometry Over the Complex Numbers*, Springer Universitext, 2012.
3. C. Voisin. *Hodge Theory and Complex Algebraic Geometry I*, Cambridge University Press, 2002.
4. P. Griffiths and J. Harris. *Principles of algebraic geometry*, Wiley 1978.

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a one-hour revision class in the Easter Term.