# Prof. **Olga Rossi**

(Department of Mathematics, University of Ostrava, Czech Republic)

Phd course

# "Geometric structures in the calculus of variations"

## Abstract

The course is an introduction to the calculus of variations on manifolds. In the context of the history, the exposition surveys main results achieved during the past 40 years in understanding the geometric structure of extremal problems.
We present the developments and generalizations of the traditional three pillars of the theory: the Lagrangian theory, the Hamilton and Hamilton-Jacobi theory, and the theory of symmetries and conservation laws, as well as the modern fourth pillar - the theory of variational sequences and bicomplexes.  Applications mainly to problems in geometric mechanics and to integration of differential equations are considered, and open problems are discussed.

Main topics:
- Vector distributions on manifolds, symmetries and first integrals
- Jet bundles, calculus on jet bundles, jet connections
- The first variation formula, Euler-Lagrange equations, Noether theorem
- The inverse problem of the calculus of variations
-  Exterior differential systems in the calculus of variations, Hamilton equations
- Symmetries and conservation laws, geometric integration methods based on symmetries
- Jet fields, complete integrals, and the Hamilton-Jacobi equation
- Hamiltonian theory for PDEs, dual jet bundles, multi-symplectic forms, and Hamiltonian connections
- Examples of Hamilton field equations:  Instantons, Electromagnetic  and  Yang-Mills fields, gravity

## Calendar

The course will run from April 13 to April 17, 2015, and from April 20 to April 24, 2015
from 10.30 to 12.30,
at the Aula Dottorato (first floor) of the Department of Mathematics "F. Enriques" of the University of Milan, Via C. Saldini n.50 – 20133 Milano

information: segrdott.mat@unimi.it

**UNIVERSITÀ DEGLI STUDI DI MILANO**

DIPARTIMENTO DI MATEMATICA