Within the **Erasmus+ Cooperation** we announce a short course

Analysis on Manifolds II

Hamiltonian systems in geometric mechanics and field theory

The course is a continuation of the advanced course on the calculus of variations on manifolds delivered in spring 2014. The main topic will be the Hamiltonian theory for variational ODEs and PDEs on manifolds, generalizing the successful symplectic setting for classical Hamiltonian mechanics. We shall present an overview of the theory developed since 1980's, as well as open problems.

Teacher: Prof. Olga Rossi (University of Ostrava)

Time and place will be decided in the first meeting: Monday 27/10, 12:15, room 306 (house 6) in Kräftriket (SU)

6 lectures (2 hours)

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Contents

1. Variational equations in jet bundles
- Jet bundles
- Lagrangians, Lepage forms, and the first variation formula
- Symmetries and conservation laws
- The inverse problem of the calculus of variations

2. Hamiltonian mechanics
- Euler-Lagrange and Hamilton equations in classical mechanics
- Symplectic mechanics
- Hamilton equations in jet bundles, Lepage manifolds
- Classification and structure theorems for ODEs
- Regular Lagrangian systems
- Jet fields, canonical transformations and the Hamilton-Jacobi equation
- Dual jet bundles and Poisson brackets in higher order mechanics

3. Hamiltonian field theory
- Hamilton-De Donder equations
- Lepage manifolds, regular Lagrangians and Legendre transformation
- Einstein equations and Maxwell equations as a regular Hamiltonian system
- Dual jet bundles, multisymplectic forms, and the structure of variational PDEs
- The inverse variational problem in Hamiltonian formulation
- Some open problems