Colloquium

Dr. Roman Popovych
Wolfgang Pauli Institute, Vienna

Monday, September, 26, 2016
2:00p.m., HH-3017

Inverse problems on conservation laws and conservative parameterizations

Abstract:

The standard (direct) problem on conservation laws concerns finding the space of conservation laws of a given system of differential equations or at least a subspace of this space with certain additional constraints, e.g., on order of conservation laws. At the same time, several important applications, e.g., the parameterization of differential equations, need solving the inverse problem, which has received less attention so far although. In a narrow sense, the inverse problem on conservation laws intuitively means deriving the general form of systems of differential equations with a prescribed set of conservation laws. More generally, it can be interpreted as the study of properties of systems for which something is known about their conservation laws. A precise formulation of inverse problem on conservation laws requires considerable efforts including analysis on which data of conservation laws are appropriate, and the extended Kovalevskaya form for systems of differential equations are essentially involved in this study.

We completely solve several inverse problems on conservation laws, including the inverse problem on integrating factors of single ordinary differential equations. Using the class of (1+1)-dimensional evolution equations, we demonstrate how the solution of the inverse problem on conservation laws can help to solve the direct problem for the same class of equations. Results on a specific case of inverse problems that is associated with families of conservation laws parameterized by arbitrary functions are applied to conservative parameterization of the vorticity equation. The generalized second Noether theorem is shown to well fit within the framework presented.