1058-58-88 **Juha Pohjanpelto*** (juha@math.oregonstate.edu), Department of Mathematics, Oregon State University, Corvallis, OR 97331. *Symmetries, conservation laws, and variational principles in classical field theories.*

Noether's theorem associates to every symmetry of a variational problem a conservation law for the corresponding Euler-Lagrange equations. Noether's second theorem, in turn, asserts that infinite dimensional Lie symmetry pseudogroups correspond to differential constraints among the Euler-Lagrange equations.

These classical theorems suggest the following problem first enunciated by Takens in 1977: Suppose that a system of differential equations is invariant under a given pseudogroup of transformations and that the system admits the conservation laws and is subject to the differential identities corresponding to these symmetries. Does it then follow that the system can be written as the Euler-Lagrange equations of some Lagrangian? Besides its intrinsic mathematical interest, Takens' question has far-reaching ramifications in physical field theories where symmetries and conservation laws are of primary importance in determining the form of the field equations.

In this talk I will review my recent joint work with G. Manno and R. Vitolo on Takens' problem for non-abelian gauge theories and with Ian Anderson on Takens' problem for metric field theories, involving the infinite dimensional symmetry pseudogroups of gauge transformations and of local diffeomorphisms, respectively. (Received February 04, 2010)