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ZAVOD ZA TEORIJSKU FIZIKU
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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

(Zajednički seminari Zavoda za teorijsku fiziku,
Zavoda za eksperimentalnu fiziku i Zavoda za teorijsku fiziku PMF-a)

Loop groups, integrable systems and Segal-Wilson Grassmannian

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Abstract:

In this talk we present a group theoretic formulation of integrable systems from the loop group point of view. We show that if a loop group G admits Birkhoff factorization $G = G_- G_+$, then one can define an action of $\mathbf{R^n}$ on G which induces a hierarchy of integrable systems formulated as the zero-curvature condition on the Lie algebra of G_+. Solutions of these equations are given in terms of commuting flows on the homogeneous space G/G_+. We illustrate this construction by deriving the nonlinear Schrödinger (NLS) and Heisenberg magnet (HM) equation with classical spins. We also discuss the gauge transformation between integrable systems in terms of different Birkhoff factorizations of G. It is shown that if the NLS and HM flows are Laurent polynomials in the spectral variable, then the gauge transformation $NLS \mapsto HM$ is equivalent to an algebraic transformation Γ between the polynomial coefficients. Explicit computation of NLS flows is discussed in terms of the Segal-Wilson Grassmannian $Gr(H)$. We show that solutions of NLS are given in terms of Baker functions for special subspaces $W \in Gr(H)$. By modifying the ideas of Segal and Wilson we construct a sequence of subspaces $\{W_n\}$ which yields multisoliton solutions of NLS. These solutions are mapped to multisoliton solutions of HM via the transformation Γ.

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