Caudrelier, Vincent; Stoppato, Matteo; Vicedo, Benoît
On the Zakharov-Mikhailov action: 4d Chern-Simons origin and covariant Poisson algebra of the Lax connection. (English) [Zbl 07383280]

Summary: We derive the 2d Zakharov-Mikhailov action from 4d Chern-Simons theory. This 2d action is known to produce as equations of motion the flatness condition of a large class of Lax connections of Zakharov-Shabat type, which includes an ultralocal variant of the principal chiral model as a special case. At the 2d level, we determine for the first time the covariant Poisson bracket r-matrix structure of the Zakharov-Shabat Lax connection, which is of rational type. The flatness condition is then derived as a covariant Hamilton equation. We obtain a remarkable formula for the covariant Hamiltonian in terms of the Lax connection which is the covariant analogue of the well-known formula “$H = \text{Tr} L^2$.”

MSC:
70H06 Completely integrable systems and methods of integration for problems in Hamiltonian and Lagrangian mechanics
70S05 Lagrangian formalism and Hamiltonian formalism in mechanics of particles and systems
70S15 Yang-Mills and other gauge theories in mechanics of particles and systems

Keywords:
integrable field theories; 4d Chern-Simons theory; covariant Hamiltonian formalism; Zakharov-Mikhailov action; covariant classical r-matrix

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References: