Commun. Math. Phys. 159, 93–119 (1994)

Communications in
Mathematical
Physics

The Second Gelfand–Dickey Bracket as a Bracket on a Poisson–Lie Grassmannian

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Received: December 1, 1992

Dedicated to Israel M. Gelfand at his 80^{th} *birthday*

Abstract: We introduce a Poisson structure on a Grassmannian $\mathrm{Gr}_k(V)$ on which the Poisson–Lie group $\mathrm{GL}(V)$ acts in a Poisson–Lie way. We discuss the analytic complications connected with the infinite-dimensional case $V = C^\infty(\mathbb{R})$ and show that an open subset of $\mathrm{Gr}_k(V)$ with this Poisson structure is isomorphic to the Gelfand–Dickey manifold of differential operators of order k with the second Gelfand–Dickey bracket. In fact we introduce as a consequence a Poisson–Lie action of an enormous group on the Gelfand–Dickey manifold generalizing (on the semiclassical level) the Sugavara inclusion.

Contents