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Poisson cohomology of scalar multidimensional Dubrovin-Novikov brackets

Guido Carlet, Matteo Casati, Sergey Shadrin

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**POISSON COHOMOLOGY OF SCALAR
MULTIDIMENSIONAL DUBROVIN-NOVIKOV BRACKETS**

GUIDO CARLET, MATTEO CASATI, AND SERGEY SHADRIN

ABSTRACT. We compute the Poisson cohomology of a scalar Poisson bracket of Dubrovin-Novikov type with D independent variables. We find that the second and third cohomology groups are generically non-vanishing in $D > 1$. Hence, in contrast with the $D = 1$ case, the deformation theory in the multivariable case is non-trivial.

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1. INTRODUCTION

The multidimensional Dubrovin-Novikov (DN) type Poisson brackets were introduced by Dubrovin and Novikov in [7, 8].

Let $x = (x^1, \dots, x^D)$ be coordinates on the torus T^D and $u = (u^1, \dots, u^N)$ be variables on an open ball $U \subset \mathbb{R}^N$ (or more generally local coordinates on a smooth N -dimensional manifold M). The Dubrovin-Novikov brackets are of the form

$$\{u^i(x), u^j(y)\} = \sum_{\alpha=1}^D \left(g^{ij\alpha}(u(x)) \partial_{x^\alpha} \delta(x-y) + b_k^{ij\alpha}(u(x)) \partial_{x^\alpha} u^k(x) \delta(x-y) \right) \quad (1)$$

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