

# Classical double, $R$ -operators and negative flows of integrable hierarchies

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Using classical double  $\tilde{\mathcal{G}}$  of the Lie algebra  $\tilde{\mathfrak{g}}$  equipped with the classical  $R$ -operator we define two sets of mutually commuting functions with respect to the initial Lie-Poisson bracket on  $\tilde{\mathfrak{g}}^*$  and its extensions. We consider in details examples of the Lie algebras  $\tilde{\mathfrak{g}}$  with the "Kostant-Adler-Symes"  $R$ -operators and the corresponding two sets of mutually commuting functions. Using the constructed commutative Hamiltonian flows on different extensions of  $\tilde{\mathfrak{g}}$  we obtain zero-curvature equations with  $\tilde{\mathfrak{g}}$ -valued  $U - V$  pairs. Among such, the equations are so-called "negative flows" of soliton hierarchies. We illustrate our approach by several examples.