

# The Hamiltonian structure of the two-dimensional mKP-hierarchy on the extended phase space

*Pidstryhach IAPMM of the NASU, Lviv, Ukraine*  
*E-mail: ohen@ukr.net*

In the paper [1] the existence problem of Hamiltonian representation for the two-dimensional KP-hierarchy coupled with the corresponding evolutions of eigenfunctions of the associated spectral problems has been considered. This problem has been solved by use of some Backlund transformation on a suitably extended phase space. In the present report it is established the existence of the Hamiltonian representation for the extended two-dimensional mKP-hierarchy in the form

$$L_{t_n} = [L_{\geq 1}^n, L - c\partial/\partial y],$$

$$q_{i,t_n} = L_{\geq 1}^n q_i, \quad q_{i,t_n}^* = -\partial^{-1}(L_{\geq 1}^n)^* \partial q_i^*, \quad i = \overline{1, N},$$

where  $L := f_1^{-1} l f_1 - c f_1^{-1} (\partial f_1 / \partial y) = \partial^p + \sum_{m=1}^{p-1} v_m \partial^m + q_1 + \partial^{-1} q_1^* \partial + \sum_{i=2}^N q_i \partial^{-1} q_i^* \partial$ ,  $l := \partial^p + \sum_{k=0}^{p-1} u_k \partial^k + \sum_{i=1}^N f_i \partial^{-1} f_i^*$ ,  $v_m, u_k \in C^\infty(\mathbb{S} \times \mathbb{S}; \mathbb{C})$ ,  $q_i, q_i^*, f_i, f_i^* \in C^\infty(\mathbb{S} \times \mathbb{S}; \mathbb{C})$ ,  $\partial := \partial/\partial x$ ,  $x, y \in \mathbb{S} \simeq \mathbb{R}/2\pi\mathbb{Z}$ , the index " $\geq 1$ " denotes a pure differential part of the corresponding integro-differential operator,  $t_n \in \mathbb{R}$ ,  $n \in \mathbb{N}$ , by means of the Backlund transformation connecting the two-dimensional KP- and mKP-hierarchies on the extended phase spaces and being generated by the gauge transformation (see [2]) on the dual space to the central extension of the Lie algebra of integro-differential operators.

The Hamiltonian representations for the additional symmetries of the extended two-dimensional mKP-hierarchy are obtained as the result of the transformation being the composition of Backlund transformation generated by the gauge one and the Backlund transformation on the extended phase space of the two-dimensional KP-hierarchy.

- [1] Hentosh O.Ye., Prykarpatsky A.K., *Integrable three-dimensional coupled nonlinear dynamical systems related with the centrally extended operator Lie algebras*, *Opuscula Mathematica* **27**, 2, (2007), pp. 231-244.
- [2] Oevel W., Strampp W., *Constrained KP hierarchy and bi-Hamiltonian structures*, *Commun. Math. Phys.* **157**, (1993), pp. 51-81.