

Symmetry reduction of second heavenly equation and 2 + 1 - dimensional Hamiltonian integrable system

D. Yazıcı¹ M.B. Sheftel²

April 30, 2007

1. Department of Physics, Yıldız Technical University, 34210 Esenler, Istanbul (Turkey).
2. Department of Physics, Boğaziçi University, 34342 Bebek, Istanbul (Turkey).

Recently we discovered that the second heavenly equation of Plebański $u_{tt}u_{xx} - u_{tx}^2 + u_{xz} + u_{ty} = 0$, presented in two-component form, is a 3 + 1-dimensional multi-Hamiltonian integrable system [1]. In paper [2] we studied all nonequivalent 2 + 1-dimensional symmetry reductions of this system. In general, symmetry reductions do not conserve the Hamiltonian structure of the original equations. Here we show that one particular symmetry reduction, with respect to the special combination of translations generated by $X = \partial/\partial z - \alpha^{-1}\partial/\partial y + \alpha\partial/\partial t$, yields the two-component 2 + 1-dimensional multi-Hamiltonian integrable system $u_t = q$, $q_t = [q_x^2 + \alpha(q_x - q_y) - u_{xy}]/u_{xx}$, where α is an arbitrary constant. For this system, we present the Hamiltonian and recursion operators, point symmetries and integrals of motion.

References

- [1] Neyzi, F., Nutku, Y. and Sheftel, M. B. *J. Phys. A: Math. Gen.*, **38** (8473–85), 2005.
- [2] Neyzi, F., Sheftel, M.B. and Yazici, D. *Physics of Atomic Nuclei*, **70** (584–92), 2007.