

Lift of noninvariant solutions of heavenly equations and new 4-dimensional ultra-hyperbolic metrics

M.B. Sheftel^{1,2} A.A. Malykh², Y. Nutku³

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1. Department of Physics, Boğaziçi University, 34342 Bebek, Istanbul (Turkey).
2. Department of Higher Mathematics, North Western State Technical University, Millionnaya St. 5, 191186, St. Petersburg (Russia).
3. Feza Gürsey Institute, PO Box 6, Cengelkoy, 81220 Istanbul (Turkey).

Our goal is to obtain non-invariant solutions of 4-dimensional heavenly equations that will yield new gravitational metrics with no Killing vectors. This property is characteristic for the famous gravitational instanton $K3$. For solving this problem, we have developed a procedure reverse to the symmetry reduction, called **lift**, based on the use of partner symmetries [1].

We show how partner symmetries of the 4-dimensional hyperbolic complex Monge-Ampère equation ($HCMA$): $u_{1\bar{1}}u_{2\bar{2}} - u_{1\bar{2}}u_{2\bar{1}} = -1$ provide a lift of non-invariant solutions of the three-dimensional Boyer-Finley equation (BF): $\psi_{z\bar{z}} = e^{\psi_x}\psi_{xx}$ to non-invariant solutions of $HCMA$. The lift is applied to non-invariant solutions of BF , obtained earlier by the method of group foliation [2], and yields new non-invariant solutions of $HCMA$. We construct new Ricci-flat nonsingular ultra-hyperbolic metrics with no Killing vectors, Newman-Penrose moving co-frames, and non-zero curvature 2-forms.

References

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