

Two different bi-Hamiltonian structures for the first heavenly equation of Plebanski

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For the first heavenly equation of Plebanski in a two-component evolutionary form we obtain Lagrangian and Hamiltonian representations. We derive two linearly independent recursion operators for symmetries of this system related by a discrete symmetry of both the two-component system and its symmetry condition. Acting by these operators on the first Hamiltonian operator J_0 we obtain second and third Hamiltonian operators. However, we were not able to find Hamiltonian densities corresponding to the latter two operators. Therefore, we construct two recursion operators, which are either even or odd, respectively, under the above-mentioned discrete symmetry. Acting with them on J_0 we generate another two Hamiltonian operators J_+ and J_- and find the corresponding Hamiltonian densities, thus obtaining two bi-Hamiltonian representations for the first heavenly equation in a two-component form.