

Journal of Nonlinear Mathematical Physics, Vol. 19, No. 4 (2012) 1250036 (11 pages)

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DOI: 10.1142/S1402925112500362

DARBOUX INTEGRABILITY OF A SIMPLIFIED FRIEDMAN–ROBERTSON–WALKER HAMILTONIAN SYSTEM

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Received 26 June 2012

Accepted 26 September 2012

Published 31 December 2012

We characterize the Darboux first integrals of a simplified Friedman–Robertson–Walker Hamiltonian system depending on one parameter.

Keywords: Darboux first integrals; Darboux polynomials; Friedman–Robertson–Walker Hamiltonian system.

PACS: Primary: 34A05, 34A34, 34C14

1. Introduction and Statement of the Main Result

Given a system of ordinary differential equations depending on parameters in general is very difficult to recognize for which values of the parameters the equations have first integrals because there are no satisfactory methods to answer this question.

In this paper we study the first integrals of the simplified Friedman–Robertson–Walker Hamiltonian differential system in $\mathbb{R}^4$

$$\begin{aligned}\dot{x} &= -p_x, \\ \dot{y} &= p_y, \\ \dot{p}_x &= x - bxy^2, \\ \dot{p}_y &= -y - bx^2y,\end{aligned}\tag{1}$$