

Mathematical Physics

Explicit integrable systems on two dimensional manifolds with a cubic first integral

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A few years ago Selivanova gave an existence proof for some integrable models, in fact geodesic flows on two dimensional manifolds, with a cubic first integral. However the explicit form of these models hinged on the solution of a nonlinear third order ordinary differential equation which could not be obtained. We show that an appropriate choice of coordinates allows for integration and gives the explicit local form for the full family of integrable systems. The relevant metrics are described by a finite number of parameters and lead to a large class of models on the manifolds S^2 , H^2 and $P^2(\mathbb{R})$ containing as special cases examples due to Goryachev, Chaplygin, Dullin, Matveev and Tsiganov.

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