

# Singular motion of a symmetric Manakov top

Božidar Jovanović

*Mathematical Institute, SASA, Belgrade, SERBIA*

[bozaj@mi.sanu.ac.rs]

We consider a motion of  $SO(n_1) \times \cdots \times SO(n_p)$ -symmetric free rigid body around a fixed point [6]. The system is integrable in a noncommutative sense on by means of the Manakov and the Noether integrals [1, 2]. The geodesic flow of the reduced submersion metric on the homogeneous space  $SO(n)/SO(n_1) \times \cdots \times SO(n_p)$  is also integrable [2, 3, 7], giving an important family of homogeneous spaces with integrable geodesic flows.

Further, an interesting problem is the description of trajectories of the corresponding Euler equations on the subspace  $\mathfrak{v}$  of  $\mathfrak{so}(n)$  given by the zero value of the Noether integrals [4]. Some of the Manakov integrals become dependent, but the new polynomial integrals on  $\mathfrak{v}$  appear. In the case of the  $SO(n-2)$ -symmetry, it is shown that almost all trajectories are periodic and that the motion can be expressed in terms of the elliptic functions. In the case of the  $SO(n-3)$ -symmetry, we prove the solvability of the problem by using Kozlov's result on the Euler-Jacobi-Lie theorem [5].

- [1] Bolsinov AV. Compatible Poisson brackets on Lie algebras and the completeness of families of functions in involution. *Mathematics of the USSR-Izvestiya*. 1992; 38(1): 69-90.
  - [2] Dragović V, Gajić B, Jovanović B. Singular Manakov Flows and Geodesic Flows of Homogeneous Spaces of  $SO(n)$ . *Transformation Groups*. 2009; 14(3): 513-530. arXiv:0901.2444
  - [3] Dragović V, Gajić B, Jovanović B. On the completeness of the Manakov integrals. *Fundamentalnaya i prikladnaya matematika*. 2015; 20(2): 35-49. arXiv:1504.07221 [nlin.SI]
  - [4] Dragović V, Gajić B, Jovanović B. Note on Free Symmetric Rigid Body Motion. *Regular and Chaotic Dynamics*. 2015; 20: 293-308.
  - [5] Kozlov VV. The Euler-Jacobi-Lie Integrability Theorem. *Regular and Chaotic Dynamics*. 2013; 18(4): 329-343.
  - [6] Manakov SV. Note on the integrability of the Euler equations of  $n$ -dimensional rigid body dynamics. *Funktsional'nyi Analiz i ego Prilozheniya*. 1976; 10(4): 93-94 (in Russian).
  - [7] Mykytyuk IV. Integrability of geodesic flows for metrics on suborbits of the adjoint orbits of compact groups. *Transformation groups*. 2016; 21: 531-553. arXiv:1402.6526.
-