

(Non)integrability of natural Hamiltonian systems: tricks and methods

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I will consider natural Hamiltonian systems with two degrees of freedom and speak about the existence and nonexistence of integrals that are polynomial in momenta. This is a classical topic, in my talk I will give a historical overview and explain the classical and modern motivation. In the mathematical part of my talk, I will mostly discuss the following questions: given a metric, how to prove the (non)existence of an integral of a given degree, and how to find it explicitly? I will explain the classical and modern methods to study this question. As an application, I will present new systems admitting an integral of degree 3 in momenta and a solution of a problem explicitly stated by J.~Brink.

The first result is joint with V. Shevchishin and the second with B. Kruglikov.