Open Problem 3: On the Integrability of Hamiltonian Systems

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Assume that a complex analytical Hamiltonian system has a solution $\gamma(t)$ and that the Galois groups associated to the k -th variational equations along $\gamma(t)$ (see [1]) have identity components which are abelian for all k .

But assume also that the system is not integrable, with meromorphic first integrals, in the Liouville–Arnold sense.

How one can characterize those systems? Do there exist some formal integrals in a vicinity of $\gamma(t)$?

See [1] for background and, in special, section 7 for related open questions.

Reference

1. Morales, J.J., Ramis, J.P., Simó, C.: Integrability of Hamiltonian systems and differential Galois groups of higher variational equations. *Annales Sci. de l'ENS 4^e série* **40**, 845–884 (2007)

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