Graduate

Dynamics and Lie Theory Seminar

Lax formalism for Hamiltonian systems

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Date: 24/02/2022
Time: 15:00

Abstract. A Lax pair for a Hamiltonian system (M, ω, H) consists of two matrix-valued functions (L, P) on the phase space (M, ω) of the system, such that the Hamiltonian evolution equation of motion associated to the Hamiltonian $H \in C^\infty(M)$ can be written as a "zero curvature equation", also known as Lax equation, of the form

$$\frac{d}{dt}L + [L, P] = 0.$$

The notion of a Lax representation has proved to be very powerful not only for constructing new examples and explicit integration, but also for studying topological properties of integrable systems, [3], [2]. The aim of this talk is to provide an introductory overview about the role played by Lax pairs in the study of Hamiltonian systems.

References

[1] Babelon, O.; Bernard, D.; Talon, M.; Introduction to Classical Integrable Systems, Cambridge Monographs on Mathematical Physics (2007).

[2] Correa, E. M.; Grama, L.; Lax formalism for Gelfand-Tsetlin integrable systems, Bulletin des Sciences Mathematiques, v. 170, p. 102999, 2021.

[3] Izosimov, A., Singularities of Integrable Systems and Algebraic Curves, Int. Math. Res. Notices, (2017) 5475-5524.

[4] Lax, P. D.; Integrals of nonlinear equations of evolution and solitary waves, Commun. Pure Appl. Math. 21 (1968) 467-490.