

On metriplectic dynamics and geometry: joining Hamiltonian and dissipative dynamics

Philip J. Morrison

Sherwood Meeting

Knoxville, TN May 8–10, 2023

Abstract

Although an early generalization of Lagrangian mechanics to include dissipation was proposed by Rayleigh (1894) and subsequently various other frameworks for dissipation were given, e.g., for phase separation in Cahn-Hilliard (1958) and Ricci flows in Hamilton (1982), here we discuss, metriplectic dynamics (MD), a bracket formalism approach begun by the author (1982) for describing systems that have both Hamiltonian and dissipative parts, which places the laws of thermodynamics in a dynamical systems setting. The motivation of MD is to describe dissipation in a kind of bracket formalism that complements the nondissipative noncanonical Poisson bracket formalism (flows on Poisson manifolds). Recent thoughts on the topic, in particular its geometric structure and thoughts on its use in numerics, will be presented.

PJM supported by U.S. Dept. of Energy Contract #DE-FG05-80ET-53088.