On Symplectic Reduction in Classical Mechanics

Butterfield, Jeremy (2005) On Symplectic Reduction in Classical Mechanics.

Abstract

This paper expounds the modern theory of symplectic reduction in finite-dimensional Hamiltonian mechanics. This theory generalizes the well-known connection between continuous symmetries and conserved quantities, i.e. Noether's theorem. It also illustrates one of mechanics' grand themes: exploiting a symmetry so as to reduce the number of variables needed to treat a problem. The exposition emphasises how the theory provides insights about the rotation group and the rigid body. The theory's device of quotienting a state space also casts light on philosophical issues about whether two apparently distinct but utterly indiscernible possibilities should be ruled to be one and the same. These issues are illustrated using ``relationist'' mechanics.

Keywords:	Hamiltonian mechanics; symmetry; reduction; conserved quantities; symplectic geometry; relationism
Subjects:	Specific Sciences: Physics: Classical Physics
ID Code:	2373
Deposited By:	Butterfield, Jeremy
Deposited On:	22 July 2005
Additional Information:	This is a Chapter of the forthcoming North Holland `Handbook of Philosophy of Physics', edited by J. Earman and J. Butterfield