Symmetries and invariances in classical physics

Brading, Katherine and Castellani, Elena (2005) Symmetries and invariances in classical physics.

Full text available as:
PDF - Requires a viewer, such as Adobe Acrobat Reader or other PDF viewer.

Abstract

Symmetry, intended as invariance with respect to a transformation (more precisely, with respect to a transformation group), has acquired more and more importance in modern physics. This Chapter explores in 8 Sections the meaning, application and interpretation of symmetry in classical physics. This is done both in general, and with attention to specific topics. The general topics include illustration of the distinctions between symmetries of objects and of laws, and between symmetry principles and symmetry arguments (such as Curie's principle), and reviewing the meaning and various types of symmetry that may be found in classical physics, along with different interpretative strategies that may be adopted. Specific topics discussed include the historical path by which group theory entered classical physics, transformation theory in classical mechanics, the relativity principle in Einstein's Special Theory of Relativity, general covariance in his General Theory of Relativity, and Noether's theorems. In bringing these diverse materials together in a single Chapter, we display the pervasive and powerful influence of symmetry in classical physics, and offer a possible framework for the further philosophical investigation of this topic.

Keywords:	Symmetry, Classical Mechanics, Curie's Principle, Group Theory, Relativity, Noether's Theorems
Subjects:	Specific Sciences: Physics: Classical Physics Specific Sciences: Physics: Symmetries/Invariances Specific Sciences: Physics: Relativity Theory Specific Sciences: Physics
ID Code:	2569
Deposited By:	Castellani, Elena
Deposited On:	18 December 2005
Additional Information:	Forthcoming in J. Butterfield and J. Earman (eds.), Handbook of the Philosophy of Physics, North-Holland.