



## Scope of the action principle

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### **Abstract**

Laws of motion given in terms of differential equations can not always be derived from an action principle, at least not without introducing auxiliary variables. This is the case for the Bohmian dynamics which can not be derived from an action that depends only the particle positions and the wave function. By allowing auxiliary variables, e.g. in the form of Lagrange multipliers, an action is immediately obtained. We consider some ways how this can be done. A particularly interesting approach brings the theory in the form of a gauge theory, with the auxiliary variables as gauge degrees of freedom. So any theory with a dynamics given by differential equations, in particular Bohmian mechanics, can be derived from an action principle by turning it into a gauge theory.