

6.2: Phase Space

Newton wrote his equation of motion not as force equals mass times acceleration, but as force equals *rate of change of momentum*. Momentum, mass times velocity, is the natural "quantity of motion" associated with a time-varying dynamical parameter. It is some measure of how important that coordinate's motion is to the future dynamical development of the system.

Hamilton recast Lagrange's equations of motion in these more natural variables (q_i, p_i) , positions and momenta, instead of (q_i, \dot{q}_i) . The q 's and p 's are called *phase space* coordinates.

So phase space is the same identical underlying space as state space, just with a different set of coordinates. Any particular state of the system can be completely specified either by giving all the variables (q_i, \dot{q}_i) or by giving the values of all the (q_i, p_i) .

This page titled [6.2: Phase Space](#) is shared under a [not declared](#) license and was authored, remixed, and/or curated by [Michael Fowler](#).