

$$\frac{d\textcolor{teal}{q}_i}{dt} = \left[M^{-1} \textcolor{blue}{p} \right]_i$$

$$\frac{d\textcolor{blue}{p}_i}{dt} = - \frac{\partial \textcolor{brown}{U}(\textcolor{teal}{q})}{\partial \textcolor{teal}{q}_i}$$