

The Emergence of Mechanics

(a mathematical fantasy)

- Newton's Second Law: $\mathbf{F} = m \mathbf{a} = d\mathbf{p}/dt \equiv \dot{\mathbf{p}}$

[Dot Notation for Time Derivatives]

- Time Integral: $\int \mathbf{F}(t) dt = \Delta\mathbf{p}$

[Impulse changes Momentum]

- Dot Product with \mathbf{r} & Path Integral: $\int \mathbf{F}(\mathbf{r}) \cdot d\mathbf{r} = \Delta(\frac{1}{2} m v^2)$

[Work changes Kinetic Energy]

- Cross Product with \mathbf{r} : $\mathbf{r} \times \mathbf{F} \equiv \boldsymbol{\Gamma} = \mathbf{r} \times \dot{\mathbf{p}} = \dot{\mathbf{L}}$

[Torque changes Angular Momentum]