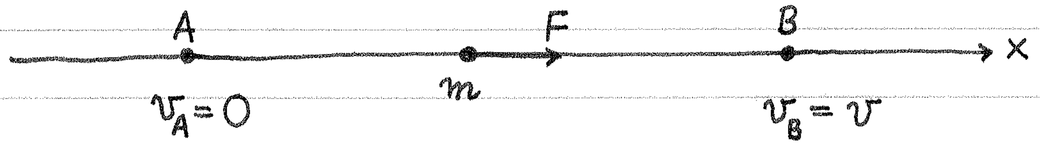
Newtons 2. lov : $\vec{F} = \frac{d\vec{p}}{dt}$

Arbeid W utført av $\vec{F}$ på partikkel

→ endring i partikkelens kinetiske energi :

$$W = \int_A^B \vec{F} \cdot d\vec{\ell} = \Delta E_k$$



$$E_k = \int_A^B F\,dx = \int_A^B \frac{dp}{dt}\,dx = \int_0^v \frac{dp}{dv} \underbrace{\frac{dx}{dt}}_{v} dv$$

$$\frac{dp}{dv} = \frac{d}{dv}\left\{\frac{mv}{\sqrt{1-v^2/c^2}}\right\} = \frac{m}{\sqrt{1-v^2/c^2}} + \frac{mv \cdot \frac{1}{2} \cdot \frac{2v}{c^2}}{(1-v^2/c^2)^{3/2}} =$$

$$= \frac{m(1-v^2/c^2) + m\,v^2/c^2}{(1-v^2/c^2)^{3/2}} = \frac{m}{(1-v^2/c^2)^{3/2}}$$

$$\Rightarrow E_k = \int_0^v \frac{mv\,dv}{(1-v^2/c^2)^{3/2}} = \Bigg|_0^v \frac{mc^2}{(1-v^2/c^2)^{1/2}}$$

$$= \frac{mc^2}{\sqrt{1-v^2/c^2}} - mc^2 = \gamma mc^2 - mc^2$$

Hvileenergi : $E_0 = mc^2$

Total energi : $E = E_k + E_0 = \gamma mc^2$

Hvis $\underline{v \ll c}$: $\gamma \approx 1 + \frac{v^2}{2c^2} \Rightarrow \underline{E_k} \approx \left(1 + \frac{v^2}{2c^2}\right)mc^2 - mc^2 = \underline{\frac{1}{2}mv^2}$ OK!