

## Summary

Binding energy

$$(\text{mass of combo})c^2 = (\text{mass of constituents})c^2 + \overbrace{\text{BE}}^{\text{Binding Energy}}$$

far apart

$$(\text{mass of combo})c^2 < (\text{mass of constituents})c^2 \quad \text{for bound states}$$

far apart

## Energy and Momentum:

$$E_0 = mc^2$$

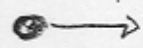
Rest

$$E_0 = mc^2$$



Moving:

$$E=? \quad p=?$$



$E_0$  = Energy of a particle at rest

- What about kinetic energy & momentum when moving
- What is the velocity of a slow particle:

$$p = mu \implies u = \frac{p}{m} = \frac{c^2 p}{mc^2} = \boxed{\frac{c^2 p}{E} = u}$$

This also works for light:

$$u = c^2 \frac{p}{E} = c \left( \frac{cp}{E} \right) = c \quad \checkmark$$

So

$$\boxed{u = c^2 \frac{p}{E}}$$