Conservation of linear momentum

Four questions

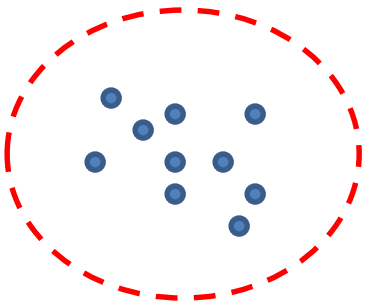
1. What is it? $\vec{P} = m\vec{V}$

   - For a particle, it's
   - Again, I don't really know, but…

It's a vector

2. How can it be stored (What is $\vec{P}_{sys}$?)

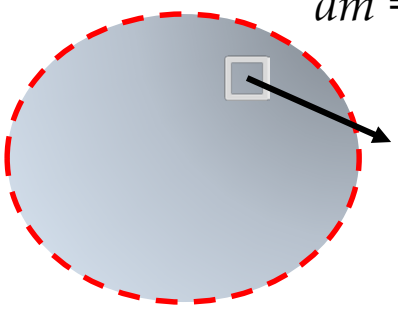
System of particles



$$\vec{P}_{sys} = \sum_i m_i \vec{V}_i$$

Continuum

$dm = \rho d\forall$



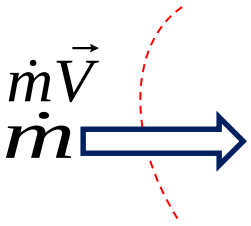
$$\vec{P}_{sys} = \int_{\forall_{sys}} \vec{V}\rho d\forall$$

Usually $m\vec{V}_G$

Conservation of linear momentum

3. How can it be transported? (How does it cross system boundaries?)

Flow boundaries

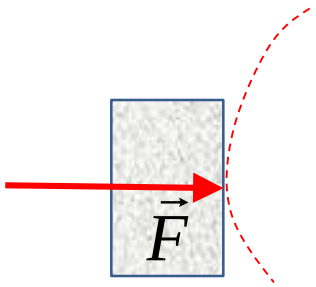


~~LM of mass *m* at boundary is~~

$\dot{m}\vec{V}$

Rate of LM transport due to mass flow is

Non-flow boundaries



A force is a rate of LM transport at a non-flow boundary!

(Or at least *not due to flow*.)

4. How is generated and/or consumed?

It's not! It's **conserved**.

$$\frac{d}{dt}\left(B_{sys}\right) = \dot{B}_{in} - \dot{B}_{out} + \dot{B}_{gen} - \dot{B}_{con}$$

$$\frac{d}{dt}\left(\vec{P}_{sys}\right) = \sum \vec{F}_{net} + \sum \dot{m}\vec{V}_{in} - \sum \dot{m}\vec{V}_{out}$$

Net *rate* of LM transport at non-flow boundaries

Net *rate* of LM transport at flow boundaries