8.701

Introduction to Nuclear and Particle Physics

Markus Klute - MIT

1. Fermions, bosons, and fields

1.5 Reactions

Measuring properties of forces

Three basic properties that can be experimentally determined

1) Masses (or energies) of bound states

2) Decay rates or widths of unstable particles

3) Reaction rates expressed as **cross sections**

Reactions

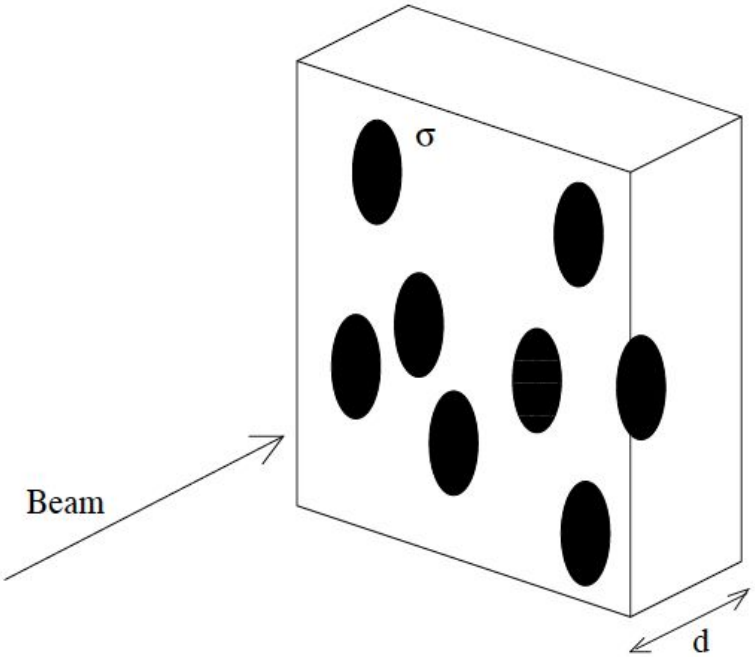
Reaction rate =

Beam rate *

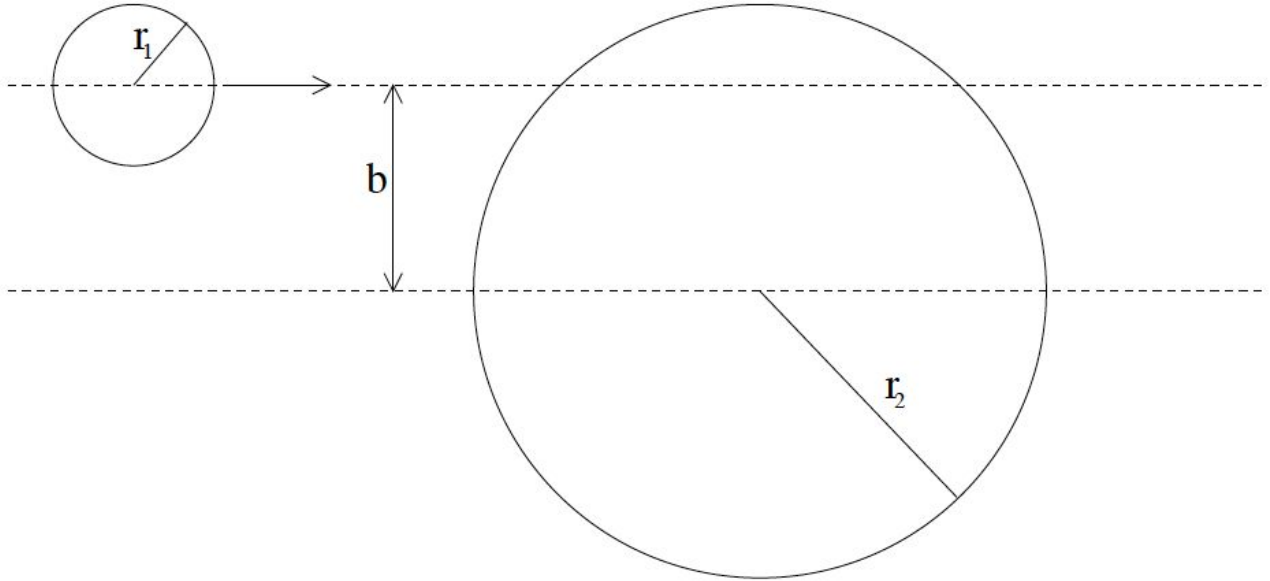
Number density *

Thickness *

Likelihood of a collision to occur

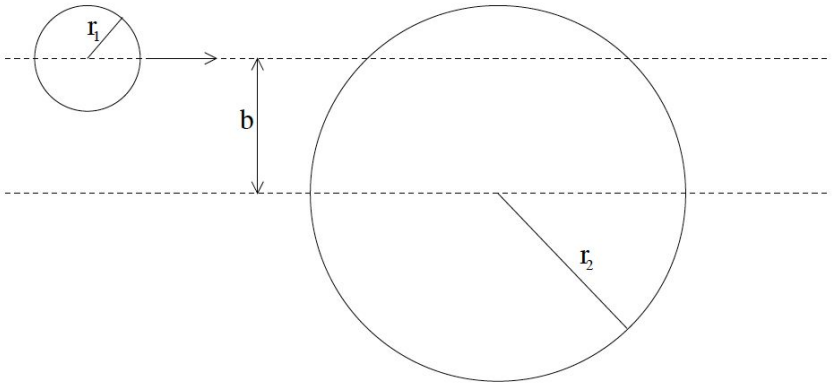


Reactions - classical model



Collision happens when $b < r_1 + r_2$

Reactions - classical model

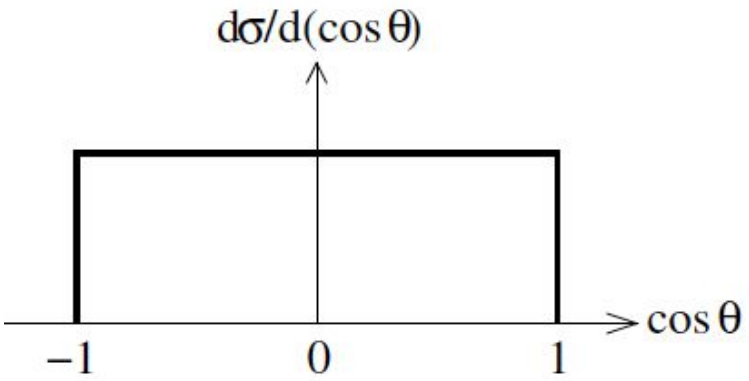


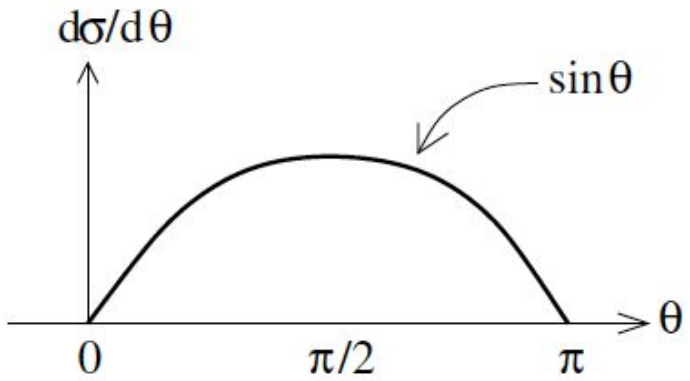
$$\frac{d\sigma}{d\theta} = \frac{\pi}{2}(r_1 + r_2)^2 \sin\theta$$

$$\frac{d\sigma}{d\theta d\phi} = \frac{1}{4}(r_1 + r_2)^2 \sin\theta$$

$$\frac{d\sigma}{d\Omega} = \frac{d\sigma}{d(\cos\theta)\, d\phi} = \frac{(r_1 + r_2)^2}{4}$$

Reactions - classical model





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