E > 0 or E < 1: hyperbola

\[ \frac{p}{r} = 1 + e \cos \theta \]

\[ \Rightarrow r = \frac{p}{1 + e \cos \theta} \]

\[ r_{\text{min}} = \frac{p}{1 + e} \]

\( e = 1 \), then we have a parabola

IVa) Collisions between particles

i) deintegration \( O \rightarrow a \)

\( p \) is conserved but \( E_{\text{kin}} \) is not

ii) elastic collision: the internal state of the particles does not change

\( \Rightarrow p \) and \( E_{\text{kin}} \) are conserved.

IVb) Scattering

Cross-section \( \sigma \)

\( \sigma \) is the number of particles per unit time per unit area per beam