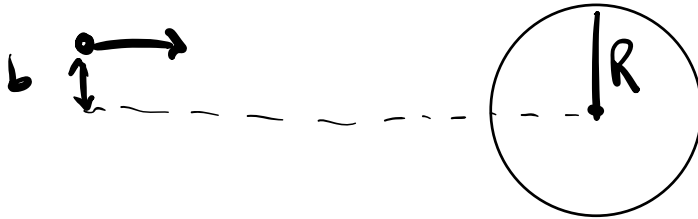


Exercise: We compute the cross section of a hard sphere target for both a point-particle projectile and a hard sphere projectile.

(Source: Taylor Mechanics, Chapter 14)



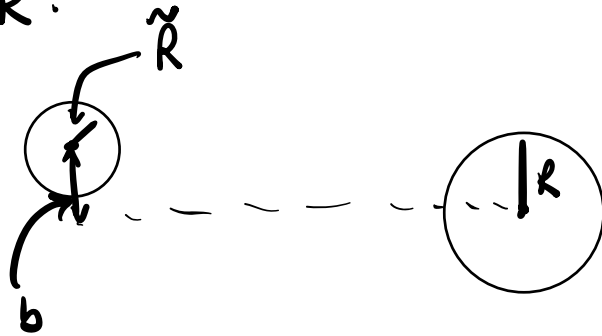
We consider a point-particle projectile incident on a hard-sphere target of radius  $R$  with impact parameter  $b$ .



The point particle will collide with the sphere so long as  $b \leq R$ , so to the point particle, the sphere looks like a circle of radius  $R$ , and the scattering cross section of the target is given by

$$\sigma = \pi R^2$$

Next, we consider the case where the projectile is also a hard sphere of radius  $\tilde{R}$ :



Now, since the impact parameter is measured from the center of the projectile, there will clearly be a collision so long as  $b < R + \tilde{R}$ . Thus, to the projectile, the target appears to be a circle of radius  $R + \tilde{R}$  and thus the scattering cross section is given by

$$\sigma = \pi (R + \tilde{R})^2$$

Evidently, the scattering cross-section is a combined property of the target and the projectile.