Question: Given a Potential what is the Scattering Cross Section for a Particle which moves toward it with an impact Parameter \(b\)?

Answer: Defining the scattering angle in terms of the impact parameter is often difficult, but once done, the differential scattering cross section is given by a formula. Here is the recipe for answering this question.

1.) [Hard Part] Based on geometry of the problem or physical reasoning, write \(b\) as a function of the angle \(\chi\). The angle \(\chi\) is the angle made between the asymptote, from which an incoming particle tends toward the center of the potential, with the asymptote toward which the outgoing particle tends.

2.) Plug into the formula for the differential cross section: \(d\sigma = 2\pi b(\chi) \left| \frac{db}{d\chi} \right| d\Omega\)

3.) The cross section is the integral of \(d\sigma\). \(\sigma = \int d\sigma = \int_{\Omega} 2\pi b(\chi) \left| \frac{db}{d\chi} \right| d\Omega\)

4.) For most problems there is azimuthal symmetry and the integral over \(d\phi\), the polar angle yields \(2\pi\), so that \(d\Omega = 2\pi \sin(\chi) d\chi\).

\[\text{for more details, the potential must be specified. See specific examples for more information}\]