Problem Set 6.

Scattering of slow particles. Scattering of fast particles.

Problem 6.1

Find the scattering length in the potential

$$U(r) = \begin{cases} -U_0, & r < R \\ 0, & r > R; \end{cases} \tag{1}$$

Why does the scattering length diverge at some values of parameters?

Problem 6.2

Find the scattering length and the cross-section for slow particles scattered by a hard sphere

$$U(r) = \begin{cases} \infty, & r < R \\ 0, & r > R \end{cases} \tag{2}$$

Can you find the correction of the order k^2?

Problem 6.3

Find the scattering cross-section of a fast particle on the potential in Problem 6.1. You may assume $kR \gg 1$ and $E \gg |U_0|$ (here k and E denote the momentum and the energy of the incident particle).