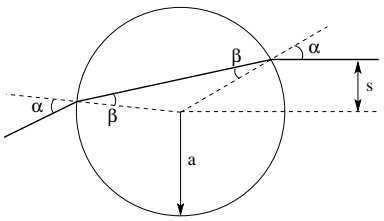
[mex168] Scattering from a spherical potential well

Consider a spherical potential well of depth U and radius a, decribed by the potential energy $V(r) = -U\Theta(a-r)$. According to [mex167], the path of an incident particle with energy E encountering this potential will then be that of a ray of light refracted from a sphere with refractive index $n = \sqrt{1+U/E}$. (a) Calculate the maximum scattering angle as a function of n. (b) Show that the scattering cross section has the form

$$\sigma(\theta) = \frac{a^2 n^2}{4\cos(\theta/2)} \left| \frac{[n\cos(\theta/2)-1][n-\cos(\theta/2)]}{[n^2+1-2n\cos(\theta/2)]^2} \right|.$$



Solution: