Inelastic scattering

$$\psi \sim S_\ell e^{ikr} - (-)^\ell e^{-ikr}$$

Elastic scattering $|S_\ell| = 1$

Inelastic scattering $|S_\ell| < 1$

$$f = \frac{1}{2ik} \sum (2\ell+1) P_\ell(\cos\theta)(S_\ell - 1)$$

$$\sigma_e = \frac{\pi}{k^2} \sum_\ell (2\ell+1) |1 - S_\ell|^2$$

$$\sigma_r = \frac{\pi}{k^2} \sum_\ell (2\ell+1) \left(1 - |S_\ell|^2 \right)$$

$$\sigma_t = \sigma_e + \sigma_r = \frac{2\pi}{k^2} \sum (2\ell+1) \left(1 - \mathrm{Re}\, S_\ell \right)$$

$$\begin{cases} \sigma_e^{(\ell)} = \dfrac{\pi}{k^2} (2\ell+1) \left| 1 - S_\ell \right|^2 \\ \sigma_r^{(\ell)} = \dfrac{\pi}{k^2} (2\ell+1) \left(1 - |S_\ell|^2 \right) \\ \sigma_t^{(\ell)} = \dfrac{2\pi}{k^2} (2\ell+1) \left(1 - \mathrm{Re}\, S_\ell \right) \end{cases}$$

If $S_\ell = 0$

then $\sigma_e^{(\ell)} = \sigma_r^{(\ell)} = \frac{\pi}{k^2}(2\ell+1)$

If $f(0) = \frac{k}{4\pi}\sigma_t$

Slow particles

$l = 0$

$$S_0 = e^{2i\delta_0} \simeq 1 - 2i\alpha k$$

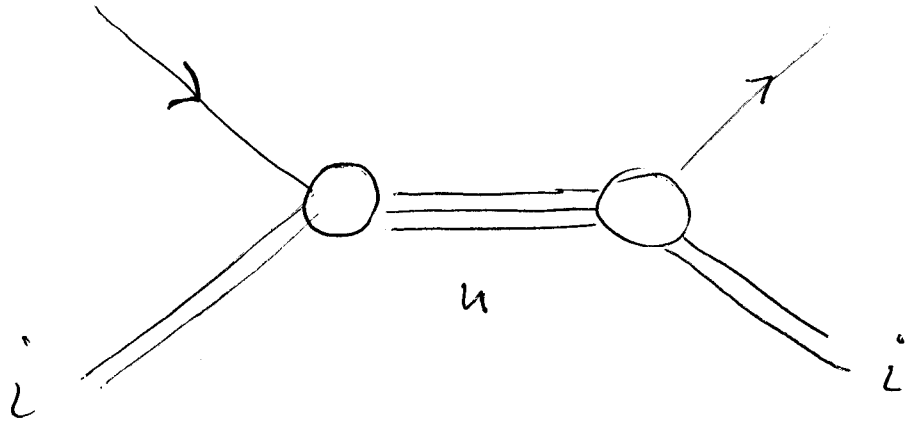
$$\delta_0 = -\alpha k$$

$$\alpha = \alpha_1 + i\alpha_2 \qquad \alpha_2 < 0$$

$$\sigma_e = 4\pi |\alpha|^2$$

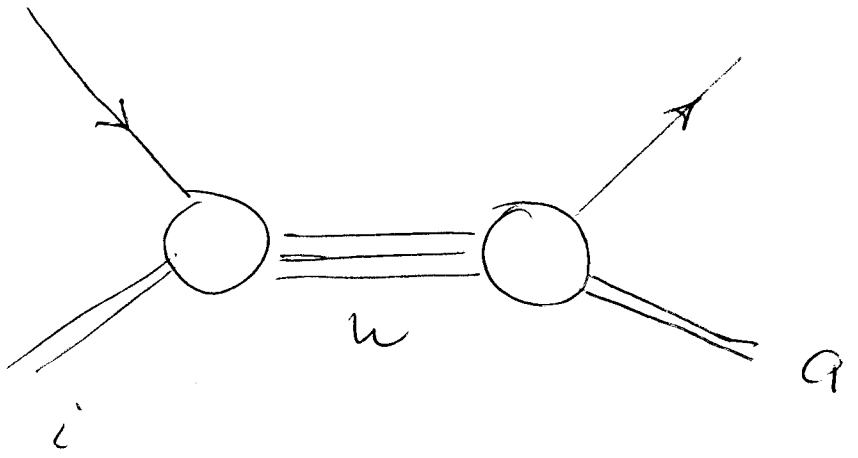
$$\sigma_r = 4\pi |\alpha| / k$$

Breit - Wigner's formula



$$\sigma_e = \frac{4\pi}{k^2}(2l+1)\,\frac{\Gamma^2/4}{(\mathcal{E}_i - \mathcal{E}_n)^2 + \Gamma^2/4}$$

$$\Gamma \Rightarrow \Gamma = \sum \Gamma_a$$



$$\sigma_{ra} = \frac{4\pi}{k^2}(2l+1)\,\frac{\Gamma_i \Gamma_a/4}{(\mathcal{E}-\mathcal{E}_0)^2 + \Gamma^2/4}$$