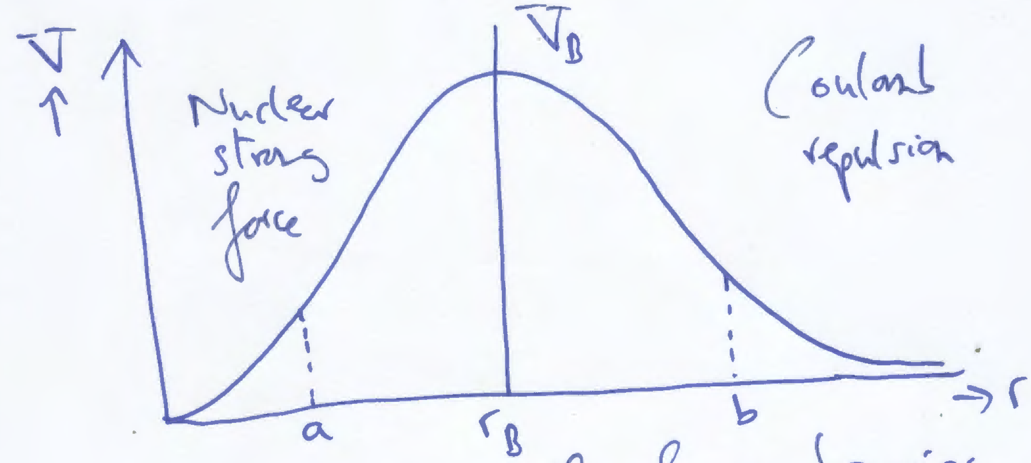
229(5): Fusion Barrier Potential.

Reference: Google "fusion internuclear potential energy" then: "Nuclear fusion forming the heaviest elements":
www.pitp.physics.ubc.ca/confs/qinfo-nbody/talks/hinde.ppt

Fig (1)



In this process, V_B is the fusion barrier.
Therefore the combined potential is:

$$V = V_0 \left(1 - \frac{1}{1 + \exp\left(\frac{r - R_0}{a}\right)} \right) + \frac{Z_1 Z_2 e^2}{4\pi\epsilon_0 r} \quad \text{—(1)}$$

The transmission coefficient of quantum tunnelling is:

$$T = \frac{4}{\left(2\theta + \frac{1}{2\theta}\right)^2} \quad \text{—(2)}$$

where:

2)

$$\theta = \exp\left(\frac{(2\mu)^{1/2}}{\hbar}\int_a^b \left(V(x) - E\right)^{1/2} dx\right) - (3)$$

in the WKB approximation.

Eq. (1) is a combination of a Woods Saxon potential and Coulomb potential. Here:

V_0 = potential barrier height

a_1 = effective surface thickness

R = radius parameter.

Z_1, Z_2 = numbers of protons in atoms 1 and 2.

Deep quantum tunnelling is a process that is considered in standard fusion theory, but in low energy fusion theory the condition must be found where:

$$\boxed{T \to 1 \text{ for } E \ll V} - (4)$$

The Schroedinger equation is:

$$\left(-\frac{\hbar^2}{2\mu}\nabla^2 + V\right)\psi = E\psi - (5)$$

3) where

$$\mu = \frac{m_1 m_2}{m_1 + m_2} \quad - (6)$$

is the reduced mass.

An atom of mass m_1 interacts with an atom of mass m_2. The WKB approximation is used, i.e. V does not vary rapidly with x.

In some theories of low energy nuclear fusion, a wave of some kind is present. This is described sometimes as a phonon wave. In ECE theory it is a wave of spacetime. The Schrodinger equation (5) is a limit of the ECE wave equation:

$$(\Box + R)\, q^a_\mu = 0. \quad - (7)$$

The next note will use eq. (7) to describe absorption of a spacetime wave by changing R. The potential (1) is a special case of R.