Low Energy Nuclear Reactions w/o Tunnelling Explained STEWART BREKKE, Northeastern Illinois University (former grad student) — Using the phenomenon of nuclear vibration low energy nuclear reactions can be explained using classical mechanics. Consider an incoming positive charge such as a proton approaching a vibrating nucleus. If the amplitudes of nuclear oscillation are equal in all directions, the position of the incoming positive charge is 
\[ r = [(x + AcosX)^2 + (y + AcosY)^2 + (z + AcosZ)^2]^{1/2}. \]
Then the KE needed (barrier height) is \( KE = kQ_1 Q_2 / r \). If the nucleus is considered as point nucleus, and the contact point is \( x = AcosX, y = AcosY \) and \( z = AcosZ \), KE needed is \( KE = kQ_1 Q_2 / [(2AcosX)^2 + (2AcosY)^2 + (2AcosZ)^2]^{1/2} \). Collecting terms KE needed is \( KE = kQ_1 Q_2 / (12A^2 cos^2 B)^{1/2} \) if all the cosines are equal. Therefore, the barrier height for an oscillating nucleus with incoming positive charge is \( KE = kQ_1 Q_2 / (3.46 AcosB) \). If \( RMS cos = 0.707 \), the average barrier height is \( KE = kQ_1 Q_2 / 2.45A \), where A is the average amplitude of nuclear of vibration. In deuterium-deuterium fusion occurring on the sun, the temperature needed is \( 4.0 \times 10^7 K \). The nuclear barrier height to be overcome is \( 8.286 \times 10^{-15} j \) using the equipartition of energy formula \( 1/2mv^2 = 3/2kT \). Solving for A, the average amplitude of vibration needed for two deuterium nuclei to fuse is approx. 11.33 fermis.