The attraction between flattened cores can be estimated from the spherical case because charge conservation keeps the protons' deflection fields comparable to their free-space profiles. This means that their core volume remains roughly constant, and so does their peak isoexternal boundary deflection:

$$t_c \cong \frac{3\Diamond_q}{4\pi R_{rc}^3} \tag{12.6}$$

Thus when cores flatten during a separation of ($d<2R_{rc}$), the variable radial terms of Equation (12.2) (underlined):

$$F_s(d \geq 2R_{rc}) = 2\left(\int_{r=d-R_{rp}(d)}^{d+R_{rp}(d)} t\,dr\right) = -\frac{3\Diamond_q}{4\pi}\left(\frac{1}{\left(\underline{\underline{d-R_{rp}(d)}}\right)^2} - \frac{1}{\left(d+\underline{\underline{R_{rp}(d)}}\right)^2}\right)$$

become asymmetrically fixed at the maximally-recessed proton core radius, R_{rc}:

$$F_{sa}(d \leq 2R_{rc}) \cong -\frac{3\Diamond_q}{4\pi}\left(\frac{1}{R_{rc}^2} - \frac{1}{(d+R_{rc})^2}\right) \tag{12.7}$$

When ($d<2R_{rc}$), core excision is defined entirely by distance of separation. It decreases with increased proximity, eventually falling to zero at (d = 0) since completely flattened cores lose their capacity for field excision. Equation (12.7) is identified as F_{sa} as it is the attractive *component* of the Strong force of flattened cores.

The Strong attraction of core excision attenuates as cores collapse against each other while the repulsion of core distortion rapidly increases. The confluence of these two effects can be described by combining the deformation of Equation (11.13) with the attraction of Equation (12.7):

$$F_s(d \leq 2R_{rc}) \approx -\frac{3\Diamond_q}{4\pi}\left(\frac{5}{4R_{rc}^2} - \frac{1}{(d+R_{rc})^2} - \frac{1}{d^2}\right) \tag{12.8}$$

where d is again the distance between the protons' centers and R_{rc} is the size of two recessed spherical proton cores at first contact. Although additional recession may occur when cores flatten against each other, our linear core approximation defines R_{rc} as minimum core size at any distance of separation. Core deformation is nonlinear, so Equation (12.8) is only an approximation of the actual Strong force of flattened cores, but it provides an accurate description of its general character. Note that F_s diverges to infinity at (d = 0).

STRONG FORCE

From Equations (12.2) and (12.8), the Strong force between two protons is shown below for a range of separation from 0 to 5 Fermi. The dotted trace shows what the Strong force would look like in the absence of its core deformation component:

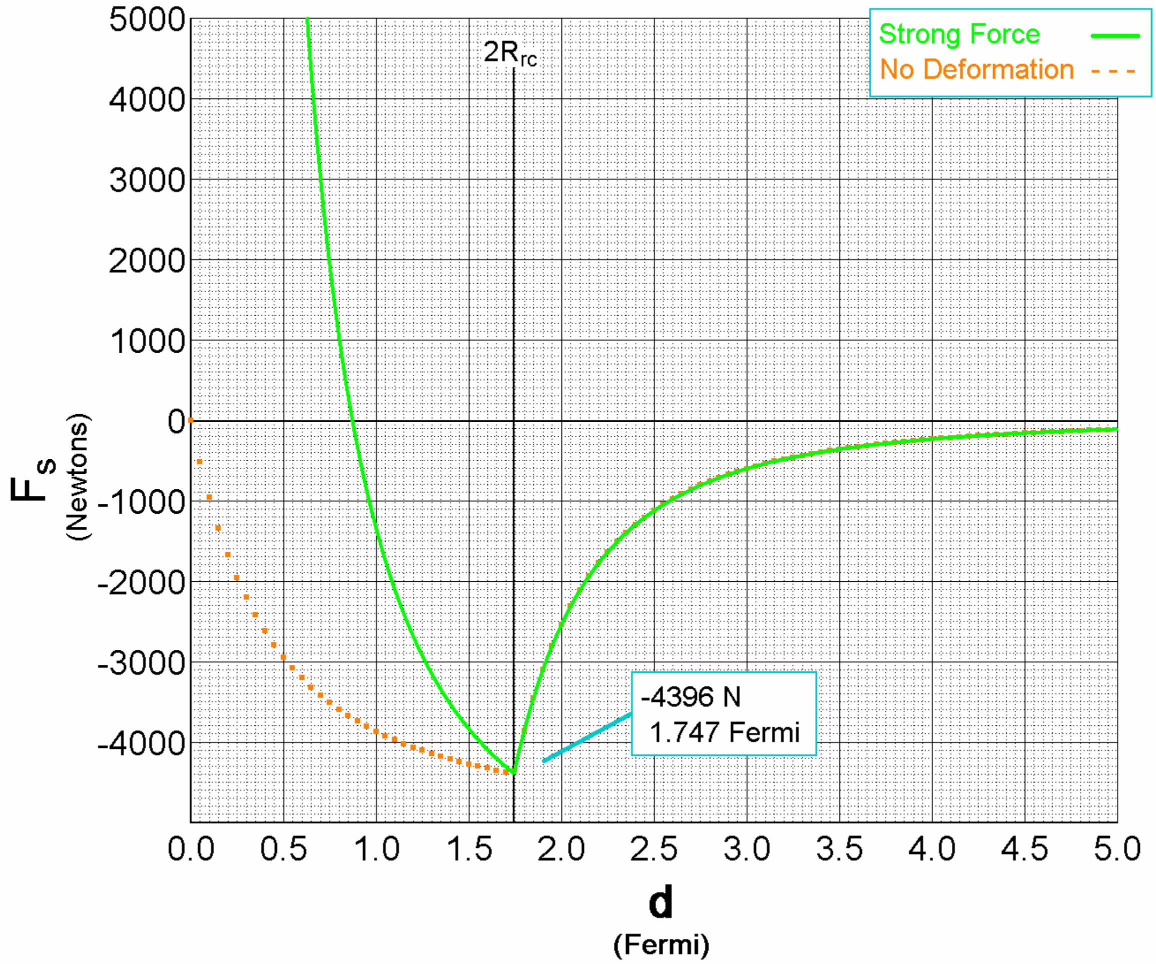

Figure (12.5) Strong force between two protons, with and without core deformation

The Strong force in a system of two protons peaks at –4400 N near ~1.75 F, defined by the relatively mild core recession in deuterium. The enhanced core recession found in heavier nuclei corresponds to a much more powerful force that reaches its maximum at an inter-nucleon spacing closer to 1.2 F. One of the reasons the nuclear force is so difficult to characterize is because it varies with the core size of interacting particles, and their core size varies with their proximity and density. F_s becomes repulsive in a system of two protons near a separation distance of 0.8 F, diverging rapidly to infinity at a separation of (d = 0). *Particle cores cannot occupy the same space at the same time.*