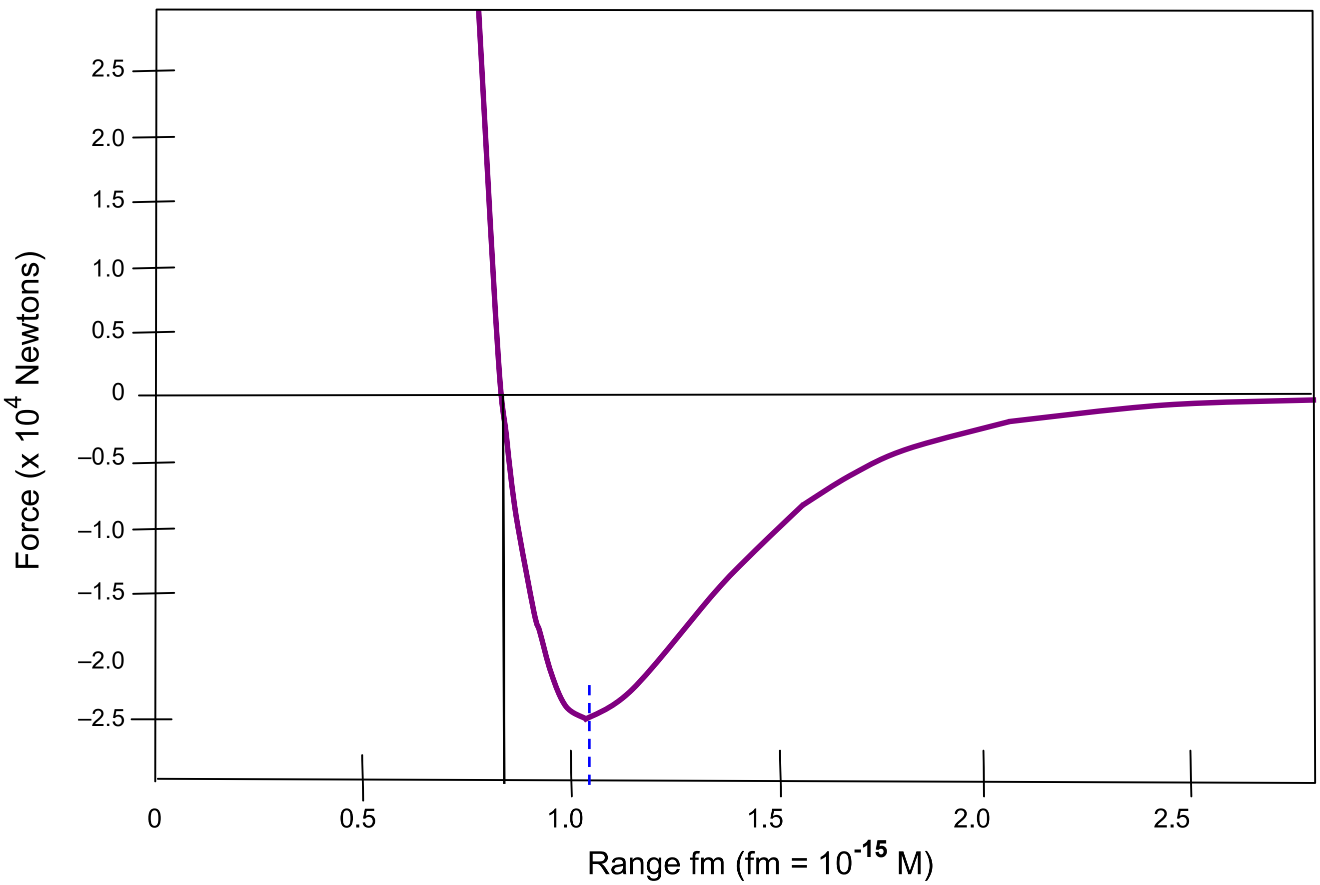
Strong Nuclear Force Transitions to the Weak Gravitation Force

An atom's nucleus is made up of relatively high mass protons and neutrons, held together by a strong nuclear force that acts over a distance of about 10^{-14} meters or 10 fm (fm = femtometer = 10^{-15} meters). Gravitational forces exist between any two masses, which are derived from the total proton and neutron masses in the atom's nucleus.

As previously noted, there are *attractive* strong nuclear forces between protons and neutrons that hold the nucleus together, along with *repulsive* nuclear forces between neutrons and protons that keep them apart. Below is a graph showing the strength in Newtons (N) of the strong nuclear force on its protons and neutrons over a distance of about 2.7 fm (2.7 x 10^{-15} meters).



The graph shows that when the distance between any protons and neutrons is *less* than about 0.8 fm (at 0 Newtons) that the SNF between them is repelling and that when the distance between the protons and neutrons are greater than 0.8 fm the SNF is attracting. From this graph we can see that the attracting SNF is strongest (-25,000 N) at 1.1 fm and decreases exponentially towards zero past 1.1 fm. But since the SNF force is 10^{39} **stronger** than the gravitational force (GF), this exponential decrease of force towards 0 Newtons can become an extremely small number.

I propose that beyond 2.7 fm the SNF becomes the GF. Sort of like how high frequency photons can display *wave* characteristics and how low frequency photons display *particle* characteristics as the photon's frequency drops into the sound frequency range. Maybe some examples will help.

The weak GF generated from the Hydrogen Atom nucleus:

The hydrogen *atom* has the smallest mass and nucleus with only 1 proton in a 1.1 fm diameter nucleus and an atomic radius of 53,000 fm. The H_2 gas molecule has two hydrogen nuclei that are 75,000 fm apart with overlapping atomic radii—refer to the diagrams below.

The simple algebraic equation that describes the gravitational force between any two masses is:

$\mathbf{N} = [\mathbf{G} \times (m_1 \times m_2)] \div \mathbf{R}^2$

Where **N** = Newtons of force, **G** is the gravitational constant (6.67×10^{-11}), and **R** is the distance in meters between masses m_1 and m_2.

If we use the 1.67×10^{-27} kg mass of a proton for masses m_1 and m_2 we get a GF of:

$$N_{GH_2} = [G \times (m_1 \times m_2)] \div R^2 = [6.67\times10^{-11} \times (1.67\times10^{-27} \times 1.67\times10^{-27})] \div R^2$$
$$= (6.67 \times 10^{-11}) \times (2.79\times10^{-54}) = \mathbf{(1.86 \times 10^{-64})} \div \mathbf{R^2} \text{ Newtons}$$

The distance **R** between the centers of the two nuclei of a H_2 molecule is 0.75×10^{-10} m (or 75,000 fm) giving the GF between the two nuclei of:

$$N_{GH_2} = 1.86\times10^{-64} \div (0.75\times10^{-10})^2 = 1.86\times10^{-64} \div (0.56\times10^{-20}) = \mathbf{3.3 \times 10^{-44}} \text{ Newtons}$$

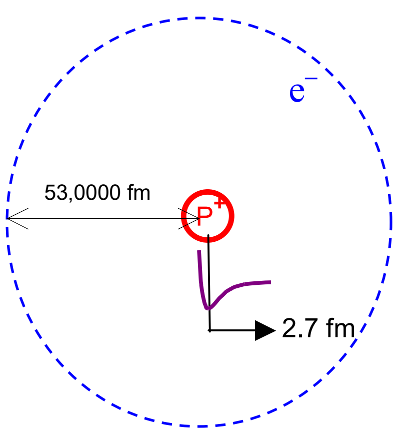
We can now compare this GF strength to the maximum strength of the SNF for an H_2 molecule. The maximum SNF (N_{SNF}) is 25,000 N (or $2.5\text{X}10^4$) Newtons. Thus when comparing the GF to the SNF we have a *ratio* of:

$$N_{GH_2} \div N_{SNF} = (3.3\times10^{-44}) \div (2.5\times10^4) = \mathbf{1.3 \times 10^{-48}} \text{ (not } 10^{-39} \text{ stronger)}$$

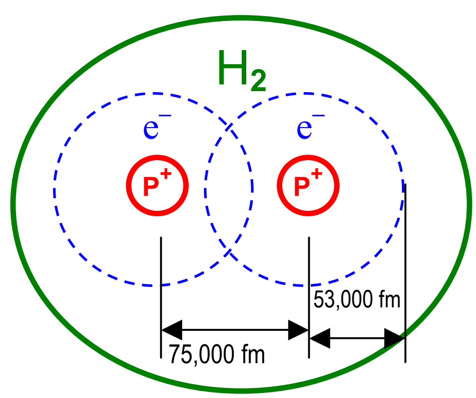
Thus, the distance **R** where the SNF becomes the GF must be *shorter* than 75,000 fm. If we choose a distance of 2.7 fm, which is outside the 1.1 fm hydrogen nucleus, but within the hydrogen atom's 53,000 fm radius we have:

$$N_{GH_2} = 1.86\times10^{-64} \div (2.7 \times10^{-15})^2 = 1.86\times10^{-64} \div (7.29\times10^{-30}) = \mathbf{0.255 \times 10^{-34}} = \mathbf{2.55 \times 10^{-35}}$$

This gives a GF to SNF ratio of $N_{GH_2} \div N_{SNF} = (2.55\times10^{-35}) \div (2.5\times10^4) = \mathbf{1.0 \times 10^{-39}}$



For H_2 it seems that 2.7 fm (2.7×10^{-15} m) is the distance from the 1.1 fm nucleus that the SNF becomes the 10^{-39} weaker GF.



Thus, the exponentially declining SNF transitions to the 10^{-39} weaker GF about 2-3 fm *outside* the 1.1 fm hydrogen nucleus, but *within* the 53,000 fm hydrogen atom's radius.

The weak GF generated from the heavier Oxygen Atom nucleus:

The oxygen *atom* has 8 protons and 8 neutrons in a 3.0 fm diameter nucleus with an atomic radius of 74,000 fm. The O_2 gas molecule has two overlapping atomic radii that are 121,000 fm apart—refer to the diagrams below.

An oxygen atom with 8 protons and 8 neutrons has a mass of (16 x $1.67\text{x}10^{-27}$ kg) = $26.7\text{x}10^{-27}$ kg. Thus the equation for oxygen is:

$$N_{GO_2} = [G \text{ x } (m_1 \text{ x } m_2)] \div R^2 = [6.67\text{x}10^{-11} \text{ x } (26.67\text{x}10^{-27} \text{ x } 26.7\text{x}10^{-27})] \div R^2$$
$$= (6.67\text{x}10^{-11}) \text{ x } (711\text{x}10^{-54}) = \mathbf{(4.74 \text{ x } 10^{-62}) \div R^2} \text{ Newtons}$$

At a distance **R** of $1.21\text{x}10^{-10}$ m (121,000 fm) between the two oxygen nuclei in an O_2 molecule we have a gravitational force of:

$$N_{GO_2} = (4.74\text{x}10^{-62}) \div (1.21\text{x}10^{-10})^2 = (4.74\text{x}10^{-62}) \div (1.46\text{x}10^{-20}) = 3.25 \text{ x } 10^{-42} \text{ Newtons}$$

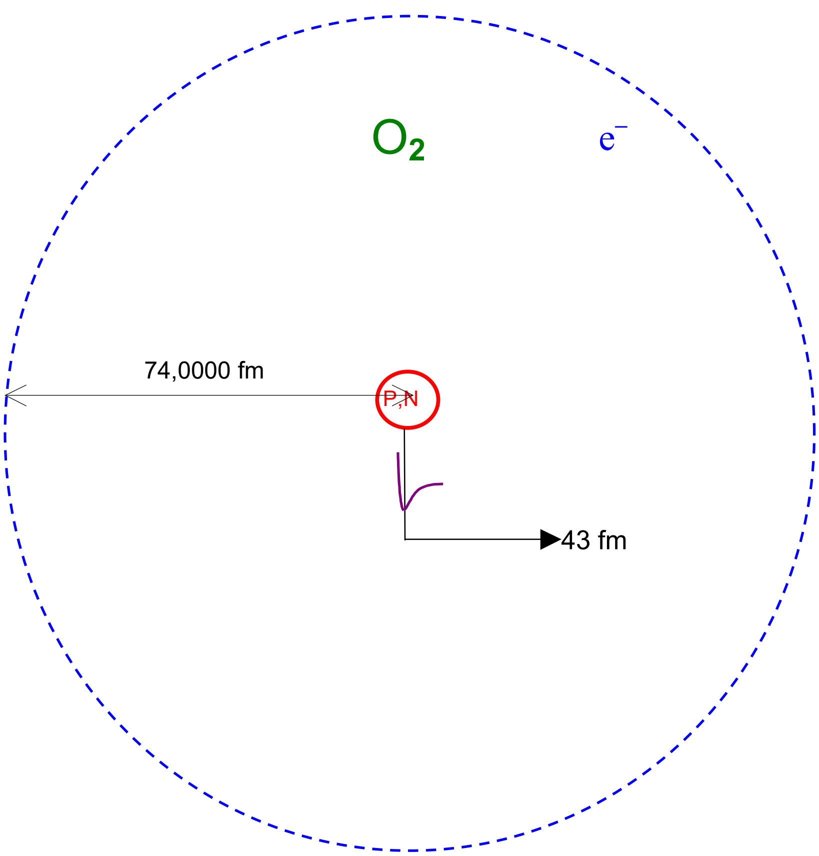
This gives us a $N_{GO_2} \div N_{SNF}$ forces ratio of:

$$N_{GO_2} \div N_{SNF} = (3.25\text{x}10^{-42}) \div (2.5\text{x}10^4) = \mathbf{1.3 \text{ x } 10^{-46}} \quad \text{(not } 10^{-39} \text{ stronger)}$$

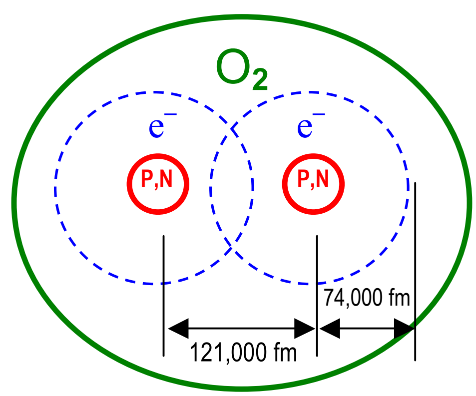
Thus, the distance **R** where the SNF becomes the GF must be *shorter* than 121,000 fm. If we choose a distance **R** of 43 fm, which is outside the 3.0 fm oxygen nucleus, but within the oxygen atom's radius we have:

$$N_{GO_2} = (4.74\text{x}10^{-62}) \div (44\text{x}10^{-15})^2 = (4.74\text{x}10^{-62}) \div (18.5\text{x}10^{-28}) = \mathbf{2.56 \text{ x } 10^{-35} \text{ Newtons}}$$

This gives us a $N_{GO_2} \div N_{SNF}$ ratio of $N_{GO_2} \div N_{SNF} = (2.56\text{x}10^{-35}) \div (2.5\text{x}10^4) = \mathbf{1.0 \text{ x } 10^{-39}}$



Thus for the oxygen molecule, the exponentially declining SNF transitions to the 10^{-39} weaker GF about 43 fm *outside* the O_2 nucleus, but *within* the 74,000 fm oxygen atom's radius.



The weak GF generated from a heavy Gold Atom nucleus:

The Au *atom* has 79 protons and 118 neutrons in a 7.0 fm diameter nucleus with an atomic radius of 146,000 fm. Two gold molecules in a "face centered cubic" structure are 576,000 fm apart and their *non*-overlapping atoms have a radius of 146,000 fm—refer to the diagrams below.

The Au atom (much heavier than the hydrogen or oxygen atoms) has 79 protons and 118 neutrons in a 7.0 fm diameter nucleus. Refer to the diagrams below.

The mass of a gold atom is: 197 x $1.67\text{x}10^{-27}$ kg = $329\text{x}10^{-27}$ kg = 3.29x $\text{x}10^{-25}$ kg.

N_{GAu} = [G x (m_1 x m_2)] ÷ R^2 = [$6.67\text{x}10^{-11}$ x ($3.29\text{x}10^{-25}$ x $3.29\text{x}10^{-25}$)] ÷ R^2
= (6.67 x 10^{-11}) x ($10.8\text{x}10^{-50}$) = **(7.8 x 10^{-60})** ÷ **R^2** Newtons

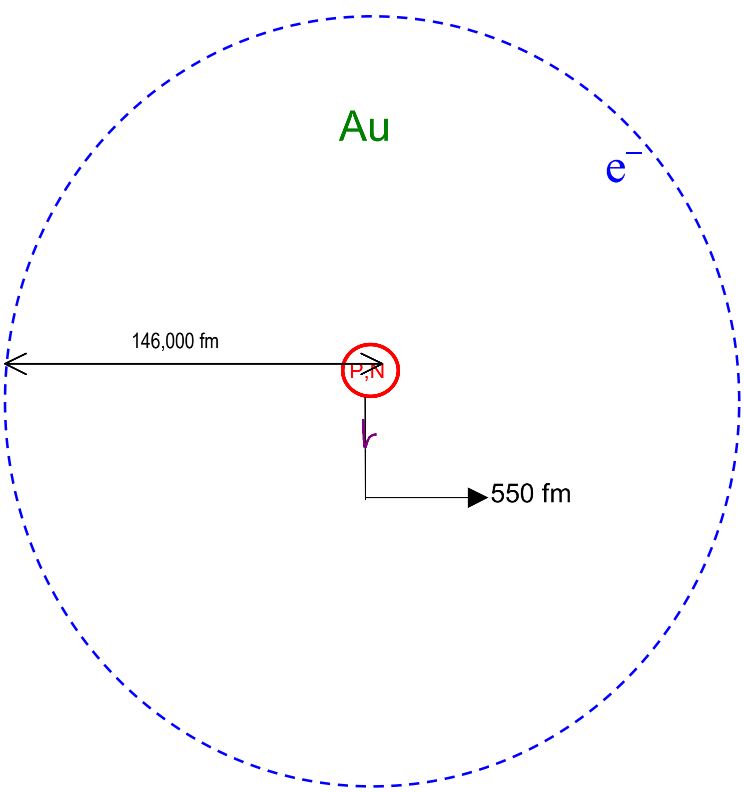
At a distance of $5.76\text{x}10^{-10}$ m (576,000 fn) between two gold nuclei we have GF of:
N_{GAu} = ($7.8\text{x}10^{-60}$) ÷ ($5.76\text{x}10^{-10}$)^2 = ($7.8\text{x}10^{-60}$) ÷ ($33.2\text{x}10^{-20}$) = 2.35 x 10^{-39} Newtons

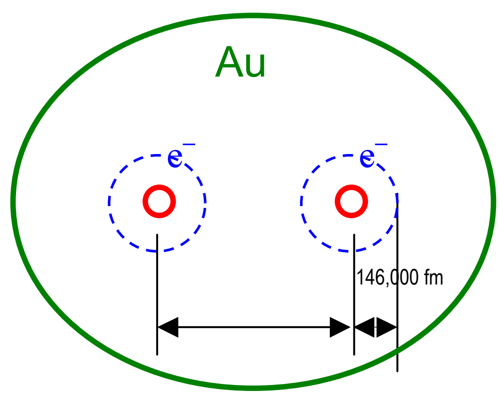
This gives us a N_{GAu} ÷ N_{SNF} forces ratio of:
N_{GAu} ÷ N_{SNF} = ($2.35\text{x}10^{-39}$) ÷ ($2.5\text{x}10^{4}$) = **0.94 x 10^{-43}** (not 10^{-39} stronger)

Thus, the distance **R** where the SNF becomes the GF must be *shorter* than 576,000 fm. If we choose a distance **R** of 550 fm, which is outside the 7.0 fm gold nuclei, but within the 146,000 fm gold atom's radius we get.

N_{GAu} = ($7.8\text{x}10^{-60}$) ÷ ($5.5\text{x}10^{-13}$)^2 = ($7.8\text{x}10^{-60}$) ÷ ($31\text{x}10^{-26}$) = 2.5 x 10^{-35} Newtons

This gives us a N_{GAu} ÷ N_{SNF} ratio of N_{GAu} ÷ N_{SNF} = ($2.5\text{x}10^{-35}$) ÷ ($2.5\text{x}10^{4}$) = **01.0 x 10^{-39}**





For Au it seems that 550 fm (550 $\text{x}10^{-15}$) is the distance from 7.0 fm gold nucleus where the SNF becomes the 10^{-39} weaker GF, but *within* the 146,000 fm gold atom's radius.

In conclusion, the SNF *transitions* into the weak GF outside an atoms nucleus, but within that atoms radius and extends onward to combine with other collected masses.