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The Radii and Densities of Elementary Particles and Periodic Table Nucleons

Ardeshir Irani

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We calculate the size as the radius of a sphere, along with the density of all the elementary particles of the first column of the Standard Model of Particle Physics viz. the Up and Down quarks, the electron, the electron neutrino, the proton, the neutron, and the nuclei of all the elements and isotopes of the Periodic Table, using their known masses and the previously calculated radii (r) of the electron and the electron neutrino since $r_e/r_{\nu_e} = m_e/m_{\nu_e}$, can be extended further to calculate r_p, r_n, r_{Up}, r_{Down} and their densities, and $r_{Nucleon\ Number}$ with a Table of nucleon radii that increase and nucleon density that decrease as the number of nucleons increase. The radii of the largest size nuclei can be observed experimentally by electron microscopes as confirmation of the theoretical calculations.

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Keyterms: radius, density, electron, electron neutrino, proton, neutron, up quark, down quark, table of nuclear radiuses and densities.

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I. INTRODUCTION

We consider only the elementary particles of the first column of the Standard Model of Particle Physics because the elementary particles of the second and third columns are all unstable except for the three neutrinos of all three columns that are known to change flavor. The unstable elementary particles of the second and third columns decay into the elementary particles of the first column, and that is the reason the atoms that make up the four states of matter and the elements of the Periodic Table consist of protons, neutrons, and electrons as the building blocks of the Universe. We calculate for only stable nuclei and their isotopes, not considering unstable nuclei with exceptions made either because of their abundance, longevity or importance to calculate their radii and densities.

II. RADIUS CALCULATIONS

Starting with the radius of the electron = $4.68\text{x}10^{-16}$m (Reference 1) and the radius of the electron neutrino = 2x 10^{-21}m (Reference 2) and the mass of the electron = 0.511 MeV/c^2 and the mass of the electron neutrino = 2.2 eV/c^2 from the Standard Model of Particle Physics we see that the ratio of their radii is equal to the ratio of their masses. $r_e/r_{\nu_e} = m_e/m_{\nu_e} = 4.68\text{x}10^{-16}/2\text{x}10^{-21} = 0.511\text{x}10^{6}/2.2 = 2.3\text{x}\ 10^{5}$. We use this equality ratio of the radius and mass to calculate the radius of the proton, the neutron, the Up and Down Quarks, and the elements of the Periodic Table.

For the Proton: $r_p/r_e = m_p/m_e$, $r_p = (938.27/0.511) \text{ x } 4.68\text{x}10^{-16} = 8.593\text{x}10^{-13}\text{m}\ 8.59\text{x}10^{-13}\text{m}$.

For the Neutron: $r_n/r_e = m_n/m_e$, $r_n = (939.57/0.511) \text{ x } 4.68\text{x}10^{-16} = 8.605\text{x}10^{-13}\text{m}\ 8.61\text{x}10^{-13}\text{m}$.

For the Up Quark: $r_{Up}/r_e = m_{Up}/m_e$, r_{Up} = (2.3/0.511) x $4.68\text{x}10^{-16}$ = $2.1\text{x}10^{-15}$m.

For the Down Quark: $r_{Down}/r_e = m_{Down}/m_e$, r_{Down} = (4.8/0.511) x $4.68\text{x}10^{-16}$ = $4.4\text{x}10^{-15}$m.

We change the unit of calculation from MeV/c^2 to atomic mass units (u) for convenience while calculating the sizes of the stable nuclei and their stable isotopes.

$r_{H1}/r_e = m_{H1}/m_e$, r_{H1}= (1.0078u/$5.49\text{x}10^{-4}$u) x$4.68\text{x}10^{-16}$m = .$859\text{x}10^{-12}$m. = $8.59\text{x}10^{-13}$m. The formula we use is $r_X = 8.52x10^{-13}\ m_X$ and we use the Tables of Nuclear Data (Reference 3) to determine m_X where **x** refers to the nucleon number and m_X refers to the mass of that nucleus in amu (u) to calculate the radius r_X of its nucleus in meters.

1. Hydrogen H ($r_{1,2}$) $m_{H1} \rightarrow 8.59\text{x}10^{-13}$m, $m_{H2} \rightarrow 1.72\text{x}10^{-12}$m.

Implying r_{H1} = $8.59\text{x}10^{-13}$m, r_{H2} = $1.72\text{x}10^{-12}$m, and so on for all the remaining elements that have been calculated below:

2. Helium He ($r_{3,4}$) $m_{He3} \rightarrow 2.57\text{x}10^{-12}$m, $m_{He4} \rightarrow 3.41\text{x}10^{-12}$m.
3. Lithium Li ($r_{6,7}$) $m_{Li6} \rightarrow 5.13\text{x}10^{-12}$m, $m_{Li7} \rightarrow 5.98\text{x}10^{-12}$m.
4. Beryllium Be ($r_{8,9}$) $m_{Be8} \rightarrow 6.82\text{x}10^{-12}$m, $m_{Be9} \rightarrow 7.68\text{x}10^{-12}$m.
5. Boron B ($r_{10.11}$) $m_{B10} \rightarrow 8.53\text{x}10^{-12}$m, $m_{B11} \rightarrow 9.38\text{x}10^{-12}$m.
6. Carbon C ($r_{12,13}$) $m_{C12} \rightarrow 1.02\text{x}10^{-11}$m, $m_{C13} \rightarrow 1.11\text{x}10^{-11}$m.
7. Nitrogen N ($r_{14,15}$) $m_{N14} \rightarrow 1.19\text{x}10^{-11}$m, $m_{N15} \rightarrow 1.28\text{x}10^{-11}$m.
8. Oxygen O ($r_{16.17.18}$) $m_{O16\rightarrow}$ $1.36\text{x}10^{-11}$m, $m_{O17} \rightarrow 1.45\text{x}10^{-11}$m, $m_{O18} \rightarrow 1.53\text{x}10^{-11}$m.
9. Fluorine F (r_{19}) $m_{F19} \rightarrow 1.62\text{x}10^{-11}$m.
10. Neon Ne ($r_{20,21,22}$) $m_{Ne20} \rightarrow 1.70\text{x}10^{-11}$m, $m_{Ne21} \rightarrow 1.79\text{x}10^{-11}$m, $m_{Ne22} \rightarrow 1.87\text{x}10^{-11}$m.
11. Sodium Na (r_{23}) $m_{Na23} \rightarrow 1.96\text{x}10^{-11}$m.
12. Magnesium Mg ($r_{X23,25,26}$) $m_{Mg24} \rightarrow 2.04\text{x}10^{-11}$m, $m_{Mg25} \rightarrow 2.13\text{x}10^{-11}$m, $m_{Mg26} \rightarrow 2.21\text{x}10^{-11}$m.
13. Aluminium Al (r_{27}) $m_{Al27} \rightarrow 2.30\text{x}10^{-11}$m.
14. Silicon Si ($r_{28,29,30}$) $m_{Si28} \rightarrow 2.38\text{x}10^{-11}$m, $m_{Si29} \rightarrow 2.47\text{x}10^{-11}$m, $m_{Si30} \rightarrow 2.55\text{x}10^{-11}$m.
15. Phosphorous P (r_{31}) $m_{P31} \rightarrow 2.64\text{x}10^{-11}$m.
16. Sulphur S ($r_{32,33,34,36}$) $m_{S32} \rightarrow 2.72\text{x}10^{-11}$m, $m_{S33} \rightarrow 2.81\text{x}10^{-11}$m, $m_{S34} \rightarrow 2.89\text{x}10^{-11}$m, $m_{S36} \rightarrow$ $3.06\text{x}10^{-11}$m.
17. Chlorine Cl ($r_{35,37}$) $m_{Cl35} \rightarrow 2.98\text{x}10^{-11}$m, $m_{Cl37} \rightarrow 3.15\text{x}10^{-11}$m.

18. Argon Ar ($r_{36,38,40}$) $m_{Ar36} \rightarrow 3.06x10^{-11}$m, $m_{Ar38} \rightarrow 3.23x10^{-11}$m, $m_{Ar40} \rightarrow 3.40x10^{-11}$m.

19. Potassium K ($r_{39,40,41}$) $m_{K39} \rightarrow 3.32x10^{-11}$m, $m_{K40} \rightarrow 3.41x10^{-11}$m, $m_{K41} \rightarrow 3.49x10^{-11}$m.

20. Calcium Ca ($r_{40,42,43,44,46,48}$) $m_{Ca40} \rightarrow 3.40x10^{-11}$m, $m_{Ca42} \rightarrow 3.58x10^{-11}$m, $m_{Ca43} \rightarrow 3.66x10^{-11}$m, $m_{Ca44} \rightarrow 3.75x10^{-11}$m, $m_{Ca46} \rightarrow 3.92\ x10^{-11}$m, $m_{Ca48} \rightarrow 4.09\ x10^{-11}$m.

21. Scandium Sc (r_{45}) $m_{Sc45} \rightarrow 3.83x10^{-11}$m.

22. Titanium Ti ($r_{46,47,48,49,50}$) $m_{Ti46} \rightarrow 3.92x10^{-11}$m, $m_{Ti47} \rightarrow 4.00x10^{-11}$m, $m_{Ti48} \rightarrow 4.09x10^{-11}$m, $m_{Ti49} \rightarrow 4.17x10^{-11}$m, $m_{Ti50} \rightarrow 4.26\ x10^{-11}$m.

23. Vanadium V ($r_{50,51}$) $m_{V50} \rightarrow 4.26x10^{-11}$m, $m_{V51} \rightarrow 4.34x10^{-11}$m.

24. Chromium Cr ($r_{50,52,53,54}$) $m_{Cr50} \rightarrow 4.26x10^{-11}$m, $m_{Cr52} \rightarrow 4.43x10^{-11}$m, $m_{Cr53} \rightarrow 4.51x10^{-11}$m, $m_{Cr54} \rightarrow 4.60x10^{-11}$m.

25. Manganese Mn (r_{55}) $m_{Mn55} \rightarrow 4.68x10^{-11}$m.

26. Iron Fe ($r_{54,56,57,58}$) $m_{Fe54} \rightarrow 4.60x10^{-11}$m, $m_{Fe56} \rightarrow 4.77x10^{-11}$m, $m_{Fe57} \rightarrow 4.85x10^{-11}$m, $m_{Fe58} \rightarrow 4.94x10^{-11}$m.

27. Cobalt Co (r_{59}) $m_{Co59} \rightarrow 5.02x10^{-11}$m.

28. Nickel Ni ($r_{58,60,61,62,64}$) $m_{Ni58} \rightarrow 4.94x10^{-11}$m, $m_{Ni60} \rightarrow 5.11x10^{-11}$m, $m_{Ni61} \rightarrow 5.19x10^{-11}$m, $m_{Ni62} \rightarrow 5.28x10^{-11}$m, $m_{Ni64} \rightarrow 5.45\ x10^{-11}$m.

29. Copper Cu ($r_{63,65}$) $m_{Cu63} \rightarrow 5.36x10^{-11}$m, $m_{Cu65} \rightarrow 5.53x10^{-11}$m.

30. Zinc Zn ($r_{64,66,67,68,70}$) $m_{Zn64} \rightarrow 5.45x10^{-11}$m, $m_{Zn66} \rightarrow 5.62x10^{-11}$m, $m_{Zn67} \rightarrow 5.70x10^{-11}$m, $m_{Zn68} \rightarrow 5.79x10^{-11}$m, $m_{Zn70} \rightarrow 5.96\ x10^{-11}$m.

31. Gallium Ga ($r_{69,71}$) $m_{Ga69} \rightarrow 5.87x10^{-11}$m, $m_{Ga71} \rightarrow 6.04x10^{-11}$m.

32. Germanium Ge ($r_{70,72,73,74,76}$) $m_{Ge70} \rightarrow 5.96x10^{-11}$m, $m_{Ge72} \rightarrow 6.13x10^{-11}$m, $m_{Ge73} \rightarrow 6.21x10^{-11}$m, $m_{Ge74} \rightarrow 6.30x10^{-11}$m, $m_{Ge76} \rightarrow 6.47\ x10^{-11}$m.

33. Arsenic As (r_{75}) $m_{As75} \rightarrow 6.38x10^{-11}$m.

34. Selenium Se ($r_{74,76,77,78,80,82}$) $m_{Se74} \rightarrow 6.30x10^{-11}$m, $m_{Se76} \rightarrow 6.47x10^{-11}$m, $m_{Se77} \rightarrow 6.55x10^{-11}$m, $m_{Se78} \rightarrow 6.64x10^{-11}$m, $m_{Se80} \rightarrow 6.81\ x10^{-11}$m, $m_{Se82} \rightarrow 6.98\ x10^{-11}$m.

35. Bromine Br $(r_{79,81})$ $m_{Br79} \rightarrow 6.72\text{x}10^{-11}$m, $m_{Br81} \rightarrow 6.89\text{x}10^{-11}$m.

36. Krypton Kr $(r_{78,80,82,83,84,86})$ $m_{Kr78} \rightarrow 6.64\text{x}10^{-11}$m, $m_{Kr80} \rightarrow 6.81\text{x}10^{-11}$m, $m_{Kr82} \rightarrow 6.98\text{x}10^{-11}$m, $m_{Kr83} \rightarrow 7.06\text{x}10^{-11}$m, $m_{Kr84} \rightarrow 7.15\ \text{x}10^{-11}$m, $m_{Kr86} \rightarrow 7.32\ \text{x}10^{-11}$m.

37. Rubidium Rb $(r_{85,87})$ $m_{Rb85} \rightarrow 7.23\text{x}10^{-11}$m, $m_{Rb87} \rightarrow 7.40\text{x}10^{-11}$m.

38. Strontium Sr $(r_{84,86,87,88})$ $m_{Sr84} \rightarrow 7.15\text{x}10^{-11}$m, $m_{Sr86} \rightarrow 7.32\text{x}10^{-11}$m, $m_{Sr87} \rightarrow 7.40\text{x}10^{-11}$m, $m_{Sr88} \rightarrow 7.49\text{x}10^{-11}$m.

39. Yttrium Y (r_{89}) $m_{Y89} \rightarrow 7.57\text{x}10^{-11}$m.

40. Zirconium Zr $(r_{90,91,92,94,96})$ $m_{Zr90} \rightarrow 7.66\text{x}10^{-11}$m, $m_{Zr91} \rightarrow 7.75\text{x}10^{-11}$m, $m_{Zr92} \rightarrow 7.83\text{x}10^{-11}$m, $m_{Zr94} \rightarrow 8.00\text{x}10^{-11}$m, $m_{Zr96} \rightarrow 8.17\ \text{x}10^{-11}$m.

41. Niobium Nb (r_{93}) $m_{Nb93} \rightarrow 7.92\text{x}10^{-11}$m.

42. Molybdenum Mo $(r_{92,94,95,96,97,98,100})$ $m_{Mo92} \rightarrow 7.83\text{x}10^{-11}$m, $m_{Mo94} \rightarrow 8.00\text{x}10^{-11}$m, $m_{Mo95} \rightarrow 8.09\text{x}\ 10^{-11}$m, $m_{MO96} \rightarrow 8.17\text{x}10^{-11}$m, $m_{Mo97} \rightarrow 8.26\ \text{x}10^{-11}$m, $m_{MO98} \rightarrow 8.34\text{x}10^{-11}$m, $m_{Mo100} \rightarrow 8.51\text{x}10^{-11}$ m.

43. Technetium Tc $(r_{97,98,99})$ $m_{Tc97} \rightarrow 8.26\text{x}10^{-11}$m, $m_{Tc98} \rightarrow 8.34\text{x}10^{-11}$m, $m_{Tc99} \rightarrow 8.43\text{x}10^{-11}$m.

44. Ruthenium Ru$(r_{96,98,99,100,101,102,104})$ $m_{Ru96} \rightarrow 8.17\text{x}10^{-11}$m, $m_{Ru98} \rightarrow 8.34\text{x}10^{-11}$m, $m_{Ru99} \rightarrow 8.43\text{x}\ 10^{-11}$m, $m_{Ru100} \rightarrow 8.51\text{x}10^{-11}$m, $m_{Ru101} \rightarrow 8.60\ \text{x}10^{-11}$m, $m_{Ru102} \rightarrow 8.68\text{x}10^{-11}$m, $m_{Ru104} \rightarrow 8.86\text{x}10^{-11}$ m.

45. Rhodium Rh (r_{103}) $m_{Rh103} \rightarrow 8.77\text{x}10^{-11}$m.

46 Palladium Pd $(r_{102,104,105,106,107,108,110})$

$m_{Pd102} \rightarrow 8.68\text{x}10^{-11}$m, $m_{Pd104} \rightarrow 8.86\text{x}10^{-11}$m, $m_{Pd105} \rightarrow 8.94\text{x}10^{-11}$m, $m_{Pd106} \rightarrow 9.02\text{x}10^{-11}$m, $m_{Pd107} \rightarrow 9.11\ \text{x}10^{-11}$m, $m_{Pd108} \rightarrow 9.19\text{x}10^{-11}$m, $m_{Pd110} \rightarrow 9.36\text{x}10^{-11}$m.

47. Silver Ag $(r_{107,109})$ $m_{Ag107} \rightarrow 9.11\text{x}10^{-11}$m, $m_{Ag109} \rightarrow 9.28\text{x}10^{-11}$m.

48. Cadmium Cd $(r_{106,108,110,111,112,113,114,116})$ $m_{Cd106} \rightarrow 9.02\text{x}10^{-11}$m, $m_{Cd108} \rightarrow 9.19\text{x}10^{-11}$m, $m_{Cd110} \rightarrow 9.36\text{x}10^{-11}$m, $m_{Cd111} \rightarrow 9.45\text{x}10^{-11}$m, $m_{CD112} \rightarrow 9.53\ \text{x}10^{-11}$m, $m_{Cd\,113} \rightarrow 9.62\text{x}10^{-11}$m, $m_{Cd114} \rightarrow 9.70\text{x}\ 10^{-11}$m, $m_{Cd116} \rightarrow 9.88\text{x}10^{-11}$m.

49. Indium In $(r_{113,115})$ $m_{In113} \rightarrow 9.62\text{x}10^{-11}$m, $m_{In\,115} \rightarrow 9.79\text{x}10^{-11}$m.

50. Tin Sn $(r_{112,114,115,116,117,118,119,120,122,124})$ $m_{Sn112} \rightarrow 9.53\text{x}10^{-11}$m, $m_{Sn114} \rightarrow 9.70\text{x}10^{-11}$m, $m_{Sn115} \rightarrow 9.79\text{x}10^{-11}$m, $m_{Sn116} \rightarrow 9.88\text{x}10^{-11}$m, $m_{Sn117} \rightarrow 9.96\ \text{x}10^{-11}$m, $m_{Sn118} \rightarrow 10.05\text{x}10^{-11}$m, $m_{Sn119} \rightarrow 10.13\text{x}10^{-11}$m, $m_{Sn120} \rightarrow 10.22\text{x}10^{-11}$m, $m_{Sn122} \rightarrow 10.39\text{x}10^{-11}$m, $m_{Sn124} \rightarrow 10.56\text{x}10^{-11}$m.

51. Antimony Sb $(r_{121,123,125})$ $m_{Sb121} \rightarrow 10.30\text{x}10^{-11}$m, $m_{Sb123} \rightarrow 10.47\text{x}10^{-11}$m, $m_{Sb125} \rightarrow 10.64\text{x}10^{-11}$m.

52. Tellurium Te $(r_{120,122,123,124,125,126,128,130})$

$m_{Te120} \rightarrow 10.22\text{x}10^{-11}$m, $m_{Te122} \rightarrow 10.39\text{x}10^{-11}$m, $m_{Te123} \rightarrow 10.47\text{x}10^{-11}$m, $m_{Te124} \rightarrow 10.56\text{x}10^{-11}$m, $m_{Te125} \rightarrow 10.64\ \text{x}10^{-11}$m, $m_{Te126} \rightarrow 10.73\text{x}10^{-11}$m, $m_{Te128} \rightarrow 10.90\text{x}10^{-11}$m, $m_{Te130} \rightarrow 11.07\text{x}10^{-11}$m.

53. Iodine I (r_{127}) $m_{I127} \rightarrow 10.81\text{x}10^{-11}$m.

54. Xenon Xe $(r_{124,126,128,129,130,131,132,134,136})$ $m_{Xe124} \rightarrow 10.56\text{x}10^{-11}$m, $m_{Xe126} \rightarrow 10.73\text{x}10^{-11}$m, $m_{Xe128} \rightarrow 10.91\text{x}10^{-11}$m, $m_{Xe129} \rightarrow 10.98\text{x}10^{-11}$m, $m_{Xe130} \rightarrow 11.07\text{x}10^{-11}$m, $m_{Xe131} \rightarrow 11.15\text{x}10^{-11}$m, $m_{Xe132} \rightarrow 11.24\text{x}10^{-11}$m, $m_{Xe134} \rightarrow 11.41\text{x}10^{-11}$m, $m_{Xe136} \rightarrow 11.58\text{x}10^{-11}$m.

55. Cesium Cs (r_{133}) $m_{Cs133} \rightarrow 11.32\text{x}10^{-11}$m.

56. Barium Ba $(r_{130,132,134,135,136,137,138})$ $m_{Ba130} \rightarrow 11.07\text{x}10^{-11}$m, $m_{Ba132} \rightarrow 11.24\text{x}10^{-11}$m, $m_{Ba134} \rightarrow 11.41\text{x}10^{-11}$m, $m_{Ba135} \rightarrow 11.49\text{x}10^{-11}$m, $m_{Ba136} \rightarrow 11.58\text{x}10^{-11}$m, $m_{Ba137} \rightarrow 11.66\text{x}10^{-11}$m, $m_{Ba138} \rightarrow 11.75\text{x}10^{-11}$m.

57. Lanthanum La $(r_{138,139})$ $m_{La138} \rightarrow 11.75\text{x}10^{-11}$m, $m_{La139} \rightarrow 11.83\text{x}10^{-11}$m.

58. Cesium Ce $(r_{136,138,140,142})$ $m_{Ce136} \rightarrow 11.58\text{x}10^{-11}$m, $m_{Ce138} \rightarrow 11.75\text{x}10^{-11}$m, $m_{Ce140} \rightarrow 11.92\text{x}10^{-11}$m, $m_{Ce142} \rightarrow 12.09\text{x}10^{-11}$m.

59. Praseodymium Pr (r_{141}) $m_{Pr141} \rightarrow 12.01\text{x}10^{-11}$m.

60. Neodymium Nd $(r_{142,143,144,145,146,148,150})$ $m_{Nd142} \rightarrow 12.09\text{x}10^{-11}$m, $m_{Nd143} \rightarrow 12.18\text{x}10^{-11}$m, $m_{Nd144} \rightarrow 12.26\text{x}10^{-11}$m, $m_{Nd145} \rightarrow 12.35\text{x}10^{-11}$m, $m_{Nd146} \rightarrow 12.43\text{x}10^{-11}$m, $m_{Nd148} \rightarrow 12.60\text{x}10^{-11}$m, $m_{Nd150} \rightarrow 12.77\text{x}10^{-11}$m.

61. Promethium Pm $(r_{145,146,147})$ $m_{Pm145} \rightarrow 12.35\text{x}10^{-11}$m, $m_{Pm146} \rightarrow 12.43\text{x}10^{-11}$m, $m_{Pm147} \rightarrow 12.52\text{x}10^{-11}$m.

62. Samarium Sm $(r_{144,147,148,149,150,152,154})$ $m_{Sm144} \rightarrow 12.26\text{x}10^{-11}$m, $m_{Sm147} \rightarrow 12.52\text{x}10^{-11}$m, $m_{Sm148} \rightarrow 12.60\text{x}10^{-11}$m, $m_{Sm149} \rightarrow 12.69\text{x}10^{-11}$m, $m_{Sm150} \rightarrow 12.77\text{x}10^{-11}$m, $m_{Sm152} \rightarrow 12.94\text{x}10^{-11}$m, $m_{Sm154} \rightarrow 13.11\text{x}10^{-11}$m.

63. Europium Eu ($r_{151,153}$) $m_{Eu151} \rightarrow 12.86\text{x}10^{-11}$m, $m_{Eu153} \rightarrow 13.03\text{x}10^{-11}$m.

64. Gadolinium Gd ($r_{152,154,155,156,157,158,160}$) $m_{Gd152} \rightarrow 12.94\text{x}10^{-11}$m, $m_{Gd154} \rightarrow 13.11\text{x}10^{-11}$m, $m_{Gd155} \rightarrow 13.20\text{x}10^{-11}$m, $m_{Gd156} \rightarrow 13.28\text{x}10^{-11}$m, $m_{Gd157} \rightarrow 13.37\text{x}10^{-11}$m, $m_{Gd158} \rightarrow 13.46\text{x}10^{-11}$m, $m_{Gd160} \rightarrow 13.63\text{x}10^{-11}$m.

65. Terbium Tb (r_{159}) $m_{Tb159} \rightarrow 13.54\text{x}10^{-11}$m.

66. Dysprosium Dy ($r_{156,158,160,161,162,163,164}$) $m_{Dy156} \rightarrow 13.28\text{x}10^{-11}$m, $m_{Dy158} \rightarrow 13.46\text{x}10^{-11}$m, $m_{Dy160} \rightarrow 13.63\text{x}10^{-11}$m, $m_{Dy161} \rightarrow 13.71\text{x}10^{-11}$m, $m_{Dy162} \rightarrow 13.80\text{x}10^{-11}$m, $m_{Dy163} \rightarrow 13.88\text{x}10^{-11}$m, $m_{Dy164} \rightarrow 13.97\text{x}10^{-11}$m.

67. Holmium Ho (r_{165}) $m_{Ho165} \rightarrow 14.05\text{x}10^{-11}$m.

68. Erbium Er ($r_{162,164.166,167,168,170}$) $m_{Er162} \rightarrow 13.80\text{x}10^{-11}$m, $m_{Er164} \rightarrow 13.97\text{x}10^{-11}$m, $m_{Er166} \rightarrow 14.14\text{x}10^{-11}$m, $m_{Er167} \rightarrow 14.22\text{x}10^{-11}$m, $m_{Er168} \rightarrow 14.31\text{x}10^{-11}$m, $m_{Er170} \rightarrow 14.48\text{x}10^{-11}$m.

69. Thulium Tm (r_{169}) $m_{Tm169} \rightarrow 14.39\text{x}10^{-11}$m.

70. Ytterbium Yb ($r_{168,170,171,172,173,174,176}$) $m_{Yb168} \rightarrow 14.31\text{x}10^{-11}$m, $m_{Yb170} \rightarrow 14.48\text{x}10^{-11}$m, $m_{Yb171} \rightarrow 14.56\text{x}10^{-11}$m, $m_{Yb172} \rightarrow 14.65\text{x}10^{-11}$m, $m_{Yb173} \rightarrow 14.73\text{x}10^{-11}$m, $m_{Yb174} \rightarrow 14.82\text{x}10^{-11}$m, $m_{Yb176} \rightarrow 14.99\text{x}10^{-11}$m.

71. Lutetium Lu ($r_{175,176}$) $m_{Lu175} \rightarrow 14.90\text{x}10^{-11}$m, $m_{Lu176} \rightarrow 14.99\text{x}10^{-11}$m.

72. Hafnium Hf ($r_{174,176,177,178,179,180}$) $m_{Hf174} \rightarrow 14.82\text{x}10^{-11}$m, $m_{Hf176} \rightarrow 14.99\text{x}10^{-11}$m, $m_{Hf177} \rightarrow 15.08\text{x}10^{-11}$m, $m_{Hf178} \rightarrow 15.16\text{x}10^{-11}$m, $m_{Hf179} \rightarrow 15.25\text{x}10^{-11}$m, $m_{Hf180} \rightarrow 15.33\text{x}10^{-11}$m.

73. Tantalum Ta ($r_{180,181}$) $m_{Ta180} \rightarrow 15.33\text{x}10^{-11}$m, $m_{Ta181} \rightarrow 15.42\text{x}10^{-11}$m.

74. Tungsten W ($r_{180,182,183.184,186}$) $m_{W180} \rightarrow 15.33\text{x}10^{-11}$m, $m_{W182} \rightarrow 15.50\text{x}10^{-11}$m, $m_{W183} \rightarrow 15.59\text{x}10^{-11}$m, $m_{W184} \rightarrow 15.67\text{x}10^{-11}$m, $m_{W186} \rightarrow 15.84\text{x}10^{-11}$m.

75. Rhenium Re ($r_{185,187}$) $m_{Re185} \rightarrow 15.76\text{x}10^{-11}$m, $m_{Re187} \rightarrow 15.93\text{x}10^{-11}$m.

76. Osmium Os ($r_{184,186,187,188,189.190,192}$) $m_{Os184} \rightarrow 15.67\text{x}10^{-11}$m, $m_{Os186} \rightarrow 15.84\text{x}10^{-11}$m, $m_{Os187} \rightarrow 15.93\text{x}10^{-11}$m, $m_{Os188} \rightarrow 16.01\text{x}10^{-11}$m, $m_{Os189} \rightarrow 16.10\text{x}10^{-11}$m, $m_{Os190} \rightarrow 16.18\text{x}10^{-11}$m, $m_{Os192} \rightarrow 16.36\text{x}10^{-11}$m.

77. Iridium Ir ($r_{191,193}$) $m_{Ir191} \rightarrow 16.27\text{x}10^{-11}$m, $m_{Ir193} \rightarrow 16.44\text{x}10^{-11}$m.

78. Plutonium Pt ($r_{190,192,194,195,196,198}$) $m_{Pt190} \rightarrow 16.18\text{x}10^{-11}$m, $m_{Pt192} \rightarrow 16.36\text{x}10^{-11}$m, $m_{Pt194} \rightarrow 16.53\text{x}10^{-11}$m, $m_{Pt195} \rightarrow 16.61\text{x}10^{-11}$m, $m_{Pt196} \rightarrow 16.70\text{x}10^{-11}$m, $m_{Pt198} \rightarrow 16.87\text{x}10^{-11}$m.

79. Gold Au (r_{197}) $m_{Au197} \rightarrow 16.78\text{x}10^{-11}$m.

80. Mercury Hg ($r_{196,198,199,200,201,201,202,204}$) $m_{Hg196} \rightarrow 16.70\text{x}10^{-11}$m, $m_{Hg198} \rightarrow 16.87\text{x}10^{-11}$m, $m_{Hg199} \rightarrow 16.95\text{x}10^{-11}$m, $m_{Hg200} \rightarrow 17.04\text{x}10^{-11}$m, $m_{Hg201} \rightarrow 17.12\text{x}10^{-11}$m, $m_{Hg202} \rightarrow 17.21\text{x}10^{-11}$m, $m_{Hg204} \rightarrow 17.38\text{x}10^{-11}$m.

81. Thallium Tl ($r_{203,205}$) $m_{Tl203} \rightarrow 17.29\text{x}10^{-11}$m, $m_{Tl205} \rightarrow 17.46\text{x}10^{-11}$m.

82. Lead Pb ($r_{204,206,207,208}$) $m_{Pb204} \rightarrow 17.38\text{x}10^{-11}$m, $m_{Pb206} \rightarrow 17.55\text{x}10^{-11}$m, $m_{Pb207} \rightarrow 17.63\text{x}10^{-11}$m, $m_{Pb208} \rightarrow 17.72\text{x}10^{-11}$m, which is the last of the Stable Nuclides.

83. Bismuth Bi (r_{209}) $m_{Bi209} \rightarrow 17.81\text{x}10^{-11}$m.

84. Polonium Po ($r_{208,209}$) $m_{Po208} \rightarrow 17.72\text{x}10^{-11}$m, $m_{Po209} \rightarrow 17.81\text{x}10^{-11}$m.

85. Astatine At ($r_{207,208,209,210,211}$) $m_{At207} \rightarrow 17.63\text{x}10^{-11}$m, $m_{At208} \rightarrow 17.72\text{x}10^{-11}$m, $m_{At209} \rightarrow 17.81\text{x}10^{-11}$m, $m_{At210} \rightarrow 17.89\text{x}10^{-11}$m, $m_{At211} \rightarrow 17.98\text{x}10^{-11}$m.

86. Radon Rn (r_{222}) $m_{Rn222} \rightarrow 18.92\text{x}10^{-11}$m.

87. Francium Fr ($r_{223,224,225}$) $m_{Fr223} \rightarrow 19.01\text{x}10^{-11}$m, $m_{Fr224} \rightarrow 19.09\text{x}10^{-11}$m, $m_{Fr225} \rightarrow 19.17\text{x}10^{-11}$m.

88. Radium Ra ($r_{226,228}$) $m_{Ra226} \rightarrow 19.26\text{x}10^{-11}$m, $m_{Ra228} \rightarrow 19.43\text{x}10^{-11}$m.

89. Actinium Ac (r_{227}) $m_{Ac227} \rightarrow 19.34\text{x}10^{-11}$m.

90. Thorium Th ($r_{229,230,232}$) $m_{Th229} \rightarrow 19.51\text{x}10^{-11}$m, $m_{Th230} \rightarrow 19.60\text{x}10^{-11}$m, $m_{Th232} \rightarrow 19.77\text{x}10^{-11}$m.

91. Protactinium Pa (r_{231}) $m_{Pa231} \rightarrow 19.68\text{x}10^{-11}$m.

92. Uranium U or Ur ($r_{232,233,234,235,236,238}$) $m_{U232} \rightarrow 19.77\text{x}10^{-11}$m, $m_{U233} \rightarrow 19.86\text{x}10^{-11}$m, $m_{U234} \rightarrow 19.94\text{x}10^{-11}$m, $m_{U235} \rightarrow 20.03\text{x}10^{-11}$m, $m_{U236} \rightarrow 20.11\text{x}10^{-11}$m, $m_{U238} \rightarrow 20.28\text{x}10^{-11}$m.

93. Neptunium Np ($r_{236,237}$) $m_{Np236} \rightarrow 20.11\text{x}10^{-11}$m, $m_{Np237} \rightarrow 20.20\text{x}10^{-11}$m.

94. Plutonium Pu ($r_{236,238,239,240,241.242,244}$) $m_{Np236} \rightarrow 20.11\text{x}10^{-11}$m, $m_{Np238} \rightarrow 20.28\text{x}10^{-11}$m, $m_{Np239} \rightarrow 20.37\text{x}10^{-11}$m, $m_{Np240} \rightarrow 20.45\text{x}10^{-11}$m, $m_{Np241} \rightarrow 20.54\text{x}10^{-11}$m, $m_{Np242} \rightarrow 20.62\text{x}10^{-11}$m, $m_{Np244} \rightarrow 20.79\text{x}10^{-11}$m.

95. Americium Am ($r_{241,242,243}$) m_{Am241} → 20.54x10^{-11}m, m_{Am242} → 20.62x10^{-11}m, m_{Am243} → 20.71x 10^{-11}m.

96.Curium Cm ($r_{245,246,247,248}$) m_{Cm245} → 20.88x10^{-11}m, m_{Cm246} → 20.96x10^{-11}m, m_{Cm247} → 21.05x 10^{-11}m, m_{Cm248} → 21.14x10^{-11}m.

97. Berkelium Bk (r_{247}) m_{Bk247} → 21.05x10^{-11}m.

98. Californium Cf ($r_{249,250,251,252}$) m_{Cf249} → 21.22x10^{-11}m, m_{Cf250} → 21.31x10^{-11}m, m_{Cf251} → 21.39x 10^{-11}m, m_{Cf252} → 21.48x10^{-11}m.

99. Einsteinium Es ($r_{252,253,254,255,256,257}$) m_{Es252} → 21.48x10^{-11}m, m_{Es253} → 21.56x10^{-11}m, m_{Es254} → 21.64x10^{-11}m, m_{Es255} → 21.73x10^{-11}m, m_{Es256} → 21.82x10^{-11}m, m_{Es257} → 21.90x10^{-11}m.

100. Fermion Fm ($r_{253,257}$) m_{Fm253} → 21.56x10^{-11}m, m_{Fm257} → 21.90x10^{-11}m.

101. Mendelevium Md ($r_{257,258,259,260}$) m_{Md257} → 21.90x10^{-11}m, m_{Md258} → 21.99x10^{-11}m, m_{Md259} → 22.08x10^{-11}m, m_{Md260} → 22.16x10^{-11}m.

All nuclei beyond nuclear number 260 are very unstable (have very short half-lives) and therefore are not being considered. The same instability applies to nuclei numbers between 212 and 221 that will also be left out of the Table. The reason for the instability pertains to their large number and the way the protons and neutrons are situated within the nucleus. Since the nucleon binding forces act over short distances as the nucleus gets larger in size the binding forces which acts over only a few neighboring nucleons cannot compete with the longer range electrical repulsive forces between protons, hence the nucleus becomes unstable.

III. DENSITY CALCULATIONS

Density (ρ) = Mass/Volume = Mass / ($4\pi r^3/3$) using the values of r from the Radius Calculations and the known values of Mass.

Electron ρ = 2.12x10^{15} Kg/m^3.

Electron Neutrino ρ = 1.18x10^{26} Kg/m^3.

Up Quark ρ = 1.06x10^{14} Kg/m^3.

Down Quark ρ = 2.41x10^{13} Kg/m^3.

Proton and Neutron Density ρ = 6.30x10^{8} Kg/m^3.

The Radius and Density Table of the Nucleons of the Periodic Table are used to correct the mistakes made in Physics Textbooks that all sized nuclei have the same Density (Reference 4) of 2.3x10^{17} *kg/*m^3

based on the incorrect assumption that the radius of all nuclei is proportional to $A^{\frac{1}{3}}$ *where A is their Mass Number, and therefore their Density is independent of their Mass Number.*

. Within the Table S = Stable Nucleus and U = Unstable Nucleus. Simplifying the formula ρ = M/V to: ρ = (No. of Nucleons x 3.99x 10^{-28})/ r^3 Kg/m^3 we get:

Number of Nucleons.	Radius in m.	Density in Kg/m^3.
1 H-S	$8.59x10^{-13}$	$6.30x10^{8}$
2 H-S	$1.72x10^{-12}$	$1.57x10^{8}$
3 He-S	$2.57x10^{-12}$	$7.05x10^{7}$
4 He-S	$3.41x10^{-12}$	$4.03x10^{7}$
5 -----------------	Does Not Exist.	-------------------
6 Li-S	$5.13x10^{-12}$	$1.77x10^{7}$
7 Li-S	$5.98x10^{-12}$	$1.31x10^{7}$
8 Be-U	$6.82x10^{-12}$	$1.01x10^{7}$
9 Be-S	$7.68x10^{-12}$	$7.93x10^{6}$
10 B-S	$8.53x10^{-12}$	$6.43x10^{6}$
11 B-S	$9.38x10^{-12}$	$5.32x10^{6}$
12 C-S	$1.02x10^{-11}$	$4.51x10^{6}$
13 C-S	$1.11x10^{-11}$	$3.79x10^{6}$
14 N-S	$1.19x10^{-11}$	$3.31x10^{6}$
15 N-S	$1.28x10^{-11}$	$2.85x10^{6}$
16 O-S	$1.36x10^{-11}$	$2.54x10^{6}$
17 O-S	$1.45x10^{-11}$	$2.22x10^{6}$
18 O-S	$1.53x10^{-11}$	$2.01x10^{6}$
19 F-S	$1.62x10^{-11}$	$1.78x10^{6}$
20 Ne-S	$1.70x10^{-11}$	$1.62x10^{6}$
21 Ne-S	$1.79x10^{-11}$	$1.46x10^{6}$
22 Ne-S	$1.87x10^{-11}$	$1.34x10^{6}$
23 Na-S	$1.96x10^{-11}$	$1.22x10^{6}$
24 Mg-S	$2.04x10^{-11}$	$1.13x10^{6}$
25 Mg-S	$2.13x10^{-11}$	$1.03x10^{6}$
26 Mg-S	$2.21x10^{-11}$	$9.61x10^{5}$
27 Al-S	$2.30x10^{-11}$	$8.85x10^{5}$
28 Si-S	$2.38x10^{-11}$	$8.29x10^{5}$
29 Si-S	$2.47x10^{-11}$	$7.68x10^{5}$
30 Si-S	$2.55x10^{-11}$	$7.22x10^{5}$
31 P-S	$2.64x10^{-11}$	$6.72x10^{5}$
32 Sulphur-S	$2.72x10^{-11}$	$6.34x10^{5}$
33 Sulphur-S	$2.81x10^{-11}$	$5.93x10^{5}$
34 Sulphur-S	$2.89x10^{-11}$	$5.62x10^{5}$

35 Cl-S	$2.98x10^{-11}$	$5.28x10^{5}$
36Sulphur,Ar-S	$3.06x10^{-11}$	$5.01x10^{5}$
37 Cl-S	$3.15x10^{-11}$	$4.72x10^{5}$
38 Ar-S	$3.23x10^{-11}$	$4.50x10^{5}$
39 K-S	$3.32x10^{-11}$	$4.25x10^{5}$
40 Ar, Ca-S	$3.40x10^{-11}$	$4.06x10^{5}$
41 K-S	$3.49x10^{-11}$	$3.85x10^{5}$
42 Ca-S	$3.58x10^{-11}$	$3.65x10^{5}$
43 Ca-S	$3.66x10^{-11}$	$3.50x10^{5}$
44 Ca-S	$3.75x10^{-11}$	$3.33x10^{5}$
45 Sc-S	$3.83x10^{-11}$	$3.20x10^{5}$
46 Ca, Ti-S	$3.92x10^{-11}$	$3.05x10^{5}$
47 Ti-S	$4.00x10^{-11}$	$2.93x10^{5}$
48 Ti-S	$4.09x10^{-11}$	$2.80x10^{5}$
49 Ti-S	$4,17x10^{-11}$	$2.70x10^{5}$
50 Ti-S	$4.26x10^{-11}$	$2.58x10^{5}$
51 V-S	$4.34x10^{-11}$	$2.49x10^{5}$
52 Cr-S	$4.43x10^{-11}$	$2.39x10^{5}$
53 Cr-S	$4.51x10^{-11}$	$2.31x10^{5}$
54 Cr, Fe-S	$4.60x10^{-11}$	$2.21x10^{5}$
55 Mn-S	$4.68x10^{-11}$	$2.14x10^{5}$
56 Fe-S	$4.77x10^{-11}$	$2.06x10^{5}$
57 Fe-S	$4.85x10^{-11}$	$1.99x10^{5}$
58 Fe, Ni-S	$4.94x10^{-11}$	$1.92x10^{5}$
59 Co-S	$5.02x10^{-11}$	$1.86x10^{5}$
60 Ni-S	$5.11x10^{-11}$	$1.79x10^{5}$
61 Ni-S	$5.19x10^{-11}$	$1.74x10^{5}$
62 Ni-S	$5.28x10^{-11}$	$1.68x10^{5}$
63 Cu-S	$5.36x10^{-11}$	$1.63x10^{5}$
64 Ni, Zn-S	$5.45x10^{-11}$	$1.58x10^{5}$
65 Cu-S	$5.53x10^{-11}$	$1.53x10^{5}$
66 Zn-S	$5.62x10^{-11}$	$1.48x10^{5}$
67 Zn-S	$5.70x10^{-11}$	$1.44x10^{5}$
68 Zn-S	$5.79x10^{-11}$	$1.40x10^{5}$
69 Ga-S	$5.87x10^{-11}$	$1.36x10^{5}$
70 Zn, Ge-S	$5.96x10^{-11}$	$1.32x10^{5}$
71 Ga-S	$6.04x10^{-11}$	$1.29x10^{5}$
72 Ge-S	$6.13x10^{-11}$	$1.25x10^{5}$

73 Ge-S	$6.21x10^{-11}$	$1.22x10^{5}$
74 Ge, Se-S	$6.30x10^{-11}$	$1.18x10^{5}$
75 As-S	$6.38x10^{-11}$	$1.15x10^{5}$
76 Ge, Se-S	$6.47x10^{-11}$	$1.12x10^{5}$
77 Se-S	$6.55x10^{-11}$	$1.09x10^{5}$
78 Se-S	$6.64x10^{-11}$	$1.06x10^{5}$
79 Br-S	$6.72x10^{-11}$	$1.04x10^{5}$
80 Se, Kr-S	$6.81x10^{-11}$	$1.01x10^{5}$
81 Br-S	$6.89x10^{-11}$	$9.88x10^{4}$
82 Kr-S	$6.98x10^{-11}$	$9.62x10^{4}$
83 Kr-S	$7.06x10^{-11}$	$9.41x10^{4}$
84 Kr, Sr-S	$7.15x10^{-11}$	$9.17x10^{4}$
85 Rb-S	$7.23x10^{-11}$	$8.97x10^{4}$
86 Kr, Sr-S	$7.32x10^{-11}$	$8.75x10^{4}$
87 Sr-S	$7.40x10^{-11}$	$8.57x10^{4}$
88 Sr-S	$7.49x10^{-11}$	$8.36x10^{4}$
89 Y-S	$7.57x10^{-11}$	$8.19x10^{4}$
90 Zr-S	$7.66x10^{-11}$	$7.99x10^{4}$
91 Zr-S	$7.75x10^{-11}$	$7.80x10^{4}$
92 Zr, Mo-S	$7.83x10^{-11}$	$7.65x10^{4}$
93 Nb-S	$7.92x10^{-11}$	$7.47x10^{4}$
94 Zr, Mo-S	$8.00x10^{-11}$	$7.33x10^{4}$
95 Mo-S	$8.09x10^{-11}$	$7.16x10^{4}$
96 Mo, Ru-S	$8.17x10^{-11}$	$7.02x10^{4}$
97 Mo-S	$8.26x10^{-11}$	$6.87x10^{4}$
98 Mo, Ru-S	$8.34x10^{-11}$	$6.74x10^{4}$
99 Tc-U, Ru-S	$8.43x10^{-11}$	$6.59x10^{4}$
100 Ru-S	$8.51x10^{-11}$	$6.47x10^{4}$
101 Ru-S	$8.60x10^{-11}$	$6.34x10^{4}$
102 Ru, Pd-S	$8.68x10^{-11}$	$6.22x10^{4}$
103 Rh-S	$8.77x10^{-11}$	$6.09x10^{4}$
104 Ru, Pd-S	$8.86x10^{-11}$	$5.97x10^{4}$

105 Pd-S	$8.94x10^{-11}$	$5.86x10^{4}$
106 Pd, Cd-S	$9.02x10^{-11}$	$5.76x10^{4}$
107 Ag-S	$9.11x10^{-11}$	$5.65x10^{4}$
108 Pd, Cd-S	$9.19x10^{-11}$	$5.55x10^{4}$
109 Ag-S	$9.28x10^{-11}$	$5.44x10^{4}$
110 Pd, Cd-S	$9.36x10^{-11}$	$5.35x10^{4}$
111 Cd-S	$9.45x10^{-11}$	$5.25x10^{4}$
112 Cd, Sn-S	$9.53x10^{-11}$	$5.16x10^{4}$
113 In-S	$9.62x10^{-11}$	$5.06x10^{4}$
114 Cd, Sn-S	$9.70x10^{-11}$	$4.98x10^{4}$
115 Sn-S	$9.79x10^{-11}$	$4.89x10^{4}$
116 Sn-S	$9.88x10^{-11}$	$4.80x10^{4}$
117 Sn-S	$9.96x10^{-11}$	$4.72x10^{4}$
118 Sn-S	$10.05x10^{-11}$	$4.64x10^{4}$
119 Sn-S	$10.13x10^{-11}$	$4.57x10^{4}$
120 Sn, Te-S	$10.22x10^{-11}$	$4.49x10^{4}$
121 Sb-S	$10.30x10^{-11}$	$4.42x10^{4}$
122 Sn, Te-S	$10.39x10^{-11}$	$4.34x10^{4}$
123 Sb-S	$10.47x10^{-11}$	$4.28x10^{4}$
124 Sn,Te,Xe-S	$10.56x10^{-11}$	$4.20x10^{4}$
125 Te-S	$10.64x10^{-11}$	$4.14x10^{4}$
126 Te, Xe-S	$10.73x10^{-11}$	$4.07x10^{4}$
127 I-S	$10.81x10^{-11}$	$4.01x10^{4}$
128 Xe-S	$10.91x10^{-11}$	$3.93x10^{4}$
129 Xe-S	$10.98x10^{-11}$	$3.89x10^{4}$
130 Xe, Ba-S	$11.07x10^{-11}$	$3.82x10^{4}$
131 Xe-S	$11.15x10^{-11}$	$3.77x10^{4}$
132 Xe, Ba-S	$11.24x10^{-11}$	$3.71x10^{4}$
133 Cs-S	$11.32x10^{-11}$	$3.66x10^{4}$
134 Xe, Ba-S	$11.41x10^{-11}$	$3.60x10^{4}$
135 Ba-S	$11.49x10^{-11}$	$3.55x10^{4}$
136 Ba, Ce-S	$11.58x10^{-11}$	$3.49x10^{4}$

137 Ba-S	$11.66x10^{-11}$	$3.45x10^{4}$
138 Ba, Ce-S	$11.75x10^{-11}$	$3.39x10^{4}$
139 La-S	$11.83x10^{-11}$	$3.35x10^{4}$
140 Ce-S	$11.92x10^{-11}$	$3.30x10^{4}$
141 Pr-S	$12.01x10^{-11}$	$3.25x10^{4}$
142 Nd-S	$12.09x10^{-11}$	$3.21x10^{4}$
143 Nd-S	$12.18x10^{-11}$	$3.16x10^{4}$
144 Sm-S	$12.26x10^{-11}$	$3.12x10^{4}$
145 Nd-S	$12.35x10^{-11}$	$3.07x10^{4}$
146 Nd-S	$12.43x10^{-11}$	$3.03x10^{4}$
147 Pm-U	$12.52x10^{-11}$	$2.99x10^{4}$
148 Nd-S	$12.60x10^{-11}$	$2.95x10^{4}$
149 Sm-U	$12.69x10^{-11}$	$2.91x10^{4}$
150 Sm-S	$12.77x10^{-11}$	$2.87x10^{4}$
151 Eu-S	$12.86x10^{-11}$	$2.83x10^{4}$
152 Sm-S	$12.94x10^{-11}$	$2.80x10^{4}$
153 Eu-S	$13.03x10^{-11}$	$2.76x10^{4}$
154 Sm, Gd-S	$13.11x10^{-11}$	$2.73x10^{4}$
155 Gd-S	$13.20x10^{-11}$	$2.69x10^{4}$
156 Gd, Dy-S	$13.28x10^{-11}$	$2.66x10^{4}$
157 Gd-S	$13.37x10^{-11}$	$2.62x10^{4}$
158 Gd, Dy-S	$13.46x10^{-11}$	$2.59x10^{4}$
159 Tb-S	$13.54x10^{-11}$	$2.56x10^{4}$
160 Gd, Dy-S	$13.63x10^{-11}$	$2.52x10^{4}$
161 Dy-S	$13.71x10^{-11}$	$2.49x10^{4}$
162 Dy, Er-S	$13.80x10^{-11}$	$2.46x10^{4}$
163 Dy-S	$13.88x10^{-11}$	$2.43x10^{4}$
164 Dy, Er-S	$13.97x10^{-11}$	$2.40x10^{4}$
165 Ho-S	$14.05x10^{-11}$	$2.37x10^{4}$
166 Er-S	$14.14x10^{-11}$	$2.34x10^{4}$
167 Er-S	$14.22x10^{-11}$	$2.32x10^{4}$
168 Er, Yb-S	$14.31x10^{-11}$	$2.29x10^{4}$

169 Tm-S	$14.39x10^{-11}$	$2.26x10^{4}$
170 Er, Yb-S	$14.48x10^{-11}$	$2.23x10^{4}$
171 Yb-S	$14.56x10^{-11}$	$2.21x10^{4}$
172 Yb-S	$14.65x10^{-11}$	$2.18x10^{4}$
173 Yb-S	$14.73x10^{-11}$	$2.16x10^{4}$
174 Yb-S	$14.82x10^{-11}$	$2.13x10^{4}$
175 Lu-S	$14.90x10^{-11}$	$2.11x10^{4}$
176 Yb, Hf-S	$14.99x10^{-11}$	$2.08x10^{4}$
177 Hf-S	$15.08x10^{-11}$	$2.06x10^{4}$
178 Hf-S	$15.16x10^{-11}$	$2.04x10^{4}$
179 Hf-S	$15.25x10^{-11}$	$2.01x10^{4}$
180 Hf, W-S	$15.33x10^{-11}$	$1.99x10^{4}$
181 Ta-S	$15.42x10^{-11}$	$1.97x10^{4}$
182 W-S	$15.50x10^{-11}$	$1.95x10^{4}$
183 W-S	$15.59x10^{-11}$	$1.93x10^{4}$
184 W, Os-S	$15.67x10^{-11}$	$1.91x10^{4}$
185 W, Re-S	$15.76x10^{-11}$	$1.89x10^{4}$
186 Os-U	$15.84x10^{-11}$	$1.87x10^{4}$
187 Re-U, Os-S	$15.93x10^{-11}$	$1.85x10^{4}$
188 Os-S	$16.01x10^{-11}$	$1.83x10^{4}$
189 Os-S	$16.10x10^{-11}$	$1.81x10^{4}$
190 Os-S	$16.18x10^{-11}$	$1.79x10^{4}$
191 Ir-S	$16.27x10^{-11}$	$1.77x10^{4}$
192 Os, Pt-S	$16.36x10^{-11}$	$1.75x10^{4}$
193 Ir-S	$16.44x10^{-11}$	$1.73x10^{4}$
194 Pt-S	$16.53x10^{-11}$	$1.71x10^{4}$
195 Pt-S	$16.61x10^{-11}$	$1.70x10^{4}$
196 Pt, Hg-S	$16.70x10^{-11}$	$1.68x10^{4}$
197 Au-S	$16.78x10^{-11}$	$1.66x10^{4}$
198 Pt, Hg-S	$16.87x10^{-11}$	$1.65x10^{4}$
199 Hg-S	$16.95x10^{-11}$	$1.63x10^{4}$
200 Hg-S	$17.04x10^{-11}$	$1.61x10^{4}$

201 Hg-S	$17.12x10^{-11}$	$1.60x10^{4}$
202 Hg-S	$17.21x10^{-11}$	$1.58x10^{4}$
203 Tl-S	$17.29x10^{-11}$	$1.57x10^{4}$
204 Hg-S	$17.38x10^{-11}$	$1.55x10^{4}$
205 Tl-S	$17.46x10^{-11}$	$1.54x10^{4}$
206 Pb-S	$17.55x10^{-11}$	$1.52x10^{4}$
207 Pb-S, At-U	$17.63x10^{-11}$	$1.51x10^{4}$
208 Pb-S; All nuclei > 208 are Unstable.	$17.72x10^{-11}$	$1.49x10^{4}$
209Bi, Po, At-U	$17.81x10^{-11}$	$1.48x10^{4}$
210 At-U	$17.89x10^{-11}$	$1.46x10^{4}$
211 At-U	$17.98x10^{-11}$	$1.45x10^{4}$
222 Rn-U	$18.92x10^{-11}$	$1.31x10^{4}$
223 Fr-U	$19.01x10^{-11}$	$1.30x10^{4}$
224 Fr-U	$19.09x10^{-11}$	$1.28x10^{4}$
225 Fr-U	$19.17x10^{-11}$	$1.27x10^{4}$
226 Ra-U	$19.26x10^{-11}$	$1.26x10^{4}$
227 Ac-U	$19.34x10^{-11}$	$1.25x10^{4}$
228 Ra-U	$19.43x10^{-11}$	$1.24x10^{4}$
229 Th-U	$19.51x10^{-11}$	$1.23x10^{4}$
230 Th-U	$19.60x10^{-11}$	$1.22x10^{4}$
231 Pa-U	$19.68x10^{-11}$	$1.21x10^{4}$
232 Th, Ur-U	$19.77x10^{-11}$	$1.20x10^{4}$
233 Ur-U	$19.86x10^{-11}$	$1.19x10^{4}$
234 Ur-U	$19.94x10^{-11}$	$1.18x10^{4}$
235 Ur-U	$20.03x10^{-11}$	$1.17x10^{4}$
236Ur,Np,Pu-U	$20.11x10^{-11}$	$1.16x10^{4}$
237 Ur, Np-U	$20.20x10^{-11}$	$1.15x10^{4}$
238 Ur, Pu-U	$20.28x10^{-11}$	$1.14x10^{4}$
239 Pu-U	$20.37x10^{-11}$	$1.13x10^{4}$
240 Pu-U	$20.45x10^{-11}$	$1.12x10^{4}$
241 Pu, Am-U	$20.54x10^{-11}$	$1.11x10^{4}$

242 Pu, Am-U	$20.62\text{x}10^{-11}$	$1.10\text{x}10^{4}$
243 Am-U	$20.71\text{x}10^{-11}$	$1.09\text{x}10^{4}$
244 Pu-U	$20.79\text{x}10^{-11}$	$1.08\text{x}10^{4}$
245 Cm-U	$20.88\text{x}10^{-11}$	$1.074\text{x}10^{4}$
246 Cm-U	$20.96\text{x}10^{-11}$	$1.066\text{x}10^{4}$
247 Cm, Bk-U	$21.05\text{x}10^{-11}$	$1.06\text{x}10^{4}$
248 Cm-U	$21.14\text{x}10^{-11}$	$1.05\text{x}10^{4}$
249 Cf-U	$21.22\text{x}10^{-11}$	$1.04\text{x}10^{4}$
250 Cf-U	$21.31\text{x}10^{-11}$	$1.03\text{x}10^{4}$
251 Cf-U	$21.39\text{x}10^{-11}$	$1.02\text{x}10^{4}$
252 Cf, Es-U	$21.48\text{x}10^{-11}$	$1.01\text{x}10^{4}$
253 Es, Fm-U	$21.56\text{x}10^{-11}$	$10.07\text{x}10^{3}$
254 Es-U	$21.64\text{x}10^{-11}$	$10.00\text{x}10^{3}$
255 Es-U	$21.73\text{x}10^{-11}$	$9.92\text{x}10^{3}$
256 Es-U	$21.82\text{x}10^{-11}$	$9.83\text{x}10^{3}$
257 Es, Fm, Md-U	$21.90\text{x}10^{-11}$	$9.76\text{x}10^{3}$
258 Md-U	$21.99\text{x}10^{-11}$	$9.68\text{x}10^{3}$
259 Md-U	$22.08\text{x}10^{-11}$	$9.60\text{x}10^{3}$
260 Md-U	$22.16\text{x}10^{-11}$	$9.53\text{x}10^{3}$

The density of stable nuclei varies from $6.30\text{x}10^{8}$ Kg/m^{3} for 1 nucleus to $1.49\text{x}10^{4}$ Kg/m^{3} for 208 nucleons.

IV. CONCLUSION

All the radii of the elementary particles are fundamental and therefore they should be included, along with the radii and charges of the three neutrinos, in the Table at the end of a University Physics Book in conjunction with the other Physical Constants of nature. The sizes of the nuclei of the elements depend only on the total number of nucleons. If there is an overlap of the number of nucleons between two or more elements their size will be the same. As an example, Barium, Lanthanum, and Cesium can all carry 138 nucleons of the same radius of $11.75\text{x}10^{-11}$m. Another example would be Hafnium carrying 176 nucleons of radius $14.99\text{x}10^{-11}$m with Ytterbium and Lutetium; and Hafnium carrying 180 nucleons of radius $15.33\text{x}10^{-11}$m with Tantalum and Tungsten. The radii and densities of all the nuclei of all the elements of the Periodic Table should be included in Chemistry Textbooks. Densities decrease as the number of nucleons and their radii increase. The strong nuclear attractive force between the nucleons that is short ranged begins to become weaker than the repulsive electric force between the protons that is long ranged until nucleons with higher mass number become unstable.

REFERENCES

1. Irani, A. (2024) Calculations of the Electron Radius. Journal of High Energy Physics, Gravitation and Cosmology, 10, 724-725. doi: 10.4236/jhepgc.2024.102044.
2. Irani, A. (2024) Estimates of the Charges and Size of the Three Types of Neutrinos. *Journal of High Energy Physics, Gravitation and Cosmology*, 10, 1467-1469. doi: 10.4236/jhepgc.2024.104082.
3. Tables of Nuclear Data, Nuclear Data Center, Japan Atomic Energy Agency (JAEA) wwwndc.jaea.go.jp/NuC/
4. Serway & Faughn, College Physics, Fifth Edition, Page 960, Harcourt College Publishers, Orlando, FL 32887-6777.