A unified field theory; atomic, gravitational orbitals as anti-photons

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In this essay I propose an alternate interpretation whereby particles may be linked, not by the 4 forces, but by 'physical' orbitals; that nuclear, atomic, molecular and gravitational orbital wave-functions are actually photons albeit of inverse phase (anti-photons or orbitons) that have been trapped to form standing waves. In this context a gravitational orbit would be the sum of these gravitational orbitals, the moon would therefore not be orbiting the earth, rather it would be propelled by these orbital momenta. Likewise there is no empty space within the atom or nucleus, instead particles are entangled via these physical anti-photon orbital links. As orbitals have different energy densities, movement between orbitals requires a change in energy density, a quantum buoyancy. As such, if we move the IPK 1kg reference bar to a different location (with a different g), then we will change its orbit and so its orbital mass density.

1 Introduction

This is an outline of an orbital model where, instead of the 4 forces linking particles, there are orbitals, referred to here as nuclear, atomic, molecular and gravitational. These orbitals appear to be anti-photons, photons albeit of inverse phase (i.e.: $E_{photon} + E_{anti-photon} = E_{zero}$).

At the atomic level they may be described by atomic and molecular orbital theories, although they are 'physical' waves of momentum rather than mathematical wave-functions.

I have denoted these anti-photon orbitals as orbitons in order to differentiate from the common concepts of both anti-photons and atomic orbitals.

In this model there is no empty space within the atom and the electron is linked to the nucleus, not by an electrostatic force, but by a physical standing wave (aka particle in a box) orbital (orbiton).

Furthermore, what we typically consider as a gravitational orbit around the earth is actually the sum of many gravitational orbitals, standing waves around the earth that derive from molecular orbits. As such, the term orbit itself is misleading for it suggests an object traveling through an empty medium around another object according to an abstract force.

In this model, the moon does not orbit the earth, rather the moon is pulled along its orbit path by the momentum of these gravitational orbitals; they are both the track and the locomotive. As these orbitals curve around the earth, the motion of the moon is the sum of their vector momentum. Consequently, if they are unaligned, the moon will fall to the earth with a constant acceleration. If they are all perfectly aligned, the moon will follow them at orbital velocity.

We call these 2 states potential energy (unaligned) and kinetic energy (aligned). The actual motion observed is a measure of the degree of the alignment (and the orbital mix).

This however leads to the curious observation that, as these orbitals are standing waves, the frequency and so energy of a gravitational orbital around the moon is higher (E=hv) than that of a corresponding gravitational orbital around the larger earth, ie: the smaller the object, the shorter the wavelength (circumference), and so the lower the frequency.

As the energy density of an orbital is less than the density of space ($E_{orbital} < E_{zero}$), we may anticipate a corresponding 'mass-deficit'.

Movement between orbitals is a function of orbital 'buoyancy', for example, a submarine may travel across the ocean at a fixed depth (i.e. 1000m) via propeller motion (a motion within the 1000m orbital), but to change from this equilibrium depth (the orbital itself) to rise to the surface or sink further, it must change its mass density (add or eject ballast). And so, while it is this gravitational momentum which keeps the satellite following its orbit, it is this 'bouyancy' mass-deficit which keeps the satellite (and us) from floating off into space.

1 kg is defined as the mass of the International Prototype of the Kilogram (IPK), a platinum alloy cylinder stored near Paris. If this bar were orbiting the earth, it would gain 'relativistic' mass according to its (motion through space) velocity (mass > 1kg).

To lift the bar from Paris into space, we must add velocity (momentum) to compensate for the 'mass' density difference. We find that the velocity (momentum) required to increase its 'bouyancy' mass is equal to escape velocity. Escape velocity is that velocity required to achieve the correct mass density just as the submarine takes on extra water to sink lower.

And so, if we move this bar from its vault in Paris to the top of the Eiffel tower, we may have a new 'kg'. Experiments to determine the gravitation constant G may give different results depending on whether conducted on the 1st floor or the top floor of the physics department and so we may require both a constant v and a constant g to define our mass.

The third component of a gravitational orbital is the rotation of the orbital itself, not only is the earth orbiting the sun, but that earth-sun orbit itself is also rotating like a disc. This is noticeable with elliptical orbits.

At the atomic level, when an incoming photon strikes an electron in an atom for example, it does not cause the electron to jump between orbitals, rather the original orbital (anti-photon) is deleted and then replaced with the new orbital (anti-photon) via a simple wave addition and subtraction.

Photons are thereby means by which the information of the universe is exchanged. The electron itself doesn't move, however its orbital boundary has been changed.

The energy of an atomic orbital derives from the momentum of the orbital around the nucleus, the spin of the orbital itself and rotational momentum of the entire orbital; analogous to the spin of the earth, the orbit of the earth around the sun and the disk-like earth-sun orbital rotation (noticeable with the Mercury-Sun orbit). This energy is reflected in the frequency of the atomic orbital.

2 Bohr model (n orbits):

The Niels Bohr model depicts the atom as a small positively charged nucleus surrounded by electrons that travel in circular orbits around the nucleus—similar in structure to the solar system, but with electrostatic forces providing attraction, rather than gravity.

Although considered incorrect by physicists; it does give correct results for selected systems. It was later replaced with a more useful wave model (depicting the electron and proton as waves). Nevertheless, for certain simple orbits, the Bohr model was extremely accurate and still no one knows why.

The basic Bohr model depicted these orbits as fixed, only certain orbits were allowed ('particle in a box'). In its most elementary form, it incorporates 4 values: the speed of light c, the Sommerfeld fine structure constant alpha $\alpha \sim 137.036$, the principal quantum number n and electron wavelength λ_e.

Particles exhibit a wave-particle duality. This model presumes that (modified) Bohr formulas may be applied to the particle state and so are also applicable to the gravity-mass state. Of principle discussion in this article are these particle states of the nucleus and of gravity for the simplest n orbitals as these are sufficient to illustrate the principles. Bohr as relates to atomic orbitals has received much consideration in the literature over the past 100years and need not be repeated here.

3 Electric orbits

Key:

$\lambda_a = \lambda_p + \lambda_e$ (reduced mass equivalent)
R_a = Bohr radius
v_a = orbital velocity
a_a = acceleration (hypothetical)
T_a = orbital period

$$m_{reduced} = \frac{m_e m_p}{m_e + m_p} = \frac{1}{\frac{1}{m_e} + \frac{1}{m_p}} \tag{1}$$

$$\lambda_a = \lambda_e + \lambda_p = \frac{m_P l_p}{m_e} + \frac{m_P l_p}{m_p} = \frac{m_P l_p}{m_{reduced}} \tag{2}$$

$$R_a = \alpha n^2 \lambda_a \tag{3}$$

$$v_a = \frac{c}{\alpha n} \tag{4}$$

$$a_a = \frac{c^2}{\alpha^3 n^4 \lambda_a} \tag{5}$$

$$T_a = \frac{2\pi\alpha^2 n^3 \lambda_a}{c} \tag{6}$$

$$E_n = \frac{m_e v_a^2}{2} \tag{7}$$

4 Nuclear orbits

$$m_{nuc} = m_p + m_n \tag{8}$$

$$\lambda_s = \frac{\lambda_p + \lambda_n}{4} = \frac{l_p m_P}{m_{nuc}} \tag{9}$$

$$r_0 = \sqrt{\alpha}\lambda_s \tag{10}$$

$$R_s = \alpha \lambda_s \tag{11}$$

$$v_s^2 = \frac{c^2}{\alpha} \tag{12}$$

$$E = \frac{m_{nuc} v_s^2}{2} \tag{13}$$

1. Gravitational binding energy (μ):
The gravitational binding energy is the energy required to pull apart an object consisting of loose material and held together only by gravity.

$$\mu = \frac{3GM^2}{5R} \tag{14}$$

$$G = \frac{l_p c^2}{m_P} \tag{15}$$

$$R = \sqrt{(\alpha)} r_0 = \alpha \lambda_s \tag{16}$$

$$M = m_P$$

$$\mu = \frac{3 m_{nuc} c^2}{5\alpha} \tag{17}$$

$$\mu = \frac{3 m_{nuc} v_s^2}{5} \tag{18}$$

Average GBE in the nucleus = 8.22MeV/nucleon

2. Strong binding energy (SBE):
Nuclear binding energy is the energy required to split a nucleus of an atom into its component parts. The component parts are neutrons and protons, which are collectively called nucleons.

The electrostatic coulomb constant;

$$a_c = \frac{3e^2}{20\pi\epsilon r_0} \tag{19}$$

$$\frac{e^2}{\epsilon} = \frac{4\pi l_p m_P c^2}{\alpha} \tag{20}$$

$$a_c = \frac{3 l_p m_P c^2}{5\alpha r_0} \tag{21}$$

$$SBE = \sqrt(\alpha) a_c \tag{22}$$

$$SBE = \frac{3 l_p m_P c^2}{5 \sqrt{\alpha} r_0} \tag{23}$$

$$SBE = \frac{3 m_{nuc} c^2}{5\alpha} \tag{24}$$

$$SBE = \frac{3 m_{nuc} v_s^2}{5} \tag{25}$$

Average SBE in the nucleus = 8.22MeV/nucleon

3. Fermi term:
The density of nucleons in a nucleus:

$$n = \frac{3}{4\pi r_0^3} \tag{26}$$

$$E_f = \frac{h^2}{4\pi^2 m_{nuc}}.(\frac{3\pi^2 n}{2})^{2/3} \tag{27}$$

$$E_f = \frac{m_P^2 l_p^2 c^2}{m_{nuc}}.(\frac{9\pi}{8})^{2/3}.\frac{1}{r_0^2} \tag{28}$$

$$E_f = \frac{m_{nuc} c^2}{\alpha}.(\frac{9\pi}{8})^{2/3} \tag{29}$$

$$E_f = m_{nuc} v_s^2.(\frac{9\pi}{8})^{2/3} = 31.5 MeV \tag{30}$$

5 Gravitational orbitals

1. Gravitational wavelength = Schwarzschild radius r_S

$$\lambda_g = \frac{2G(m_a + m_b)}{c^2} = \frac{2 l_p . m_a}{m_P} + \frac{2 l_p m_b}{m_P} = r_{S a} + r_{S b} \tag{31}$$

$$R_g = \alpha n^2 \lambda_g \tag{32}$$

$$v_g^2 = \frac{c^2}{2\alpha n^2} \tag{33}$$

$$a_g = \frac{c^2}{2\alpha^2 n^4 \lambda_g} \tag{34}$$

$$T_g^2 = \frac{8\pi^2 \alpha^3 n^6 \lambda_g^2}{c^2} \tag{35}$$

$$E_n = \frac{m v_g^2}{2} \tag{36}$$

$$n = (\frac{T c^3}{\sqrt(2\alpha) 4\pi\alpha\mu})^{1/3} \tag{37}$$

Example - Earth surface orbit (see on-line calculator [2]):
$\mu_{earth} = 398600.4418$
$\lambda_{earth} = 2\mu_{earth}/c^2 = r_S = .00887 m$
$n = 2290;$
$R_g = 6374.293 km$
$a_g = 9.81 m/s^2$
$T_g = 5064.8 s = 84.4$mins
$v_g = 7907.75 m/s$
$n = 2291;$
$R_g = 6380 km$
$a_g = 9.79 m/s^2$
$T_g = 5071.4 s$
$v_g = 7904 m/s$

2. Gravitational potential energy between 2 orbits

$$\delta.\mu_{GPE} = \frac{GMm}{r_1} - \frac{GMm}{r_2} \tag{38}$$

where r = radius...

$$r_1 = \alpha n_1^2 \lambda_g$$
$$r_2 = \alpha n_2^2 \lambda_g$$

As Planck units...

$$\frac{GMm}{r_n} = \frac{l_p c^2}{m_P} \frac{Mm}{1} \frac{1}{\alpha n^2 \lambda_{M+m}} \tag{39}$$

$$= \frac{hc}{2\pi\alpha n^2 \lambda_{M+m}} \frac{Mm}{m_P^2} \tag{40}$$

Rydberg (gravity)...

$$R = \frac{1}{2\pi r}(\frac{1}{n_1^2} - \frac{1}{n_2^2}) = \frac{1}{2\pi\alpha\lambda_{M+m}}(\frac{1}{n_1^2} - \frac{1}{n_2^2}) \tag{41}$$

$$f = Rc(\frac{1}{n_1^2} - \frac{1}{n_2^2}) \tag{42}$$

$$E_{tot} = hf \frac{Mm}{m_P^2} \tag{43}$$

$$N_{graviton} = \frac{Mm}{m_P^2} \tag{44}$$

$$E_{graviton} = hRc(\frac{1}{n_i^2} - \frac{1}{n_f^2}) \tag{45}$$

$$E_{tot} = E_{graviton} N_{graviton} \tag{46}$$

Example (see on-line calculator [2]):
Earth mass $M = 5.97x10^{24} kg$
Satellite mass $m = 1 kg$
Earth surface $n = 2290$ ($r = 6374 km$)
Geosynchronous orbit $n = 5890$ ($r = 42169 km$)

$$f_{graviton} = n_{2290}\ orbit - n_{5890}\ orbit$$

$$f_{graviton} = 7.485 - 1.132 = 6.354 Hz$$

$$E_{graviton} = 0.412x10^{-32} J$$

$$N_{gravitons} = M.m/m_P^2 = 0.126x10^{41}$$

$$E_{total} = E_{graviton} . N_{gravitons} = .53x10^8 (J/Kg)$$

Note that c/7.485Hz = 40050km corresponds to the circumference of the earth, and so gravitational orbitals are standing waves that encircle the earth. The formula for $N_{gravitons}$ (i.e.: the total number of gravitational waves = orbitals) suggests that every atom in the satellite is linked to every atom in the earth, as such gravitational orbitals may be seen simply as extensions of molecular orbitals.

If these $0.126x10^{41}$ orbital waves of momentum are all unaligned as they circumnavigate the earth, the net result of summing their vectors of motion is that the satellite will appear to fall (accelerate) downwards, if they are all aligned, the satellite will follow them in orbit. Potential energy and kinetic energy become measures of this degree of alignment.

3. Gravitational time dilation

Gravitational time dilation is the difference of elapsed time in regions with different gravitational potential. The lower the gravitational potential (the closer the clock is to the source of gravitation), the more slowly time passes.

v_{escape}

$$\frac{2GM}{r_g c^2} = \frac{r_S}{r_g} = \frac{r_S}{\alpha n^2 r_S} = \frac{v_{escape}^2}{c^2} = \frac{1}{\alpha n^2} \tag{47}$$

v_{orbit}

$$\frac{v_g^2}{c^2} = \frac{1}{2\alpha n^2} \tag{48}$$

Circular orbits:

$$\frac{v_{escape}^2}{c^2} + \frac{v_{orbit}^2}{c^2} = \frac{1}{\alpha n^2} + \frac{1}{2\alpha n^2} = \frac{3}{2\alpha n^2} \tag{49}$$

Example: n=2290 (R=6374km):

$$v_{orbit} = \sqrt{\frac{c^2}{2\alpha n^2}} = 7907.75 m/s \tag{50}$$

$$v_{escape} = \sqrt{\frac{c^2}{\alpha n^2}} = 11183.25 m/s \tag{51}$$

4. The classical tests of relativity

i) Perihelion precession of Mercury's orbit

semi-minor axis: $b = \alpha l^2 \lambda_g$

semi-major axis: $a = \alpha n^2 \lambda_g$

Radius of curvature:

$$L = \frac{b^2}{a} = \frac{a l^4 \lambda_g}{n^2} \tag{52}$$

$$\frac{3\lambda_g}{2L} = \frac{3n^2}{2\alpha l^4} \tag{53}$$

Using n=378, l=374, Mercury orbit = 87.9691days

$$\frac{3n^2}{2\alpha l^4} * 1296000 * 100 * 365.252/87.9691 = 43.015 \tag{54}$$

precession = 43.015 arc secs (per 100yrs)

Number of orbits required to complete 1296000 arc secs:

$$N_{orbits} = \frac{2\alpha l^4}{3n^2} = 12509680$$

If $l = n$, we find the formula for circular orbits eq.49;

$$\frac{3n^2}{2\alpha l^4} = \frac{3}{2\alpha n^2} \tag{55}$$

Rotational velocity (l=n):

$$v_{rotate} = \frac{3c}{\sqrt{(2\alpha)} 2\alpha n^3} \tag{56}$$

Rotational period (l=n):

$$T_{rotate} = \frac{\sqrt{(2\alpha)} 4\pi\alpha^2 n^5 \lambda}{3c} \tag{57}$$

Suggesting the classical mercury-sun orbit is itself rotating.

ii) Gravitational redshift

$$z_{approx} = \frac{GM}{c^2 r_g} = \frac{1}{2\alpha n^2} \tag{58}$$

iii) Deflection of light $r_{star} = r_g$

$$\frac{2r_{S\,star}}{r_{star}} = \frac{2}{\alpha n^2} \tag{59}$$

5. Elliptical orbits

As a gravitational orbit is the sum of many individual orbitals, we need an additional term. The semi-major axis R_a can be calculated from T (period of gravitational orbit) [2];

$$3R_a = R_g\,(1 + \frac{2T}{T_g}) \tag{60}$$

μ_{sun} = 132712440.018 [1]

$\lambda_{sun} = 2\mu_{sun}/c^2 = 2953.25m$

Mercury: $\mu_{mercury}$ = 22032

T = 87.9691 days * 86400sec

a_o = 57 909 100km (wikipedia)

a_k = 57 909 069km (kepler)

a_n = 57 909 099km (n = 378)

$v_g = 47.907 m/s$ (47.87)

Venus: μ_{venus} = 324859

T = 224.65 days * 86400sec

a_o = 108 208 000km (wikipedia)

a_k = 108 192 651km (kepler)

a_n = 108 192 652km (n = 517)

$v_g = 35.026 m/s$ (35.02)

Earth: $\mu_{earth} = 398600.4418$
$T = 365.25636$ days * 86400sec
$a_o = 149\ 597\ 887$km (wikipedia)
$a_k = 149\ 597\ 873$km (kepler)
$a_n = 149\ 597\ 874$km (n = 608)
$v_g = 29.784 m/s$ (29.78)
Mars: $\mu_{mars} = 42828$
$T = 686.97$ days * 86400sec
$a_o = 227\ 939\ 100$km (wikipedia)
$a_k = 227\ 938\ 851$km (kepler)
$a_n = 227\ 938\ 946$km (n = 750)
$v_g = 24.145 m/s$ (24.077)

6. Gravitation formula (r_s = Schwarzschild radius)

$$r_S = \frac{2l_p M}{m_P} \tag{61}$$

$$\frac{GM}{R_g c^2} = \frac{l_p c^2}{m_P} M \frac{1}{\alpha n^2 r_S c^2} = \frac{1}{2\alpha n^2} \tag{62}$$

7. Gravitational force as a function of Planck force

$$F_p = \frac{E_p}{l_p} \tag{63}$$

$$F = \frac{M_a M_b G}{R^2} = \frac{r_{Sa} r_{Sb} F_p}{4R_g^2} = \frac{r_{Sa} r_{Sb} F_p}{4\alpha^2 n^4 \lambda_g^2} \tag{64}$$

a) If $r_{Sa} = r_{Sb}$, the object mass is not required

$$F = \frac{F_p}{16\alpha^2 n^4} \tag{65}$$

b) If $r_{Sa} >> r_{Sb}$, the relative mass is used

$$F = \frac{r_{Sb} F_p}{4\alpha^2 n^4 r_{Sa}} \tag{66}$$

and so the force formula reduces to $F_g = m_b.a_g$

$$a_g = \frac{c^2}{2\alpha^2 n^4 (r_{Sa} + r_{Sb})} \tag{67}$$

$$F.c^2 = \frac{r_{Sa}.r_{Sb} a_g F_p}{2r_{Sa} + 2r_{Sb}} = \frac{r_{Sa} r_{Sb} a_g F_p}{2r_{Sa}} \tag{68}$$

$$r_{Sb} = \frac{2l_p m_b}{m_P} \tag{69}$$

$$F = \frac{2l_p m_b}{m_P} \frac{a_g E_p}{2l_p} \frac{1}{c^2} = m_b a_g \tag{70}$$

8. Gravitational energy ($m_{object} << M_{earth}$)

$$E_{graviton} = hf = \frac{hc}{2\pi r_g} = \frac{m_P c^2 l_p}{r_g} = \frac{m_P c^2 l_p}{\alpha n^2 \lambda_{earth}} = \frac{m_P^2 v_g^2}{M_{earth}} \tag{71}$$

energy per graviton to reach escape velocity

$$E_{ev} = \frac{m_P^2 v_s^2}{M} \tag{72}$$

- earth as black hole; n = 1, E = .325e-6eV
earth surface; r = 6374.3km, n = 2290, E = .619e-13eV
- moon as black hole; n = 1, E = .264e-4eV
moon surface; r = 1737.1km, n = 10735, E = .229e-12eV
- M = .1426e18kg (i.e.: a small planet);

$$M = \frac{2\alpha m_P^2}{m_e} = .1426e18 \tag{73}$$

$$E_{ev} = \frac{m_P^2 v_s^2}{2\alpha m_P^2 / m_e} = \frac{m_e c^2}{2\alpha^2} = 13.6eV \tag{74}$$

The number of orbitals per orbit;

$$N_{earth} = \frac{M_{earth} m}{m_P^2} = .126e41 \tag{75}$$

$$N_{moon} = \frac{M_{moon} m}{m_P^2} = .155e39 \tag{76}$$

$E_{tot} = E_{ev}.N$ reduces to

$$E_{tot} = m v_g^2 = \frac{m v_s^2}{2} \tag{77}$$

And so, as noted earlier, escape velocity is not proportional to the mass (of the earth or the moon), but instead to n.

$$V_{earth} = \sqrt{\frac{c^2}{\alpha 2290^2}} = 11.183 km/s \tag{78}$$

$$V_{moon} = \sqrt{\frac{c^2}{\alpha 10735^2}} = 2.386 km/s \tag{79}$$

6 Molecular Orbitals

Molecular orbitals are the sum of atomic orbitals as described by the standard molecular orbital model although in this context they are physical orbitals and not wave-functions.

Listed here for reference are some dissociation energies for homonuclear diatomic molecules as approximate geometrical terms.
Li-Li (1.12eV)

$$Li - Li = \frac{2m_e v_a^2}{25} = 1.09eV \tag{80}$$

F-F (1.6eV)

$$F - F = \frac{3m_e v_a^2}{25} = 1.63eV \tag{81}$$

B-B (3.0eV)

$$B - B = \frac{2m_e v_a^2}{9} = 3.02eV \tag{82}$$

H-H (4.52eV)

$$H - H = \frac{m_e v_a^2}{3} = 4.54eV \tag{83}$$

O-O (5.2eV)

$$O - O = \frac{3m_e v_a^2}{8} = 5.10eV \tag{84}$$

Positronium

$$(+)e - (-)e = \frac{m_e v_a^2}{2} = 6.8eV \tag{85}$$

N-N (9.8eV)

$$N - N = \frac{18m_e v_a^2}{25} = 9.8eV \tag{86}$$

7 Atomic orbital transitions

According to consensus, an incoming photon hits the atom and an electron jumps to a higher orbital. How this instantaneous process occurs and what constitutes empty space in the atom (which is 99.99999999999 percent of the atom) remains a mystery.

Here I have proposed that the orbital is a physical entity, a photon albeit of opposite phase that has been trapped to form a standing wave and which I denote as an anti-photon.

Analysis of the Rydberg formula suggests the incoming photon is actually 2 photons; the first photon corresponds to the present electron orbital, the 2nd photon corresponds to the new orbital. If so, then the orbitals are themselves photons, albeit standing waves of inverse phase (ie: anti-photons) whereby photon+antiphoton = 0.

And so the incoming photon ($+\lambda$) does not cause the electron to jump between orbitals, rather it deletes the present $n = i$ orbital and replaces it with the new $n = f$ orbital.

The Rydberg formula re-written as 2 photons;

$$(+\lambda) = \frac{R}{n_i^2} - \frac{R}{n_f^2} = (+\lambda_i) - (+\lambda_f) \tag{87}$$

(incoming) photon ($+\lambda$) = ($+\lambda_i$) - ($+\lambda_f$)
antiphoton (standing wave) orbital = ($-\lambda_i$)
photon + antiphoton = ($+\lambda_i$) + ($-\lambda_i$) = 0
then 0 - ($+\lambda_f$) = ($-\lambda_f$)

For an $n = i$ orbital, orbital wavelength = λ_a

$$(-\lambda_i) = (-)\ \frac{c}{4\pi\alpha^2 n_i^2 \lambda_a} \tag{88}$$

Incoming photon ($+\lambda$) = ($+\lambda_i$) - ($+\lambda_f$)

$$(+\lambda) = (+)\ \frac{c}{4\pi\alpha^2 n_i^2 \lambda_a}\ -\ (+)\ \frac{c}{4\pi\alpha^2 n_f^2 \lambda_a} \tag{89}$$

Change of orbitals from $n = i$ to $n = f$:

$$(+\lambda_i)\ +\ (-\lambda_i) = 0 \tag{90}$$

$$0\ -\ (+\lambda_f) = (-\lambda_f) = (-)\ \frac{c}{4\pi\alpha^2 n_f^2 \lambda_a} \tag{91}$$

From this wave addition followed by subtraction, we have simply replaced the $n = i$ orbital with the $n = f$ orbital. The electron has not moved, however the boundary of its orbital has changed.

In molecular orbital theory, the terminology used is bonding and anti-bonding orbitals, nevertheless the principle is the same, i.e.: the molecular bonding orbital is an anti-photon ($E < 0$), the anti-bonding orbital is the inverse photon ($E > 0$). When summed, the molecular bonding and anti-bonding orbitals cancel ($E = 0$).

8 Discussion:

I have described here a mechanism that replaces force exchange with physical links - the orbitals themselves. Movement within the orbital occurs according to the orbital momentum, movement between orbitals requires a change in momentum, akin to buoyancy.

The same principle applies to nuclear, atomic, molecular and gravitational orbitals, the primary difference being that gravitational orbits are the sum of multiple orbitals, conversely in the atom there is only 1 orbital linking each electron with the nucleus. Likewise ionization energy, escape velocity, nuclear binding energy... are essentially the same.

The Bohr orbital model presented here relates to the particle state (of wave-particle duality), as the wave state in the atom is more predominant, the Bohr model has limitations, however these are less apparent in the gravitational orbitals as these may be treated statistically. Nevertheless the underlying principle linking the 4 orbital types can be seen.

References

1. NASA planetary factsheet
   http://nssdc.gsfc.nasa.gov/planetary/factsheet/
2. Online orbital calculator
   www.planckmomentum.com/orbitals