Relative Propagated Outward Flow Concentrations: Earth Surface Objects vs. Earth Gravitational Field

Note: In the earlier treatment of the concentrations problem in the book *Gravitics: The Physics of the Behavior and Control of Gravitation* μ_0 *and* ε_0 were erroneously treated as vector quantities whereas they are actually scalar and so treated here.

FLOW CONCENTRATIONS

For the present purposes the interest is in the potential for slowing of the gravitational *Propagated Outward Flow* Flowing radially outward from the Earth by some configuration of matter at the Earth's surface. The relative amount of slowing depends on the relative amounts or concentrations of the source [Earth gravitation] and encountered [configuration of matter at the Earth's surface] *Propagated Outward Flow* streams.

The problem is, then, to determine within a specified type of matter at the Earth's surface the relative magnitude, u_2, of its ambient *Propagated Outward Flow* as envisioned in Figure 6-4 as compared to u_1, the gravitational Flow propagation arriving from Earth below as envisioned in Figure 6-5. Then the slowing of u_1 by u_2 can be determined.

The Ambient Flow

The ambient Flow within any type of matter is spherically outward from its sources, the atomic components of the matter. Any such stage of this spherical propagation pattern can be split into two hemispheres. That splitting can be chosen to be such that one hemisphere directly faces horizontally. Then, the radially outward rays of that hemisphere all have a component, u_2, in the horizontal direction. That situation is depicted in Figure C-1, below.
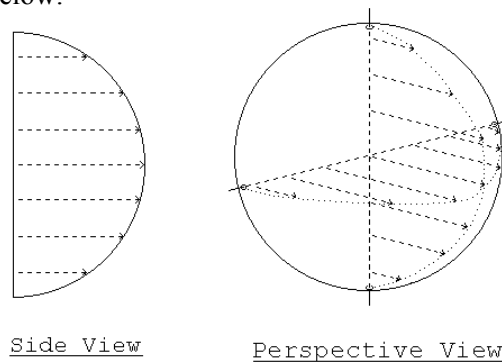

Side View   Perspective View

Figure C-1
Example Rays of u_2 The Horizontal Components of the Radial Outward Flow

Of course, the rays are not discrete rays neatly arranged along a vertical and a horizontal axis. Rather those shown in the figure represent the continuum of medium Flow. All of the rays of the components of u_2 would completely fill the hemisphere volume. The average magnitude of the components corresponds to that hemi-volume divided by the area of the circular base of the hemisphere.

```
(C-1)  r is the radius of the hemisphere, which here
          corresponds to the medium amplitude, u(d),
          where d = r, for a purely radial ray.
```

$$\text{Volume of Hemisphere} = \frac{1}{2} \cdot \frac{4}{3} \cdot \pi \cdot r^3$$

$$\text{Area of Hemisphere Base} = \pi \cdot r^2$$

$$\text{Average } u_2 = \frac{2}{3} \cdot r \text{ and corresponds to } \frac{2}{3} \cdot [u(d=r)]$$

Some example successive stages of the spherically outward Flow from a single particle Flow source are depicted in Figure C-2, below.
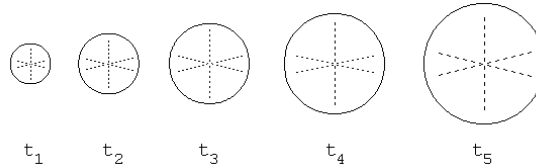

$$t_1 \qquad t_2 \qquad t_3 \qquad t_4 \qquad t_5$$

Figure C-2
Some Stages in a Particle's Spherical Propagation

A single stage, such as that of Figure C-1, of the smoothly continuous sequence of stages of which Figure C-2 is a few intermittent examples, is not a solid hemisphere of medium. Rather it is the wave front of medium propagation at an instant of time. A single stage is the outer surface shell of the hemisphere.

The components of medium Flow pertaining to that shell act at the curved shell surface, not the theoretical flat circular base of the hemisphere of medium Flow. Mathematically one can let the smoothly continuous sequence of such shells be represented by a finite number of nested shells of minute but finite thickness. One such shell is depicted in Figure C-3, below.
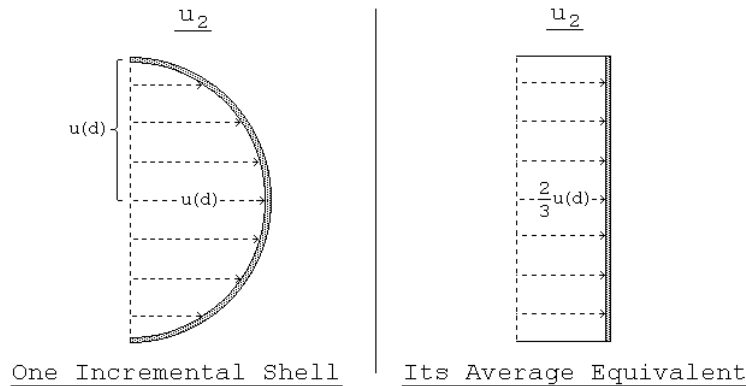

One Incremental Shell | Its Average Equivalent

Figure C-3
A Single Theoretical Shell of Medium Flow

112

The inverse-square variation of the medium Flow, $u(d)$, with distance, d, from the center of the source particle from which it is propagated is depicted in Figure C-4, below.
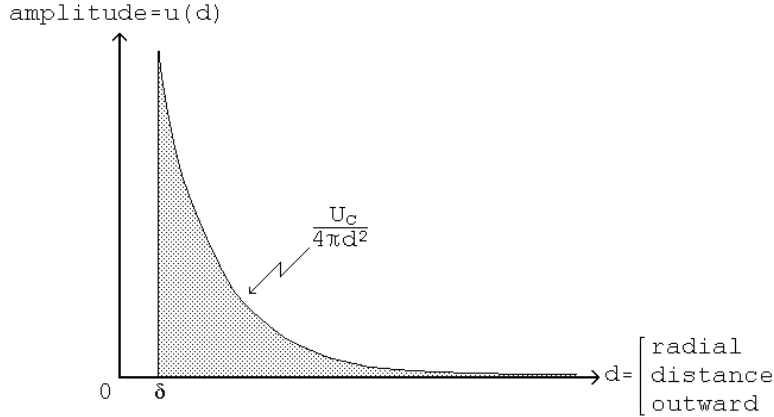

amplitude=u(d)

$\frac{U_C}{4\pi d^2}$

d= ⎡radial
⎢distance
⎣outward

0   δ

Figure C-4
Flow Amplitude vs. Distance From Center

This amplitude is actually the concentration, the amount of medium per unit area at the surface of a sphere centered on the particle Flow source, as depicted in any single stage of the type depicted in Figure C-2. That amount of medium, itself, is actually the amplitude of the *[1 - Cosine]* form of medium oscillation. [The δ in Figure C-4, above, is the radius of the particle Flow source's core.]

Each atom effectively resides in a cube of side S. The particle Flow source of the atom is at the center of the cube and propagates Flow outward in all directions. Per the above Figure C-4, that propagation extends out infinitely in all directions becoming rapidly reduced in magnitude. The cubic volume associated with some single atom experiences the Flow of medium from other adjacent and distant atoms through it in addition to its own propagating medium.

Rather than attempt to sum the myriad varied contributions of all of the other affecting sources in the material to the medium Flow within a particular atom's volume-cube, the same net effect can be obtained by attributing all the action of that particular atom (and each individual atom) as taking place within its own volume-cube. That is, the effect and action per Figure C-4 from $d = \delta$ to ∞ is attributed all to the volume-cube of its source atom with that volume-cube unaffected by medium from other atoms.

Assuming a uniform composition of the matter in question, the matter within which the ambient Flow concentration is to be determined, then the average inter-atomic spacing is the same value as the side of the atom's volume-cube, S. That quantity is the cube root of the reciprocal of the density of the matter times the weight of a single component atom.

The maximum hemisphere centered on the center of the atom, the center of the atom's volume-cube, as in Figure C-2, that can fit within the cube of volume allotted to the atom is of radius $R = \frac{1}{2} \cdot S$.

The calculation of S is as follows.

113

(C-2)

$$\text{Density} = \frac{\text{Weight}}{\text{Volume}} = \frac{\text{Atomic Weight}}{S^3}$$

$$S^3 = \frac{1}{\text{Density}} \cdot \text{Atomic Weight}$$

$$= \frac{\text{Total Volume}}{\text{Total Weight}} \cdot \left[\begin{array}{l} \text{Weight of One Atom} = \\ \text{Atomic Mass Number} \times \\ 1.661 \cdot 10^{-27} \ \text{kg/}_{\text{amu}} \end{array} \right]$$

$$= \text{Volume for One Atom}$$

$$S = [\text{Volume for One Atom}]^{1/3}$$

Table C-5, below, gives some typical values for these quantities in SI units .

From the table it is clear that inter-atomic spacings, *S,* in solid elements are on the order of *2.0* to *3.0 × 10^{-10} meters.* In a gas at atmospheric pressure the spacing is on the order of *10^{-9} meters.* [The value of δ, the radius of the core of a proton or an electron, is *4.05084 × 10^{-35} meters*, on the order of *10^{-25}* times smaller].

Matter	Density	Weight of Atom	Spacing, S
Air	16	25.9×10^{-27}	1.17×10^{-9}
Water	1000	$18. \times 10^{-27}$	2.62×10^{-10}
Carbon	2250	19.95×10^{-27}	2.07×10^{-10}
Aluminum	2700	44.80×10^{-27}	2.55×10^{-10}
Iron	7870	92.88×10^{-27}	2.28×10^{-10}
Lead	11342	345.35×10^{-27}	3.12×10^{-10}

Table C-5
Some Example Inter-Atomic Spacings

The latest medium Flow from the source of u_2, that Flow which has not yet propagated outward and inverse square diffused, has the greatest concentration of medium per area, but it will intercept, interact with, only the smallest target area of external rays, u_1, because it is the smallest shell, analogous to *t1* of Figure C-2. This is the ray of case "a" in Figure C-6, below.
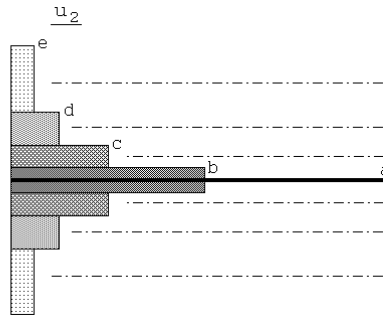

Figure C-6
Encountered Medium Flow for Various Incoming Rays

Medium that had been propagated a moment earlier has progressed somewhat in its inverse square diffusion as in case "b" in Figure C-6. Its concentration of medium per area is less because of the distance that it has propagated, but it will intercept a greater

target area of external rays of u_1 for the same reason. The situation is similar but more progressed with the further successive cases in the figure.

An external ray of u_1 that is directed at the center of the encountered particle Flow source will encounter all of the cases depicted in Figure C-6, as indicated in the figure. But an incoming ray that is directed at a point some lateral distance away from the center of the encountered center will encounter only those cases of Figure C-6 which overlay its path.

All of the cases from "a" through "e" and beyond, that is all of the shells from $d = \delta$ to $d = \infty$ can be summed as infinitesimally thick individual shells by integration as follows.

Of the various cases in the above figure, a ray of an intermediate case, such as "c" in the above figure, intercepts all of the cases / shells with a greater radius than the intermediate ray's lateral displacement from the center of the particle Flow source. If we let r represent that lateral displacement of the ray, d the distance outward from the source of u_2 that the shell has traveled, and U_c the fundamental amplitude of the *[1 – cosine]* oscillation, then the summation of the concentrations that that ray encounters in the various shells on outward from lateral displacement r is as follows (the $2/3$ is to deal in average per equation *(C-1)*).

(C-3)
$$\frac{2}{3} \cdot \int_r^\infty \frac{U_c}{4\pi \cdot d^2} \cdot dd$$

This equation *(C-3)* is the product of medium Flow concentration and a distance (the variable of integration, d). That which is needed is the average medium Flow concentration within the atom's volume cube, that is over the range $d = \infty$ to R $(R = \frac{1}{2} \cdot s = \frac{1}{2} \cdot [the\ volume\ cube\ side])$. The integration on the variable d to ∞ then divided by the distance only out to R attributes all of the atom's medium Flow propagation solely to its own volume-cube.

Therefore, dividing equation *(C-3)* by *[R – δ]* = R because $R >> \delta$ and performing the integration the equation *(C-4)*, below, is obtained.

(C-4)
$$\frac{2}{3 \cdot R} \cdot \int_r^\infty \frac{U_c}{4\pi \cdot d^2} \cdot dd$$

$$= \frac{U_c}{6\pi \cdot R} \cdot \left[-\frac{1}{d} \right]_r^\infty$$

$$= \frac{U_c}{6\pi \cdot R \cdot r}$$

In Figure C-6, while a ray of "a" encounters the greatest concentration of medium Flow, only a very minor portion can be in position to experience that concentration. On the other hand, a ray of "c" encounters a reduced medium Flow concentration but a much larger number of rays can have that experience. The number of rays that can experience the medium Flow concentration for any particular lateral displacement, r, is the area of the concentric ring of radius r and thickness dr. For

each of the r's of equation *(C-4)* the number of incoming rays of u_1 that encounter that concentration is thus $2\pi \cdot r \cdot dr$.

Therefore, equation *(C-4)*, above, must be integrated by the factor $2\pi \cdot r \cdot dr$ over the range that r can have within the atom's volume-cube, from $r = \delta$ to $r = R$. That process weights each of the different medium Flow concentrations encountered by incoming rays that lie in the successively greater r displacement rings and sums the weighted values. Then dividing that result by the overall target area involved, $\pi \cdot [R^2 - \delta^2] = \pi \cdot R^2$ because $R \gg \delta$, gives the average medium Flow concentration contributed by actions within the hemisphere of radius R centered on the center of the source of the *Propagated Outward Flow* and oriented toward the incoming medium Flow.

(C-5)
$$\frac{1}{\pi \cdot R^2} \cdot \int_{\delta}^{R} 2\pi \cdot r \cdot [\text{Equation } (A-4)] \cdot dr$$

$$= \frac{1}{\pi \cdot R^2} \cdot \int_{\delta}^{R} 2\pi \cdot r \cdot \frac{U_c}{6\pi \cdot R \cdot r} \cdot dr = \frac{1}{\pi \cdot R^2} \cdot \int_{\delta}^{R} \frac{U_c}{3 \cdot R} \cdot dr$$

$$= \frac{U_c}{3\pi \cdot R^3} \cdot [R - \delta] = \frac{U_c}{3\pi \cdot R^2} \quad [R - \delta = R \text{ because } R \gg \delta]$$

This average medium Flow concentration contains the only medium Flow components, u_2, present within the hemisphere within the cube of volume allocated to the atom. That medium concentration must be averaged over the overall cube of atomic volume. The result is the average medium Flow concentration throughout the hypothesized piece of matter.

(C-6)
$$\begin{aligned}\text{Overall Average Concentration} &= \frac{U_c}{3\pi \cdot R^2} \cdot \frac{\text{Hemisphere Volume}}{\text{Atomic Cube Volume}} \\[2mm]
&= \frac{U_c}{3\pi \cdot R^2} \cdot \frac{1/2 \cdot [^4/_3 \cdot \pi \cdot R^3]}{S^3} \\[2mm]
&= \frac{2 \cdot U_c \cdot [\frac{1}{2} \cdot S]}{9 \cdot S^3} \quad [R = \frac{1}{2} \cdot S] \\[2mm]
&= \frac{U_c}{9 \cdot S^2}\end{aligned}$$

However, this calculation has been for a simple particle Flow source such as a proton or electron. In general, atoms in matter consist of a number of such particles in combination. While their individual Flows are positive and negative, for the purposes of the effect of μ_0 and ε_0 that polarity has no significance; each Flow has the same effect; they do not offset each other.

More precisely the nucleus of an atom is effectively the result of the combining of A protons and $A - Z$ electrons into one overall new particle Flow source oscillating in a complex manner. A is the atomic mass number and Z is the atomic number. The average amplitlude of the complex oscillation of an atomic nucleus is equal to $Z \cdot U_c$.

116

That average value is the result, however, of a $+U$ average value of $A \cdot U_C$ and a $-U$ average value of $[A - Z] \cdot U_C$. That is, the atomic nucleus propagates an average medium amplitude of $A \cdot U_C$ in $+U$ and simultaneously a lesser average medium amplitude of $[A - Z] \cdot U_C$ in $-U$.

Furthermore, the atom's orbital electrons collectively propagate at the same time an average medium amplitude of $Z \cdot U_C$ in $-U$. Those sources of medium Flow are not located at the atomic nucleus, but their average effect is as if they were so located because of their orbits around the atomic nucleus.

The total medium Flow concentration in a piece of solid matter made up solely of atoms of specie $[{}^{Z}(Element\ Symbol)_A]$ is, then, $A \cdot U_C$ in $+U$ plus $[A - Z] + Z = A \cdot U_C$ in $-U$. That is a collective medium Flow concentration of $2 \cdot A \cdot U_C$. Equation *(C-6)* then becomes as follows for any such matter.

(C-7)   Medium Flow Concentration Within Matter $= \dfrac{2 \cdot A \cdot U_C}{9 \cdot S^2}$

Using this result, the relative medium Flow concentrations in various forms of matter can be compared. This is done at Table C-7, below, for the same substances as listed in the preceding Table C-5, using the values of $S = [the\ inter\text{-}atomic\ spacing]$ from that table.

Matter	Atomic Wt, A	Spacing, S	Ambient Medium
Air	14.99 amu	1.17×10^{-9}	$U_C \cdot 2.43 \times 10^{18}$
Water	18.02 "	2.62×10^{-10}	$U_C \cdot 5.83 \times 10^{19}$
Carbon	12.01 "	2.07×10^{-10}	$U_C \cdot 6.23 \times 10^{19}$
Aluminum	26.98 "	2.55×10^{-10}	$U_C \cdot 9.22 \times 10^{19}$
Iron	55.85 "	2.28×10^{-10}	$U_C \cdot 2.39 \times 10^{20}$
Lead	207.19 "	3.12×10^{-10}	$U_C \cdot 4.73 \times 10^{20}$

Table C-7
Some Example Medium Flow Concentrations, u_2, In Matter

The Incoming Gravitational Flow

Equation *(C-7)* gives the value of u_2, the ambient Flow within matter, which ambient Flow slows the incoming gravitational Flow, u_1. Having determined the value of u_2 it is now necessary to do that for u_1.

The effective gravitational Flow front, u_1, is purely horizontal, that is all rays are vertical, per Huygens Principle applied to the myriad individual wavelets of the myriad gravitating atoms of which the Earth is composed.

The gravitational acceleration produced by one proton acting on a second proton at a separation distance of one meter is as follows.

(C-8)
$$a_g = G \cdot \frac{m_p}{d^2} = (6.67 \cdot 10^{-11}) \cdot \frac{1.67 \cdot 10^{-27}}{1^2}$$
$$= 1.12 \cdot 10^{-37}\ meter/_{second^2}$$

The medium Flow concentration producing that acceleration is as follows.

117

(C-9)
$$u_g = \frac{U_c}{4\pi \cdot 1^2} = U_c \cdot [7.96 \cdot 10^{-2}]$$

The ratio of these two, that is the gravitational acceleration per amount of medium Flow concentration is:

(C-10)
$$\frac{a_g}{u_g} = \frac{1.12 \cdot 10^{-37}}{U_c \cdot [7.96 \cdot 10^{-2}]}$$

$$= \frac{1.41 \cdot 10^{-36}}{U_c} \text{ relative } {}^{meter}/_{second^2}$$

However, this result is only the case when the source of the gravitational field is a proton having a proton's mass, and, therefore, a proton's Flow oscillation frequency. The gravitational effect is directly proportional to the mass of the source of the gravitational field and the frequency of that source's Flows is directly proportional to its mass.

Therefore, in order to apply in general, equation *(C-10)* must be multiplied by A, the atomic mass in *amu* of the particular gravitational source, divided by *1.07…* the atomic mass in *amu* of a proton.

(C-11)
$$\frac{a_g}{u_g} = \frac{[1.41 \cdot 10^{-36}] \cdot A}{1.07 \cdot U_c}$$

$$= \frac{1.32 \cdot 10^{-36} \cdot A}{U_c} \text{ relative } {}^{meter}/_{second^2}$$

The ambient Flow concentration in any particular direction in the several substances listed in the preceding Table C-7 then corresponds to the following gravitational accelerations.

Matter	Atomic Wt, A	Ambient Medium	Grav Accel'n
Air	14.99 amu	$U_c \cdot 2.43 \times 10^{18}$	4.81×10^{-17}
Water	18.02 "	$U_c \cdot 5.83 \times 10^{19}$	1.39×10^{-15}
Carbon	12.01 "	$U_c \cdot 6.23 \times 10^{19}$	9.88×10^{-16}
Aluminum	26.98 "	$U_c \cdot 9.22 \times 10^{19}$	3.28×10^{-15}
Iron	55.85 "	$U_c \cdot 2.39 \times 10^{20}$	1.76×10^{-14}
Lead	207.19 "	$U_c \cdot 4.73 \times 10^{20}$	1.29×10^{-13}

Table C-8
Example Ambient Internal Gravitational Accelerations in Matter

For comparison, the value of the Earth's gravitational acceleration at the surface of the Earth is *9.8* ${}^{m}/_{sec2}$. Thus the ambient Flow concentrations, as measured by their equivalent gravitational accelerations, available to produce slowing of incoming gravitational Flow of the Earth are on the order of *10^{-15}* times too small to have any noticeable effect.

Or, looked at the other way, from equation *(C-11)* the medium Flow concentration corresponding to Earth's gravitational acceleration at the surface is

(C-12)
$$u_g = \frac{U_c \cdot 9.8}{1.32 \cdot 10^{-36} \cdot A} = \frac{7.94 \cdot 10^{36} \cdot U_c}{A}$$

118

The principal components of the Earth are approximately as given in Table C-9, below. From the table the overall average atomic weight, A, of the Earth is about $A = 32.5$.

Earth Component	Percent of Total	Symbol	Atomic Weight	Contribution to Average
Iron	31.0	Fe	55.9	17.3
Oxygen	30.0	O	16.0	4.8
Silicon	16.0	Si	28.1	4.5
Magnesium	15.0	Mg	24.3	3.7
Nickel	2.0	Ni	58.7	1.2
Calcium	1.5	Ca	40.1	0.6
Aluminum	1.3	Al	27.0	0.4
Other	2.0	--	--	--
Earth Average Atomic Weight, A				32.5

Table C-9
Earth Average Atomic Weight, A

CONCLUSION AND RATIOS

Therefore, u_g at the Earths' surface is on the order of

$$u_{gravitational} = u_1 \approx 2 \cdot 10^{35} \cdot U_c$$

using A = 32.5 in equation C-12 compared to the ambient Flow concentrations in matter of on the order of

$$u_{local\ ambient} = u_2 \approx 1 \cdot 10^{20} \cdot U_c$$

per the preceding Table C-8 so that

$$u_{gravitational} \approx 10^{15} \cdot u_{local\ ambient}$$

It would thus appear that the medium Flow concentration of Earth surface gravity is so immensely greater than the ambient Flow in local matter that no useful slowing of the Earth's gravitational Flow can be directly effected by a modest amount of matter.

For a useful interaction of matter and gravitational field to take place it would be necessary either to have matter with on the order of 10^{15} times more ambient Flow or a region in space with on the order of 10^{15} times less gravitational Flow or some mixture of those two differences. The former case would require matter of immense density and the latter case gravity so weak that control of it would be of little interest.

Thus the direct use of natural local matter itself to deflect, refract, or otherwise affect or control gravitational Flows appears to be self-defeating in that the amount of matter needed to produce a useful Flow medium concentration would itself be an immense gravitating mass. And, thus, practical control of gravitation requires finding alternative methods of gravitational Flow management.

Such an alternative method is that of Figure 6-7.

THE CAVENDISH EXPERIMENT

In the late 18th Century the British scientist Henry Cavendish measured the gravitational attraction between a pair of <u>lead</u> spheres one weighing 0.73 and the other 158 $kilograms$ separated by a distance of 230 $millimeters$. Comparing the gravitational attraction of the spheres to the Earth's gravitational attraction for the larger one it was found that

(C-13) $\dfrac{\text{The spheres attraction for each other}}{\text{The Earth's attraction for the larger}} = 3.2 \cdot 10^{-13}$

a value close enough to the earlier above obtained ratio of

(C-14) $\dfrac{u_{local\ ambient} = u_2 \approx 1 \cdot 10^{20} \cdot U_c}{u_{gravitational} = u_1 \approx 2 \cdot 10^{35} \cdot U_c} = 5 \cdot 10^{-14}$

to approximately validate these calculations and their estimates.

The value 10^{15} for this ratio will be used as being somewhat more conservative an estimate.