

The Science Behind Gravito-Electric Power Generation

by

Roger Ellman

Abstract

From a start of only the limitation on the speed of light, the necessity of conservation, and the impossibility of an infinity in material reality, the present paper presents a comprehensive development of the mechanics, the operation of gravitation and the deducing of means to controlling gravitation.

Experience shows that everything has a cause and that those causes are themselves the results of precedent causes, and *ad infinitum*. Defining and comprehending the causality or mechanism operating to produce any observed behavior is essential to understanding or explaining the behavior.

The behavior of gravitation is well known, described by Newton's Law of Gravitation. But what gravitational mass is, how gravitational behavior comes about, what in material reality produces the effects of gravitation, is little understood. The extant hypotheses include Einstein's General Relativity's bending of space, efforts to develop "quantum gravitation", and attempts to detect "gravitons". None of those addresses the cause, the mechanism of gravitation.

As demonstrated in the following gravitation is an outward flow from gravitating masses [Part I]. That means that by manipulating that flow gravitation can be controlled [Part II].

It is developed that gravitational action can be deflected partially levitating objects otherwise attracted as presented in the following. That effect makes it possible to extract energy from the gravitational field, which makes the generation of gravito-electric power technologically feasible.

Such plants would be similar to hydro-electric plants and would have their advantages of not needing fuel and not polluting the environment. However, gravito-electric plants could be much smaller than hydro-electric plants; their location would not be restricted to suitable water elevations, and the plants and their produced energy would be much less expensive.

Gravito-electric power can be placed into operation now. It can replace all existing nuclear and fossil fuel plants, and would essentially solve the problem of global warming to the extent it is caused by fossil fuel use.

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Part I – The Nature of Gravitation

The behavior of gravitation is well known, described by Newton's Law of Gravitation. But what gravitational mass is, how gravitational behavior comes about, what in material reality produces the effects of gravitation, is little understood. The extant hypotheses include Einstein's General Relativity's bending of space, efforts to develop "quantum gravitation", and attempts to detect "gravitons". None of those addresses the cause, the mechanism of gravitation.

Experience shows that everything has a cause and that those causes are themselves the results of precedent causes, and *ad infinitum*. Defining and comprehending the causality or mechanism operating to produce any observed behavior is essential to understanding or explaining the behavior.

From a start of only the limitation on the speed of light, the necessity of conservation, and the impossibility of an infinity in material reality, the present Part I presents a comprehensive development of the mechanics, the operation of gravitation

The Einstein model of gravitation is that of his General Theory of Relativity. That theory describes the behavior of gravitation and the effects that it produces. But, it does not address the cause, the mechanism, of that behavior and effects. The closest that General Relativity comes to the cause or mechanism of gravitation is the contending that gravitational mass "curves" or distorts "space", the distortion leading to the various effects of gravitation. However, no cause or mechanism for the contended distortion of space is offered nor is an explanation of what that "space" or space-time is and how it is subject to being curved or distorted.

The comprehensive explanation of the cause and mechanism of gravitation as derived from the origin of the universe, the Modern Newtonian Model of Gravitation, is not a replacement for, nor contradiction of, the useful aspects of General Relativity but a supplementing of it with an alternative model which unlike General Relativity leads to resolution of the problem of "Big G" and to partial control of gravitation and applications of it.

The development of the Modern Newtonian Model of Gravitation consists of the following steps. Each step results in new "hard" facts generated directly from prior "hard" facts. The development does not contain nor rely on opinions. Consequently, while it is deemed a "model" it is an exact factual description of what it treats.

- 1 – How the universe's particles of matter came into existence.
- 2 – How they came to be propagating an outward flow.
- 3 – The reservoir supply for the substance of the outward flow.
- 4 – The speed of the outward flow.
- 5 – A particle's flow encountering another particle slows its outward flow.
- 6 – The outward flow has momentum.
- 7 – Gravitation is the momentum reaction to outward flow slowing.

STEP 1 – HOW THE UNIVERSE’S PARTICLES OF MATTER CAME INTO EXISTENCE

Only absolute nothing [emptiness containing nothing, the zero of existence] requires no explanation of how it came to be. It is to be expected, as the natural condition. The only way something else, a universe, can come into existence from prior absolute nothing without an infinite rate of change at its beginning is to begin as an oscillation of the form $[1 - \text{Cos}(2\pi ft)]$. The only way that can happen without violating the principle of conservation [no something from nothing] is for there simultaneously to have come into existence the negative or opposite of that oscillation, *i.e.* $-[1 - \text{Cos}(2\pi ft)]$ so that the two together are still equivalent to absolute nothing.

As with Descartes, because we are here thinking about this, then apparently the two oscillations did not promptly mutually annihilate, which means that they were so unstable that they even more promptly exploded into the mass of matter particles of our universe, the “Big Bang”. That mass of particles can themselves only be like their parents, oscillations of the forms $\pm[1 - \text{Cos}(2\pi ft)]$.

Each oscillation is three-dimensional because three dimensions is the minimum number that can involve space part of which is not its own boundary. Therefore the oscillations are spherical.

Every oscillation that we know in nature exhibits, and the very theory of oscillations in the abstract requires, that the oscillation consist of two aspects of the substance which is oscillating [e.g. pendulum position and velocity, electric potential and current] storing and exchanging back and forth the energy of the oscillation. With one aspect varying in oscillatory fashion then when that aspect decreases there must be some "place" for its energy to go, a place in which it is stored until it reappears in that aspect when it increases again. It cannot completely disappear or be lost because the oscillation would die. That "place" is the oscillation's second aspect and it obviously must vary in a manner related to the first aspect's variation, but with its energy storage in opposite phase.

The matter of the universe is a mass of particles each a spherical oscillation.

STEP 2 – HOW THE MATTER PARTICLES CAME TO PROPAGATING AN OUTWARD FLOW

Each Matter Particle’s Central Core

Each of the myriad original matter particle’s spherical oscillations had to be of some determined size, some volume. That develops as follows.

Newton's law of gravitation expressed in terms of m_{source} and $m_{acted-on}$ and with both sides of the equation divided by $m_{acted-on}$ is, of course,

$$(I-1) \quad a_{grav} = G \cdot \left[\frac{m_{source}}{d^2} \right]$$

stating that gravitation is a property of a body's mass.

However, mass and energy are equivalent, so that a mass, m , is proportional to a frequency, f , that is characteristic of that mass. That is

$$(I-2) \quad m \cdot c^2 = h \cdot f \quad \text{or} \quad f = \left[\frac{c^2}{h} \right] \cdot m$$

so that the m_{source} of equation (I-3) has a corresponding equivalent frequency, f_{source} .

That being the case, the gravitational acceleration, a_{grav} , can be expressed in terms of that frequency as the change, Δv , in the velocity, v , of the attracted mass per time period, T_{source} , of the oscillation at the corresponding frequency, f_{source} , as follows.

$$(I-3) \quad a_{grav} = \Delta v / T_{source} = \Delta v \cdot f_{source}$$

Gravitation and the Planck Length

It can then be reasoned using equation (I-3) = equation (I-1) as follows .

$$(I-4) \quad a_{\text{grav}} = \Delta v \cdot f_{\text{source}} = G \cdot \left[\frac{m_{\text{source}}}{d^2} \right]$$

Equation (I-5), below, is obtained by using that frequency is proportional to mass so that with f_p and m_p as the proton frequency and mass then $f_{\text{source}} = [m_{\text{source}} / m_p] \cdot f_p$.

$$(I-5) \quad \Delta v \cdot \left[\frac{m_{\text{source}}}{m_p} \right] \cdot f_p = G \cdot \left[\frac{m_{\text{source}}}{d^2} \right]$$

Rearranging and canceling m_{source} on both sides of the equation,

$$(I-6) \quad \Delta v = \frac{G \cdot m_p}{d^2 \cdot f_p} \text{ per cycle of } f_{\text{source}}.$$

Then substituting, per equation (I-2), $m_p = [h \cdot f_p] / c^2$,

$$(I-7) \quad \Delta v = \left[\frac{G}{d^2 \cdot f_p} \right] \cdot \left[\frac{h \cdot f_p}{c^2} \right]$$

$$= \frac{G \cdot h}{d^2 \cdot c^2} \text{ per cycle of } f_{\text{source}}.$$

The Planck Length, l_p , is defined as

$$(I-8) \quad l_p \equiv \left[\frac{h \cdot G}{2\pi \cdot c^3} \right]^{\frac{1}{2}} \text{ so that } G = \left[\frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right]$$

Substituting G as a function of the Planck Length from equation (I-8) into G as it is in equation (I-7), the following is obtained.

$$(I-9) \quad \Delta v = \left[\frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right] \cdot \left[\frac{h}{d^2 \cdot c^2} \right]$$

$$(I-10) \quad \Delta v = c \cdot \frac{2\pi \cdot l_p^2}{d^2} \text{ per cycle of } f_{\text{source}}.$$

This result states that:

- the velocity change due to gravitation, Δv ,
- per cycle of the attracting mass's equivalent frequency, f_{source} ,
which quantity, $\Delta v \cdot f_{\text{source}}$, is the gravitational acceleration, a_{grav} ,
- is a specific fraction of the speed of light, c , namely the ratio of:
 - 2π times the Planck Length squared, $2\pi \cdot l_p^2$, to
 - the squared separation distance of the masses, d^2 .

That squared ratio is, of course, the usual inverse square behavior.

This also means that at distance $d = \sqrt{2\pi} \cdot l_P$ from the center of the source, attracting mass, the acceleration, Δv , per cycle of that attracting mass's equivalent frequency, f_{source} , is equal to the full speed of light, c , the most that it is possible to be. In other words, at that [quite close] distance from the source mass the maximum possible gravitational acceleration occurs. That is the significance, the physical meaning, of l_P or, rather, of $\sqrt{2\pi} \cdot l_P$.

The physical significance of $\sqrt{2\pi} \cdot l_P$ is that it sets a limit on the minimum separation distance in gravitational interactions and it implies that a "core" of that radius is at the center of fundamental particles having rest mass. That is, equation (I-11) clearly implies that it is not possible for a particle having rest mass to be approached closer than that distance.

That physical significance of $\sqrt{2\pi} \cdot l_P$, is so fundamental to gravitation and apparently to particle structure, that it more truly represents a fundamental constant than does l_P . For those reasons that length should replace l_P as a fundamental constant of nature as follows.

$$(I-11) \quad \text{The fundamental distance constant, } \delta$$

$$\delta^2 \equiv 2\pi \cdot l_P^2$$

$$\delta = 4.051,34 \times 10^{-35} \text{ meters} \quad [2006 \text{ CODATA Bulletin}]$$

Equation (I-10) then becomes equation (I-12).

$$(I-12) \quad \Delta v = c \cdot \frac{\delta^2}{d^2} \text{ per cycle of } f_{source}$$

a quite pure and precise statement of gravitation, that gravitation is a function of the speed of light, c , and the inverse square law, in the context of the oscillation frequency, f_{source} , corresponding to the attracting, source body's mass. It makes clear that an oscillation is an integral part of gravitation

The Outward Flow from each Matter Particle

But, the spherical oscillation in a volume of radius $\sqrt{2\pi} \cdot l_P$ is not in a container. There is nothing there except the oscillating substance of the oscillation.

Therefore, what “contains” that core’s supply of oscillating substance or why doesn’t it all just quickly “slosh” out and be gone? The answer is that it is trying to do just that, to “slosh” out, as hard as it can. It cannot help propagating outward because it has no container. But it can only propagate outward at the limiting rate determined by its surface area, $4 \cdot \pi \cdot (\sqrt{2\pi} \cdot l_P)^2$ and the fastest speed possible for it to flow, the speed of light, c . That is the outward flow of each particle having rest mass.

It is difficult to conceive of the immense and complicated set of interactions, *i.e.* each individual particle paired in gravitational interaction with each other individual particle, taking place via the individual gravitational masses each “curving space” to serve its own gravitational action. The difficulty is especially so in the absence of explanation of how “space” is subject to being curved and by what mechanism the curving is effected.

There being a need for each gravitationally acting [attracting] particle to communicate to each gravitationally acting [attracted] particle the direction from the attracted particle to the attracting one and the magnitude of the attracting particle’s gravitational attraction, there must be something flowing, continuously, carrying that information, spherically outward, from every gravitating particle to every other gravitating particle. That *flow*-communication is the gravitational field, an active process not a static state.

Furthermore, the necessity for gravitation that an oscillation and its frequency are closely involved in the effect [equations (I-10) and (I-12)] and therefore in what is communicated by the flow means that the *flow* itself must be oscillatory.

STEP 3 – THE RESERVOIR SUPPLY FOR THE SUBSTANCE OF THE OUTWARD FLOW

For such a flow to persist and to have persisted the billions of years since the “Big Bang” there must be a supply of that outward flowing substance in every matter particle. And, that “supply” must be an extremely concentrated reservoir of that which flows outward [concentrated relative to the outward flow]. The radius $\sqrt{2\pi} \cdot l_p$ spherical core of each matter particle is the reservoir supplying the billions of years of outward flow propagation from each particle

That the core is impenetrable is due to its immense concentration of billions of years worth of flow of the outward flow substance in the minute central core of radius $\sqrt{2\pi} \cdot l_p = 4.05134 \times 10^{-35}$ meters of every matter particle.

STEP 4 – THE SPEED OF THE OUTWARD FLOW

The outward flow has to be of the same form as the spherical oscillation that generated it, $[1 - \cos(2\pi ft)]$. It travels outward under the same influence or control as does light: that which we call the permeability and dielectric of free space, μ_0 and ϵ_0 and, consequently, the speed of light. The μ_0 and ϵ_0 , like electric inductance and capacitance, support the two aspects of the oscillation between which the energy exchanges back and forth.

But, when the original oscillation came into existence it did so in absolute nothing. There was no “free space” with μ_0 and ϵ_0 . There was nothing but the original oscillation. And, after the immediate explosion into all of the particles of the universe, each of those particles was propagating its outward flow into *nothing, emptiness*.

Where did the μ_0 and ϵ_0 come from? The only thing they could have come from was the original oscillation. There is no other possible source because everything else was absolute nothing, “the zero of existence”. The μ_0 and ϵ_0 are inherent in the substance of the oscillation, which means, μ_0 and ϵ_0 are also inherent in the outward propagation. Each particle’s outward *flow* contains its μ_0 and ϵ_0 .

STEP 5 – A PARTICLE’S FLOW ENCOUNTERING ANOTHER PARTICLE SLOWS ITS OUTWARD FLOW

In a universe of the myriad particles resulting from the Big Bang, each of those particles propagating its own outward *flow* radially in all directions, there are many instances of the *flow* from one particle [the “source” particle] encountering, running into, the outward-*flow*-propagating-center core of another particle [the “encountered” particle]. Such “source” particle *flows* are inverse square reduced in magnitude the farther that their wave front has traveled from its “source”.

The flow behavior is analogous to that of an electric transmission line where the rate of travel of an oscillation down the line is determined by the time it takes to build up the electric current for each oscillation cycle through each infinitesimal increment of the line’s distributed series inductance $[L_p]$ and to build up the electric potential for each oscillation cycle on each infinitesimal increment $[C_p]$ of the line’s distributed shunt capacitance. The transmission line speed of flow is determined by the well-established relationship equation (I-13).

$$(I-13) \quad \text{Speed} = \frac{1}{\sqrt{L_p \cdot C_p}}$$

For particles’ propagating oscillating *flow* the factor determining its speed of propagation is the time required to build up the *flow* amount for each oscillation cycle through each infinitesimal increment of the *flow*’s μ_0 and the *flow*’s potential for each oscillation cycle on each infinitesimal increment of the *flow*’s ϵ_0 . But, in radially outward propagating particle’s *flow*, the *flow* amount is inverse square spread out and the potential likewise both in exactly the same proportion as its μ_0 and ϵ_0 . The ratio of the *flow* amount to its μ_0 and of its *flow* potential to its ϵ_0 remains constant, and so likewise the speed, radially outward, of its propagation, c .

Upon encountering another particle that arriving *flow*'s μ_0 and ϵ_0 (scalar not vector) (much inverse square reduced) combine with the (full magnitude) μ_0 and ϵ_0 in the new outgoing propagation of the encountered center, the μ_0 sum and the ϵ_0 sum each being larger values. The result is that that "encountered" particle's new outward *flow* is slowed relative to its natural otherwise speed. That is, its speed of *flow* is determined by a combination of the parameters μ_0 and ϵ_0 larger than its *flow*'s otherwise natural values. The speed of *flow* is determined by the well-established relationship

$$(I-14) \quad \text{Speed} = \frac{1}{\sqrt{\mu_0 \cdot \epsilon_0}}$$

STEP 6 – THE OUTWARD FLOW HAS MOMENTUM

The oscillating substance of each of the myriad particles has its mass. There is no other place or thing to be the mass of those particles. Therefore the propagating outward *flow* has momentum, the inherent effect of the product of mass, inherent in the substance of the *flow*, and the *flow*'s velocity.

In the absence of other effects the outward *flow* is naturally radially outward. While the outward *flow* effectively transmits pulses of momentum outward in its $[1 - \cos(2\pi ft)]$ oscillation, the core source of that *flow* is experiencing radially inward equal but opposite pulses of momentum in accordance with Newton's third law of motion. In effect the core source is under reaction compression. Because that effect is radially uniform it produces no net affect on the particle.

STEP 7 – GRAVITATION IS THE MOMENTUM REACTION TO OUTWARD FLOW SLOWING.

The incoming *flow* from a distant "source" particle having the effect of slowing the speed of the "encountered" particle's outward propagated *flow* causes that "encountered" particle's outward *flow* to have less momentum than if it were not slowed, again momentum being the product of mass and velocity.

Therefore the Newton's Third Law reaction to that reduced outward *flow* momentum, reaction back on the "encountered" particle, is smaller than otherwise. That effect takes place on the side of the "encountered particle" facing toward the "source" particle from which the slowing - causing *flow* came.

But, on the opposite side of the "encountered" particle no such slowing of its outward propagated *flow* is present so that the outward *flow* there has the full natural momentum and the Newton's Third Law reaction on the particle on that side is the full natural amount. Consequently, the "encountered" particle experiencing its usual full momentum reaction back on itself on its side opposite that facing the incoming *flow* from the "source" but experiencing reduced reaction back on itself on its side facing the incoming *flow* from the "source", experiences a net momentum reaction toward the "source" particle from which the slowing-causing *flow* came.

Thus the particle experiences $[1 - \cos(2\pi ft)]$ pulses of momentum increase toward the "source" gravitationally attracting particle which constitute the gravitational acceleration.

SUMMARY AND CONCLUSION FOR PART I

The Universe's matter came into existence in the only possible form that avoids an impossible infinite rate of change and satisfies the requirement of conservation: a pair of oscillations of the form $\pm[1 - \cos(2\pi ft)]$. Witnessed by we here addressing the issue, those did not mutually annihilate so, being unstable, they exploded into the myriad particles of the universe.

Those myriad particles must, inevitably, propagate similar oscillatory outward *flow* and have been doing so for billions of years.

Their outward *flow* is at $\text{Speed} = \frac{1}{\sqrt{\mu_0 \cdot \epsilon_0}}$ because the μ_0 and ϵ_0 are inherent in its *flow*.

That particle's outward *flow* encountering another particle slows the encountered's outward *flow* on the side encountered because the μ_0 and ϵ_0 of the incoming *flow* add to the μ_0 and ϵ_0 of the encountered particle's outward *flow* so that the encountered's speed of outward *flow* there is slowed.

That reduces the encountered particle's outward *flow* momentum there and its reaction back on that side of the encountered particle while on the encountered particle's opposite side the *flow* and reaction momentum remain the same.

The result is momentum increments accelerating the encountered particle toward the source of the slowing-causing *flow*, which is gravitational acceleration.

Part II – Control of Gravitation

It is obvious that control of gravitation requires control of the outward *flow* from particles having rest mass.

SUMMARY DEVELOPMENT

Light normally travels in a straight direction. But, when some effect slows a portion of the light wave front the direction of the light is deflected. In Figure II-1 below, the shaded area propagates the arriving light at a slower velocity, v' , than the original velocity, v , [its index of refraction, n' , is greater] so that the direction of the wave front is deflected from its original direction.

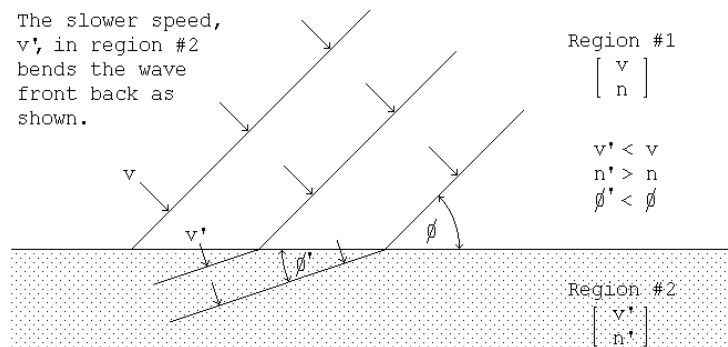


Figure II-1 - Deflection of Light's Direction by Slowing of Part of Its Wave Front

A slowing of part of its wave front is the mechanism of all bending or deflecting of light. In an optical lens, as in Figure II-2 below, light propagates more slowly in the lens material than outside the lens. The amount of slowing in different parts of the lens depends on the thickness of the lens at each part. In the Figure II-the light passing through the center of the lens is slowed more than that passing near the edges. The result is the curving of the light wave front.

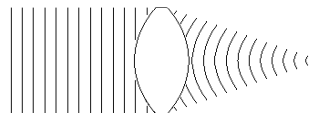


Figure II-2 - The Bending of Light's Wave Front by an Optical Lens

“Gravitational lensing”, shown below, is an astronomically observed effect in which light from a cosmic object too far distant to be directly observed from Earth becomes observable because a large cosmic mass [the “lens”], located between Earth observers and that distant object, deflects the light from the distant object as if focusing it, somewhat concentrating its light toward Earth enough for it to be observed from Earth. The light rays are so bent because the lensing object slows more the portion of the wave front that is nearer to it than it slows the farther away portion of the wave front.

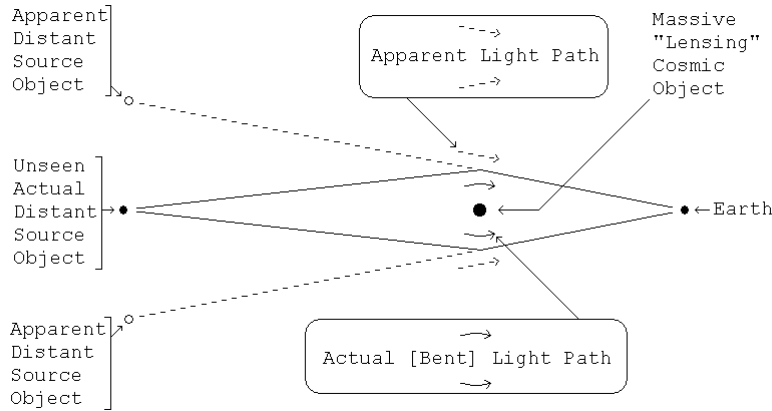


Figure II-3 - Gravitational Lensing Bending of Light Rays

The same effect occurs on a much smaller scale in the diffraction of light at the two edges of a slit cut in a flat thin piece of opaque material as shown below. The bending is greater near the edges of the slit because the slowing is greater there. The effect of the denser material in which the slit is cut slows the portion of the wave front that is nearer to it more than the portion of the wave front in the middle of the slit.

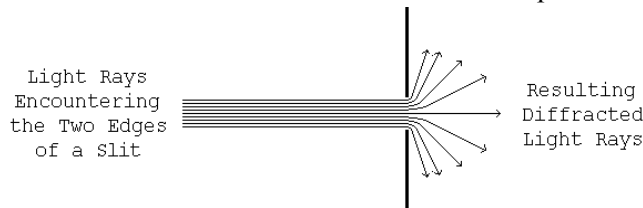


Figure II-4 - Diffraction at a Slit Causing Bending of Light Rays

Huygen's principle achieved its renown for its explanation of the interference patterns characteristic of diffraction, but its premise that light propagates radially outward from each point along its wave front cannot be valid because then focused light beams such as of search lights and laser beams would not be possible. An alternative cause of the diffraction effect must be found.

In both of these cases, gravitational lensing and slit diffraction, the direction of the wave front is changed because part of the wave front is slowed relative to the rest of it. In the case of gravitational lensing the part of the wave front nearer to the "massive lensing cosmic object" is slowed more. In the case of diffraction at a slit the part of the wave front nearer to the solid, opaque material in which the slit is cut is slowed more.

But, neither of the cases, gravitational lensing and slit diffraction, involves the wave front passing from traveling through one substance to another as in the first illustration, above. The wave front in the gravitational lensing case is traveling only through cosmic space. The wave front in the slit diffraction case is traveling only through air. There is no substance change to produce the slowing. What is it that slows part of their wave fronts thus producing the deflection ?

In the case of gravitational lensing the answer is that the effect is caused by gravitation. There is no other physical effect available. But how does gravitation produce slowing of part of the incoming wave front so as to deflect it ? Gravitation, at least as it is generally known and experienced, causes acceleration, not slowing.

ELECTRO-MAGNETIC FIELD (LIGHT) AND GRAVITATIONAL FIELD (GRAVITY)

1 - Light

Given two particles [e.g. electrons or protons] that have electric charges, the particles being separated and with the usual electric [Coulomb] force between them, if one of the charged particles is

moved the change can produce no effect on the other charge until a time equal to the distance between them divided by the speed of light, c , has elapsed.

For that time delay to happen there must be something flowing from one charge to the other at speed c [a fundamental constant of the universe] and each charge must be the source of such a *flow*.

That electric effect is radially outward from each charge, therefore every charge must be propagating such a *flow* radially outward in all directions from itself, which *flow* must be the "electric field".

When such a charge moves with varying velocity it propagates a pattern called electromagnetic field outward into space. Light is that pattern, that field traveling in space. Since light's source is a charged particle that, whether the particle is moving or not, is continuously emitting its radially outward *flow* that carries the affect of its charge, then light's electromagnetic field is a pattern of variations in that *flow* due to the charge's varying velocity.

2 - Gravity

Given two masses, i.e. particles that have mass [e.g. electrons or protons], being separated and with the usual gravitational force [attraction] between them, if one of the masses is moved the change can produce no effect on the other mass until a time equal to the distance between them divided by the speed of light, c , has elapsed.

For that time delay to happen there must be something flowing from one mass to the other at speed c and each particle, each mass must be the source of such a *flow*.

That gravitational effect is radially outward from each mass, therefore every mass must be propagating such a *flow* radially outward in all directions from itself, which *flow* must be the "gravitational field".

3 - That Flow

We therefore find that the fundamental particles of atoms, of matter, which have both electric charge and gravitational mass, must have something flowing outward continuously from them and:

- Either the particles have two simultaneous, separate outward *flows*, one for the effects of electric charge and another for gravitation, or
- They have one common universal outward *flow* that acts to produce all of the effects: electric and electromagnetic field [light] and gravitational field [gravity].

Two such simultaneous *flows* constituting the two fields and two supporting reservoirs supplying the *flows* is clearly untenable. There can only be one reservoir in each particle's "core" and one resulting *flow* producing both the gravitational field and the electric field if for no other reason than because two supply reservoirs would mutually interfere with comprehensive spherically outward *flow* of each.

The single outward *Flow* from particles, carrying both the electric and electromagnetic field and the gravitational field, means that gravitational field can have an affect on light, on electro-magnetic field because they both are the same medium – the universal outward *Flow*.

The "gravitational lensing" presented earlier above is experimentally observed gravitational field affecting light.

GRAVITATIONAL SLOWING / DEFLECTION OF LIGHT

Because that universal outward *Flow* originates at each particle and *flows* radially outward in all directions its density or concentration decreases inversely as the square of distance from the source of the *Flow*. At a large distance from the source the wave front of a very small portion of the total spherical outward *Flow* is essentially flat – a "plane *Flow*".

In the above Part I, Step 4, Page 6 it was presented:

When the original oscillation came into existence it did so in absolute nothing. There was no “free space” with μ_0 and ϵ_0 . There was nothing but the original oscillation. And, after the immediate explosion into all of the particles of the universe, each of those particles was propagating its outward *flow* into *nothing, emptiness*.

Where did the μ_0 and ϵ_0 come from? The only thing they could have come from was the original oscillation. There is no other possible source because everything else was absolute nothing, “the zero of existence”. The μ_0 and ϵ_0 are inherent in the substance of the oscillation, which means, μ_0 and ϵ_0 are also inherent in the outward propagation. Each particle’s outward *flow* contains its μ_0 and ϵ_0 .

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Upon encountering another particle that arriving *flow*’s μ_0 and ϵ_0 (scalar not vector) (much inverse square reduced) combine with the (full magnitude) μ_0 and ϵ_0 in the new outgoing propagation of the encountered center, the μ_0 sum and the ϵ_0 sum each being larger values. The result is that that “encountered” particle’s new outward *flow* is slowed relative to its natural otherwise speed. That is, its speed of *flow* is determined by a combination of the parameters μ_0 and ϵ_0 larger than its *flow*’s otherwise natural values. The speed of *flow* is determined by the well-established relationship

$$(I-14) \quad \text{Speed} = \frac{1}{\sqrt{\mu_0 \cdot \epsilon_0}}$$

That slowing of an encountered *flow* by an encountering *flow* can produce deflection of the direction of propagation of the *flow* as presented in Part II, Pages 8 and 9.

In “gravitational lensing” gravitational *Flow* produces deflection of the *Flow* that carries light. That deflected *Flow* is the same *Flow* that also simultaneously carries gravitation. Thus the gravitational *Flow* from one mass can also produce deflection of the gravitational *Flow* from another mass.

Therefore, a properly configured material structure can deflect gravitation away from its natural action, reducing the natural gravitation effect on objects that the gravitation would otherwise encounter and attract.

That same effect, on a vastly reduced scale, produces the deflection, the bending of the light direction that is seen in slit diffraction, Figure II-4. In the diffraction effect the role of the “massive lensing cosmic object” is performed by the individual atoms making up the opaque thin material in which the slit is cut. That effect shows that the gravitational lensing process, involving immense cosmic masses, can be implemented on Earth on a much smaller scale practical for human use.

THE ENERGY ASPECT AND THE SOURCE OF THE FLOW

But, changing the “natural gravitation effect” means changing the gravitational potential energy of objects in the changed gravitational field. If the energy is changed where does the difference come from or go to ?

The potential energy for an object of mass, m , at a height, h , in a gravitational field is truly potential. It is the kinetic energy that the mass would acquire from being accelerated in the gravitational field if it were to fall. The greater the mass, m , the greater is the kinetic energy, $\frac{1}{2} \cdot m \cdot v^2$. The greater the distance, h , through which the mass would fall the greater the time of the acceleration, the greater the velocity, v , achieved, the greater the kinetic energy, $\frac{1}{2} \cdot m \cdot v^2$.

While at rest at height h [as on a shelf] the total mass of the object is the same as its rest mass. The object has no actual “potential energy”. It is merely in a situation where it could acquire energy, acquire it by falling in the gravitational field. Falling, the mass of the object increases as its velocity increases, reflecting its gradually acquired kinetic energy.

Since, until it falls, the object does not have the energy that it will acquire when it falls in the gravitational field the energy that it acquires must come from the gravitational field.

The energy of gravitational field is in its *Flow* radially outward from all gravitational masses. The *Flow* is a *flow* of the potential for energy, realized at any encounter with another gravitational mass

- That *Flow* creates potential energy, creates the situation where kinetic energy could be acquired, at any gravitational mass that it encounters.
- It does so continuously, replenished and replenishing by the on going continuous outward *Flow*.
- It does so continuously, regardless of the number or amount of masses encountered and regardless of their distance from the source of the *Flow*.
- At each encountered mass the amount of the *Flow* varies with the magnitude of its source mass and varies inversely as the square of the distance from it.

But, for there to be a continuous *Flow* outward from each mass particle, each must be a supply, a reservoir, of that medium which is *flowing*. The original supply of the *Flow* medium, of gravitational potential energy, came into existence at the “Big Bang” the beginning of the universe.

If that immense reservoir of energy could be tapped by tapping some of its appearance in its outward *Flow*, which is the gravitational field, it could be a vast supply of energy cheaply, cleanly, and permanently without [for practical human / Earth purposes] being used up.

Since the original “Big Bang” the outward *Flow* has been very gradually depleting the original supply. That process, an original quantity gradually depleted by *flow* away of some of the original quantity is an exponential decay process and the rate of the decay is governed by its time constant. In the case of the decay of the universal *Flow*, appearing among other places in the outward *Flow* from every gravitating mass, the time constant is about $\tau = 3.57532 \cdot 10^{17} \text{ sec}$ ($\approx 11.3373 \cdot 10^9 \text{ years}$).

TAPPING THE ENERGY OF THE GRAVITATIONAL FIELD

The general vertically upward outward *Flow* of gravitational energy can be tapped by deflecting part of a local region’s gravitational *Flow* away from its normal vertical direction. Figure II-5 below [the slit diffraction Figure II-4 from earlier above but now rotated 90°] illustrates such deflection using a single slit.

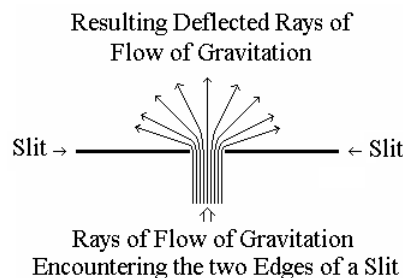


Figure II-5 - Slit Diffraction, the Basic Element of a Gravitation Deflector

Multiple such slits parallel to each other would spread the deflection left and right in the figure. Additional multiple such slits at right angles to the first ones would spread the deflection over a significant area.

GRAVITATION DEFLECTOR DESIGN

The edges of the slit in the above Figure II-5 are actually rows of atoms. A cubic crystal, such as of Silicon, consists of such rows of atoms, multiple rows and rows at right angles, all equally spaced – a naturally occurring configuration of the set of slits required for deflection of gravitation.

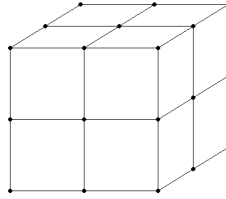


Figure II-6 - A Small Piece of a Cubic Crystal

The *Flow* from each of the cubic crystal's atoms is radially outward. Therefore its concentration falls off as the square of distance from the atom. The amount of slowing of an incoming gravitational *Flow*, and therefore the amount of its resulting deflection, depends on the relative concentrations of the atoms' *Flow* and the overall gravitational *Flow*.

In the case of diffraction of the *Flow* of light at a slit the concentration of the *Flow* from the atoms of the slit material is comparable to the concentration in the horizontal *Flow* of the light, because it originates from a local source, not from the Earth's immense gravitation.

But for the *Flow* from the atoms of the slit to deflect the much more concentrated vertically upward *Flow* of Earth's gravitation the *Flow* from the atoms of the slit must also be much more concentrated. The only way to achieve that more concentrated *Flow* is a configuration in which the *Flow* of Earth's gravitation is forced to pass much closer to the atoms of the slit so that, per the inverse square variation in the atoms' *Flow*, it will pass through a concentration of the slit atom's *Flow* comparable to the concentration in the Earth's gravitational *Flow*.

The spacing between the edges of the diffracting slit is about $5 \cdot 10^{-6}$ meters. The spacing of the atoms at the corners of the "cubes" in a Silicon cubic crystal is $5.4 \cdot 10^{-10}$ meters. An inter-atomic spacing of less than $2 \cdot 10^{-19}$ meters, much closer than the natural spacing in the Silicon cubic crystal, is required to obtain deflection of a major portion of the Earth's gravitational *Flow*.

Such a close atomic spacing cannot be obtained by directly arranging for, or finding a material that has, such a close atomic spacing. However, that close an atomic spacing can be effectively produced relative to just the vertical *Flow* of gravitation by slightly tilting the Silicon cubic crystal's cubic structure relative to the vertical.

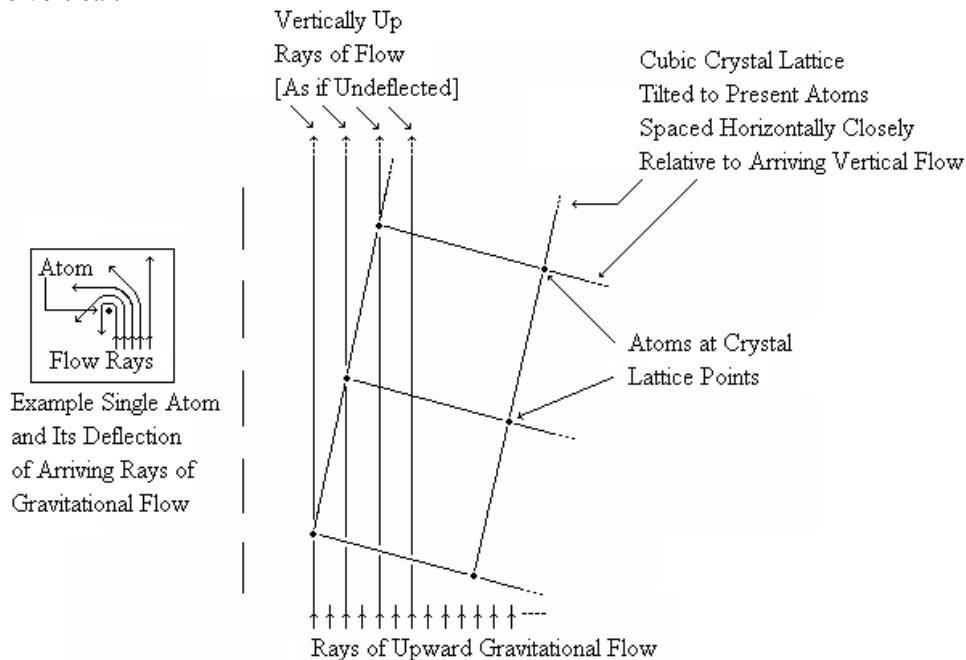


Figure II-7 - Cubic Crystal Lattice Tilted for Effective Gravitational Flow Deflection

Figure II-7 illustrates the tilting, schematically and not to scale, and shows how it increases the number of crystal atoms closely encountered by the upward gravitational *Flow*.

By appropriate tilting of the cubic structure each of its $5.4 \cdot 10^{-10}$ meters inter-atomic spaces is effectively sub-divided into 10^{10} “sub-spaces” each of them $5.4 \cdot 10^{-20}$ meters long and with an atom in each. A 4.5 mm shim on a 30 cm diameter Silicon cubic crystal ingot produces such an effect, producing a tilt $tangent = 0.015$ for a $tilt\ angle = 0.86^\circ$ that produces the objective effective sub-division of the crystals’ natural inter-atomic spacing, a sub-division that acts only on vertical *Flow*, as of gravitation.

Pure, monolithic, Silicon cubic crystals up to 30 cm in diameter are grown for making the “chips” used in many electronic devices. The gravitation deflector requires a large, thick piece of Silicon cubic crystal rather than the thin wafers sawed from the “mother” crystal for “chip” making.

Per the detailed analysis in the references, The Silicon cubic crystal ingot for the deflector is to be:

- 30 cm in diameter,
- 50 cm or more thick,
- with the orientation of the cubic structure marked for tilt-generating shims proper placement, and
- with the bottom face of the cylinder sawed and polished flat at a single cubic structure plane of atoms.

Mean free path [*MFP*] is the average straight line distance a moving particle travels between encounters with another particle. For atoms in solid matter the mean free path is

$$MFP = \frac{1}{[Atoms\ Per\ Unit\ Volume] \cdot [Atom\ Cross\ Section\ Area]}$$

For the Earth the atoms per unit volume is on the order of

$$Atoms\ per\ Unit\ Volume = 5 \cdot 10^{28}\ per\ cubic\ meter.$$

In the cubic crystal deflector the atomic spacing produced by the tilt is about 10^{-20} meters. Each therefore has cross sectional space available to it of that of a circle of that diameter so that for this purpose the atom’s cross section area is

$$\begin{aligned} Atom\ Cross\ Section\ Area &= \pi/4 \cdot [10^{-20}]^2 \\ &= 8 \cdot 10^{-39}\ meter^2 \end{aligned}$$

For targets as fine as those in the cubic crystal deflector, the mean free path in the Earth’s outer layers is, therefore

$$MFP = 2.5 \cdot 10^9\ meters$$

The mean free path in the 50 cm thick minutely tilted Silicon cubic crystal ingot for intercepting Earth’s natural vertically outward gravitation is $\frac{1}{2}$ the 50 cm thickness of the ingot. The gravitation deflector is about 10^{10} times more effective than the natural Earth at intercepting Earth’s natural gravitation. However, that effectiveness is only for vertical rays of *Flow*. The Silicon crystal’s mean free path for non-vertical *Flow* – *Flow* already once deflected within the crystal – is that of Earth, $2.5 \cdot 10^9$ meters, which takes the once-deflected *Flow* out of the crystal.

The overall deflector consists of:

- A support having a verified perfectly horizontal upper surface for the cubic crystal deflector bottom face to rest upon;
- The Silicon cubic crystal ingot specified above; and

- Precision shims 4.5 mm thick for producing the tilt of the cubic crystal ingot, the shims located at the mid-point of two adjacent sides of the horizontal plane of the cubic structure as in Figure II-8 below.

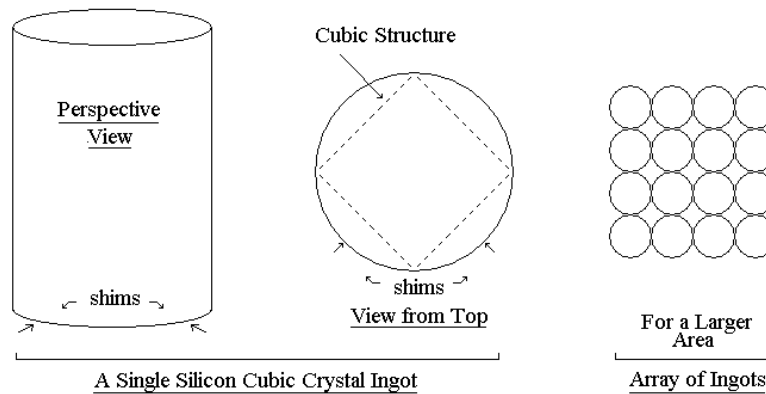


Figure II-8 – The Silicon Cubic Crystals Arrangements

- For an array of ingots for a larger area than a single ingot can provide, the individual ingots can be machined to fit snugly together. That could be done by machining them to a square cross section or, better, to a hexagonal one.

PRACTICAL ASPECTS AND DESIGN ENGINEERING

While the net gravitational field is vertically upward, i.e. radially outward from the Earth’s surface, local gravitation is radially outward from each particle of matter. As in Figure II-9 below, a mass above the Earth’s surface receives rays of gravitational attraction from all over its surrounding surface and the underlying body of the Earth.

The net effect of all of the rays’ horizontal components is their cancellation to zero.

The net effect of all of the rays’ vertical components is Earth-radially-outward gravitation.

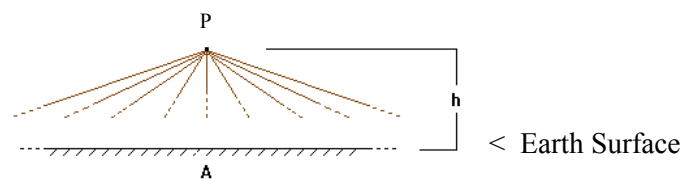


Figure II-9 - Rays of Gravitation from the Surroundings

1 - Gravitational Ray’s Horizontal and Vertical Components.

One can consider all of the net gravitational effect on objects as being due to the vertical component of all of the myriad rays of gravitational field *Flow* at a wide variety of angles to the horizontal. This “components aspect” is valid because of the “components aspect” appearance in the “Gravitational Lensing” effect on cosmic light.

The various rays of the *Flow* propagation from the individual particles of the gravitating body [for example the Earth] are from each individual particle of it to the selected point [above the gravitating body] on which their action is being evaluated. That is the point *P* in the above Figure II-9 directly above the “A” at height *h* in the figure.

The Earth’s gravitational action along a ray of *Flow* takes place from the Earth’s surface to deep within the Earth. The inverse square effect, that the strength of a *Flow* source is reduced as the square of the increase in the radial distance of it from the object acted upon, is exactly offset by that the number of

such sources acting [per “ray” so to speak] increases as the square [non-inverse] of that same radial distance. That is, the volume, hence the number, of *Flow* sources for a ray of propagation at the object is contained in a conical volume, symmetrically around the ray with its apex at the object acted upon.

However, because the net gravitational effect is produced only by the vertical component of each ray of *Flow* propagation, the effectiveness of each ray is proportional to the Cosine of the angle between that ray and the perfectly vertical as the angle θ in Figure II-10 below.

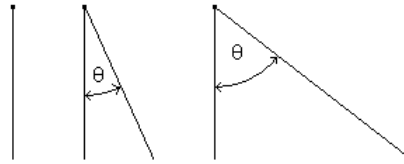


Figure II-10 – The Gravitational Field Ray Angle to the Vertical

The actual total gravitational action includes all rays from $\theta = 0$ through to $\theta = 90^\circ$. That range would require an infinitely large deflector to act on all such rays, that is the deflector would have to be a disk of infinite radius. For lesser values of the maximum θ addressed, the portion of the total gravitation sources included is the integral of $\text{Cos } \theta \cdot d\theta$ from $\theta = 0$ to $\theta = \text{Chosen Lesser Value}$. The integral of the *cosine* is the *sine*. Example lesser portions of the total gravitational action addressed as θ varies are presented in the table below.

θ	<u>Sin θ = Fraction of Total Maximum Gravitational Action</u>
0°	0.000
30°	0.500
45°	0.707
60°	0.866

The gravitational deflector as a disk beneath the *Object* to be levitated must extend horizontally far enough to intercept and deflect the *Chosen Lesser Value* of angle θ rays of gravitational wave *Flow* that are able to act on the *Object* of the deflection as depicted in Figure II-11 below.

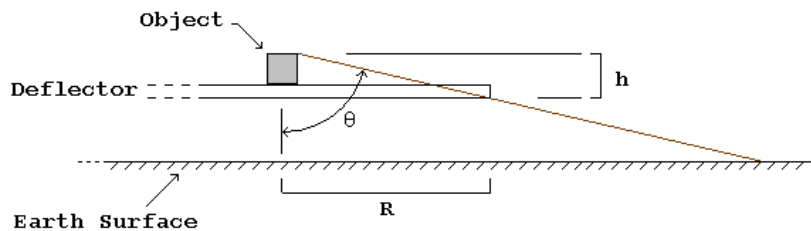


Figure II-11 – Size Requirements for a Disk Shaped Deflector

For the perfectly vertically traveling rays of gravitation waves the required vertical distance that must be traveled within the cubic crystal is the previously presented 50 cm and 0 horizontal distance is traversed in so doing. But a ray at angle θ , in order to traverse the required 50 cm vertically, must traverse horizontally $50 \cdot \text{Tan}[\theta]$ cm, at the same time. For θ more than 45° that can become quite large and the deflector likewise.

Because the deflector disk must extend over a large area to deflect most of the gravitation, an alternative, and better, solution to the problem of rays of gravitation arriving over the range from $\theta = 0$ to $\theta = 90^\circ$ is to wrap the deflector up the sides of the *Object* to be levitated as shown below.

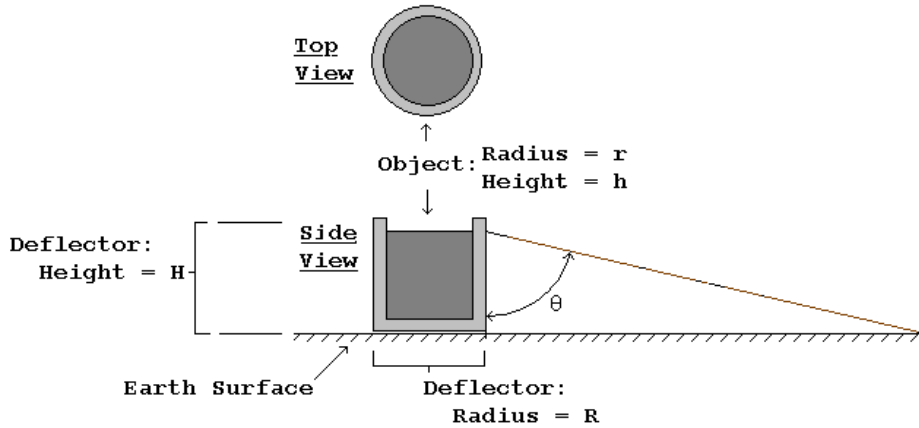


Figure II-12 – A Cup Shaped Gravitation Deflector

In this configuration the deflector takes up little more space than the *Object* levitated. However, the non-perfectly vertical traveling rays must still travel within the cubic crystal the horizontal distance $50 \cdot \text{Tan}[\theta]$ cm. That requires that the horizontal thickness of the vertical sides of the cup-shaped deflector must be of that $50 \cdot \text{Tan}[\theta]$ cm thickness.

Because the value of $\text{Sin } \theta$ and, therefore, the fraction of the total gravitational action, increases relatively little above $\theta = 60^\circ$ whereas the value of $\text{Tan}[\theta]$ increases quite rapidly, from 1.7 to ∞ above $\theta = 60^\circ$ that $\theta = 60^\circ$ is the appropriate value to which to design. The thickness of the “walls” of the “cup” would then be $50 \cdot \text{Tan}[60^\circ] = 85$ cm. The deflector would be only slightly larger than the *Object* levitated.

2 - The Array Structure and Size.

The Deflector consists of an array of Silicon cubic crystals. The crystals forming the disk-shaped “base” of the “cup” need to be about 0.5 m in height to achieve their maximum deflection effectiveness. Those forming the “sides” of the cup can be the same kind of 0.5 m crystals stacked and aligned vertically.

The crystals can effectively be grown in diameters up to about 30 cm, however those cylindrical pieces must then be machined down to of hexagonal cross section so that a number of them can fit together with negligible open space between. The hexagonal cross section area would be about $A = 0.06 \text{ m}^2$

Some examples of these data are presented in the table below for small sample deflectors.

d	h	Cup Disk Base		Cup Sides			Total Crystals
		Area	Crystals	Nr of Layers	Area	Crystals	
1	1	0.785	14	2	4.94	99	212
10	10	78.5	1,310	20	28.97	580	12910

3 - Calibrating the Individual Silicon Crystals

The individual crystals making up the deflector cannot be grown exactly identical to each other. In each the orientation of the long axis of the cubic crystal structure may vary minutely from each of the others. That is, it is not certain that each crystal’s base is purely a single plane of atoms of the cubic structure and thus is exactly perpendicular to the long axis of the crystal.

To find the optimum tilt and orientation for a single crystal the tilt must be varied over the range of possibilities while the effect of gravitation from exactly below it is observed on a balance scale. But most of the effect of gravitation on a single crystal is not from exactly below it.

The solution is to conduct the optimization atop a structure, that relying on the inverse square effect, effectively isolates the crystal from most of the gravitation from surrounding sources except that exactly below it – a high pedestal having a cross section comparable to that of the crystal, as in the Figure.

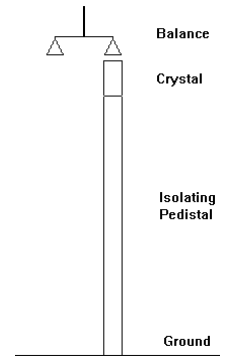


Figure II-13

To conduct that calibration on thousands of crystals should not be necessary if a method can be developed to exactly measure the long axis orientation in any given crystal. The process can then determine the optimum orientation of the crystal tilt relative to the actual long axis of a few cubic crystals being calibrated. That same crystal tilt relative to the actual long axis can then be applied to each of the other crystals.

The long axis orientation problem could also be solved by insuring that the base of each crystal is a single plane of atoms of the cubic structure.

THE AMOUNT OF DEFLECTION

The manner of the deflection is curving of the path of rays of gravitational *Flow* as they pass close to atoms of the deflector with the direction to which curved depending on the relative positions of the ray and an atom and the amount of the curving depending on how close the ray passes to the atom. Because of the range of those variables and their various combinations the “deflection” is essentially a “scattering” in various amounts in various directions, all scattering being away from the perfectly vertical upward which the deflector is designed to solely deflect.

The “scattering” is illustrated two-dimensionally in Figure II-14 below. Three dimensionally it can be visualized as that Figure II-viewed from the top while rotated through a full circle.

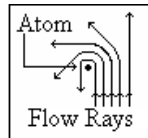


Figure II-14 - Single Atom Deflection of Rays of Gravitational Flow

The physical example of the “scattering” is the diffraction pattern of light diffracted by a slit. Figure II-15, below, presents the diffraction pattern produced by a slit that is $5.4 \cdot 10^{-6}$ meter wide with incoming light of wavelength $4.13 \cdot 10^{-7}$ meter. The peaks and valleys of the pattern, the interference pattern, are a phenomenon of the light imprint on the *Flow* that carries it. The envelope of the pattern is the relative amounts of the underlying *Flow* carrying the light.

For that reason, while the interference pattern varies according to the wavelength of the light involved, the form of the envelope of that pattern is always the same.

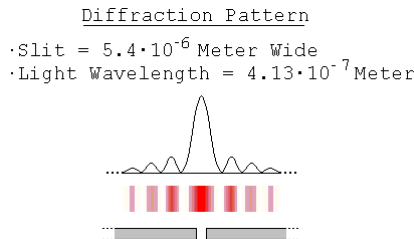


Figure II-15 - A Slit Light Diffraction Pattern

The *Flow* concentration produced by the two slit edges falls off with distance from the edge inversely as the square of distance from its atoms. The Cauchy-Lorentz Distribution is an inverse square function of its variable. Its Density Function can represent the relative *Flow* intensity pattern produced by the diffraction process by representing the envelope of the diffraction pattern. In Figure II-16, the Cauchy-Lorentz distribution is fitted to the diffraction pattern by the appropriate choice of value of its distribution parameter γ [Greek *gamma*].

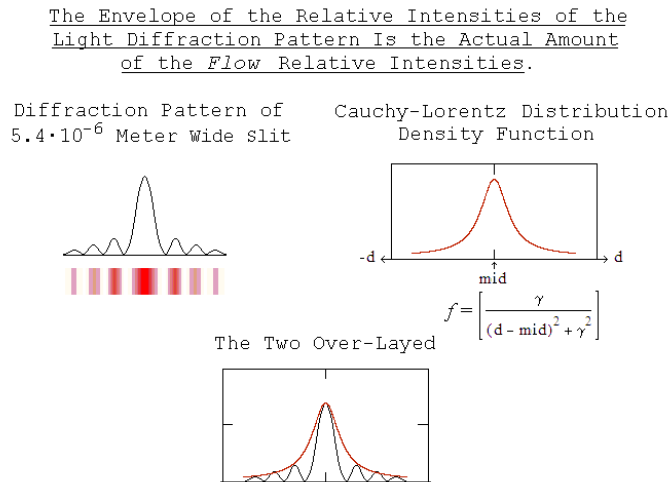


Figure II-16 - The Cauchy-Lorentz Distribution Diffraction Pattern Envelope

The deflection angle, Φ , is the angle of deflection of the rays to any particular point on the diffraction pattern. That is Φ is the angle of deflection of the rays directed to that particular point and of intensity per the Cauchy-Lorentz Distribution at that point.

The interest here is not in the location of the light interference maxima and minima, but rather in the deflection angles the diffraction imposes on the *Flow*. However, calculation of the deflection angles to the minima provides a good indication of the amount of *Flow* deflection over the overall diffraction pattern. The table below presents that data for the $5.4 \cdot 10^{-6}$ meter wide slit with incoming light of wavelength $4.13 \cdot 10^{-7}$ meter. [The minimums are counted outward from the center peak of the diffraction interference pattern].

Minimum #	Φ°	Minimum #	Φ°
1	4.39	8	37.72
2	8.80	9	43.50
3	13.26	10	49.89
4	17.81	11	57.28
5	22.48	12	66.60
6	27.36	13	83.86
7	32.37	14	$\text{Sin}(\Phi) > 1.0$

$$\text{Sin}(\Phi) = n \cdot [\text{light wavelength} / \text{slit width}], n = 1, 2, \dots$$

Figure II-17 – Table of Diffraction Minimums Deflection Angles

The above table demonstrates that the deflection of the *Flow* is at least in amounts up to 90° . That deflection may well extend to angles beyond 90° , but there is no way of determining that from the diffraction pattern. However, while the light of the diffraction pattern cannot be deflected beyond 90° in any case because the light cannot penetrate the material containing the slit, the *Flow* readily penetrates and permeates all of material reality.

The tilt of the cubic crystal structure divides the slit into 10^{10} sub regions the first and last of which are at the slit's edge and produce the maximum deflection. The tilt so arranges that ultimately all of the vertical components of the incoming vertical *Flow* must pass through one of those "at the edge of the slit" regions and must experience maximum deflection.

The overall average effect is equivalent to every ray's vertical component curving at least 90° because the crystal tilt causes every ray to pass extremely close to an atom at some point in the crystal, as the extreme rays in the Figure II-below.

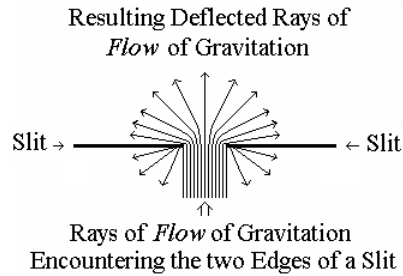


Figure II-18 – Single Slit Gravitation Deflection

There does not appear to be any way to analyze, calculate, or evaluate in advance the overall deflection that is achieved other than by actual experiment. With the overall average effect equivalent to every ray's vertical component curving 90° , i.e. to the horizontal, the overall total net effect of the vertical components after deflection is zero. Then the overall amount of deflection is 100% of the natural un-deflected gravitation reducing the gravitation to essentially zero.

GRAVITO – ELECTRIC POWER GENERATION

Gravito-electric power generation is similar to hydro-electric power generation in which the energy of water falling in Earth's gravitational field powers water-turbines that drive electric generators.

In gravito-electric power, depicted schematically in the Figure II-below, a gravitation deflector makes the water in the central region of the mechanism lighter than that in the outer region, which is acted on by natural gravitation. The lighter reduced gravitation water floats up on the in-*flow* under it of the heavier natural gravitation water. The result is continuous circulation of the water, like a continuous waterfall.

Water turbines like those used in hydro-electric plants can be placed in the gravito-electric continuous water *flow* to drive electric generators as in hydro-electric plants.

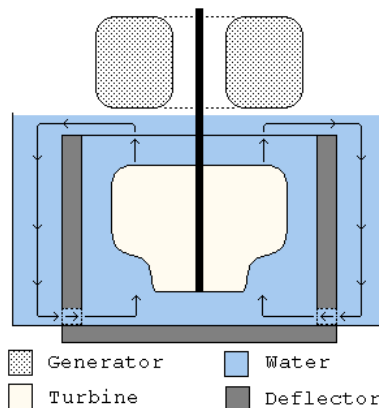


Figure II-19 – Gravito-Electric Power Generation