SECTION 2

General Gravitic Behavior

U-WAVES

U-wave propagation is basically in straight lines outward from its source until encounter with other U-waves produces deflection of their direction.

GRAVITATION, U-WAVE FLOW, AND THE AFFECT OF MATTER

Gravitation is caused by the U-waves that encounter a center-of-oscillation producing an increase in the ambient U-wave concentration on the encountered side of the core of the encountered center. That has the effect of reducing the encountered core’s speed of propagation of new medium in the direction from which the gravitation - causing U-waves came.

As presented in *The Origin and Its Meaning* that effect creates an imbalance in the core's propagation, an imbalance that cannot exist.

As a result, to correct (or, rather, to prevent) the imbalance, the encountered core must and does take on an increment of velocity in the direction from which the gravitation - causing U-waves came. Such an increment of velocity change must take place for each cycle of arriving gravitation - causing U-wave. The result is an acceleration that is proportional to the frequency of the arriving U-waves, which frequency is itself proportional to the mass of the source center from which those U-waves came.

The effect is also proportional to the amplitude of the arriving gravitation bearing U-waves making it vary inversely as the square of the distance from the wave-source center.

Control over gravitation then requires controlling the U-waves that produce the gravitational effects. Therefore the natural behavior of U-wave *Flow* must be studied. The only source of U-waves is matter and use of matter would appear to be the principal if not sole means of affecting the flow of U-waves.

U-waves in Matter

The components of optics that are applicable to gravitics are those characteristic of any propagating wave:

speed – refraction – diffraction.

The components of optics that depend on the transverse electromagnetic field aspect of light, and therefore do not apply to gravitics are:

reflection – polarization – and
the electromagnetic aspect of refraction.

The interference of the forward and rearward oscillations of a center-of-oscillation is fundamental to the matter waves of particles, and interference between U-waves encountering each other in free space occurs but has no significant effect.

The speed of light, i.e. the speed of actual electromagnetic light, in matter is the consequence of two effects:

· The speed of the U-waves on which the light is imprinted, and
· Interaction of the light with the matter through which it is passing.

The speed of actual light in matter and the speed of propagation of U-waves in that same matter are different, the light being slower to the extent of delay due to the light's interaction with the matter. Light's electromagnetic field excites matter's electrons [and atomic nuclei to a lesser extent]. The excited charges promptly re-radiate the light but the process introduces a slight delay which appears as slower propagation of the light in the matter. As a result, the index of refraction of actual light is not correct in analyzing U-wave behavior. What is needed is the U-waves' speed itself, without light's effect.

Per *Appendix A, Index of Refraction of U-Waves vs. of Light*, about 5% of the index of refraction of light, *n*, is the variation of n *vs.* frequency, which is that due to the light's electromagnetic interaction with the electrons of the material the light passes through. The remaining about 95% of the index is due to the frequency-independent action of the material on the U-waves carrying the light, and is the index of refraction of U-waves in that material.

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*".

As presented in *The Origin and Its Meaning*, U-waves may be slowed when passing through other U-waves. The mechanism that causes U-waves to slow when they pass through each other applies only to the components of their vector directions that are not exactly in the same direction. Equation (16-36) of *The Origin and Its*

Meaning, given below as equation *(2-1)*, presents the amount of that slowing for the two *Flows'* components in exactly opposite directions.

(2-1) Flows u_1 and u_2 at resulting speeds c_1 and c_2

[a] Each of the two flows separately:

Same Direction

$$c_1 = c \cdot \frac{u_1(\text{amplitude})}{u_1(\mu_0 \text{ and } \varepsilon_0)} = c$$

$$c_2 = c \cdot \frac{u_2(\text{amplitude})}{u_2(\mu_0 \text{ and } \varepsilon_0)} = c$$

Opposite Directions

$$c_1 = c \cdot \frac{u_1(\text{amplitude})}{u_1(\mu_0 \text{ and } \varepsilon_0)} = c$$

$$c_2 = c \cdot \frac{u_2(\text{amplitude})}{u_2(\mu_0 \text{ and } \varepsilon_0)} = c$$

[b] The two flows encountering each other:

Same Direction

$$c_{1,2} = c \cdot \frac{u_1(\text{amp}) + u_2(\text{amp})}{u_1(\mu,\varepsilon) + u_2(\mu,\varepsilon)} = c$$

Opposite Directions

$$c_1 = c \cdot \frac{u_1(\text{amp})}{u_1(\mu,\varepsilon) + u_2(\mu,\varepsilon)} < \text{"c"}$$

$$c_2 = c \cdot \frac{u_2(\text{amp})}{u_1(\mu,\varepsilon) + u_2(\mu,\varepsilon)} < \text{"c"}$$

Such slowing depends on the relative amounts or concentrations of the opposed direction U-wave *Flows*, u_1 and u_2. Their amplitudes or concentrations are radially diverging, inverse-square diminishing vector quantities and cannot add in opposite directions; their permeability and dielectric constants, μ and ε, are scalar quantities that determine the speed of U-wave propagation and which combine as shown in equation *(2-1)* above.

For two flows not in exactly the same direction, one can be resolved into two components: one component in exactly the same direction as the other flow and the other component at a right angle relative to it. The right angle component acts to slow the other flow as just described while the component in the exact same direction as the other flow has no such effect.

More specifically, the variation in the amount of slowing with the angle between the two flows is as the Sine of that angle for angles

0 to 90° and for angles 90° to 180° it is the value of the above equation 2-1 case for flows in “Opposite Directions”.

Waves slowed by this effect resume their original speed based on their own propagating values of μ_0 and ε_0 once they have traveled beyond interacting with the flow that caused their slowing.

In Figure 2-1, below, picturing *Flow* #1 of that figure as that from a “lensing” gravitational mass and *Flow* #2 as that of the light from a distant object, then the figure depicts how the *Flow* of the “lens” slows part of the wave front of the *Flow* of the propagating light. The slowing is greater for rays of light that pass close to the lens and is less for those farther out. Thus the wave front of the light is deflected or bent as in the actually observed “gravitational lensing”.

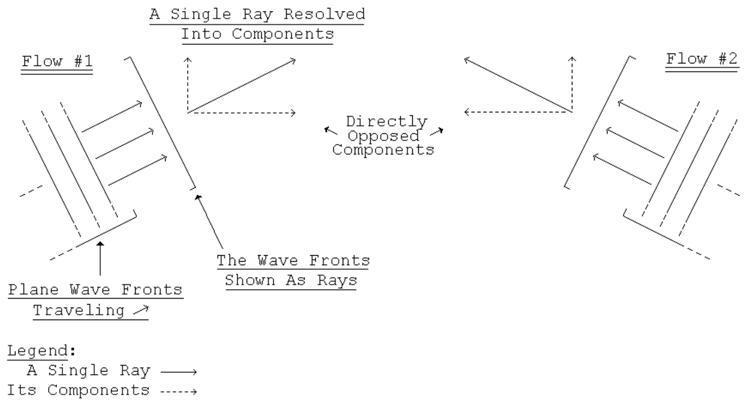


Figure 2-1 - The Encounter of Two Flows

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. 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.

For gravitics purposes the interest is in the potential for slowing of the gravitational U-wave flux flowing radially outward from the Earth by some configuration of matter at the Earth's surface. Because the amount of slowing depends on the relative amounts or concentrations of the opposed-direction U-wave *Flows* it is necessary to determine within a specified type of matter at the Earth's surface the magnitude, u_2, of the component of its ambient U-wave *Flow* that is directly opposite to u_1, the gravitational U-wave propagation arriving from below. Then the slowing of u_1 by u_2 can be determined.

That analysis is performed in *Appendix B, Relative U-wave Concentrations: Earth Surface Objects vs. Earth Gravitational Field*. The result is that the U-wave gravitational *Flow* at the Earths' surface is

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

compared to the ambient U-wave *Flow* concentrations in local matter, i.e. small objects at the Earth's surface, of

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

so that

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

which also means that the gravitational attraction for each other [i.e. horizontally] between Earth's surface local objects is on the order of 10^{15} times weaker than the Earth's gravitational attraction downward that they all experience.

It would thus appear that the medium *Flow* concentration of gravitation at the Earth's surface 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 reasonable amount of matter. I.e., it would appear that the index of refraction of the Earth's gravitational U-wave *Flow* remains unchanged for practical purposes regardless of the local matter or empty space through which it passes.

In that regard the analysis of *Index of Refraction of U-Waves* in *Appendix A* is irrelevant. Such determinations of index of refraction are of Earth surface objects involving minute U-wave concentrations relative to Earth's gravitational field and do not indicate a capability to refract the much greater U-wave concentration of Earth's gravity.

Thus the direct use of natural local matter to deflect or control gravitational U-waves appears to be self-defeating. The amount of matter needed to produce a useful U-wave medium concentration would itself be an immense gravitating mass. Finding alternative methods of gravitational U-wave management, a way to increase the effective value of $u_{local\ ambient}$ or to increase its effectiveness, is needed as pursued further below in this analysis.

U-WAVES IN OPTICS

Refraction

Optical refraction is the bending of light when it passes from a substance of one index of refraction [one speed of propagation] into a substance of different index of refraction [different speed of propagation]. The speed of propagation differences are effects of the behavior of light as light and the behavior of the underlying U-waves carrying the light.

Having just determined that local matter is essentially unable to affect gravitational U-waves it is necessary to see how natural local matter nevertheless is the major cause of optical refraction. It is because of the distinction between the immensely concentrated

U-wave field that constitutes the gravitational field and the relatively minute concentration U-wave fields of local matter.

The [Earth's] gravitational U-wave field is the cumulative effect of all of the matter of the entire planet propagating U-waves directed, in net effect, radially outward [to us upward] from the planet. A local piece of matter, such as a piece of glass for example, is comprised of particles all propagating U-waves radially outward in all directions. The number of such source particles in the local piece of matter is immensely smaller than the number whose U-wave propagation makes up the gravitational U-wave field.

Light is slowed in a substance primarily because its U-waves are slowed [about 95% of the effect per Appendix A]. The U-waves carrying the light are of a relatively small concentration, namely the amount propagated by the light's actual source [A glowing filament, an excited gas, etc.]. Its U-waves are slowed by their encounter with the "directly opposite" component of the U-waves flowing from the atoms of the substance in which the light is flowing. That component is also of a small concentration, negligible compared to Earth's gravitational field, but in a magnitude range able to affect the light's U-waves.

The refractive bending of a light beam is the bending of the U-wave front by the matter in the refraction-causing object as illustrated in Figures 1-1, 1-2, and 1-3 of the preceding Section 1.

That process is not overwhelmed by the immensely greater gravitational U-wave *Flow* in which it is immersed because the gravitational flow, radially outward from the Earth is a vertical flow at the Earth's surface whereas refractive actions at the Earth's surface are horizontal actions. There is no interaction between U-wave *Flows* at right angles to each other because the U-wave spreading vector flow and spreading vector potential cannot interact at right angles to those vectors of other U-wave *Flows*, and the U-wave scalar μ_0 and ε_0 "oriented" to those same vectors can only combine with other U-wave *Flows* if so oriented to the "oriented" scalar μ_0 and ε_0 of those other *Flows*.

Diffraction

Diffraction, the bending of light around an edge, is as illustrated in Figure 1-5a, repeated below.

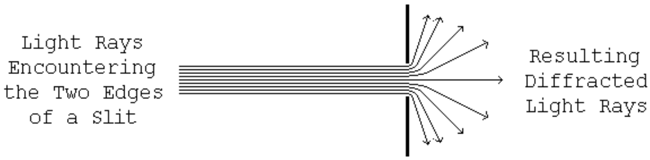


Figure 1-9a, Diffraction of Light Rays [Repeated]

U-wave propagation is in straight lines outward from its source until encounter with other U-waves produces deflection. The edges of the slit in Figure 1-9a, above, are the boundary between the substance of the barrier in which the slit is an opening, which is some material opaque substance, and the substance of the opening, which is air or free space as the case may be.

The matter density of those two regions, the barrier and the opening, are different and the density of local U-wave propagation in them differs. That local U-wave propagation is radially outward in all directions from each particle of matter of the barrier and of the air in the slit, and some of that propagation has a component directed opposed to the U-waves carrying the incoming light.

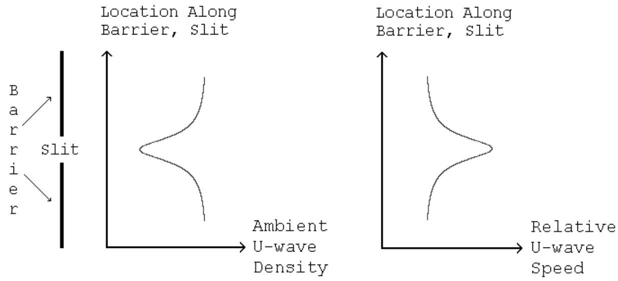


Figure 2-1
Varied U-wave Concentration and Slowing Across a Slit

As a result there is a gradient across the slit in the amount of ambient U-wave propagation and its component directed opposed to the U-waves bringing the incoming light [from the left in Figure 1-9a and 2-1, above.] Those opposed U-waves slow the arriving U-waves encountering the slit in varied amounts depending on where across the slit the incoming light-carrying U-waves arrive.

At the edges of the slit the U-waves are slowed more than in the middle of the slit. The slit is a region of smoothly varied speed of U-wave propagation. The U-waves' wave front is consequently deflected and that deflection appears as diffraction, of the light carried on the U-waves. Rather than the sharp refraction at a precise boundary as in Figures 1-1, 1-2, and 1-3, there is a gradual refraction depending on the location of a particular light ray relative to the edge of the slit.

The different travel distances for rays that are more or less bent causes the light waves carried by the U-waves arriving at any particular point to be at different relative phases so that they interfere with each other producing the typical diffraction pattern as in Figure 1-9b, reproduced below.

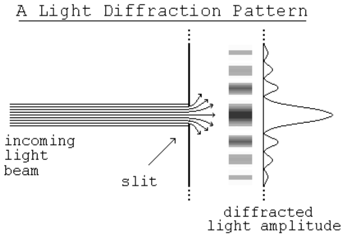


Figure 1-9b
A Light Diffraction Pattern

Thus diffraction is a purely U-wave effect. The reasons for that conclusion that light diffraction is purely a U-wave phenomenon and that the affect on light is solely because the U-waves carrying the light are so differentially slowed are as follows.

- The evidence of searchlight and laser light beams staying largely focused [except for minor scattering due to dust particles and fog] refutes the Huygens Principle explanation of diffraction [Section 1, page 11]. That principle would require dispersion of focused light beams if it were a description of behavior in material reality rather than being merely a method for determining the resultant wavefront in special cases.

- Light passing through a material, such as glass as in refraction, interacts electromagnetically with the atomic electrons in the material. But in the case of light diffraction the slit edge is opaque and light travel through it is not applicable. In light diffraction there is no significant electromagnetic interaction with the material's electrons. [In x-ray diffraction the x-rays do pass through the material and the diffractive effect is due to both U-wave slowing as in light diffraction and to electromagnetic slowing as in light refraction.]

- The frequency dependence in diffraction, that which produces the interference pattern, is only due to the light riding on the U-waves traveling different distances on U-waves passing through different locations across the slit width, and different distances traveled produce different phases of the light arriving at any particular point.

- In light diffraction the deflecting of the incoming rays is a smooth fan-shaped spread overall [as shown in Section 3 and the Cauchy-Lorentz distribution]. But the slowing of each individual ray varies in oscillatory fashion according to the oscillatory form of the encountered U-waves that cause the slowing. Therefore the amount of deflection of each ray oscillates. That has the effect of each ray appearing to propagate in a Huygen's Principle manner: not in all available directions at the same time, but overall directed in a range of available directions.

- The diffraction of sound and of water waves is a different phenomenon from diffraction of light. Sound and water waves are longitudinal oscillations in their air and water. They consist of variation in the pressure a result of variation in the velocity and density of individual particles [atoms and molecules] in the air or water, an oscillatory longitudinal compression – decompression. They propagate without spreading only when surrounded on all sides of their direction of propagation in their medium of propagation, air or water, by synchronized like waves propagating in the same direction. At a slit or an edge that condition is removed so that the waves spread into the unoccupied region adjacent to the propagating sound or water waves.

Thus the only undisposed-of available cause of the light ray bending in light diffraction is U-wave deflection due to differential U-wave slowing.

[The classical treatment of diffraction, unaware of light as an imprint on the U-waves carrying it, attributes the spreading of the light on the far side of the slit to the operation of Huygen's Principle and light's electromagnetic field, and concentrates its attention on the interference patterns that appear in light diffraction depending on the wavelength of the light relative to the width of the slit.]

GRAVITATIONAL U-WAVE MANAGEMENT METHODS

Gravitational U-wave management requires controlling the amount of U-waves or their direction of propagation. The amount is determined solely by the amount of matter and any benefit from that form of control is more than offset by the disadvantage of the major amount of additional matter required to produce an effect. The remaining aspect of the problem is how to manage the direction of U-wave propagation.

Prism Deflecting

Prism deflecting of light waves is illustrated in Figure 1-8, repeated, below, and analyzed in its preceding Figure 1-7 and subsequent discussion. The benefit of this method would be that 100% reflection or 90º deflection, as desired, would be obtained and those could be readily continuously varied in effectiveness over the range of 0% to 100%.

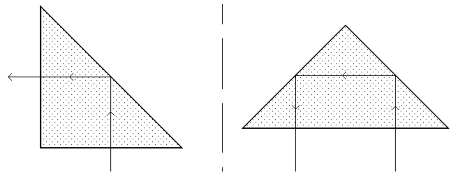


Figure 1-8 [repeated]
Reflecting Action of a 90° Right Prism

The principle problem with this method is that a practical implementation that operates on U-waves, as compared to how it operates on a light imprint on them, appears to be difficult. As already developed earlier above for a useful interaction of matter and gravitational field to take place it would be necessary to have matter with on the order of 10^{15} times more ambient U-wave *Flow* than natural Earth-surface matter.

Possibly the apparent concentration of atoms [U-wave sources] obtained for the vertical-looking-upward perspective of gravitational U-wave *Flow* by a slight tilting of a cubic crystal [see Figure 2-4, below] might produce sufficient U-wave concentration opposed to gravitation's vertical *Flow* so as to slow the gravitational *Flow* enough. But that requires the full height of the crystal to produce the full effect at the crystal's lower surface. Progressing upward through the crystal the slowing-producing downward U-wave *Flow* becomes progressively weaker to essentially none at the top surface of the crystal.

That leads to another problem, that of the boundary between the two regions involved in diffraction. For light the velocity of propagation in different regions depends on the characteristics of the region. For U-waves it depends on the characteristics of the U-waves. The only known method of slowing U-waves is by means of other

U-waves having a component of direction of velocity directly opposed to the direction of the U-waves to be slowed.

Thus for light the two regions of different propagation velocity are defined by the materials involved, e.g. glass and air. But for U-waves the physical boundary of materials [e.g. silicon crystal and air] is not the actual boundary between two regions of different propagation velocity because a sharp such boundary cannot be created using the only means of slowing available, directly opposed U-waves.

A suitable ninety degree right prism device for U-waves would be one having its critical angle for the combination of the material of the initial region [the glass of Figure 1-4] and in atmosphere or space above it less than $45°$.

Equation (2-2) below results directly from the earlier above equations (1-3), the definition of the *index of refraction*, and equation (1-12) and its development.

(2-2)
$$\frac{\text{Velocity Within Prism}}{\text{Velocity Above Prism}} = \frac{v}{v'} = \frac{v}{c} < \text{Sin}[45°]$$

$$\text{Velocity Within Prism} = v < 0.707 \cdot c$$

In this application, the velocity above the prism is c, the natural U-wave velocity. Therefore, to obtain this prism reflection the U-wave propagation velocity within the prism must be reduced to less than $0.707 \cdot c$ which would, pending further developments, appear to be impossible.

The vertical component of a gravitation ray traveling at an angle of 45° or less above the horizontal would be at the requisite Velocity Within the Prism = $v < 0.707 \cdot c$. However, its velocity would be that same above the prism also, to no net critical angle beneficial effect.

THE CRITICAL ANGLE PROBLEM AND THE NEGATIVE ANSWER

To obtain "perfect reflection" by means of an *angle of incidence greater than the critical angle* with U-waves requires greater slowing of the U-waves to obtain a reasonable critical angle than is presently feasible, per the above. At present the critical angle is minutely less than 90° [the angle whose sine is the speed of U-waves in Silicon, slightly slowed by the atomic density in Silicon compared to in air, divided by the speed in air].

Trying instead to deal with a feasible critical angle means a critical angle only minutely less than 90°. That requires an angle of incidence [which must be greater than the critical angle] of essentially 90°.

It is apparent that that does not produce "perfect reflection". The world is full of flat surfaces impacted by gravitation at 90° with no indication of any deflection effect.

X-Ray Focusing

One of the problems in using reflection or refraction to manage the direction of U-waves is that U-waves naturally penetrate and permeate all matter. To the *Flow* of the U-waves it as if the potential reflecting or refracting matter does not exist; it is essentially ignored.

A more familiar case of that kind of problem is that of focusing x-rays, which, because of their much greater energy and their wavelength much shorter than light, fairly readily penetrate most materials unless the material is present in significant thicknesses. Thus the case of x-rays is somewhat intermediate between that of easily managed light and difficult-to-manage U-waves.

The problem of x-ray focusing has been solved and the solution is used in spacecraft designed to function as x-ray telescopes for astronomical investigations in the x-ray spectrum of the cosmos. The most successful of those is the spacecraft named Chandra. It uses an x-ray focusing system known as Wolter I [after the developer of the technology].

X-ray telescopes must be very different from optical ones. X-ray photons penetrate into a mirror in much the same way that bullets slam into a wall. Likewise, just as bullets ricochet when they hit a wall at a grazing angle, so too will X-rays ricochet off mirrors. The mirrors have to be exquisitely shaped and aligned nearly parallel to incoming X-rays. Thus they look more like barrels than the familiar dish shape of optical telescopes. A diagram of the Chandra X-ray Telescope appears in Figure 2-1, below.

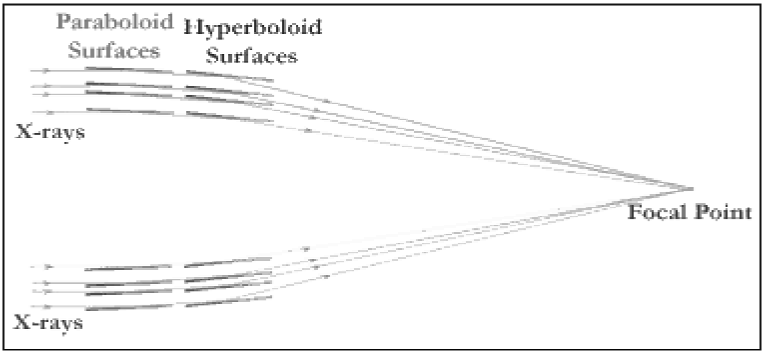


Figure 2-1
The Chandra X-ray Telescope

However, even this "grazing incidence" type of propagation direction control will not work for U-waves. Just as the wavelength of x-rays is much smaller than that of light, so that of U-waves is much smaller than that of x-rays.

Parameter	Light	X-Rays	U-Waves
Typical Frequency	10^{15} herz	10^{19} herz	10^{23} herz
Typical Wavelength	$3{\cdot}10^{-7}$ m	$3{\cdot}10^{-11}$ m	$3{\cdot}10^{-15}$ m

Table 2-3
Light vs. X-Rays vs. U-Waves Comparison
[herz is cycles per second]

Slit Focusing

A solution to the problem might be "slit focusing", using the diffraction effect of light encountering a slit as described earlier above. This phenomenon is entirely a U-wave effect. The diffraction of the light is due to the U-wave wave front being deflected because the U-waves in the middle of the slit propagate at a faster speed than those near the edge, that being due to the difference in the ambient U-wave densities in the two regions.

Thus significant U-wave deflection can be obtained where the U-waves pass close to an "edge". While a step in the direction of practical control over gravitation, that is a long way from a functioning practical system. The problem is that the nearness to the "edge" must be on the order of 10^{-7} meters for even a moderate amount of deflection of Earth's surface local ambient U-waves, and those are on the order of 10^{15} times weaker than Earth's gravitational U-waves.

X-ray Crystallography

Extensive research has been done in the field of using crystalline forms of matter to diffract x-rays. That field is termed x-ray crystallography and its main purpose is the study of the form and structure of various crystalline forms. Analysis of the diffraction patterns from passing an x-ray beam through the crystal can provide substantial information on the atomic structure within the crystal.

This has been developed to the point where it is now possible to create crystalline forms of organic compounds, such as proteins, and to develop understanding of the organic compound's structure from analysis of its diffraction patterns.

For the present purpose the significance of x-ray crystallography is that it demonstrates the scattering of the x-ray beam by the crystal structure, a different form of diffraction pattern from the form produced by a slit. But, the use of scattering of the U-wave gravitational flux could be expected to effectively reduce the portion of that flux producing gravitational action on objects directly above the crystal.

Crystal Deflecting

Thus a candidate for objects to cause diffraction of U-waves to achieve U-wave deflection is the atoms in the uniform lattice of a crystal. Interatomic spacings for this purpose in a cubic crystal lattice are on the order of about $3 \cdot 10^{-10}$ meters, nearly 1000 times closer than the 10^{-7} meter width parameter for diffraction at a slit earlier above.

In a cubic crystal lattice most U-wave rays pass far from its atoms. But, if the crystal is appropriately tilted relative to the vertical as in Figure 2-4 on the following page, every vertical component of arriving U-wave rays could be forced to pass close to an atom.

While the net gravitational effect is vertically upward, i.e. radially outward from the Earth's surface, local gravitation is radially outward from each center of oscillation. A mass above the Earth's surface receives rays of gravitational attraction from all over the Earth's surrounding surface and its underlying body within 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.

The objective here is to make use of the fact that the U-waves of interest, the U-wave gravitational flux, consists purely of the components of the rays that are directed radially outward from the Earth's surface so that locally the flux is purely parallel vertically upward components of rays.

By tilting the repetitive regular structure of the cubic crystal it can be arranged that all of the vertical components of rays of the gravitational U-wave flux pass close to atoms of the cubic crystal. The tilt operates dominantly on such vertical rays components and has relatively little effect on other U-wave propagation.

The tilt creates an effective [for vertical U-wave rays components] decrease in the interatomic spacing of the atoms in the cubic crystal lattice. For example, those atoms are uniformly spaced, typically at a little over 10^{-10} meter apart. If the tilted cubic crystal were 1 centimeter thick, it would have 10^{8} layers of atoms. Then the tilting of the cubic crystal orientation, as indicated in the above Figure 2-4, could provide an atomic spacing effective on vertically oriented rays components of about 10^{-18} meter, as compared to the crystal's natural spacing of about 10^{-10} *meter* or about 10^{11} *times closer* than the 10^{-7} *meter* upper limit on spacing from the earlier case of a slit.

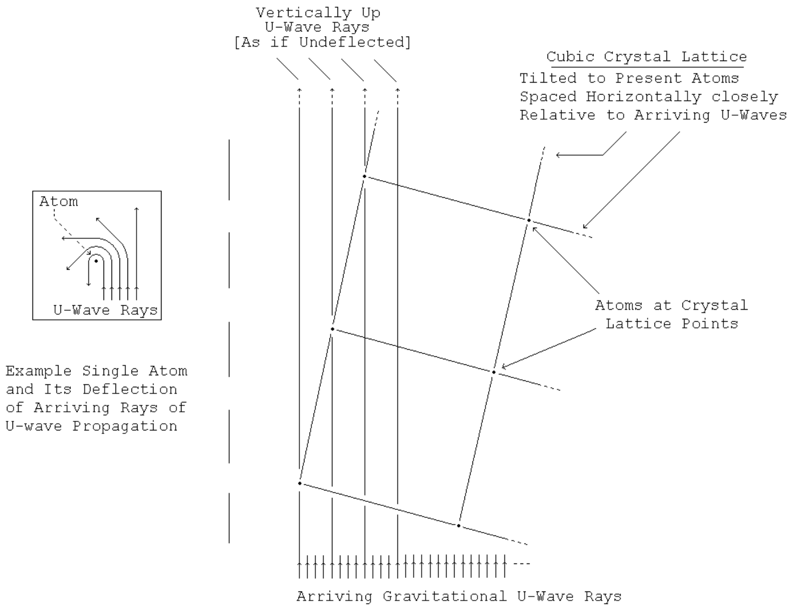


Figure 2-4
Cubic Crystal Lattice Oriented to Produce Maximal U-wave Deflection
[Schematic, Not to Scale]

A measure of the relative deflection producing power is the Mean Free Path for vertical components of rays of U-wave propagation in the tilted cubic crystal deflector as compared to the mean free path experienced by those same vertical components of rays as they pass through the Earth's layers in their outward, gravitation - producing, paths.

The mean free path is determined by imagining U-wave rays directed toward an infinitesimally thin slab of material containing spaced individual, identical atom “targets”, the slab being of thickness dx and width and height L. The total area of the slab face is L^2.

The U-wave ray interception area presented by the targets is the number of targets times their individual common cross sectional area, A. The number of targets is their concentration per unit volume, C, times the volume of the slab, $L^2 \cdot dx$.

Letting the density of the incoming U-waves be D, we seek the reduction in that density, dD, as it travels distance dx through the target-bearing slab.

The fractional rate of target encounters in that travel is the interception area presented by the targets divided by the total area of the slab.

(2-3)
$$\text{Rate} = \frac{\text{Targets Interception Area}}{\text{Total Slab Area}} = \frac{C \cdot [L^2 \cdot dx] \cdot A}{L^2} = C \cdot A \cdot dx$$

The reduction, dD, in the density, D, of the incoming U-waves, because of their passing through the slab, is the original arriving density times that above fractional *Rate* of reduction. The result is a typical decaying exponential for which the decay constant is, in this case, the *Mean Free Path* or *MFP* as follows.

(2-4)
$$dD = -\{D \cdot \text{Rate}\} = -\{D \cdot [C \cdot A \cdot dx]\}$$

$$\frac{dD}{dx} = -D \cdot C \cdot A$$

$$D = D_0 \cdot \varepsilon^{-C \cdot A \cdot x}$$

$$= D_0 \cdot \varepsilon^{-[x/MFP]} \qquad [MFP = 1/C \cdot A]$$

Therefore the mean free path is

$$(2\text{-}5)\quad MFP = {}^{1}/_{C\cdot A}$$

$$= \frac{1}{[C,\ \text{Atoms Per Unit Volume}] \cdot [A,\ \text{Atom Cross Section Area}]}$$

For the Earth the concentration of atoms is on the order of $C = 5\cdot10^{28}$ *per cubic meter*. In the cubic crystal deflector that has just been suggested the target spacing achieved by the tilt is 10^{-18} meters. Each such target has cross sectional area space available to it equal to a circle of that diameter so that

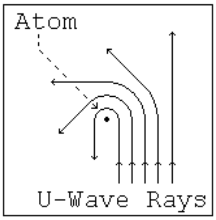
$$(2\text{-}6)\quad A = {}^{\pi}/_{4}\cdot[10^{-18}]^2 = 8\cdot10^{-37}\ \text{meter}^2$$

and, for targets as fine as those in the cubic crystal deflector, the mean free path in the Earth's outer layers is

$$(2\text{-}7)\quad MFP = 2.5\cdot10^{7}\ \text{meters}$$

as compared to the corresponding mean free path in the *1 centimeter* thick cubic crystal deflector slab of *1 centimeter* or about 10^9 times shorter.

Referring again to the inset box at the left side of Figure 2-4, above and repeated below, depending on how close they pass to the deflecting atom different rays of U-waves will be deflected different amounts. [The figure should be considered in its effect as if viewed from above and rotated around the vertical through a full 360°.]



Rather than the ideally preferred 180° deflection of all rays so that they are returned toward their source, the effect of the cubic crystal deflector is to scatter the rays in many directions but to generally reduce the net number exiting above the deflector and still directed vertically upward. Other than in the specifically vertical orientation of the slightly tilted crystal the general mean free path in the crystal is on the order of 10^9 meters [over 1,000,000 miles]. Thus most of the scattered rays of U-waves should exit the deflector without further interaction.

The cubic crystal deflector should produce major, reduction in the gravitational action on whatever is above it, but it should not necessarily succeed in totally removing that action.

Here the applicable focusing process is the "Coulomb Focusing" analyzed in the book *The Origin and Its Meaning* [see Section 1], treating the focusing action of a particle nucleus on incoming U-waves. The details are in Section 16 of the book, beginning at page 247. There the attention is on that portion of incoming U-waves that is focused onto the center of the encountered center-of-oscillation [particle]. Now the attention must be on the remaining portion of those incoming U-waves, that part which "misses" the encountered center.

The situation is broadly analogous to a ray of light from a far distant galaxy passing by and near to a less distant galaxy which gravitationally deflects the light beam. Now the deflected light is incoming U-waves with their gravitational effect and now the deflection is the desired management of the incoming gravitation - causing U-waves. And, of course, now the dimensions involved are many orders of magnitude smaller than are those of the inter-galactic case.

The problem now is to quantify the deflection of those U-waves. Section 3 presents detailed calculations for U-wave deflection at a slit.

Section 4 then applies those results to analysis of a cubic crystal to function as a U-wave deflector based on the above concept.

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 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 $\tau = 3.57532 \cdot 10^{17}$ sec ($\approx 11.3373 \cdot 10^{9}$ years).

Focused Deflecting Considerations

In general U-waves, including their gravitational effect, cannot be focused. In order to focus with a lens type device it must be possible to design it so that the slowing of the wave front caused by the lens follows a specific intended pattern, for example a spherical convex lens. But, the only such pattern available to apply to U-waves is the inverse square variation of U-wave intensity with distance from the wave source.

In order to focus with a mirror type device, it being possible to shape a mirror to a specific intended pattern, U-waves would have to reflect. But, U-waves cannot reflect. Reflection occurs when the electromagnetic [light] modulation on the U-wave stream transfers to atoms of the reflecting surface which then immediately re-radiate the light with conservation of momentum resulting in equal angles of incidence and reflection. The U-wave stream itself is not reflected.

Diffraction of U-waves produces a quasi-focusing effect, but its shape or pattern is negligibly controllable and the output focuses at different focal points so that the output image is blurred. Figure 2-5 illustrates this for an atom of the cubic crystal lattice.

The effect in Figure 2-5 is not real focusing because different rays are directed to different "focal points". What it really illustrates is the scattering away from the pure vertical that the cubic crystal deflector produces.

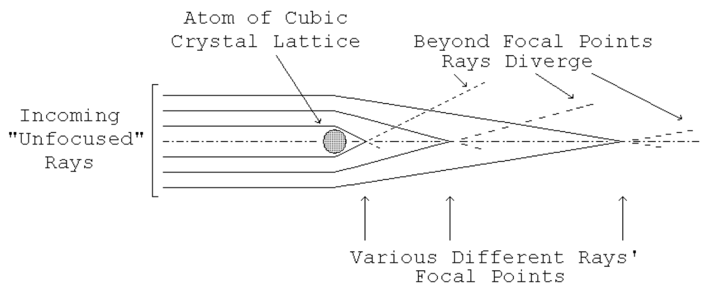


Figure 2-5
Diffractive "Focusing" of U-waves

The only known instance of apparently focused U-waves is the effect of a large cosmic mass located between we observers and a second, more distant, cosmic light source object, an effect termed "gravitational lensing". The arrangement is the same as in the above Figure 2-5 except for a vast difference in scale.

However, gravitational lensing focuses different rays on to different focal points as in Figure 2-5. In practice, when such an effect is observed with astronomical telescopes, the observer is at only a single focal point and observes only a narrow range of focal points resulting in the appearance of a somewhat "focused" image.