Chapter 22

HOW AND WHY LIGHT REALLY TRANSMITS AND PROPAGATES

Because, empirically, an emitted light ray instantly and continuously transmits at c relative to its medium of empty space, this instantaneous and constant velocity of c en vacuo is an inherent property of light. It follows that the motion of the light ray's material source body is totally irrelevant to this instantaneous and constant emission and transmission velocity of light at c. The position of light's point of emission in space relative to the changing position of its material source body must always remain uncertain. A light ray continues to transmit at c relative to the medium of empty space as it propagates in all possible linear directions away from its point of emission in space and toward other linearly moving material bodies at various relative velocities of c – v or c + v depending upon relative directions. The type of motion of the material body that ultimately receives the light ray and their combined velocities at contact are also irrelevant to such transmission velocity of light at c.

Just as ponderable matter and the quantum world of atoms are very different, so also are ponderable matter and electromagnetic radiation (light) totally different phenomena. Thus all three phenomena are governed by very different laws of nature. In this chapter, we will discuss, describe and attempt to explain some of the unique laws that govern the phenomenon of light.

A. Why is the motion of a light ray's material source body irrelevant to its transmission velocity of light at *c*? Why is inertial motion irrelevant to light?

Unlike material objects, the phenomenon of light comes into existence on a ponderable material body when photons (a form of energy) are generated and emitted by atoms by reason of chemical (molecular), electromagnetic, atomic or other processes that excite or change the energy state of such atoms.[1] (Halliday, p. 890) By reason of this process, photons of light are emitted at a certain position of its material light source, which position at that instant coincides with the 'point of emission' of such photons in

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[1] *A priori*, an atom and an electron are particles of matter, whereas a photon is a massless electromagnetic particle (bit of energy).

space.

Experimentally, the instant that a light ray is emitted *en vacuo* it transmits at the constant velocity of *c* (300,000 km/s) in all possible linear directions away from its point of emission through the medium of the vacuum of empty space, and regardless of the velocity and direction of motion of its material light source. (see Figure 22.1; Einstein, 1905d [Dover, 1952, p. 38]; Einstein, *Relativity*, p. 21) In effect: "[T]he velocity of emission of light from any body, however it is moving, is measured as *c* with respect to the body." (Dingle, 1961, p. 20) Bradley's 1728 experiment (the aberration of starlight), Arago's 1810 focus of a lens experiment, de Sitter's binary star observations and conclusions, and other terrestrial experiments appear to confirm this fact. [2] (see Chapter 7) It follows that the transmission velocity "of light is always the same with respect to the medium" of empty space. (see Dingle, 1961, p. 17) Why do these empirical facts appear to be true? Because if the transmission velocity of light depended upon the motion of its material source body, then such transmission velocity would always be empirically measured to be different with respect to its medium of empty space, and with respect to the material objects which it ultimately contacts, which is not the case.

Thus, this instantaneous and constant emission velocity or transmission velocity of light at *c en vacuo* must be an <u>inherent property</u> of the phenomenon of light in the vacuum of empty space[3] and the velocity of the material emitting body and the direction of such velocity are inherently irrelevant to and independent of the transmission velocity

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[2] This result is also what all of the 19th century 'ether drift' light experiments implied. (Goldberg, p. 106) In retrospect, the null results of the M & M experiment also inferred that the velocity of light's material source body (i.e. Earth) and its direction of motion is independent of and irrelevant to the emission velocity and the transmission velocity of light at *c* in Michelson's apparatus.

[3] Einstein acknowledged that this constant velocity of light was contained in Maxwell's equations. (see Einstein, 1905e [Dover, 1952, p. 69, footnote]) The word 'property' is more commonly used in chemistry to describe the <u>principle characteristics</u> of a thing or substance; for example, "the properties of a chemical compound." (Webster's New World Dictionary, 1991, p. 1078)

of such light ray. Such inherent property (a light ray's instantaneous and constant transmission velocity of *c*) may be characterized as an abstract or absolute velocity without reference to a material body, or if one prefers, it may be characterized as a velocity relative to the light ray's point of emission in space or relative to its medium of empty space. All of such characterizations are equally valid.

It is also a known empirical fact that the transmission velocity of each different wavelength of light is in general determined solely by the properties of the specific transparent <u>material</u> medium through which it propagates at any instant.[4] Such specific transmission velocity can be considered to be a property of each different wavelength of light through such specific material medium. (see Chapter 6C) It follows that each unique transmission velocity only relates to such specific material medium, and that the property of such specific transmission velocity is independent of everything else except such specific material medium.[5]

Empirically, a light ray continues to transmit indefinitely at the constant velocity of *c* relative to its medium of empty space without any further application of energy, as it propagates over endless distances through the vacuum of empty space. Also, unlike material objects, when the light ray contacts another material object in space with a reflective surface, it instantly changes its direction of propagation and continues to transmit in a new direction at *c*, regardless of the speed or direction of motion of the reflective material object.[6] (Figure 22.2) When the light ray finally contacts a material

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[4] The shorter the wavelengths of a light ray, the slower it transmits through a particular transparent material medium. (Chapter 6C and Figure 6.8)

[5] In effect, there are almost an infinite number of transmission velocities of EM waves of radiation relative to different material media and relative to the linear motions of such material media. (see Chapters 6 & 7)

[6] The reflective body can be considered as the light ray's new point of emission in space. By the way, the Moon is a good reflective body because its surface is largely composed of silicon (glass).

object without a reflective surface it is absorbed, and its existence as light is instantly terminated.[7] These empirical conclusions have been confirmed by numerous observations and experiments.

Let us now ask the reciprocal question: Why does a light ray instantly and constantly transmit at velocity *c* away from its point of emission in space, regardless of the state of motion or velocity of its material light source? The answer is because velocity *c* is an <u>intrinsic</u> characteristic and an <u>inherent property</u> of the phenomenon of light *en vacuo*. Empirically, the phenomenon of light cannot exist, nor continue to exist at any location *en vacuo*, without velocity *c*. Nor can it transmit at any other velocity than *c en vacuo*. Without velocity *c*, light *en vacuo* would not be the same phenomenon.[8] Similar conclusions apply to lesser transmission velocities of light through transparent material media.

The fact that such point of emission in space is also located on a moving material body is irrelevant to velocity *c*. The only reference position that is relevant to velocity *c* is a light ray's <u>abstract</u> point of emission in space. Thus, the prior position, contemporaneous position, future position, change of position or velocity of the material source body remains irrelevant to the phenomenon of light and its velocity *c*. (Figure 22.1) This is the reason why the motion of an inertial observer relative to the motion of a light ray's source body had no meaning or relevance with respect to the phenomenon of light or its velocity in Einstein's early emission or ballistic theory of light.[9] (see Chapter

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[7] Einstein asserted that light and other "radiation conveys inertia between the emitting and <u>absorbing</u> bodies." (Einstein, 1905e [Dover, 1952, p. 71]) If so, does it also convey inertia with respect to its reflecting bodies? Was Einstein equating the transmission of light with a force? (see Chapter 33)

[8] The same conclusions apply for all forms (wavelengths) of electromagnetic radiation.

[9] The motion v of the inertial observer was only relevant with respect to the <u>relative velocity</u> of the tip of the light ray (c – v or c + v).

21B)

Let us consider a terrestrial example of this principle. The velocity of a moving train is irrelevant to the transmission velocity of a light ray emitted from its headlight. Even Einstein agreed with this. (Einstein, 1905d [Dover, 1952, p. 38]) The velocity of the train is not added to (nor subtracted from) the transmission velocity of such light ray in order to determine the total velocity of the light ray relative to the medium of the air through which it propagates. Thus, the classical theorem of the 'addition of velocities' for material bodies (described in Chapter 19) does not apply to the emission, point of emission, or the transmission velocity of the non-material light ray. It is irrelevant.

On the other hand, the velocity of a material train is not irrelevant to a material man walking forward through its moving carriages. Both of their material velocities must be added together to compute the total velocity of the man relative to the material railway embankment. (Einstein, *Relativity,* pp. 19 – 20; Figure 7.1) Why? Because, unlike a light ray transmitting at velocity *c*, the velocity of any material object is not an inherent property of that object. It does not instantaneously occur as a universally constant velocity of all material objects. Rather, the velocities and motions of all material objects vary and depend upon their mass, the energy applied, their accelerations, their material momentum, their material inertia, the resistance applied, gravity, and other variable criteria relating to each specific material object. None of these material variables apply to light.[10] Thus, the classical theorem of the 'addition of velocities' does apply to the velocity of one material object relative to the velocities of other material objects.

It follows from the above discussion that it does not matter whether the motion of

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[10] Einstein's claim that gravity has a possible effect on a light ray and its velocity will be discussed in Chapter 42, and in a later separate treatise.

the material source of a light's point of emission is inertial (uniform in a straight line), or accelerated (as with gravitational motion or orbital motion), or arbitrary (moving at varying speeds and in varying directions like a roller coaster). The instant that light comes into existence at a point in space on a material source body which exhibits any kind of motion, or any velocity, it instantly (without any applied force or acceleration) and constantly transmits away from that point in space at velocity *c*, regardless of the prior, contemporaneous or future motion of such material source body. There is no physical or general relationship between the point of emission of light at velocity *c* in space and the motion of its material source body. Thus, Einstein's first postulate concerning the material relativity (equivalence of inertial motions) of material bodies relative to the velocity of light at *c* (Einstein, 1905d [Dover, 1952, pp. 37 – 38]) is irrelevant to the phenomenon of light and invalid on its face. (also see Chapters 23 & 24)

B. What is the Uncertainty Principle of Light?

At the exact instant that a ray of light is emitted at a material light source (i.e. on Earth), the mass point of the material light source and the point of emission of the light ray coincide, and they are located at exactly the same point in cosmic space. (Figure 22.1) One second later: a) all such rays of light have propagated straight away from their point of emission and outward into space in all possible linear directions, and the tips of each light ray are then located and propagating outward at points approximately 300,000 km away from their point of emission; b) the abstract point of emission of each light ray *a priori* remains at its original undeterminable position in cosmic space; and c) the mass point of the material light source on Earth has moved away from the abstract point of emission of the light ray at the undeterminable velocity *v* of the Earth and in some undeterminable direction relative to such point of emission. (Figure 22.1)

The abstract point of emission of a light ray theoretically never moves from its original position in cosmic space, because how can an abstract nothing move? In effect, the point of emission abstractly remains stationary or at 'rest' at the same position in cosmic space, and the light ray propagates away from it at velocity *c*. With respect to light's point of emission at rest in space, Dingle stated: "Clearly, if we are to speak of velocities at all, we must imply such a standard [of rest relative to the medium], and we may legitimately assume that [such point of emission] is embodied in a universal medium, [empty space] or ether, so long as we do not grant that medium any physical properties." (Dingle, 1961, p. 14)

We do not know the absolute magnitude of velocity v of the Earth relative to such abstract point of emission of light theoretically 'at rest' in cosmic space. Is it 0 km/s? Is it 30 km/s, the orbital velocity of the Earth relative to the Sun? Is it 225 km/s, the velocity of the Earth relative to the core of the MW galaxy (plus or minus 30 km/s, its solar orbital velocity)? Is it 225 km/s ± 30 km/s ± 310 km/s, the velocity of the Earth in the Milky Way Galaxy relative to the Andromeda Galaxy? Or is it some other relative velocity or velocities? In what direction is the absolute velocity of the Earth relative to such point of emission? We do not know that either. We can never determine the absolute velocity or absolute direction of the Earth relative to the abstract point of emission of such light ray. (see Chapter 10)

Therefore, how can we determine the relative future position and distance of such point of emission of the light ray relative to the moving Earth at any instant in time? If we cannot, then how can we comply with Einstein's requirement to construct a rigid set of Cartesian coordinates relative to such abstract point of emission, in order to measure the Earth's velocity and position relative to such point of emission, or relative to the velocity of the tip of such propagating light ray? (Einstein, *Relativity*, pp. 6-9, 22; see Figure 25.2B) We cannot. The location of light's point of emission in space relative to light's material source body (mass point of emission), and relative to the tip of such propagating light ray, must always remain completely uncertain…and impossible to describe or locate.

The one thing that is certain, however, is that the abstract point of emission of such light ray began at a point in the void of cosmic space and remains there, wherever 'there' is, because how can an abstract point in the void of space (nothing) move? This concept of an abstract motionless point of emission in space is similar to an absolute place in Newton's immovable absolute space and similar to a point in Lorentz's mythical and stationary ether, two concepts that have been discarded for decades. Yet where else can such point of emission be? Such are the uncertainties of this enigmatic phenomenon called light.

Einstein asserted that: "We must refer the process of propagation of light (and indeed every other process) to a rigid reference body (co-ordinate system)." (Einstein, *Relativity*, p. 22) But if neither the abstract point of emission of a light ray in space nor its propagating tip can be located, then how can 'the process of propagation of light be referred to a rigid reference body? How can such process of light propagation be described or measured from the material Earth by Cartesian coordinates,[11] as Einstein asserted they must? For these reasons, what relevance do Cartesian coordinates, and the

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[11] Since we do not even know the relative velocity, the direction of velocity, or the distance of the Earth with regard to such point of emission or the tips of such propagating light rays.

inertial or other material systems of reference to which they refer, have with regard to any ray of light, its point of emission, its constant transmission velocity of *c*, and/or its variable velocity of propagation relative to linearly moving bodies in empty space? The answer is none!

Therefore we must formally postulate that rigid Cartesian coordinates, material reference frames, equivalent material inertial systems, the laws of motion of material bodies, any equations of transformation between inertial systems, the entire material concept of Galileo's Relativity (or any version thereof), and Einstein's entire Special Theory, which incorporates and depends upon such material concepts, are completely irrelevant to the emission velocity, transmission velocity, and propagation velocity of any ray of light (EM) at *c*.[12]

C. What are the possible velocities for a light ray in the medium of empty space?

In Chapter 10 we discovered that the Earth has an infinite number of different velocities relative to other celestial co-moving bodies. The same is true for a light ray. The following is a list of the possible types of velocity for a light ray in the medium of empty space.

1. The emission velocity of a light ray at *c* relative to its point of emission in empty space.
2. The transmission velocity of a light ray at *c* relative to the medium of empty space, as the light ray propagates through such medium.
3. The transmission velocity of a light ray at *c* relative to other rays of light.

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[12] Professor Dingle anticipated the possibility of this new postulate. (Dingle, 1961, p. 17) This subject will be discussed in greater detail in Chapters 23 and 24.

4. There are three basic types of propagation velocity for a light ray as it propagates over distances during time intervals relative to a myriad of co-moving material bodies:

a. A velocity of approach, as the light ray transmitting at *c* propagates (in any relative direction) toward a material body that is moving linearly at v relatively to the light ray. This relative velocity of the light ray is some magnitude of *c* + v if the body is generally moving linearly toward the light ray, and some magnitude of *c* – v if the body is generally moving linearly away from the light ray.

light ray → *c* + v ← body moving at v → *c* - v
transmitting at *c*

b. A velocity of separation, as the light ray transmitting at *c* propagates (in any relative direction) away from its source body or away from other material bodies that are moving linearly relatively to the light ray at v. This relative velocity of the light ray is some magnitude of *c* – v if the source body or other material body is linearly moving in the same general direction as the light ray, and some magnitude of *c* + v if such body is linearly moving in the opposite general direction.

light ray ← *c* - v ← body moving at v → *c* + v
transmitting at *c*

c. If, by chance, the light ray transmitting at *c* propagates toward or away from a material body that is moving precisely in a transverse path with respect to the path of the light ray, then the relative propagation velocity of the light ray will (at such instant) be *c* with respect to this relatively stationary moving body.

light ray transmitting at *c* ↓ v in either direction

d. There are, of course, other possible variations of these relative propagation velocities of light with respect to moving bodies, but they are not shown because the author assumes that the reader has sufficiently understood the message. One light ray may also propagate relative to other light rays in the aforementioned manners.

We know that the relative velocity of light (a radar beam) constantly transmitting at *c* from Earth to Venus (moving at v toward the Earth) is *c* + v, because the time interval for such to and fro propagation decreases with each measurement as Venus approaches the Earth. We also know that such relative velocity of light (radar) is *c* – v as Venus moves away from the Earth, because the time interval for such to and fro propagation increases with each measurement proportionally to the <u>relative velocity</u> of such separation.[13]

D. Why is the type of motion of the material body that receives the propagating light also irrelevant to the transmission velocity of light at *c*?

Now that we know how and why light propagates from its point of emission in space at the constant transmission velocity of *c* relative to its medium of empty space, regardless of the state of motion of its material source body, let us further examine how a light ray propagates relative to other moving bodies. As we demonstrated in Chapter 21, a light ray transmitting at the constant <u>transmission</u> velocity of *c* relative to the medium

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[13] In retrospect, the 1676 experiment of Römer (which showed that light had a finite velocity) demonstrated the same phenomena. The light from the Jovian moon Io (constantly transmitting at velocity *c*) was propagating at the relative velocity of *c* – v with respect to the Earth as the Earth moved away from it at v, and such light was propagating at the relative velocity of *c* + v with respect to the Earth as the Earth moved toward Io at v. (see Chapter 6C and Figures 6.5 and 6.6)

of empty space also very naturally has different velocities of propagation relative to all material bodies in the Cosmos that are moving linearly toward or away from such light ray. In other words, the changing relative distances and time intervals of approach (ct + vt) or separation (ct – vt) between a ray of light transmitting at *c* and a material body moving linearly at v results in a relative velocity for such light ray.[14] The magnitude of distance (and time intervals) of approach or separation from the tip of the propagating light ray to each linearly moving body varies, but the transmission velocity of light at *c* relative to the medium of empty space does not. (see Figure 21.2) Stated another way, it may take a longer or shorter interval of time for a light ray to propagate a greater or lesser distance because of the relative linear motion of the receiving body, but such light ray will always continue transmitting relative to the medium of empty space at the constant transmission velocity of *c*.

The magnitude of this relative velocity of approach or separation is solely determined by the relative linear velocity and direction of motion of such moving bodies (the targets of the propagating light rays). But it follows that the type of motion that such linearly moving bodies (the targets) are exhibiting during the propagation of each light ray is irrelevant to the transmission velocity of such light ray at *c*. Such values and magnitudes will be substantially the same whether the material body (the target) is moving linearly, obliquely, orbitally, inertially, with acceleration, with deceleration, uniformly, arbitrarily, or any combination thereof during such time interval of propagation. (Figure 22.3) Ultimately, the only variables necessary to consider are: at what point on the moving target body the ray of light (transmitting at *c* relative to empty

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[14] Again, *a priori* a light ray constantly transmitting at *c* relative to its medium of empty space also has a different relative velocity with regard to the linear motion of its material source body and all other linearly co-moving bodies in space.

space) will ultimately contact, at what instant in time, and at what relative velocity. (Figure 22.4A)

Strangely enough, the same is true with respect to two material bodies. If a bullet is fired at a linearly moving target, the <u>type of motion</u> of the linearly moving target during the flight of the bullet is irrelevant to the ultimate magnitude of relative velocity between the bullet and the target at the instant of contact. The target may be moving uniformly, arbitrarily, parabolically, with acceleration, or with deceleration, or any other way during such flight. (Figure 22.4B) Ultimately, the only relevant variables are: at what point on the moving target the bullet will strike, at what instant in time, and at what relative velocity.

At the instant that the ray of light contacts the moving target body, the light ray will either: 1) instantly be reflected at *c* in the direction of another object, regardless of the velocity of the reflecting object, 2) be absorbed and re-emitted, refracted or dispersed through a transparent or semi-transparent substance (such as air, water or glass) at a velocity less than *c*; and/or 3) end its existence as light and be absorbed by an opaque and non-reflective moving body. (see Figure 22.5) Eventually, and theoretically, each ray of light in the Cosmos will ultimately be absorbed by an object with a substantially non-reflective surface (i.e., a star) and its existence as light will instantly terminate.

Because the Special Theory of Relativity only applied to <u>inertial</u> motions of material bodies (including the targets of propagating light rays), and because gravity causes a continuous accelerating motion of material bodies (including the targets of light rays), Einstein decided that it was necessary to generalize his Special Theory so that the constant velocity of light at *c* could also apply to the accelerating motions of gravity.

(Einstein, *Relativity,* pp. 67 – 70) He attempted to accomplish this mathematical feat with his elaborate General Theory of Relativity, which included his invention of a bizarre new theory of gravity: ‘curved spacetime.’

However, because the type of motion of the target body is also irrelevant to the transmission velocity of light at *c*, there was really no requirement that the motion of such target body be inertial. It may also be accelerated, orbiting, arbitrary or any other type of motion. Thus, Maxwell’s constant transmission velocity of light at *c* relative to the medium of empty space was always valid with regard to any type of motion of a light ray’s material emitting body or target body. For this reason, Einstein’s General Theory of Relativity was unnecessary in order to explain or describe the transmission velocity of light at *c*, relative to all non-uniformly moving bodies. Since General Relativity was based on the false premise that there is a problem unless the material target of a propagating light ray exhibits a certain type of motion (i.e. inertial motion), and other false assumptions, are not Einstein’s General Theory and its mathematical consequences also meaningless?[15] The answer is yes.

E. Upon contact with a material body, the transmission velocity *c* of a light ray becomes irrelevant with respect to the velocity v of the material body.

At what velocity will a light ray transmitting at the constant velocity of *c* be received on Earth if that planet is moving toward or away from such light ray at v (i.e. 30 km/s)? The 1728 experiment of Bradley (the aberration of light), Arago’s 1810 lens focus experiment and other terrestrial experiments appeared to demonstrate that a light ray propagating at velocity *c* toward Earth is received on Earth at velocity *c* regardless of

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[15] We shall briefly examine and discuss Einstein’s General Theory of Relativity and some of its mathematical consequences in Chapter 40, and in much greater detail in a separate treatise to follow this one.

any relative linear velocity w of the Earth. (see Chapter 7) On the other hand, the Galilean transformations described the velocity of such contact as c + v or c – v.[16]

The conflict between these experiments and computations posed a paradox for the scientific community. Which was right? How could the velocity of light have the same value of c upon contact with respect to a material body (i.e. Earth) that was linearly moving in two opposite directions?[17] (see Lindley, p. 55; Rohrlich, pp. 52, 55)

Einstein's relativistic formula for the composition of velocities in his Special Theory,

$$\frac{c + \mathrm{w}}{1 + \mathrm{w}/c} = c,$$

provided a mathematical solution for this paradox. (see Chapter 29) However, the solution for the above paradox of light's velocity of receipt or contact is not a result of Einstein's relativistic formula, nor did Einstein ever explain the reasons for such paradox.

The real reasons for such experimental results and the solution for the above paradox are as follows. The fact that a light ray has a relative velocity of c – v or c + v with respect to a linearly moving material body during its propagation through empty space toward or away from such body, does not mean that the combined velocity of contact between a light ray transmitting at c and a material body moving at v is greater or less than c. The fact that the combined contact velocity of the light ray and the material body might logically be characterized as c + v or c – v, is meaningless to the situation. The instant that a light ray contacts a material object on or near the surface of the Earth it is still the phenomenon of light complete with its inherent property of the transmission

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[16] This is the magnitude that the impact of two material bodies would be.

[17] Remember Bird's dilemma with Einstein's absolute velocity of light at c: "when we go to meet an advancing light-impulse, or when we retreat from it, it still reaches us with the same velocity as though we stood still waiting for it." (Bird, p. 70) In 1916, Dingle restated the paradox: no matter what the relative motion of bodies might be, light "is emitted at velocity c and received at velocity c." (Dingle, 1961, p. 21)

velocity of *c*. Unlike an impact between two material bodies, when light contacts a linearly moving material body only a limited number of things can happen to the light ray.

For example, if it contacts a particle in the upper atmosphere it may be absorbed and reemitted by such particle, in which case it may also be dispersed in a somewhat different direction. (Figure 22.5A) If it contacts a reflective surface on Earth it will be reflected at velocity *c* in another direction. (Figure 22.5B) If it contacts a transparent material medium (such as water or glass) it will be refracted to a lesser velocity in a somewhat different direction relative to its new transparent material medium. (Figure 22.5C) When it finally contacts an opaque material substance (such as coal dust), it will be absorbed by such substance and end its existence as light.[18] (Figure 22.5D) The phenomenon of refraction is what happened when rays of starlight contacted the glass lenses in Bradley's and Arago's telescopes, and also what occurred with Fizeau's 1851 moving water experiment when starlight (used as the light source) contacted the water. (see Chapter 7)

For these reasons, such theoretical combined contact velocity (*c* + v or *c* – v) is irrelevant and meaningless with respect to the phenomenon of light and its velocity *c*, and it is also meaningless for the material body moving at v. The only substantial relevance of the constant transmission velocity of a light ray at *c* when it contacts a material object (i.e. the eyes of a human observer) is that it provides a universal constant for measurement of distant events.

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[18] None of these phenomena can happen during an impact of material bodies.

F. Why did Einstein need the M & M null results and his contraction solution to explain such paradoxical results?

During his contraction explanation of the M & M null results, Einstein assumed that "a ray of light requires a perfectly definite time t to pass from one mirror to the other and back again" in the M & M experiment…but only "if the whole system [the Earth and M & M's apparatus] be at rest with respect to the aether." (Einstein, *Relativity*, pp. 58 – 59) On the other hand, if the whole system is not absolutely at rest (which we know it cannot be), then according to Einstein a light ray must travel over a greater distance/time interval in the direction of the Earth's motion.[19] (*Id.*) However, we also know that this false concept is not true because of our discussions in Chapter 12.

Yet, if this false concept was true, as Einstein asserts that it is, then this would mean that the motion of the Earth through space affects how light propagates (i.e. a greater distance/time interval than when at rest), which would violate Einstein's second part of his postulate that the propagation of light emitted on the Earth's surface is independent of the Earth's motion.[20] Thus, Einstein needed the M & M paradox and his contraction solution to explain the missing time interval (Chapter 15C), in order to bolster his false concept of a greater distance/time interval in the direction of the Earth's motion through space, and to justify the first part of his second postulate, which asserted the absolute velocity of light at *c* which needed such theoretical contraction, otherwise his whole Special Theory would begin to fall apart.

Either Einstein's concept of a greater time interval is false, or the missing time interval is false, or Einstein's contraction solution is false, or his second postulate is false…take your choice. Actually, the only concept that is correct is the second part of

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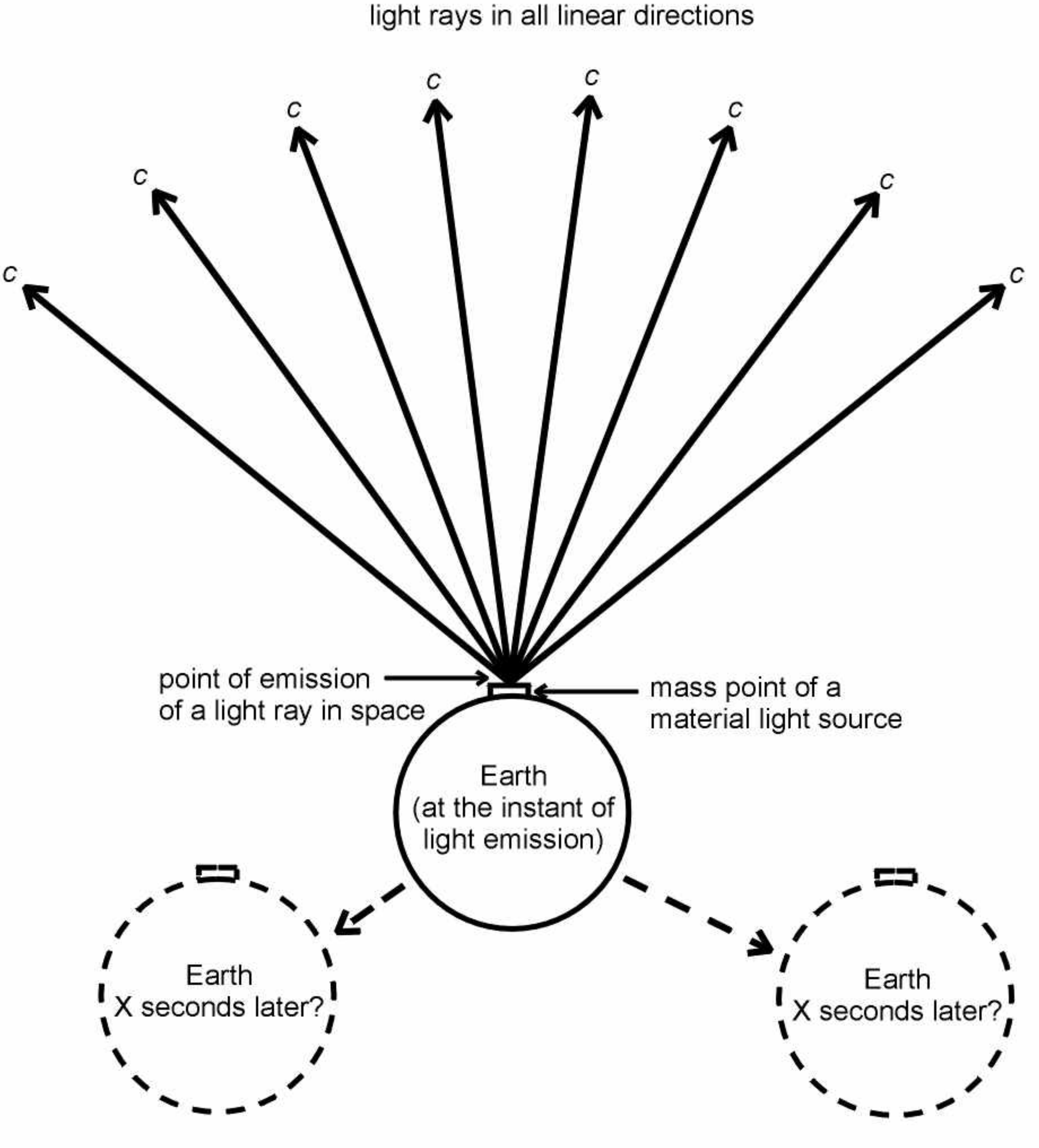
[19] See Einstein's moving light clock thought experiment in Chapter 26.

[20] This false concept would also contradict Einstein's assertion that there is no ether or absolute rest.

Einstein’s second postulate: the velocity of light at *c* is independent of the motion of its emitting body (the Earth). (see Chapter 22A)

Figure 22.1 Emission Of Light At Its Point Of Emission In Space, And The Location Of The Earth X Seconds Later



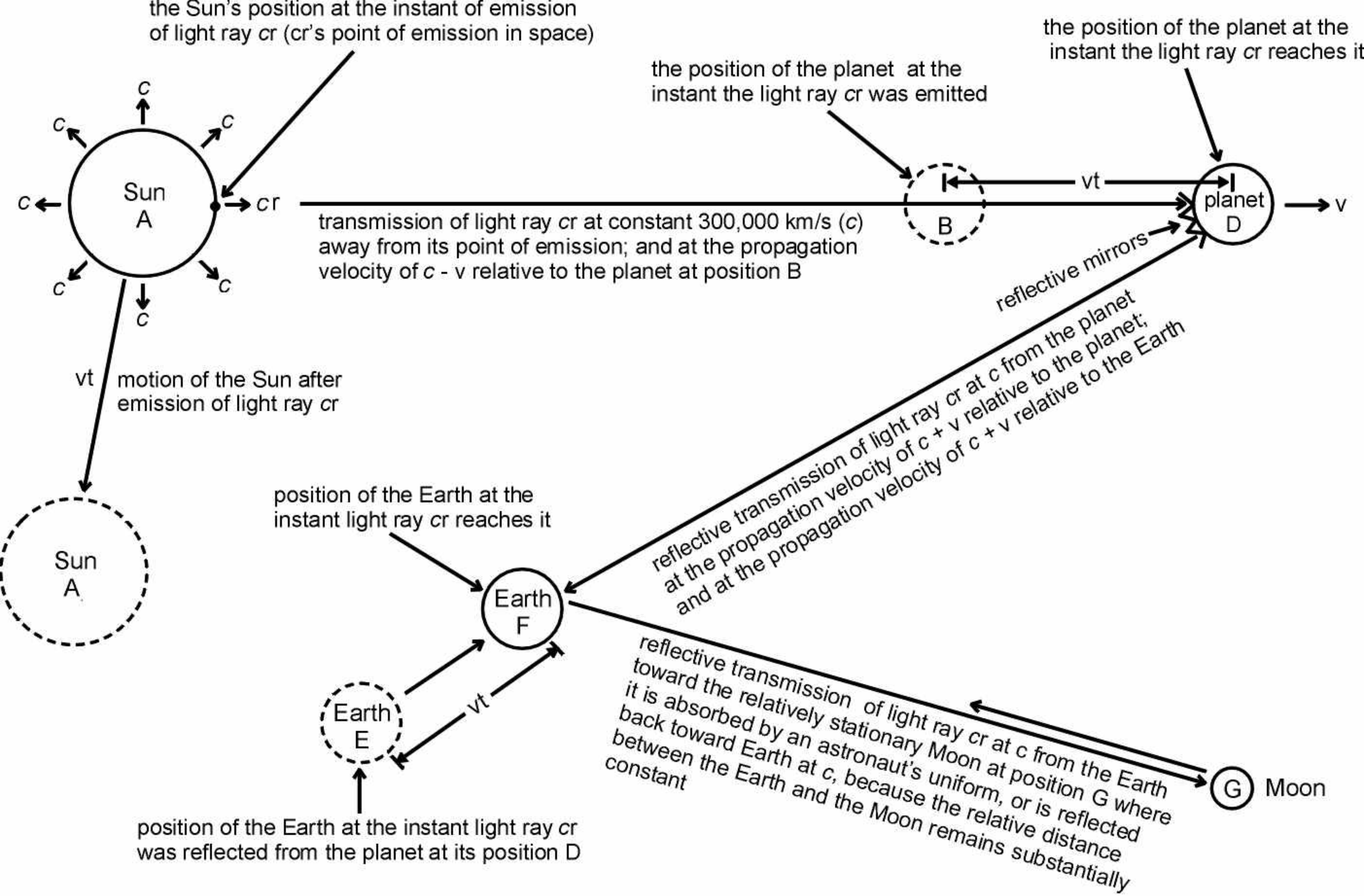
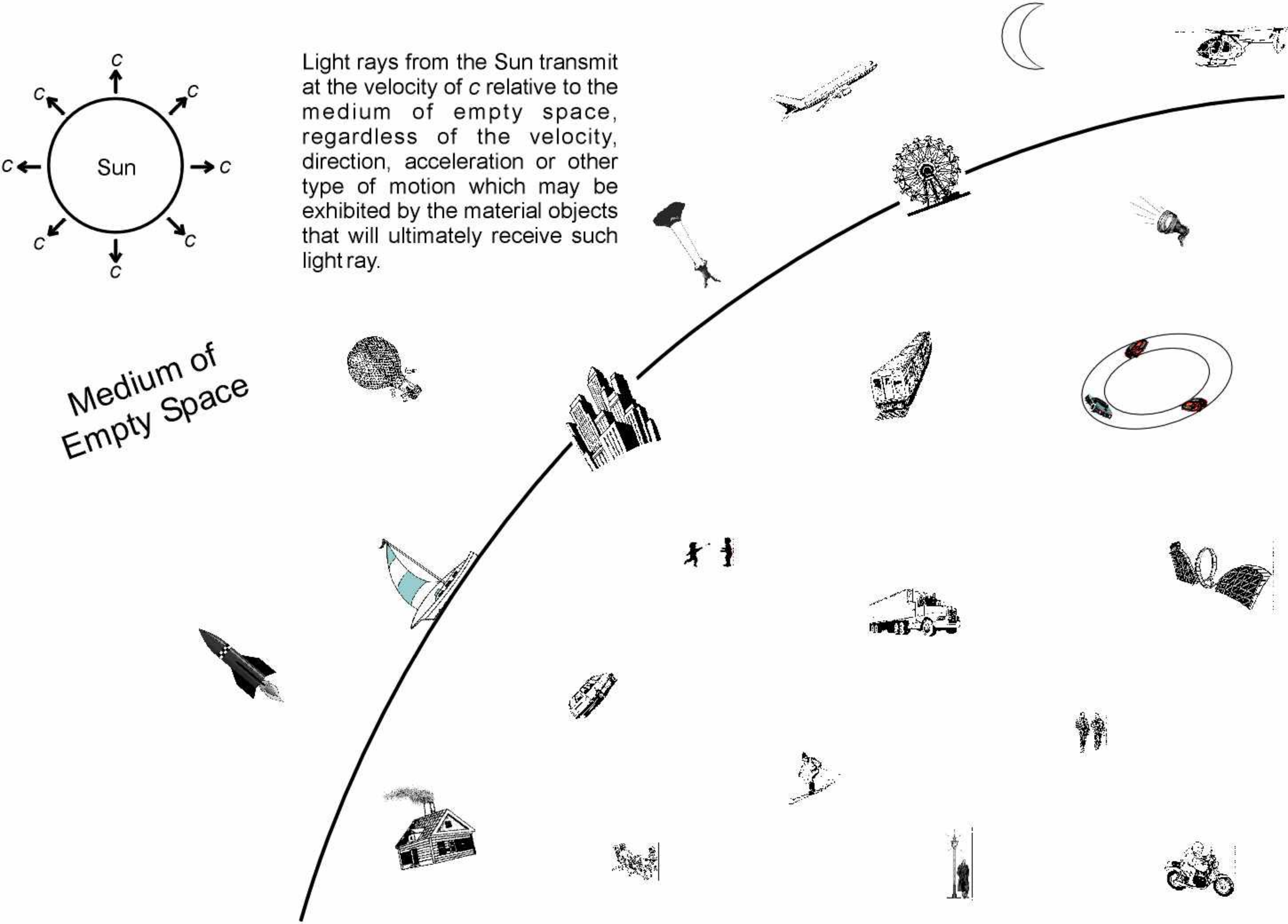


Figure 22.2 The Constant Propagation Of A Light Ray At Its Transmission Velocity Of *c*

(not to scale)

Figure 22.3 The Type Of Motion Of The Target Or Receiving Body Is Irrelevant To Velocity *c*



Light rays from the Sun transmit at the velocity of *c* relative to the medium of empty space, regardless of the velocity, direction, acceleration or other type of motion which may be exhibited by the material objects that will ultimately receive such light ray.

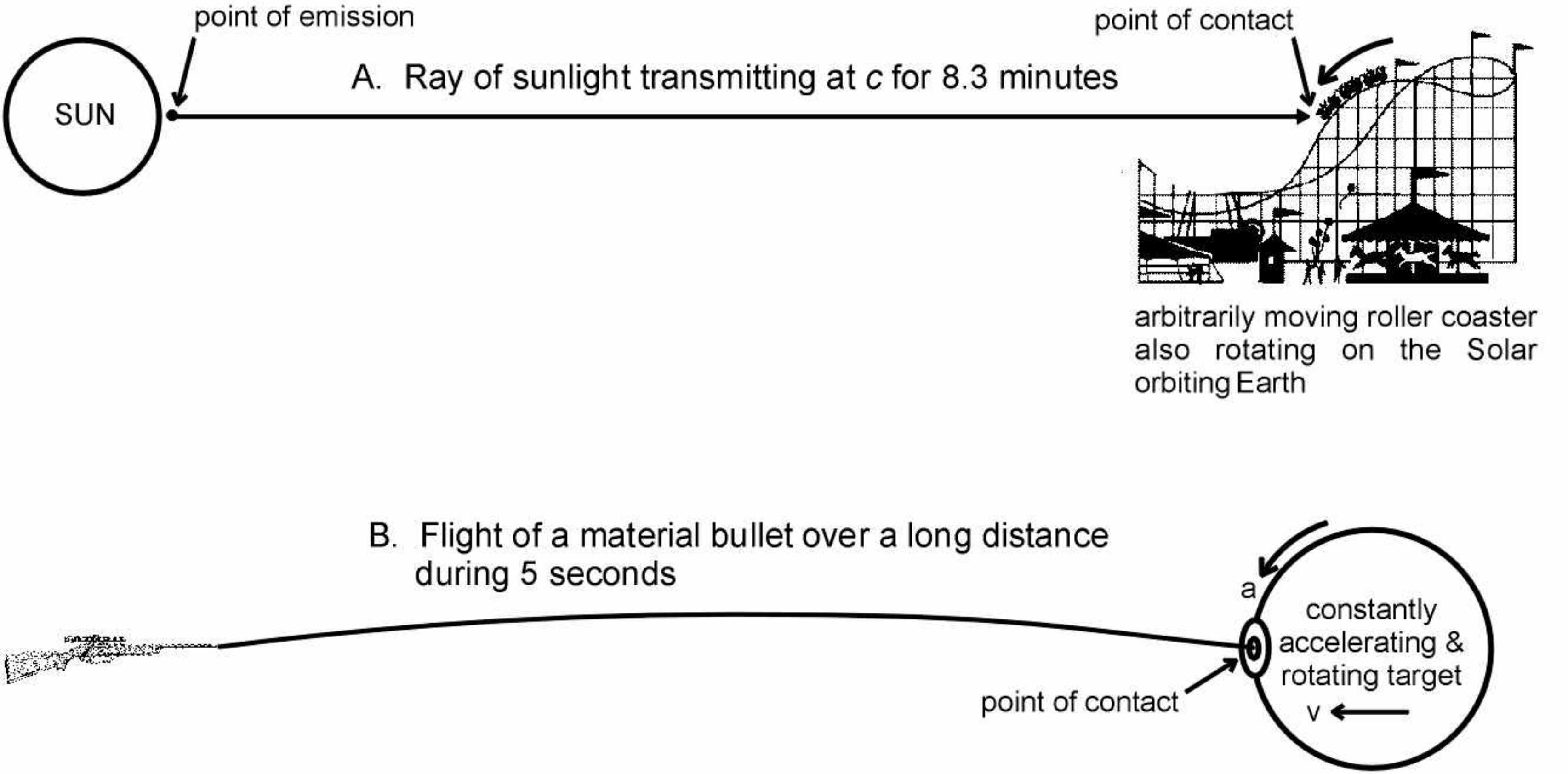


Figure 22.4 A Ray Of Light And A Material Bullet Approaching A Non-Uniformly Moving Target

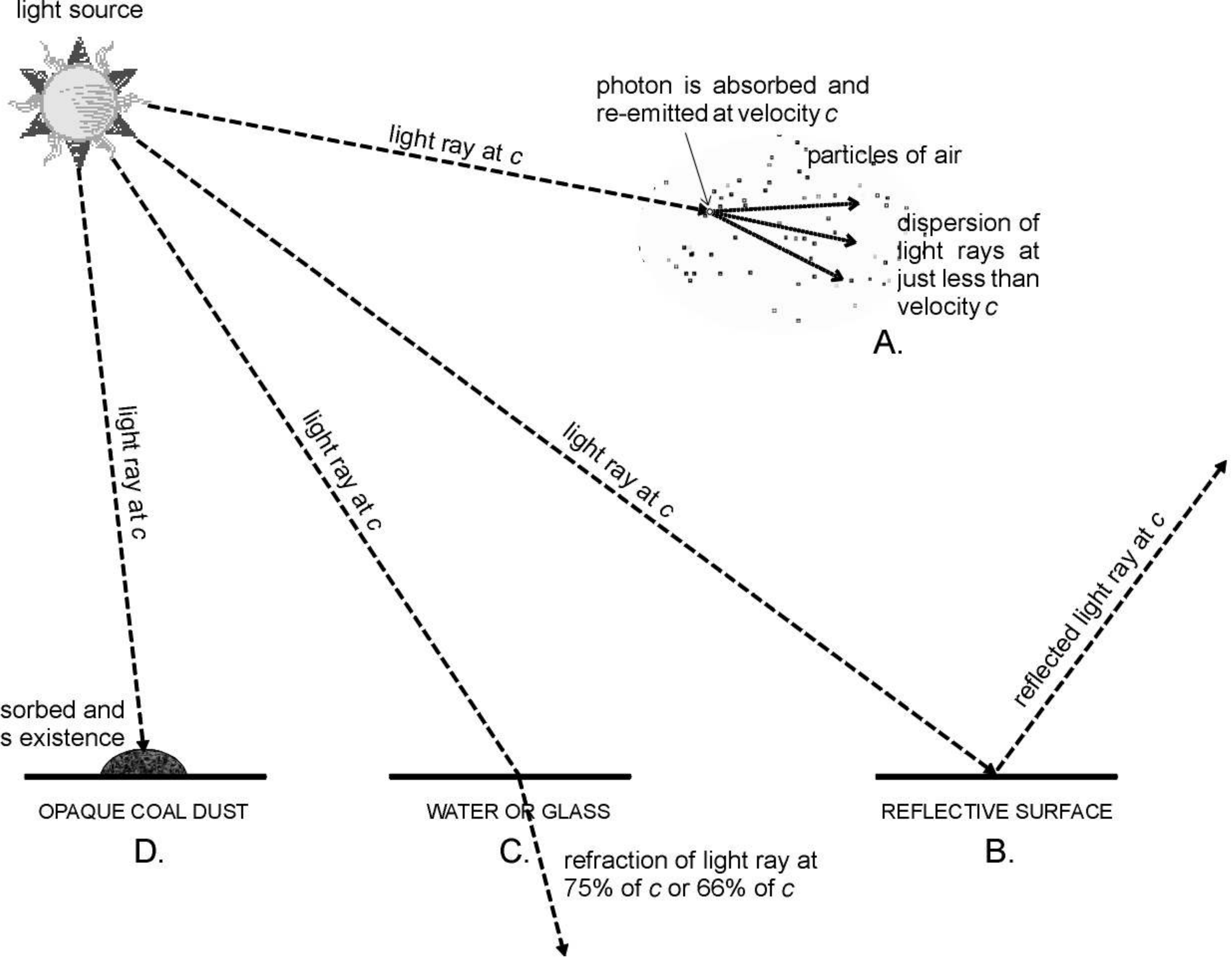


Figure 22.5 What Happens To A Light Ray Propagating At Velocity *c* From Outer Space When It Approaches And Contacts A Material Object On The Moving Earth?