TWO FUNDAMENTAL LAWS

Leslee A. Kulba

23039 Montclair Drive, Farmington Hills, MI USA 48336

E-mail lesleekulba@worldnet.att.net Telephone: (248) 476-7398

Abstract. All physical phenomena are explained in terms of particles reestablishing equilibrium in accordance with Newton's law of gravitation and Coulomb's force law. In other words, the overall rate of expansion of the universe is constant, and the net distribution of universal charge is constant. Energy exists by virtue of disturbances requiring the rest of the universe to compensate for a local rearrangement of charge or mass. Energy, in any form, has no substance, *per se*. Field lines, energy rays, and other devices traditionally contrived to simplify conceptualizations are dismissed as only complicating perceptions.

Introduction

Two of the most comprehensive concepts of the modern age originated with Henri Louis LeChatlier (1850-1931) and Ernst Mach (1838-1916). LeChatlier's principle, usually applied in the context of chemistry, states that whenever a system undergoes a stress, it shifts so as to relieve that stress. Mach applied the same principle to the universe at large, and stated that whenever a mass is moved, all other masses are affected in accordance with Newton's law of gravitation, and shift to restore equilibrium.

Contemplation of Newton's third law of motion, the law of conservation of momentum, and the law of conservation of energy reveals that the sum of the products of mass and velocity for all members of a closed system will always be constant. That is to say, it is not the center of mass of the universe that remains constant, but it is rather the rate of expansion of mass in the universe (*mv*) that remains constant. The term expansion is used loosely here, and applies whether the expansion is positive, negative, or zero.

The similarity between Newton's law of gravitation and Coulomb's law of attraction between electrical charges is obvious. Coulomb established that electrical attractions and repulsions depend on the quantities of charge involved and the distance between the particles. Unlike mass, whose universal equilibrium state is velocity-dependent, the universal equilibrium state of charge depends simply on spatial distribution. Nonetheless, analogously with Mach's principle, any alteration in the position of an electrical charge will exert forces on all other electrical charges in the universe, to diminishing degrees with distance; neighboring charges adjust so as to preserve the universal equilibrium.

By accepting the simple concepts that the overall rate of expansion of matter in the universe is constant, the net distribution of charge in the universe is constant, and that charge and mass are inextricably connected, the nature of energy can be explained simply. When a body is moved, causing other bodies in the universe to adjust to compensate for the shift in equilibrium so induced, energy is said to exist. Waves, rays, aethers, and particles are not necessary, as energy is merely the manifestation of altered configurations of charge and/or mass.

On clockwork

According to the model at hand, all atoms in the universe, by virtue of their charges, are inherently programmed to establish equilibrium with all atoms in the universe. To assume the particles know how to act is much simpler than inventing a substanceless medium, or worse, undetectable particles, to transmit the information. This is in accordance with Newton's dictum.[1] Equilibrium principles are no strangers to science. LeChatlier's principle, often used in chemistry contexts, states that when a system in equilibrium undergoes a stress, the system shifts so as to relieve that stress. Though grossly underrated, this principle is as widely-applicable in science as is the law of conservation of energy.

Another important principle, which is perhaps a corollary of LeChatlier's principle, is Mach's principle. Mach's principle, often misunderstood by reason of rote textbook phrases explaining inertia in terms of "the distant stars," is simply an expression of Newton's universal law of gravitation:

$F = Gm_1m_2/r^2$.

To paraphrase, Mach's principle states that whenever a body in the universe is moved, it upsets the equilibrium of the universe, and all other bodies in the universe must adjust their paths to compensate the shift. Of course, nearby objects will be most affected, and distant objects will scarcely feel a thing.

Students always recognize the similarity between the equation for gravitational force and that for electrical force:

$F = kq_1q_2/r^2$.

Unfortunately, the similarities are usually only addressed for mnemonic reasons, while a natural philosophical explanation is left untold. Furthermore, allusion to any kind of electrostatic equivalent of Mach's principle is not generally found.[2]

It is accepted that atoms possess charge and mass. In fact, discrete quantities of charge appear to be inextricably connected with discrete quantities of mass.[3] Left to their own devices, the masses and charges of the universe will always move to establish equilibrium. This is the law of entropy, popularly expressed as, "all things tend toward disorder." The universe is interesting because electrical forces must balance, inertial forces must balance, and both types of force must balance with each other.

Energy

Now, if entropy were all that were acting, surely the universe would have reached a very stable condition by now, and all would be motionless. However, change abounds, and the reason for the change can be termed a *vis viva*. True to the Latin sense of the word, but different from the historical applications of this term to physics, the *vis viva* is but a life force, something capable of removing bodies from their preferred equilibrium states. An example of a *vis viva* would be a human being that carried a book to the top of a cliff. By lifting the book, the *vis viva* has now imparted energy to the book-cliff system, and when the *vis viva* releases the book, nature will take control, and the universe will reestablish equilibrium.

In short, in any situation in which a *vis viva* acts to move a body out of its state of equilibrium, energy exists. This is true whether we speak of hauling a book up a cliff or simply tugging an electron a little further from its atom's nucleus. A *vis viva* imparts potential energy to a system by imposing disequilibrium; kinetic energy follows the release of the *vis viva's* influence. The equilibrium referred to in this context is a dynamic universal equilibrium. That is to say, the universe as we know it is not content to freeze in a condensed mass at 0K, but instead supports orbiting planets, stars, and galaxies.[4]

Energy can exist in many forms: chemical, heat, electric, light, and magnetic to name a few. Energy can also be subdivided another way, such that all forms are classified as either potential or kinetic. Quantifications of energy require an arbitrary reference level. This reference level is usually chosen as a base level, beyond which energy calculations are absurd to consider. For example, a book falling off a table is assumed to be able to fall no lower than the floor.

In this context, energy is still, as classically defined, a scalar quantity, and many dreams of harnessing zero-point energy can be dismissed. For one reason, a physical zero point would have to be located infinitely far from a majority of matter. Since our present situation on earth is not such a privileged position, and it would take a lot of energy to get to such a position, it would not be worth further investigation.[5] More simply, however, if a life force moves any object out of equilibrium, the object can only fall until equilibrium is reestablished, with perhaps some reverberation. Should the object fall to the other side of the base level, the mass and charge of the universe will still pull it to the equilibrium position. It is just as energetic to be displaced to the right of equilibrium as it is to be displaced to the left. There is no negative energy.

Conservation of energy

The law of conservation of energy has far-reaching implications. Its effects are manifest everywhere, and students are still presented with the classic problems of calculating the potential and kinetic energies of a falling object and observing that their sum remains constant. Why it does, is not astounding.[6]

Consider an object of mass m, falling from rest at a height, h_1, with a velocity v from a natural acceleration of g. The equation for conservation of energy would tell us that

$1/2\ mv^2 + mgh_1 = \text{constant}.(1)$

Since the object's mass is constant, we can divide by m to get another constant.

$1/2\ v^2 + gh_1 = \text{constant}.(2)$

At this point, equations of kinematics can be invoked to simplify Eq. (2). Equations of kinematics are merely algebraic expressions of basic calculus equations defining acceleration, velocity, and displacement. They describe the motions of a body and hold true in any situation, regardless of the cause. One equation,

$v_f^2 - v_o^2 = 2as,(3)$

is equivalent to

$v_f^2 - v_o^2 = 2gh_2,$

where h_2 is the distance fallen when accelerating at g, or

$v_f^2 = 2gh_2,(4)$

when the body falls from rest. This equation may be substituted in Eq. (2) to give

$1/2(2gh_2) + gh_1 = \text{constant}$, or

$gh_2 + gh_1 = \text{constant}.$

We can divide by g because it is constant, and we get

$h_2 + h_1 = \text{constant}. (5)$

In other words, the law of conservation of energy for falling bodies is equivalent to stating that the distance an object has fallen plus the distance it has yet to fall remains constant. This is so uncontestable, that it would defy reason to speak of overunity in this context.

Electromagnetic energy and waves

Imagine a universe that consists of simply one particle which possesses unit charge and unit mass. Nothing happens, so next consider a universe with two such particles. If the particles have opposite charges they will attract; the same charge, they will repel. If left alone, experience tells us that they will eventually assume an equilibrium position with respect to each other. Now consider the effect of a *vis viva* from another universe who happens to interfere with the existence of these particles. Supposing the particles attracted in the first place, the being now chooses to separate the particles. As he pulls one particle away, polarizing the system, the other particle, by its inherent nature, shifts to reestablish equilibrium, and moves toward the particle which was originally displaced.

Now consider a universe consisting of three particles arranged collinearly so their charges alternate. Again, the *vis viva* from another universe interferes with the equilibrium established by the charges and masses of the three particles, and draws one of the particles on the end away from the others. Of course, the particle next to the relocated particle will move to reestablish equilibrium, and the third particle, at a further distance, will also move, but not to as great an extent, as it is located further from the change. However, after the second particle has moved to establish equilibrium, the effect of its change on the third particle must now be equilibrated.

If we extend this scenario to a linear universe of numerous particles, we see what can be called a wave. A single change in a single particle's position will cause great changes in the nearest particles and small changes in the most distant particles. However, as consecutive particles adjust to establish equilibrium, these secondary effects ripple down the line. The result is a damped-wave effect for each pulse. In other words, news that the particle has been moved is transmitted in the form of a wave. The term wave is here invoked to describe an effect similar to a sport fans' wave, wherein individual people stand up in succession; or a water wave in which individual molecules rise in succession. Wave is not meant to imply sectarian notions of energy jiggling through space or ripples in a nonmaterial aether. It is material molecules, reacting in succession to local changes in the distribution of charge, which comprise electromagnetic waves.

The principle, of course, can be extended to two and three dimensions. Given the bipolar nature of the atom, and Coulomb's law, it follows that a quantum excitation of an electron would instantaneously change the degree of polarization of an atom, an effect which would influence nearby atoms which, in turn, would rearrange their charges to reestablish equilibrium, balancing inherent repulsions and attractions. However, excitations are instantaneously linear phenomena, occurring radially along an axis through the atomic nucleus. Coulomb forces caused by the excitation will affect neighboring atoms only along the line of force with no orthogonal component. Hence, electromagnetic radiation travels linearly away from its source.

Perhaps the most important strength of the model at hand is its simplification of electromagnetic theory. Light has no substance, but is only a manifestation of changes in the degree of electrical polarity in bulk matter. There are no fields. There are no waves. There are only particles with charges and therefore inertia, moving so as to maintain the universal balance of charge and momentum. Once force field lines and energy rays are removed from the picture, the mechanisms underlying numerous optical phenomena become simple. A few are described below, the rest can be pursued by the interested reader, with minimal effort:

Heisenberg uncertainty. Experience teaches that, given any point out in the open somewhere, images are transmitted through that point from all directions, and may be received by any number of observers from any number of vantage points. Modern physics teaches that the atom consists of a negatively-charged electron cloud surrounding a positively-charged nucleus. The electron cloud has been described as a probability wave, immeasurable as described by Heisenberg's uncertainty principle.

The model described in this paper gives a physical interpretation of the uncertainty principle. Each atom adjusts its polarity to reestablish universal equilibrium with the primary and secondary jiggling motions of adjacent atoms, and to a lesser effect, distant atoms. In doing so, it transmits information about its surrounding neighbors (to positions diametrically opposed to the sources of information with respect to the transmitting particle). To be able to relay information from all directions requires the atom, or, more specifically, the electron cloud, to act something like an amoeba, stretching and contracting in all directions. Should some scientist wish to observe the amoeba-like atom, his mere presence causes the atom to start conveying information about the scientist, his instruments, and their behavior to neighboring atoms. However, it should be noted that although the atom can polarize in all directions, instantaneous polarization is but a linear phenomenon of varying distance between the positive nucleus and the negative electron in question.

Dual nature of light: Light is neither a particle nor a wave. It is a manifestation of changes in the distribution of positively and negatively charged matter. Matter, in this context, refers to the protons and electrons with which chemists work, and not any kind of immaterial or subparticulate matter.

As described before, all particles move to compensate changes in electrical polarization imposed on neighboring particles. The universe can be imagined to be full of amoeba-shaped atoms stretching in all directions, relaying information as they do. It is not inconceivable that atoms could receive phased signals in such a way that the effects would cancel or amplify to produce the interference patterns that cause light to manifest its wave nature. If circumstances cause an electron to be pulled as far in one direction as in the diametrically opposed direction, the atom will impose zero net change in electrical charge distribution on its environment (destructive interference). Doubling a polarizing force would double the electron displacements, either in quantity or degree (constructive interference). Furthermore, to manifest a photoelectric effect, all one needs is to have a series of vigorously stretching atmospheric atoms finally encountering a surface of atoms of relatively low ionization energy.

Surface properties: We see only light that impinges on our corneas normal to the surface. Incandescent sources disturb ambient atoms, and the message of the disturbance is transmitted radially, through a volume of atoms. The eye, however, only becomes aware of the phenomenon when the disturbance runs from a surface, be it a wall or simply a suspended water droplet, to the eye. The word surface is here used to denote a change in optical density, or refractive index. Unlike gravitational force, electrical force as well as electromagnetic radiation, are subject to shielding. Any opaque medium in the path of a light signal will reflect or absorb a signal, leaving matter on its far side with no reason to be altered.

When light impinges on a surface, it can be transmitted or reflected. If it is reflected off a lustrous surface, one that reflects light with its original appearance, the message is purely reflected back to the atmosphere with little surface interaction. If the light impinges on a matte surface, the bulk matter absorbs the message and damps out all but the frequency sent back. White light allows any characteristic frequency to be sent back. Filtered light can only cause surfaces to respond to its frequency or not at all. Since matte surfaces do not reflect lustrously, the characteristic color of an object is likely dependent on the resonant frequencies of its constituent atoms. Clear, transparent materials possess interatomic bonds that impose no restrictions on the modes of vibration of their constituent molecules in the visible spectrum.

An atom in which an electron is excited will cause neighboring atoms to adjust their polarities to compensate for the change, and these changes will be compensated in a chain reaction by atoms further out. Atmospheric atoms can simply move away from the change without changing their internal structures. However, when the chain reaction encounters a surface of bulk matter, the inertia of the bulk mass will require the atoms to adjust internally to the change, and if the atoms on the surface receive sufficient energy to excite their electrons, they will become visible. Light is only observed on surfaces. It is manifest only in interstices when material screens are imposed.

Geometrical optics: Reflection has already been discussed. The law of refraction can also be described qualitatively. A relayed atomic message passing through a less-optically-dense medium, like air, must change as it encounters another medium. This is because at the surface, there are more atoms with more collective inertia to restrict motion in the lateral direction (on the sides) than there are in the normal direction (behind). The lateral damping effect causes light to bend toward the normal on entering a more-optically-dense material. Once inside, having changed the angle of the impacts, the material conveys the message linearly. This is a qualitative description of Snell's law.

Huygen's principle: Clearly, if electromagnetic radiation is simply a chain reaction of adjustments in atomic polarizations to establish equilibrium, then it is not sensible that information would travel away from the source without having repercussions in the backward direction. Such backwaves would, however, be difficult to detect; their observation would require an observer to be located in a position where he would block the light source. That light travels radially and not tangentially is reasonable in this context, because a force can exert no influence in an orthogonal plane.

Polarization of light: Light polarizing materials (such as polaroid, which are not to be confused with electrical polarizers, known as dielectrics) simply possess a crystalline structure that absorbs vibrations in some directions, while not confining them in others.

Wave characteristics: The model provides physical mechanisms to describe basic wave characteristics. For example, frequency is a measure of how rapidly an atom distorts in response to a periodic disturbance. Intensity, or amplitude, is a function of the number of collisions. Many impacts will make a surface bright, fewer will cast a relatively shadowy appearance. Finally, velocity would be dependent on how quickly atoms can relay information to each other. If atoms are in close proximity, the local inertia effects will be stronger, and the overall relay time will be slower. Velocity may depend as much on ionization energy as on mass.

Speed of light: The process by which information about an initial polarization is transmitted is as follows. One atom polarizes. By Coulomb's law, all unshielded atoms in the universe will be affected to some degree. The atoms nearest to the original disturbance are affected most; distant atoms may receive insufficient stimuli to react perceptibly. In their turns, each atom down the line from the original disturbance will deform to accommodate the recent changes in its neighbors closer to the source. Therefore, this model does not explain light as a fundamental entity, but as a chain reaction of rearranging atomic geometries.

There is a time factor associated with the distortion of the atoms. Once an atom becomes aware of the need to change, it must physically adjust its electrons, and in any but a quantum theory context, this would be a process with a duration. The fact that mass and charge are inextricably connected indicates that inertia would prevent the particles from responding immediately. The cumulative effect of a series of atoms consecutively contributing their reaction times to the transmission time for a signal would give light a velocity. A denser medium will have a greater number of atoms that will have to adjust, one at a time, over a given distance, and therefore a slower transmission speed.

Whether or not atoms become aware of the need to change instantaneously or not is not known. It would be elegant to assume that the reaction is instantaneous, as no impeding factor has been introduced into the theory. Atomic adjustments alone cannot account for the small range of light speeds over a broad range of medium densities. The universe at large, however, would impose a universal retarding influence of some kind. That is, if Coulomb forces are capable of exerting a critical level of influence on atoms within a definite range, *r*, then all atoms in that range will adjust at the first instant, regardless of how many atoms fall within that range. Once the atoms on the outskirts of *r* change, then atoms within a radius *r* from the outskirts atoms may change, *etc*.

If the speed of light is dependent only on the reaction time of individual atoms, and perhaps a universal retarding force, it will have to be constant from all directions, regardless of the motion of source and observer. Even if the reference frames are accelerating, such motions will have no effect on the time it takes one atom to inform its neighbors of a change in equilibrium, and have each atom down the line overcome the inertia imposed by the rest of the universe to realign itself accordingly, in its turn. The ratio of the distance spanned, divided by the time it took to convey a message across that distance, will always be constant for any given medium at a given temperature and pressure. The velocity at which electromagnetic signals are transmitted, as described in this model, will be inherently constant with no need to invoke special relativistic notions of time dilations or length contractions.

Vacuum and electrical inertia

One might wonder how this theory accommodates the concept of transmission of light through a vacuum, seeing it requires the presence of mass. First of all, the density of space is estimated to be around 10 to 100 particles per square cm.[7] This proximity is definitely close enough for Coulomb forces to operate. Secondly, back to the two particle universe, it might be asked if two particles, located on opposite ends of a vast space, would interact in the absence of all other matter. It is proposed that they would, and that charged particles with great separations are not generally observed to interact in this universe because of what might be termed the electric inertia of the universe.

Finally, for the critical experiment, it is suggested that if ever a space could be evacuated to the extent that a very near vacuum exists, it would be interesting to try to project a hologram into that space. If holograms are merely interference patterns, as modern theory suggests, then the images will still be manifested. If, on the other hand, light is dependent upon matter for transmission, then, in a very low vacuum, the image will not be complete; in an absolute vacuum, it won't exist.

REFERENCES

[1]According to Newton, "We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances," and Occam's razor states that the simplest of several hypotheses is best.

[2]This was suggested in a field-theory context by L. Kulba in "ESJ Forum: 'The Shape of Light,'" *Electric Spacecraft Journal*, April 23, 1999, 28:10.

[3]Recent work by David L. Bergman provides a physical explanation for this phenomenon. By describing the electron as a ring of circulating charge, Bergman has shown how Lenz' law, applied on an atomic scale, can account for inertia. This is only one of many predictive successes of Bergman's theory. See Bergman,

"NetNote," *ESJ*, February 2000, p. 30 and Bergman, "Origin of Inertial Mass", *Foundations of Science Newsletter*, 2:3.

[4]The obvious theological implications are left to the reader.

[5]This says nothing about the potential of proposed devices such as a mass falling in an ultra-precise path through the axis of the earth.

[6]Halliday, pp. 122-123, for example, implies the kinematic foundations of the conservation of potential and kinetic energy.

[7]From a telephone conversation with Richard Hull, January 26, 2000.