

# Reflection, Emission and Doppler Effects of Light Particles

by

A.C. Sturt

## Summary

The Doppler shift originated with the motion of bodies through gases, but it is regularly applied to electromagnetic radiation on the assumption that light is composed of waves. However, light is particulate, which invalidates that mechanism. This paper shows that particles of light in the form of rotating electromagnetic dipoles are compatible with Doppler for reflected light, but not for emitted light. Redshift of stars/planets cannot be caused by Doppler, and does not indicate velocities through space. However, light of high frequency is generated when bodies accelerate through the medium of space from velocities which are comparable to the speed of light, and this may explain why some galaxies appear to us to be blue-shifted.

## A. Introduction

My previous analyses in this series made the case that it is often convenient to attribute observed shifts of electromagnetic frequencies to the Doppler effect, but Doppler cannot in fact be the fundamental mechanism at work, because light does not travel through space in the same way that sound travels through a gas. Light was shown to consist of particles; it was not necessary to invoke wave forms to account for diffraction phenomena. Light particles are generated and travel independently, and so there is literally nothing between them to stretch or shrink.

The importance of this is that the redshift of stars and galaxies is considered to be the principal evidence that the Universe is expanding. Redshift is thought to be caused by the stretching of wavelengths of the light which almost all of them emit as they move away from Earth. The only possible model which could accommodate this is an expanding Universe. The redshift argument has been further refined by proposing that increases of wavelength are caused not only by the Newtonian translation of the emitters through space, but also by the expansion of space itself, which is called the cosmic redshift. This is calculated from the model of the expanding Universe for which the main evidence is in fact redshift, thus involving a certain circularity. The cosmic redshift argument is not helped by the allegation that it is only the space between galaxies which expands; the metre rule in your hand does not expand i.e. the hypothesis is seen to be very good in parts. In spite of these arguments it is still true that, if light is particulate and the particles are independent of each other, there is nothing between them to dilate.

My new particle theory of light derives from consideration of the generation of particles of light at source, which is the acceleration of electrons in a chemical bond through the medium of space (1). The electromagnetic induction that this flow of electric current causes, forms rotating electromagnetic dipoles or REDs in the medium of space which is composed of polarisable microgranules (2). These little 'whirlpools' of light are in fact what we see as light. They are then ejected by the magnetic

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component into space, through which they travel at the speed determined by the nature of the medium of space itself, the speed of light. The RED is not like a rotating compass card. Rather it is composed of successive alignments of microgranules of space resulting in a progressive spiral (3). Absorption of a particle of light occurs when it collides with an atomic structure of matching resonance in a detector. Light thus transfers energy through the medium of space from the atomic structures which generate it to the atomic structures which absorb it.

Nevertheless, there are numerous everyday applications of electromagnetic radiation which claim to use the Doppler principle to detect motion of a body, though it is not always clear whether it is change of frequency which is being detected or simply measurement of time-intervals.

If this is to be reconciled with the proposed theory of light cited above, we need to examine critically the processes involved at the fundamental level. In addition it is necessary to establish the relationship between electromagnetic radiation and the Inertial Resistance Factor  $R$  that imposes the ultimate limit on velocity, which is the speed of light  $c$  (4). It also relates to the concept of measurement of absolute velocities through space, which convention claims cannot be done, even though the speed of light which is the same everywhere at all times in all physical models provides a degree of freedom against which measurements can in principle be made.

The first step is to distinguish between reflected and emitted light, because Doppler effects are claimed for both indiscriminately.

### B. Reflected electromagnetic radiation

Astronomers use reflected electromagnetic radiation to measure the distance from Earth to planets as far away as Saturn. Radar pulses are directed to the planet from a ground-based station, and the reflections from it are detected. The distance to the planet is calculated from the minimum time for the pulses to reach the planet and return at the speed of light. The radius of the planet is calculated from the difference between this minimum time and the maximum time, which is taken to be when the pulse is reflected from the side of the planet. The planet's rate of rotation is calculated from the Doppler frequency shift between the electromagnetic radiation reflected from the approaching limb of the planet at which the frequency increases, and that reflected from the receding limb, at which it decreases, because the 'waves' are being respectively compressed and stretched by the motion.

Since there are in fact no waves, the question is how to reconcile the observations with electromagnetic radiation in the form of RED particles. Pulses are sent because it is impractical to send single particles, but the mechanism must operate at the level of the individual particle, because the particles of light in a pulse are independent of each other. Thus the leading point of the RED as described above is the first part of the spiral to hit the surface. However, each successive point on the spiral as it progresses hits the surface sooner than if the body was stationary relative to Earth. Thus the whole spiral contracts in length as a result of the reflection process. The RED which returns to Earth will make more rotations per centimetre than the one which was sent, which will be detected as an increased frequency or shorter 'wavelength'. Hence the Doppler shift.

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The corollary of this mechanism would be that the high velocity of light causes a linear separation measured along the axis of the spiral between the successive oriented microgranules of which the RED is composed. The reflection process reduces this separation. If the reflecting surface were approaching fast enough, the spiral would flatten and ultimately become a disc, which might be described as plane-polarised. The same effect might be achieved by repeated reflections of reflected light, each of which would cause the length of the spiral to decrease. This is similar to the process by which laser light is generated.

If the reflecting surface is receding, the opposite process occurs. As the RED progresses, successive parts of the spiral would hit the surface later than they would a stationary surface, because the surface moves away during the process of reflection. The axial distance which separates the successive polarised microgranules would therefore increase. The reflected RED will therefore make fewer rotations per centimetre progressed, which is detected as a lower frequency.

A static analogy might be the compression and stretching of a spiral wire spring.

REDs therefore have three dimensions, even if they can be detected only in the line of sight in which they are travelling: they have the two dimensions which are inherent in the concept of rotation and spirals; but they also have length which is measured along their axis of rotation. This length conveniently corresponds to the 'wavelength' that it would have, if it were a wave, which is why the term is so useful.

However, this is subject to the process of reflection. Reflected light is different from incident light because of the shortening or lengthening of the RED spiral. The rotation of the RED is not affected by reflection; it does not speed up or slow down, but is just sent back whence it came. However, light also travels at the same velocity  $c$  in vacuo, and this does not change during the process of reflection; only the direction changes i.e. by  $180^\circ$ . Taken together, these two factors mean that during the process of reflection the simple equation:

$$\text{frequency} \times \text{wavelength} = \text{velocity of light}$$

no longer holds. The putative wavelength has been changed independently of frequency. What registers at a detector is the frequency, because detection is the interaction of matching oscillations i.e. resonance. A process which involves plane-polarisation would be needed to discriminate between incident and reflected REDs.

This model treats a particle of light like a ball bouncing off a wall. It says nothing about the nature of its interaction with the atoms of the reflecting surface, which requires a deeper analysis of the response of their electronic structures. It simply demonstrates how Doppler shifts could work for reflected light. Energy is a different consideration. If reflection were considered to be a secondary source, the Planck relationship would indicate that the higher frequency of light reflected from an approaching surface means a higher energy level, and the converse for a receding surface. Light itself has no momentum because it has no mass and it always travels at the same speed, but reflected light could still be considered to transfer energy from the

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reflecting surface to the detector, both of which have mass. This would be heat energy, a transfer between electronic structures of atoms.

This analysis applies to all electromagnetic radiation, but in practice it may be difficult to observe with visible light because of the much higher frequency of the RED.

### C. Emitted electromagnetic radiation.

Emission of electromagnetic radiation from a distant source is a different system. Astronomers attribute changes of frequency such as redshift to the Doppler effect, but the following analysis shows that this cannot be the fundamental mechanism.

Atoms and their electronic structures are homogeneous through time and space. Anything else would make scientific nonsense, because it would mean that atoms came in different brands in different places. For example, the element sodium in its ground state on Earth must be indistinguishable from the element sodium in its ground state on a distant planet/galaxy. This identity includes not just the charges on the nucleus and the number of electrons but also their disposition i.e. the energy levels associated with their displacement. This comprises both the chemical properties of sodium and its spectral emissions when electronically stimulated.

So the electronic transition on Earth is the same as the electronic transition which occurs on the distant planet/galaxy. Since this electronic transition gives rise to the emission of the characteristic yellow sodium light, it must be the same spectral line at the same frequency.

This emission does not depend on the velocity of the emitter, because it would mean that the line observed on Earth would have to be a 'standard' which depended on the velocity of Earth, whatever that happens to be, and all sodium lines from other places would have to be measured against it. In fact we believe the sodium line to be Universal, whatever the relationship to Earth of the body on which it is measured. Anything else would mean that energy relationships, and the chemistry, changed from place to place in the Universe. This would make life very difficult! One would have to go to make measurements, though reaching a planet which has a significantly different velocity through space with respect to Earth would not be easy.

The Doppler argument proceeds from this point. You cannot sit on the surface of an atom to see this emission; you have to observe it from a few centimetres away by eye or through a spectroscope. However, this identical light particle has been separated from the structure which generated it and launched into space to travel independently at the speed of light. What effect could the velocity of its source then have on its frequency as a RED, and by what mechanism? And why should it differ from what happens on Earth?

The conclusion must be that, if the sodium line is found to have redshifted when observed from Earth, something must have happened to it in transit from its source (or 10 cms from the source!) to our observation on Earth. Thus the astronomical and (why not?) cosmic redshifts which we observe must therefore occur during transit of the

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RED through the medium of space, and depend on the distance travelled and the environment through which it passes (5).

A mechanism for this has been proposed which involves the generation of a secondary RED by electromagnetic induction by the primary RED. Since there is no input of energy during the transit through space, sharing the energy of the primary RED with the secondary RED would reduce its rate of rotation (6).

Lenses can also be used to send light back to its source, but this is a different process, one of redirection rather than repulsion. This depends on the interaction of light inside the material of the lens, which is not relevant to Doppler. However, this may offer an opportunity to test the theory that redshift is caused by transit of the RED through space. Lens systems have been left on the Moon by astronauts having a configuration which redirects laser light to the Earth station which sent it. The distance to the Moon has been calculated from the time for a pulse to make the return trip at the speed of light. There is no reason for the pulse to change during this process except in intensity, because the Moon moves very little radially, and then very slowly, with respect to Earth. If the return pulse was found to decrease in frequency, it would be confirmation that redshift was indeed caused simply by transit through the medium of space (op.cit.).

### D. The Inertial Resistance Factor ( $R$ )

My development of a radioactive clock, which measured time-intervals completely independently of conventional timekeeping (7), showed that the concept of time-dilation was invalid. The argument is the exact parallel of that used against the interpretation of redshift as the motion of stars and galaxies.

- The clock measures time-intervals purely by counting the number of 'sparks' emitted.
- The sparks are events which are completely independent of each other.
- There is nothing between these events to dilate.
- Therefore the concept of time-dilation is meaningless.

This throws into doubt the whole basis of Relativity, which depends on the inflation of the dimensions of physics.

A different model is therefore needed to account for the increasing difficulty of accelerating particles of mass as the speed of light is approached. My solution is to rehabilitate the medium of space, an 'update' of the 'ether', which was believed by Newton and Faraday but abandoned by Einstein, because it was not needed in his Theory of Relativity. The medium of space causes inertial resistance to acceleration, which results in the emission of particles of light of ever decreasing 'wavelength', as the velocity of light is approached. In other words, the acceleration gives rise to little 'whirlpools' in the medium of space as mentioned in the Introduction.

Light particles are emitted when charged masses are accelerated through the medium of space, but this must apply to all masses, charged or not. However, the only way we have of testing the phenomenon at velocities comparable to the speed of light is by charging particles of mass and putting them through an accelerator. The processes of

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collision in the Universe at large may have other mechanisms, though they too involve the atomic and subatomic levels, and so charged particles in their turn.

The frequency and energy of the light particle emitted depend on the velocity of the mass at the instant of acceleration. There is a hyperbolic relationship called the Inertial Resistance Factor  $R$  between the force required to produce unit acceleration and the velocity of the body with the asymptote at  $c$ , the velocity of light. The reason is that acceleration causes the emission of increasing proportions of applied energy in the form of electromagnetic radiation, which results in progressively smaller increases of kinetic energy, until at the velocity of light  $c$  all inputs of energy are radiated away, and no acceleration, and so no increase of velocity is possible.

The physical basis of the phenomenon is shown in the following diagrams (Figure). The orbit of the electron becomes elliptical and its eccentricity increases when the velocity of the atom becomes comparable to the speed of light. Since the electron is orbiting around the nucleus at a velocity comparable to the speed of light, say one tenth, for half of the orbit it is required to move much faster through the medium of space than the atom and its nucleus as a whole. It therefore requires hyperbolically increasing force to accelerate it. Maximum acceleration in the elliptical orbit is reached at the point at which the electron is rounding the focus, according to Kepler's Second Law. This is the point at which the RED or particle of light is ejected into space in the direction of travel of the atom, perpendicular to the orbit of the electron, by the action of its magnetic component. The energy and the frequency of the RED therefore increase hyperbolically with the velocity of the atom and its electronic structure through space.

This phenomenon cannot account for redshift because the electromagnetic radiation is always of a higher, not a lower frequency. Deceleration does not produce electromagnetic radiation. However, it could produce the blue shift of the few galaxies which astronomers believe are approaching us. It would be a property of galaxies rather than stars, because stars are relatively 'well mixed' or homogeneous bodies. By contrast galaxies are differentiated, because they are composed of many different stars. They may well contain regions which are able to act as electromagnetic accelerators of some of their constituent bodies, and so produce high energy i.e. blue radiation.

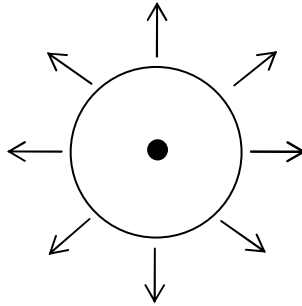
However, every action has an equal and opposite reaction. If galaxies send blue radiation in the direction of Earth, and of course it would not be visible from other directions, then there must be an equal and opposite movement of massive bodies within the galaxy in the opposite direction i.e. away from us. This movement would not be visible in the radiation which reaches us, because it would be emitted in the opposite direction i.e. away from us. In any case the combination of bodies which produced the acceleration would almost certainly accelerate much less than the body producing the blue shift.

This phenomenon raises the possibility of measuring an absolute velocity through space. This is considered to be impossible, but in fact there is already an absolute velocity through space in the form of the velocity of light *in vacuo*. In principle it ought to be possible to measure velocity anywhere in the Universe by measuring back

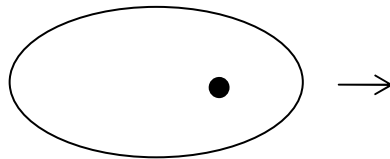
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from this yardstick. This is impossible in practice because the only way of making the measurement would require the use of the speed of light to measure times, which takes the argument round in circles.

Nucleus and orbit of electron



i. Atom at rest, particle of light from electronic stimulation emitted in any direction.



ii. Atom travelling at  $0.95c$ , particle of light emitted in the direction of travel from the point of maximum acceleration.



iii. Atom travelling at  $0.99c$ , particle of light emitted in the direction of travel from the point of maximum acceleration.

Figure. Configurations of atomic structure at increasing velocities through the medium of space. Maximum acceleration of electron when rounding the foci.

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Nevertheless, it is possible to cause a measured acceleration of a particle of mass, such as an electron, and detect the frequency of light which is emitted. If this is characteristic of a particular velocity through space, the velocity of the source can be calculated by simple difference. This is described in previous publications (8).

### E. Conclusions

- Particles of electromagnetic radiation are not spheres but REDs which progress in the form of spirals having defined lengths.
- This length is what is described as the wavelength for radiation which has been emitted by stimulation of an atom in the ground state.
- Reflected electromagnetic radiation can justifiably be described as showing a Doppler effect.
- The reflected RED is compressed or expanded by the reflection process, and so it differs from the incident light in plane-polarity.
- No Doppler effect is possible for emitted electromagnetic radiation. Frequency shift must have some other cause.
- REDs are emitted when atoms travelling at velocities comparable to the speed of light are caused to accelerate.
- Such REDs are increasingly focused in the direction of travel, and they increase hyperbolically in frequency of rotation with velocity.
- There may be blue-shifted emissions as a result of electromagnetically driven acceleration of a body towards Earth in some galaxies.

Emissions from stationary atoms are a special case of the inertial resistance phenomenon, in which a displaced electron accelerates back to its ground-state. As a result of the attraction between the positive charge on the nucleus and the negative charge on the electron.

AC Sturt

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