[198]Chamberlain, J. A. 1971. Shell Morphology and the Dynamics of Streamlining in Ectocochliate Cephalopods. *GA* 3(7):524.
[199]Lominadze, T. A. 1966. Assymmetry of the Suture Line in Late Jurassic Ammonites. *DE* 171:241.
[200]Ward. 1976. *op. cit.*, p. 459.
[201]Vermeij, G. J. 1977. The Mesozoic marine revolution: evidence from snails, predators, and grazers. *PB* 3(3):247.
[202]Mutvei, H. 1975. The mode of life in ammonoids. *PZ* 49(3):197.
[203]Packard. 1972. *op. cit.*, p. 292.
[204]Kullmann, S. and J. Wiedmann. 1970. Significance of Sutures in Phylogeny of Ammonoidea. *UP* 47, p. 2.
[205]Arkell. 1957. *op. cit.*, p. L97.
[206]Christensen, W. K. 1976. Paleobiogeography of Late Cretaceous belemnites of Europe. *PZ* 50(3):114.
[207]Chamberlain, J. A. 1976. Flow Patterns and Drag Coefficients of Cephalopod Shells *PA* 19(3):560.
[208]Westermann, G. E. G. 1973. Strength of Concave Septa and depth limits of fossil Cephalopods. *LE* 6(4):383.
[209]Saunders, W. B. and D. A. Wehmann. 1977. Shell Strength of *Nautilus* as a depth limiting factor. *PB* 3(1):83.
[210]Miller, A. K. 1949. The Last Surge of the Nautiloid Cephalopods. *EV* 3:231.
[211]Teicher, C. and R. C. Moore. 1964. Introduction. *TP* K2
[212]Scott, G. 1940. Paleoecological Factors Controlling the Distribution and mode of life of Cretaceous Ammonoids in the Texas area. *JP* 14(4):308.
[213]Haas. 1973. *op. cit.*, p. 543.
[214]Barskov, I. S. 1974. Structure of the Protoconch and Ontogeny of the Belemnites (Coleoidea, Cephalopoda). *DE* 208(1-6):218.
[215]Hallam, A. 1975. Evolutionary Size increase and longevity in Jurassic bivalves and ammonites. *NA* 258(5534):493.
[216]Wiedman. 1969. *op. cit.*, p. 1002.
[217]Arkell. 1957. *op. cit.*, p. L119.
[218]Chamberlain, J. A. and G. E. G. Westermann. 1976. Hydrodynamic Properties of Cephalopod Shell Ornament. *PB* 2:330.
[219]Tozer. 1971. *op. cit.*, p. 1002.
[220]Sakharov, A. S. and T. A. Lominadze. 1971. Ecological Interrelationships of Middle Callovian Ammonites from the Northeastern Caucasus. *DE* 196:227.
[221]Brenner, K. 1976. Ammoniten-Gehause als anzeiger von PaleoStromungen. *NP A* 151(1):101.

A SOLUTION TO SEEING STARS

DAVID M. HARRIS*

Received April 24, 1978, revised from February 14, 1978.

The question is sometimes raised: how distant stars, created only a few thousand years ago, could be visible even now, let alone at the Creation. Here a solution to the problem is proposed. The solution also offers an explanation of the red-shift of the light from stars, without any need of assuming that the universe is expanding.

Introduction

I was very interested to read the article by Lewis Neilson[1] on Certainties, Less Than Certainties, and Evolution. I was struck by the one problem that arose in the article, and would like to introduce a theory that would attempt to answer Mr. Neilson and many other Creation Scientists. This theory is completely speculative, with no experimental evidence to back it up as yet; but it does answer certain points that are difficult to explain in a young universe. This is not a fully developed theory; and I would welcome any contributions of further development that other members, perhaps more qualified than myself, could make. The question is how can we see stars that are apparently billions of light years away, if the universe is only thousands of years old? The answer proposed not only deals with that question, but also proposes a reason, not requiring expansion of the universe, for the red-shift observed in starlight.

The Problem

While I was pondering the difficulty of reconciling the fact that we can see stars that are apparently billions of light years away, with the fact that the universe is probably only thousands of years old, I suddenly remembered what a colleague from my university suggested to me last year: "What if the speed of light were only nearly always constant?" Suddenly a theory formed in front of me, and I would like to present this to the members of the Society.

*David M. Harris, B.Sc., lives at Unit 85, Frimette Court, 740 Kennedy Road, Scarborough, Ontario, Canada.

Since God created the stars on the fourth day, and apparently they were visible on the sixth day to Adam and Eve on the Earth, if the stars were indeed billions of light years away, we have the problem of how this would be possible at a finite speed of light. As rightly noted by Mr. Neilson, some Creationists propose the theory that a continuous span of light was also created by God from the star to the Earth. However, assuming the stars were billions of light years away, there is another possible answer.

A New Model

When Sir Isaac Newton put forward the laws of motion, they were true, up to a point, that of relativistic laws proposed by Einstein. It is quite possible that Einstein's postulation of the constancy of the speed of light is also only true up to a point. Suppose that it were not constant over all time or space, we could build another model of the universe on this.

Suppose that at the time of creation the speed of light were in fact infinite, then the stars would be seen immediately they were created. However, we do know that in this portion of the universe, at this time, the speed of light is not infinite, so somewhere there must have been a change. It is reasonable to assume that this change came in with the fall of man, as did many other changes such as decay and death, or as many creationists believe, the second law of thermodynamics. (See Genesis 2:17-19, Romans 5:12).

Obviously if this meant that everywhere the speed of light became a constant, that of 300,000 kilometers per second, c, we would have exactly the same problem as before. In fact the position would have been even worse

for Adam and Eve since all the stars would disappear for at least four years (the nearest star being four light years away). Worse even than that, the whole Earth would be in total darkness for 8 minutes, until light from the Sun could again reach the Earth, or be reflected from the Moon.

However, suppose we assume that at the fall a boundary, spherical in shape (though the shape is not important) moved out from the Earth at a set speed. This could almost be the reaction of the universe to sin entering into it, recoiling in shock, much as ripples on a water surface would react to a pebble dropped into it. Inside this boundary the maximum speed of anything, in particular electro-magnetic radiation, was c. However, outside the boundary the speed of light was still infinite. As will be mentioned later in this article, it would be a better model if we assume something like diffusion, i.e., that the speed of light increased at a certain rate out from the boundary, and did not become infinite until an infinite distance had been reached (i.e., it tended to infinity). Or at least it did not become infinite until a sufficient enough distance to make it not noticeable from our vantage point on the universe. For simplicity, however, we will for the moment take the model that outside the boundary the speed of light was infinite. For this model we will say that the boundary was expanding at a velocity v, this being some velocity less than that of the speed of light inside the system.

Observations from the Earth

Under this system the change in the appearance of the heavens to Adam or Eve would be a dimmer, redder Sun for a short time and stars red shifted at night. Since the boundary is receding from the Earth at velocity v, and the instant the light leaves the Sun it arrives at the boundary, this can be considered as if the Sun's light were emitted from the boundary. If the emission frequency of the Sun's light is f, and the frequency received at the Earth is f', the Doppler effect gives a change of $f' = fc/(c + v)$, which is a reduction of frequency, or a red shift.[2] The brightness, or power emitted per unit of time, would be similarly reduced. Also, instead of seeing the heavenly bodies as they were at the time of observation, they would start to see them as they were some time prior to observation time. The time taken for the light from fairly distant objects to reach the Earth would be independent of the distance from the Earth, to begin with. (Reflecting bodies would act a little differently, as I will discuss in a moment.) The length of time for the light to reach the Earth will purely be a function of the position of the boundary from the Earth (i.e., its radius), for all light emitters outside the boundary. In Figure 1 it is obvious that since the speed of light between the star and point B is infinite, the moment the light is emitted by the star, it will arrive at the boundary. If r is the radius of the boundary in units of light years, it will then take r years for the light to reach the Earth from this point, i.e., point B to the Earth E. Since during this time that the light was travelling to the Earth at speed c, the boundary was travelling in the opposite direction at speed v, at any point in time when the boundary was of radius r, observers on Earth would see the light emitted from objects outside the boundary

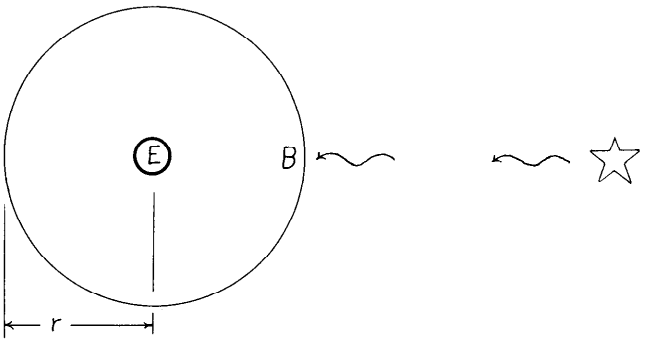

Figure 1. E is the Earth, and B the boundary. The time for the light to go a distance r light years (where its speed is not infinite) is r years; that applies inside the boundary. But at infinite speed, light from the star arrives at the boundary B instantaneously. Thus the total time taken, from the star to the Earth, is r years. These drawings, of course, are not to scale.

$r/(c + v)$ years ago. See Figure 2. If we assume that the fall was, say, 6,000 years ago, then at the present r would be equal to 3,000 light years, for $v = c/2$. Any star farther away than 2,000 light years would be seen as it was 2,000 years ago, regardless of its distance.

Other Observations

The only slight change in the appearance of the heavens, other than that of the Sun, which could have been noticed from the Earth would have been that of bodies reflecting light, for instance planets, which were farther from the Earth than the Sun was at the time of the fall. While the Sun was outside the boundary such reflecting bodies would still be seen, but reduced in brightness, and redder. See Figure 3. Consider Jupiter, for instance. The sunlight would travel to Jupiter and back to the boundary instantaneously, then to Earth in the few minutes that light would take to traverse the distance from the boundary to the Earth at speed c. Since the boundary is receding from the Earth at velocity v, and the instant the light is reflected from Jupiter it arrives at the boundary, it can be seen that this is the same as the situation for the sun as described above, and the frequency received at the Earth f', is $f' = fc/(c + v)$.

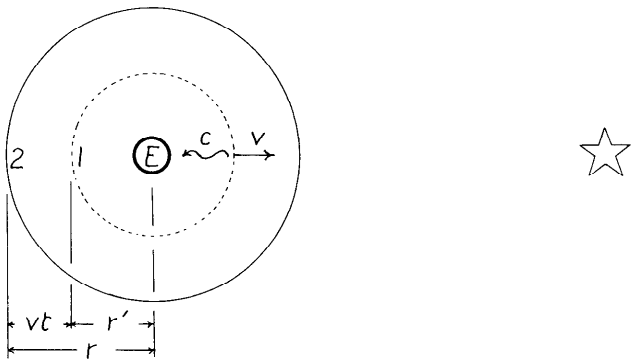

Figure 2. Suppose that the boundary was at the place shown by the broken circle at a certain time, and continued away from the Earth at speed v. Meanwhile the light proceeded toward the Earth at speed c, taking a time $t = r'/c$ to reach the Earth from the boundary at position 1. During this time, the boundary expanded to radius r, by an amount vt. Thus $t = r'/c$, and also $r - r' = vt$. So $t = r/(c + v)$. If r is in light years, t would be in years.

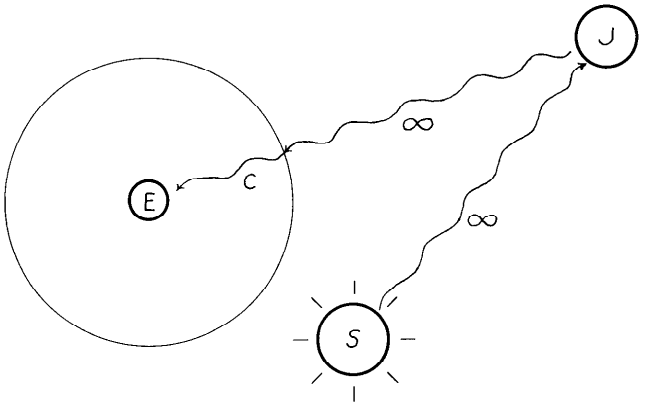

Figure 3. While the Sun was outside the boundary, reflecting bodies, such as Jupiter, indicated by J, were seen reduced in brightness and redder than now. These conditions might be called level 1 of color and brightness.

The power reflected per unit of time, or brightness, will follow a similar reduction. However, as soon as the boundary passed the Sun, the speed of light going from the Sun to Jupiter would reduce to c. This would mean that as an observer on Jupiter watched the Sun it would become dimmer and redder. The reason for the brightness and color change is basically the same as for what the Earth observer saw. Since the speed of light from the boundary to Jupiter is infinite, as light reaches the boundary, it reaches Jupiter. Since the boundary recedes from the Sun at velocity v, the frequency received on Jupiter, f', compared to the frequency emitted from the Sun is $f' = fc/(c + v)$. The brightness, related to the power output per unit time, will diminish to the same extent as the frequency, for the same reason. After striking Jupiter the light would return to Earth, be red-shifted and reduced in power once more, as in the above calculation; and Jupiter would become dimmer and redder even than before; and f'', the frequency seen on Earth from the reflection from Jupiter would be: $f'' = f(c - v)/(c + v)$ (Figure 4). In fact all light in the direction of the boundary would reduce in intensity and red-shift.[3] The reason is that the light would have to pass through the boundary, and as it penetrated the boundary it would be slowed down to speed c, red-shifted and dim. It would continue at this speed until it caught up with the other side of the boundary, where once again it would red-shift and dim.

The Earth observer would continue to see Jupiter for a further 8 minutes at level 1 of brightness and color, after the boundary had passed the Sun, until all the light that had already reached the boundary had travelled to the Earth. After 86 minutes at velocity $v = c/2$ of the boundary, the observer on Jupiter would again see the Sun at its normal brightness and color since the boundary would have reached the planet by then. The light would then journey to Earth taking approximately 86 more minutes. This would mean that Jupiter would have been at this lower level, level 2, for a total of $(2 \times 86) - 8$, or 164 minutes.

However, this may not have been noticed by the two Earth observers present at the time, since they were preoccupied with hiding from God, and making clothes out of fig-leaves (Genesis 2:7-10). Anyway, since this occurred probably in the afternoon where Adam and Eve were situated, looking at Genesis 2:8, even if Jupiter were above the horizon it could not have been seen in the daylight.

A Closer Consideration of the Nature of the Boundary

If we look carefully at the composition of the boundary, it could be seen that it could not be a two-dimensional wave (i.e., a spherical shaped surface), expanding out from the Earth. For if it were, light from a given star would arrive at all places on the half of the boundary facing it, in phase. According to Huygen's principle these places would act as secondary sources, and being all in phase would give spherical waves converging on the Earth. Or, looking at Snell's law of refraction, since the index of refraction inside the boundary would be infinite relative to the outside, the light would be refracted normally to the surface, i.e., radially, focusing on the Earth.[4] This would effectively spread the star's light out over the whole of the hemisphere. Since this is not observed, the boundary must be viewed as being diffuse, probably stretching out infinitely before the speed of light was actually infinite. This would answer another problem that would arise with a discrete boundary. With the discrete boundary all stars outside the boundary would be red-shifted by the same amount, the same as the Sun while outside, which is not borne out by observation. However, with a diffuse boundary the red shift would depend on the distance the star was from the Earth (or the boundary which is proportional to the distance from the Earth). This is the fact observed about the red shift. Also it may make the stars seem further away due to the reduction in brightness because of slowing through the boundary and the effect of apparent depth. The difference in substituting a diffuse boundary for a discrete one is largely a matter of degree, so the points mentioned remain true

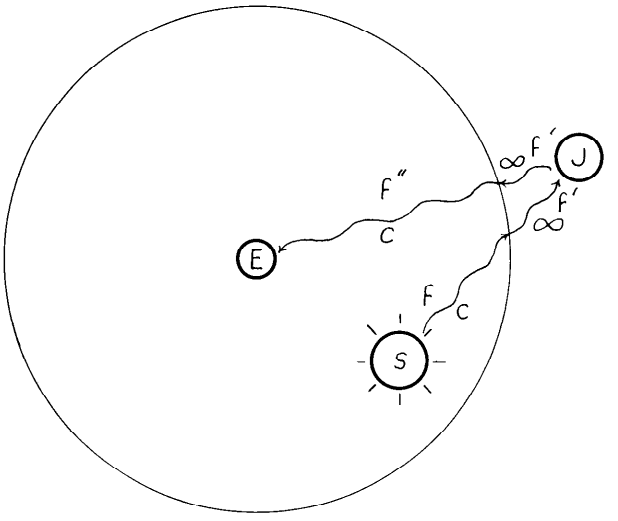

Figure 4. When the boundary passed the Sun the light was slowed down. Moreover, as the light passed through the boundary it was red-shifted, and reduced in brightness. So it became quite dark on Jupiter for a time; and on Earth, Jupiter was seen (if anyone noticed) at what might be called level 2 of color and brightness.

qualitatively where they may change quantitatively; and it is easier to demonstrate the situation using a discrete boundary.

Suggestions for Further Development

Members may like to pick up the ball at this point to try to develop the following points:

1. What kind of red shift would appear for various stars?
2. What would be the effect of the variation of the speed of light gradually with distance from the Earth?
3. What would be the effect on formulae containing the speed of light as a constant; which ones would change and which ones would not?

Conclusion

I realize that this is just an initial idea, but I feel that this theory could probably be refined by other readers, and I would welcome their expansions or opinions of it. However, this does provide at least one alternative to the problem raised, without the question arising of God showing us things that never occurred.

Acknowledgments

I should like to acknowledge the help of Mr. Harold Armstrong, M.Sc., in preparing this paper, and of Mr. Mike Leich-Devlin, B.Sc., in giving me the original idea.

References

[1]Neilson, Lewis, 1977. Certainties, less than certainties, and evolution. *Creation Research Society Quarterly* 14(3):180-182.

[2]See the discussion of the Doppler effect in the part on waves of any elementary work on physics.

[3]Oddly, this last result is just what a relativistic treatment would give. A relativistic treatment of the previous case would give a somewhat different result; but provided v be somewhat less than c the actual difference would be negligible.

[4]These matters are considered, under optics, in any elementary work on physics.

Incidentally, effects of Snell's law might arise in other cases, such as when the Earth and the Sun were inside the boundary, but Jupiter outside it, as considered. However, such points may be left for later consideration.

VARIATION AND FIXITY AMONG LIVING THINGS. A NEW BIOLOGICAL PRINCIPLE

FRANK L. MARSH*

Received November 21, 1977

This article lists the processes of variation which occur among plants and animals, and shows that a true fixity exists in nature at the level of the basic type. The presence of discontinuities between basic types is shown; and a new biological principle is stated: the Principle of Limitation of Variation among Organisms. This principle may be stated as follows: processes of biological variation can go no further than to produce new variants within basic types already in existence.

Variety

One of the delightful things in our natural world is the abundance of objects which challenge our physical senses. In the matter of *number* of living forms alone, taxonomists tell us there are well over one quarter of a million "species" or "kinds" (ignore the distinction for the moment) of plants, and one and one quarter million "kinds" of animals. No wonder we have trouble in our gardens!

There is indeed great variety among the different basic kinds of plants and animals, but in this article I wish to discuss the variation in form and structure which occurs *within the basic types.* By basic types I refer to animals as different as dogs and horses, and to plants as different as roses and sunflowers.

Fixity

The second noun in our title is "fixity" which, as a biological term, comes to us by way of the teachers of theology in the great church-connected universities of Europe. (Which all were, until not long ago.) What was taught in the area of origins by the theologians in these schools during the eighteenth and nineteenth centuries is made clear by the English historian Sir William Cecil Dampier as follows:

> "The emphasis laid by the Protestant Reformation on the verbal inspiration of the Bible led to a more literal interpretation, and by the eighteenth century an acceptance of the details of the story of organic creation, as given in the first chapter of Genesis, became necessary to orthodoxy. In the nineteenth it was apparently believed by almost the whole Christian world."[1]

For in the early nineteenth century (in contrast to the situation today, when much scepticism may be found even in schools of theology) most academics (most of whom were then clergy) accepted Genesis quite literally. Many even went beyond the literal reading, it appears, and declared that the expressions in Genesis 1, "after his kind," "after its kind," "after their kind" (See New American Standard Bible), meant that *no variation* could occur within the basic kinds. Furthermore, these theologians apparently taught that the plants and animals had been created in their forms of that day and set on the earth in the very areas where they were found in the 1820's. (It is hard to see how such a belief would

*Frank L. Marsh, Ph.D., is Professor Emeritus of Biology at Andrews University, and lives at 216 Hillcrest Drive, Berrien Springs, Michigan 49103.