

for atheists to claim that it only marks the beginning of the universe as we know it. In other words, the empirical evidence does not prove anything.

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## Explaining the Pioneer effect?

Dr Russell Humphreys has sought to explain the ‘Pioneer effect’ in terms of a cosmological model in which the dominant large-scale gravitational influence is due to a massive shell of ice, the present form of the ‘waters above’ of Gen. 1:7, enclosing the observable universe.<sup>1</sup> He claims success in predicting the observed sign and magnitude of the effect, an anomalous sunward acceleration apparent in spacecraft radar data.

Unfortunately his model and the analysis he presents seem to raise more questions than provide answers. I believe it would be helpful to readers to see his responses to some of the following issues:

1. Humphreys’ equation (10) is misleading. The definitions of  $d\tau$  and  $d\ell$  for proper time and proper distance respectively in equations (11) and (12) are perfectly correct in the right context;  $d\tau$  is defined for a *timelike* spacetime interval ( $ds^2 > 0$ ) and  $d\ell$  for a *spacelike* interval ( $ds^2 < 0$ ),<sup>2</sup> which are mutually exclusive cases. Thus they cannot be placed together in an equation for a spacetime interval. However, equation (10) is correct for the special case of a photon, which will propagate along a null geodesic ( $ds^2 = 0$ ), provided that  $d\tau$  and  $d\ell$  refer to proper time and proper distance for a *stationary observer* and not for the photon itself, for which these differentials

both vanish. In fact Humphreys’ analysis of the Pioneer effect does proceed in terms of  $d\tau$  and  $d\ell$  as measured by an observer, but this does not correspond to the normal understanding of the terms proper time and proper distance.

2. Humphreys uses arbitrary values for the mass and present-day radius of the postulated shell of ice; his values are merely those required to give an apparent Pioneer acceleration matching the observed value. Thus the only genuine prediction of his model is the *sign* of the apparent acceleration.
3. Humphreys’ analysis produces a result depending only on the Hubble constant and on the speed of light; no local parameters (e.g. the observer-spacecraft distance or the speed of the spacecraft) are involved. Thus his analysis should apply to *any* astronomical body, in particular to those for which we may have precise, repeated distance measurements, and whose motion is controlled by well-characterised forces. This certainly applies to the moon,<sup>3</sup> to other spacecraft and possibly also to other planets and asteroids. Has the relevant data ever been checked for a possible ‘Pioneer effect’? I have personally never seen such reported except for the spacecraft noted by Humphreys.
4. Humphreys implicitly assumes an infinite propagation speed for gravitational effects. This conflicts with the prevailing view that these propagate at the speed of light,<sup>4</sup> which would imply a lag amounting to billions of years between the motion of the ice shell and its gravitational effect on the solar system. It would seem incumbent on him to at least comment on this point, which is likely to have a considerable impact on his analysis.
5. The critical potential  $\Phi = -0.5c^2$  discussed after equation (25) corresponds to Humphreys’ ice shell having a radius equal to its Schwarzschild radius. Thus if

equation (25) is close to present reality, the universe has expanded relatively little (19%) since it emerged from a white hole. This raises the questions of when, in terms of biblical or Earth history, the universe emerged from its white hole, and what happened on Earth before then, given that it must have been in a timeless zone (cf. Humphreys’ reference 39)?

6. According to Humphreys’ equation (13), the proper distance traversed by a photon as measured by a stationary observer is related by the speed of light to the proper time taken, i.e. the distance in light years is numerically equal to the time in years. This is simply a basic principle of general relativity. If Creation took place 6,000 years ago in an Earth-based frame of reference, which is Humphreys’ stated position (p. 64, second column), we should only be able to see objects within 6,000 light years. Numerous astronomical objects with well-established distances should be beyond view—the Galactic Centre, globular clusters, the Andromeda galaxy M31, and so on<sup>5</sup>. Thus Humphreys’ model seems to fail against the old problem of ‘distant starlight in a young universe’.

Unless the above issues can be satisfactorily addressed for this model, it is difficult to see its value as an addition to the cosmological models already available to creationists.

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1. Humphreys, D.R., Creationist cosmologies explain the anomalous acceleration of Pioneer spacecraft, *J. Creation* 21(2):61–70, 2007; <[www.creationontheweb.com/images/journal\\_of\\_creation/vol21/5181creationist.pdf](http://www.creationontheweb.com/images/journal_of_creation/vol21/5181creationist.pdf)>.
2. Carroll, B.W. and Ostlie, D.A., *An Introduction to Modern Astrophysics*, Addison-Wesley, Reading, MA, pp.651–652, 1996.
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- See Fomalont, E.B and Kopeikin, S.M., The Measurement of the Light Deflection from Jupiter: Experimental Results, *Ap. J.* **598**:704–711, 2003, references therein, and the ensuing literature trail.
- Note that for these particular objects the redshift is either zero or negative. Thus the stretching of space between the times of emission and observation of photons is not a complicating factor.

### Russell Humphreys replies:

I appreciate Dr Worraker's calling attention to my proposed solution of the Pioneer spacecraft mystery.<sup>1</sup> His doctorate is in engineering mathematics, so I was glad to see that he didn't criticize my math, particularly my derivation of a new, exact solution of Einstein's gravitational field equations. Instead, he wants answers to questions going beyond the scope of my paper. His sketch of my model, 'a cosmological model in which the dominant large-scale gravitational influence is due to a massive shell of ice', is somewhat misleading. First, my end note 40 suggests the 'waters which were above the expanse' (Genesis 1:7) are not a solid shell of ice but rather (by now) a thin shell-like region consisting of a tenuous cloud of ice particles. Their total mass is great simply because they cover such a large area. Second, that model is not essential. I wrote that many different distributions of matter in the cosmos would give the same results. I chose the 'shell' model as an example because Psalm 148:3, 4 (NAS) implies that waters presently exist beyond the highest galaxies:

'Praise Him, sun and moon;  
Praise Him, all stars of light!  
Praise Him, highest heavens,  
And the waters that are above the heavens!'

A recent article I wrote for non-scientists about the Pioneer effect gives more details about this basic biblical cosmos.<sup>2</sup> Here are answers to Worraker's numbered points:

- Cosmologists routinely use the terms 'proper time'<sup>3</sup> and 'proper distance'<sup>4</sup> exactly the same way I did. However, since the names of the variables do not affect my equations at all, as Worraker

acknowledges, the issue is irrelevant to my conclusions.

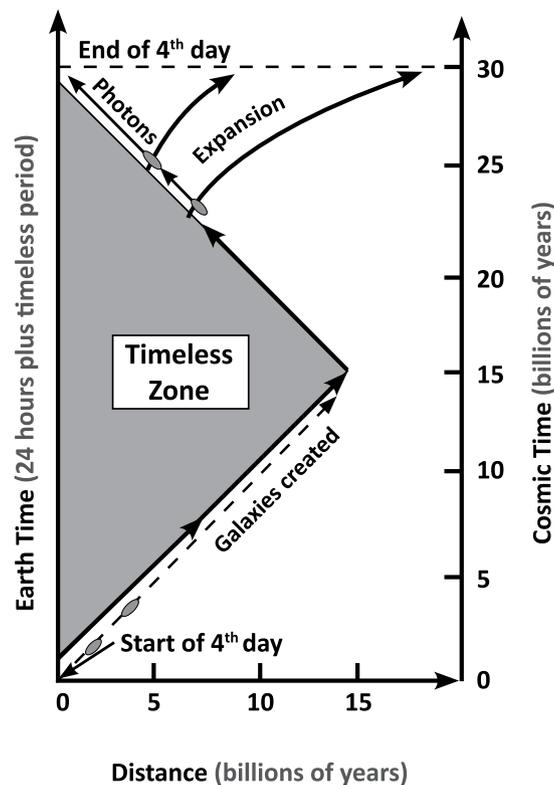
- The fit of model to data is not nearly as arbitrary as Worraker claims. Yes, I adjusted a theoretical 'knob' (the depth of the gravitational potential 'well') to match the observed Pioneer data. However, as I remarked in the conclusion, the resulting knob setting is about what we would expect from a model that has to have large time dilation in the earth's recent past. If the required potential had been more than 25% shallower or 10% deeper than the range of values in eq. (24), I would have been reluctant to offer my model as a solution.
- In my ref. 12, the JPL team concluded that the Viking spacecraft ranging data show no Pioneer-type effect for Earth and Mars.<sup>5</sup> After modifying my solution of Einstein's equations to include the Sun's gravity, and calculating geodesics (the set of possible paths through spacetime), I think I understand the reason. If I'm correct, the effect would not show up on objects with roughly circular orbits (like planets and satellites), but only on objects with highly eccentric orbits or hyperbolic trajectories (like outward-speeding spacecraft). I hope to present this in a later paper.
- I didn't assume 'infinite propagation speed', and neither do Einstein's equations. My new solution of those equations implies a continuous, smooth stretching of the fabric of space going on simultaneously everywhere with no acceleration or deceleration. Many

Old Testament verses<sup>6</sup> describe such an expansion, such as Isaiah 40:22, (NAS):

'[God] stretches out the heavens like a curtain,  
And spreads them out like a tent to dwell in.'

The stretching carries the shell of waters outward, not the other way around. The lack of 'jerking' in the motion of the fabric or shell means that there are no waves to propagate.

- Apparently Worraker missed my end note 25, which partially answers him. More detailed answers will have to wait on a future paper.
- Wrong. As a student of relativity, Worraker should remember to distinguish between time as measured on Earth and time as measured further out in the cosmos. Perhaps he did not understand my 2001 approach to the light travel time problem.<sup>7,8</sup> Figure 1 is an updated version of the key figures



**Figure 1.** Space-time paths of timeless zone and light rays. Cosmic time is time measured by physical clocks at a great distance.

in those letters. I suspect that he could not imagine why the timeless zone would expand and contract at the speed of light, forming straight diagonal edges in the graph. End note 25 of my Pioneer paper should help him visualize a reason. However, this is another of those questions which are outside the purview of the Pioneer paper, again requiring patience until a further paper can appear with more details. Dr Worraker's conclusion, 'Unless the above issues can be satisfactorily addressed for this model, it is difficult to see its value as an addition to the cosmological models already available to creationists.' expects the impossible—that a scientific paper answer in advance all the new questions it will stimulate! I've answered each of Worraker's questions, to my satisfaction if not to his. But I'm surprised he does not see the value I mentioned in the paper: it provides evidence against big bang theories and for creation cosmologies.

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## Just plain ordinary water?

I admire the stamina of DeRemer, Amunrud and Dobberpuhl<sup>1</sup> in offering a detailed commentary on a section of Scripture about which everybody has deeply-entrenched and idiosyncratic opinions, the first four days. While the authors stay within a good basic framework—ordinary-length days, no 'gap', and stars completed on the 4<sup>th</sup> day—they offer enough details to stimulate everybody to gallop off on some hobbyhorse or another. The one I ride here at least has the advantage of illustrating a very important principle in Scripture interpretation, the principle of trying to take all the Scriptures on any given topic as straightforwardly as possible. On page 71, the authors finish their 'Earth' section by saying:

'Conclusion: The original fluidic 'earth' is not seawater or H<sub>2</sub>O, but a primitive liquid-like substance (like quark soup?) from which first particles and atoms, then bodies in the cosmos, will be made, as shown next.'

In this they are saying that the word for 'waters' in Genesis 1:2, 6, 7 and 9 is not to be taken straightforwardly, but instead as code for some other material. One problem I have with that is that there are plenty of ways in Hebrew for God to have said 'primitive liquid-like substance' with great accuracy. And in a parallel New Testament passage, 2 Peter 3:5 (NAS), '... the earth was formed out of water and by water', there are even more ways to say 'fluid-like' in Greek, rather than using the word that means literal 'water'. If it were indeed 'quark soup', it would have been an enormously hot, fully ionized material, and a much better word would have been 'fire.'

But God chose none of those options. Is He a poor communicator?

But the passage itself offers strong evidence that God meant ordinary liquid water. In verses 6 and 7 He divides up the original body of water into two parts, one above the expanse (firmament) and the other below it. Then in verses 9 and 10 He gathers the part of the waters below the expanse into one place and then calls the gathering 'seas'. The pre-Flood seas probably were less salty than today's seas, which gained a lot of salts by erosion as the waters ran off the continents at the end of the Flood. The created seas probably had only as much salt as God allowed them to have by erosion when the dry land appeared. My point is that the lower part of the original body of water appears to have been ordinary water. Thus the most straightforward thing to imagine is that the original, undivided waters were also just plain ordinary liquid H<sub>2</sub>O.

As some readers may recall, I built a theory about the origin of planetary magnetic fields on this startling foundation ... that when God said 'waters', He meant it.<sup>2</sup> Remarkably, the theory not only matched observed magnetic properties of solar system bodies, but also correctly specified the magnetic properties of several solar system bodies *before* they were observed: Uranus, Neptune<sup>3</sup> and the Martian crust.<sup>4</sup> This fit of theory and data could not have happened for any other originally-created material than H<sub>2</sub>O. I would have thought such success would encourage all creationists to take the Genesis record more straightforwardly.

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