Creation cosmologies, old and new

Dr Phillip Dennis devotes a great number of equations[1] to trying to refute the relativistic basis I derived 13 years ago[2] for my second cosmology, published a year later.[3] I feel like he is beating a fossil horse, because for the last few years I have been working on a new cosmology, a third, which has very little resemblance to my first two cosmologies.

The problem I now see with my first two is that they do not pay enough attention to how God says He made the cosmos in Genesis Chapter 1. Three verses there strongly imply that the speed of light in the heavens during the first four days of creation was very great. Chapter 1 also implies that the speed of light on Earth was normal at all times, and that the speed of light in the heavens slowed down to normal just before the end of the fourth day. I have only vague ideas about how He changed the speed of light so drastically. But none of today's creationist cosmologies, including my first two, take account of these vital facts from the Bible. I hope to publish a fuller explanation of the scriptural constraints soon.

However, it is still important to know if the relativistic basis for my second cosmology is correct or not, because it applies to the spacetime within the 'waters above the heavens', which still exist today at great distances from us (Psalm 148:4). Let me point out some of what I think are Dennis's errors:

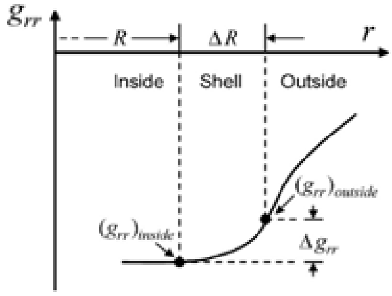

Figure A1. The metric coefficients must be continuous from outside to inside the shell.

1. Continuity across boundaries is necessary

A crucial error is that he thinks solutions of Einstein's equations do not have to be continuous across their boundaries. Figure A1 from my 2007 paper shows how I disagree, claiming that the metric coefficients (such as g_{rr}) should be continuous at two boundaries, inside and outside the mass shell. All physically possible solutions to differential equations, of which Einstein's equations are an example, must meet boundary conditions. A confusing factor here is that Dennis makes the shell have zero thickness and infinite density, a delta function, which is physically unrealistic. My solution is for a shell of finite (although small) thickness. A respected relativity textbook (to which Dennis himself refers on a different topic) says:[4]

> "In the absence of a delta-function surface layer [at a boundary $\boldsymbol{\Sigma}$] … the intrinsic geometry of $\boldsymbol{\Sigma}$ must be the same as seen from above and below,
>
> g_{ij} continuous across $\boldsymbol{\Sigma}$ (21.169)"

The textbook equation is saying that the metric coefficients g_{ij} must be continuous across a boundary. That directly contradicts Dennis. The next item is an example of how his mistake undermines much of his thinking.

2. Dennis's alternative solution lacks continuity

Dennis's pair of equations (8) are his alternative solution to the mass shell problem. But they are discontinuous at radius R, as he himself said. He saw nothing wrong with this because of his error above. So he did not look for a way to make them continuous. However, a suitable transformation of the coordinates in the first of the equations could solve the problem. Let us transform the coordinates in his first equation, which I will call eq. (8a), so that we have

$$dT^2 \rightarrow (1 + 2\Phi)\, dt^2 \quad (1)$$

$$dr^2 \rightarrow (1 + 2\Phi)^{-1}\, dr^2 \quad (2)$$

$$r^2 \rightarrow (1 + 2\Phi)^{-1}\, r^2, \text{ where} \quad (3)$$

$$\Phi = -\frac{M}{R} \quad (4)$$

If the radius of the shell, R, is constant with time, then the transformations are merely scale changes, making them clearly valid. Then his equations (8a, b) become the same as mine, and he would have continuity inside and outside the shell. But Dennis says his eq. (8a) is supposed to be valid for R changing with time also. If a changing R makes the transformations above invalid, then he would have to find a different solution for his continuity problem here.

3. Potential inside an expanding shell actually changes

Dennis's continuity error leads him into a related error, a serious one. He thinks the gravitational potential inside the shell of mass does not change with time when the radius of the shell changes. I think it does. I am guided by what happens in several similar physical systems governed by similar equations. One has to do with electric potential (voltage). The second figure of my 2007 paper, which I am here calling figure A2, applies just as well to electric potential as it does to gravitational potential. It shows how the electric potential at and inside a negatively charged spherical shell would increase as one slowly (much less than

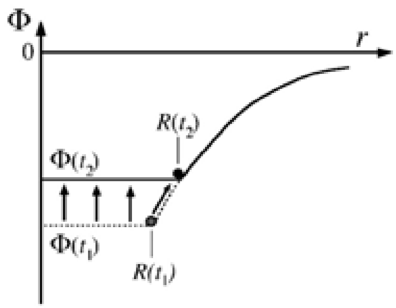

Figure A2. Increasing (from time t_1 to time t_2) the radius R of a negatively charged shell increases the (negative) electric potential Φ inside the shell.

the speed of light) increases the radius of the shell. This follows directly from simple electromagnetics and continuity of potential from outside to inside the shell. A voltmeter whose probes touch the outer surface and ground would register a negative voltage. That voltage would become less negative as the shell expands. However, the voltage difference between inside surface and outside surface would remain nearly zero throughout the expansion. Endnote 50 of my 2007 paper discusses this situation with more technical detail and a reference to a physics journal.

Another paper of mine[5] discusses a two-dimensional approximation to Einstein's equations, the mathematics of a trampoline depressed by a heavy ring. The depression is flat inside the ring. If we slowly increase the radius of the ring, the depression will rise up. The fabric inside the ring would remain flat, but it would also rise up. So the depth of the depression inside and outside would decrease. The fabric remains continuous from outside to inside of the ring. The depth of the depression (the deviation from the fabric's position with no ring) corresponds exactly to the gravitational potential as I am using it in Einstein's equations. This analogy implies the gravitational potential is continuous from outside the spherical shell to the inside, and that the potential inside the shell increases as the radius of the shell increases.

Figure A3. Trampoline illustrates gravitational potential.

4. Dennis validates my solution for the static case

Without emphasizing the point, Dennis acknowledges that my metric, his equation (9), is an exact solution for the case that the shell radius and potential Φ do not change with time. That was something I did not know before I did my 2007 derivation, and that was the main reason I did it. He made the point mathematically in his eqs. (10) through (15) by putting my metric into the Einstein equations and turning the mathematical crank. His eqs. (16), (17), and B(2) through B(4), give the results. The right-hand sides should be components of the momentum-energy tensor, $T^i{}_j$, the source term in the Einstein equations. I now agree with Dennis that this tensor should be zero inside the shell. Notice that if Φ does not change with time, all the right-hand sides will be zero. That means my metric is an exact solution for the static case.

Notice that my solution is isotropic, the same in all three space directions. For it to be correct suggests that the transformation I used to make my solution isotropic, my eq. (A44) and his eq. (20), is not the 'major mathematical error' Dennis claims it is. That is probably because the time rate of change of the potential is zero in this case.

5. Toward a time-dependent solution

When the time rate of change of the potential, $\dot{\Phi}$, is small, then the right-hand sides of Dennis's eqs. (16), (17), and B(2) through B(4) are close to zero. That would happen if the rate of change of the shell radius R were small compared to the speed of light. In that case my static solution would be a good approximation to a time-dependent solution.

But it would be helpful to have an exact time-dependent solution. Dennis's proposed alternative interior metric, eq. (8a), is not obviously time dependent. But the analogy in figure 3 suggests that a time-dependent solution exists.

Furthermore, eq. (8a) represents a flat space. But if we were to suddenly increase the radius of the ring in figure A3 at close to the speed of sound in the fabric, the fabric just inside the ring would rise before the fabric further inward would move. That would generate a wave of rising fabric moving inward toward the centre at the fabric's speed of sound. That means the fabric inside the ring would not be flat for a while, but rather slope downward toward the centre. Only after we stop the ring's outward motion, and then wait for the waves to dissipate, would the fabric inside the ring become flat again, now at a higher level.

So there are several things wrong with eq. (8a). First, it fails to connect to eq. (8b) at the shell radius R. Second, it fails to increase the potential when R increases. Third, the potential fails to have a slope when R increases rapidly.

It looks like there is something wrong with the derivation of eq. (8). Dennis's *ansatz*, eq. (1), requires $g_{\theta\theta}$ and $g_{\varphi\varphi}$ to be static and independent of Φ. That appears to lock him into a static solution which is independent of potential. Perhaps if he had started with the isotropic initial metric he used in his eq. (11), which has more general forms for $g_{\theta\theta}$ and $g_{\varphi\varphi}$, he might have found a more realistic solution.

6. The mathematics needs to connect with the physics

While Dennis criticizes other things, I think I have responded to the arguments that are essential to his case. He makes serious errors, but he is correct in saying that my solution is not exact for an expanding shell. However, that is true for his alternative metric also. It falls short of being physically plausible. His proof that my static solution is exact is helpful to me, and I am grateful for that.

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