Centre of the universe

I have a question about the existence of a 'centre' in the big bang. I recently picked up the updated and expanded edition of Stephen Hawking's *The Illustrated: A Brief History of Time*. On pages 8–9, he states the following:

> 'Newton realized that, according to his theory of gravity, the stars should attract each other, so it seemed they could not remain essentially motionless. Would they not all fall together at some point? In a letter to Richard Bentley, another leading thinker of his day, Newton argued that this would indeed happen if there were only a finite number of stars distributed over a finite region of space. But he reasoned that if, on the other hand, there were an infinite number of stars, distributed more or less uniformly over infinite space, this would not happen, because there would be no central point for them to fall to.
>
> 'This argument is an instance of the pitfalls that you encounter in talking about infinity. In an infinite universe, every point can be regarded as the centre, because every point has an infinite number of stars on each side of it. The correct approach, it was realized only much later, is to consider the finite situation, in which the stars all fall in on each other, and then to ask how things change if one adds more stars roughly uniformly distributed outside this region. According to Newton's Law, the extra stars would make no difference at all to the original ones on average, so the stars would fall in just as fast. We can add as many stars as we like, but they will still always collapse in on themselves. We now know it is impossible to have an infinite static model of the universe in which gravity is always attractive.'[1]

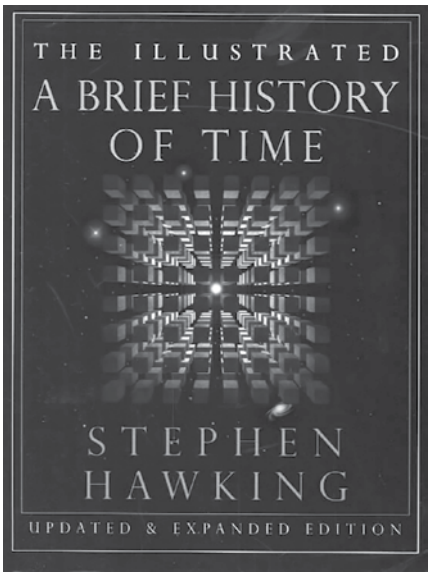
This first caught my attention because I have been re-reading the 'Starlight and Time' debate that took place in *Journal of Creation* 1998–2000. In that debate, the issue of a centre of the cosmos was a major point of contention. Conner and Page made the identical point as Hawking does above. Humphreys responded not only by pointing out what he saw as the absurdity of such a claim, but also quoted Steven Weinburg who said:

> 'On the other hand, if matter were evenly dispersed through an infinite space, there would be no center to which it could fall.'[2]

This issue is something that has bothered me since I first read it in the *Journal of Creation* debate. The contention that Hawking makes above and Conner and Page make in the debate appears absurd.

First, as Humphreys has repeatedly pointed out, they butcher the definition of the word 'centre'. Secondly, it seems that the claim that all objects outside the chosen radius of the 'finite situation' (henceforth 'Extra Stars') would have no gravitational effect, thus the stars would still fall to the centre, is illogical. For instance, take Earth as the centre and the distance to Alpha Centauri as the radius. According to Hawking, we can ignore the gravitational effects of the 'Extra Stars'. If I understand correctly, you would then estimate the mass of this 'finite situation' in order to calculate the gravitational forces. But what happens if now I want to double the radius? Do the gravitational forces increase accordingly? Do the stars that before had no gravitational effect suddenly contribute to the equation merely because I imagined an increase in my radius? This just doesn't seem to make sense. Humphreys makes this same point in regard to the 'centre':

> 'Point C [Conner/Page's arbitrarily chosen centre] is an arbitrary artefact of their method of analysis, existing only in the mind of the analyst. Another analyst might place C in a different place. Yet the Newtonian cosmos they postulated is static, motionless on a large scale. That means the forces they derive should be measurable, and therefore physically real. For example, we could measure the directions of the forces with a plumb line. So how could the derived forces be physically real if they are to point toward a purely mental location? Would the plumb line change its direction if we were to change our mental placement of the 'adopted origin of coordinates'? The answer is, no — something is clearly wrong with their derivation … their *conclusion* is illogical [emphasis in the original].'[3]



Of course, Conner and Page were postulating an infinite static universe in the debate; exactly what Hawking is above claiming that we know to be impossible. Despite this, it seems that Humphreys' statement would apply logically whether the cosmos were static or not. If Newton was right, what of Hawking's last sentence above, 'We now know it is impossible to have an infinite static model of the universe in which gravity is always attractive.'[1] Is Hawking simply coming to this conclusion by way of his assumption of an infinite universe?

Last, and related to the second point, isn't it also necessary to consider not what gravitational effect the 'Extra Stars' have *per se*, but what gravitational effect adjacent 'finite situations' have on our 'finite situation'?

Take Alpha Centauri as the centre of an adjacent 'finite situation' and the distance to Earth as its radius. Would not, at the very least, the stars that the two 'finite situations' share be pulled in both directions and thus, to some extent, cancel one's effect on the other? (As Hawking says, every point can be considered the 'centre'. So every star would be being pulled in all directions all the time. The Copernican Principle seems to require this.) To me, Newton's conclusion is valid. Of course, not being a physicist, I might be completely missing the boat here.

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References

1. Hawking, S., *The Illustrated: A Brief History of Time,* the updated and expanded 10th anniversary edition, Bantam Books, pp. 8–9, 1998.
2. Weinberg, S., *The First Three Minutes: A Modern View of the Origin of the Universe*, second paper edition, Basic Books (Harper-Collins), NY, p. 32, 1993. As quoted in: Humphries, D.R., Starlight and time: a response, *Journal of Creation* **14**(2):74, 2000.
3. Humphries, D.R., Starlight and time: a response, *Journal of Creation* **14**(2):73–74, 2000.

John Hartnett replies:

In some regards both Humphreys and Hawking are correct, but we must be very careful to understand the inherent limitations in their models.

If we start with the Hawking situation, where the universe was infinite and perfectly smooth, then Humphreys is correct in that there is no *preferred* point towards which the matter would concentrate. The problem is that the universe would still need to contract. However, without a preferred point it would want to contract toward *every point in the universe*. In other words, the energy content of any point would become infinitely large. So Hawking is correct, you cannot have a static universe where gravity is only attractive. But the result is still an infinite universe with infinite density.

If we however start with a distribution of matter that is not perfectly smooth, there would be an imbalance of forces. Thus, there would be a preferred point or points towards which matter would concentrate. The result would be an infinite universe with special points that have infinite density, but still no single centre.

The current big bang model uses the Friedmann–Lemaître–Robertson–Walker (FLRW) metric, which describes the first situation with the difference that spacetime curvature allows the infinite to become finite yet still without a boundary, i.e. unbounded—therefore no real centre. This is the result of allowing one of three situations: 1) a closed and finite universe that is curved back on itself in a hypersphere, 2) a flat, infinite, open and unbounded universe that follows Euclidean geometry and 3) a negatively curved, infinite, open universe. Observations now seem to indicate we are in number 3.

Humphreys' model for the universe has a boundary but still admits space-time curvature using a metric similar to FLRW. This boundary introduces another term into the solution of Einstein's field equations that contains a definite point in space that can truly be called a real centre for the entire distribution.

So how do we reconcile observation (number 3) with a finite universe? I believe it is simple. The expansion state of the universe (accelerating) may indicate that we are in a number 3 type but it doesn't automatically follow that the matter distribution is infinite. In fact, the most logical conclusion from Scripture is that the universe is finite. So why not a finite ball of galaxies embedded in an expanding open universe of infinite extent? This means there would be a preferred point towards which the force of gravity would be focused as in Humphreys' model—the centre. And the evidence suggests that centre is on our Galaxy.

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Translating Psalm 19:4

Andrew Kulikovsky asks a question in his article 'Scripture and general revelation'[1] which I will now answer for him: 'How then should verse 4 [of Psalm 19] be translated?'

Using Scripture to interpret Scripture, the answer to the textual portion, at least, of Mr Kulikovsky's question is found in Romans 10:18's quotation of this very passage, where qôlām is rendered as φθογγός or 'sound'.

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References

1 Kulikovsky, A.S., Scripture and general revelation, *Journal of Creation* **19**(2):23–28, 2005.

Andrew Kulikovsky replies:

Daniel Buck suggests, based on the quotation in Romans 10:18, that קולם is rendered as φθογγός or 'sound' in line with the principle that 'Scripture interprets Scripture'. While this 'principle' is often cited and used by evangelical creationists, it is nonetheless overly simplistic and somewhat circular. If we use Romans 10:18 to interpret Psalm 19:4, then what Scripture do we use to interpret Romans 10:18—Psalm 19:4? Moreover, what were the Jews and the first century Christians outside of Rome supposed to use to interpret Psalm 19:4? They did not have access to the book of Romans.

Secondly, English translations of Romans 10:18 do not render the Hebrew קולם (qôlām, 'their voice') at all. Romans 10:18 is a direct quotation of the LXX. It renders the Greek φθογγός (phthoggos, 'voice', 'sound'). As I pointed out in my paper, the LXX does not follow the Masoretic text which has קום (qăwwām, 'their measuring cord'), and which I argued could be rendered as 'extent'. In