

Chapter 23

The Light Sphere

All down through history human beings have used the sky to impose order on their lives. In Genesis 1:14, God says of the Sun and Moon and various lights in the firmament that their purpose is “*to divide the day from the night; and let them be for signs, and for seasons, and for days, and years*”.^a

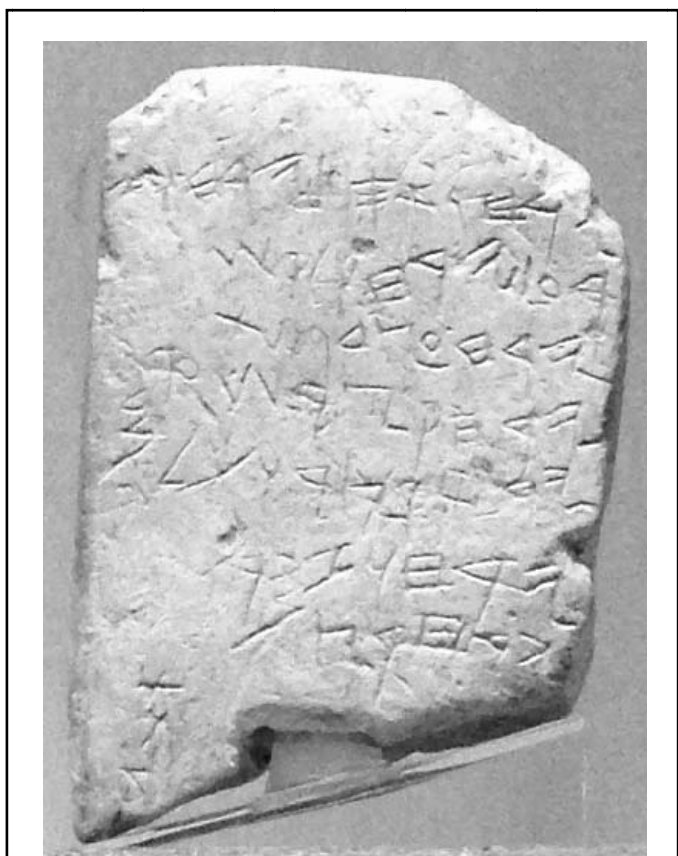


Fig.1 The Gezer Calendar
3000 years old, discovered in 1908 near Jerusalem, it ascribes duties such as harvest to specific months.

Every civilisation devised its own calendar. The wise men of ancient Chaldea gazed up into the sky from their purpose-built observatories, followed the Sun and mapped out the constellations, imbuing the spellbinding patterns with life and searching within them for meaning. From the standpoint of history we may regard their efforts as crude and unsophisticated, even misguided, as they enlisted the occult to explain why the sky revolved and some stars ‘wandered’ whilst others did not. But they were the scientists of their day, and they did their best with what they had – a clear sky, a ziggurat, and an unsearchable enigma. To solidify their theories they would enshrine them in myth. Small wonder... they probably just got fed up changing them!

Around 2,000 years later, in 1608, the telescope was invented, and we can only imagine how thrilling it must have been for the contemporaries of Galileo to view the soap-bubble surface of our cratered Moon for the very first time. And as brilliant men figured out the motions of the planets, God’s job was in jeopardy – which was strange, seeing as he was all in favour of them doing it

in the first place! The main thrust of what came to be known as the Copernican Revolution was the scientific discovery that the Sun rather than the Earth is at the centre of the solar system, which, on the face of it, says very little about God. Questions arise, such as: ‘*What does the Earth going round the Sun have to do with the centre of the universe?*’ ‘*Isn’t the Big Bang at the centre?*’ and ‘*How does man knowing these things mean there is no God?*’

In my view, confusion arises here because we are trying to compare *grasshoppers* to *aeroplanes* to *cheese*. So first...

- *Grasshoppers:*

In terms of the Solar System the Copernican Revolution was a breakthrough because it corrected the mathematics of what we observe. However, interestingly it is not even true that ‘the Sun rather than the Earth is at the centre’. Why? Because the entire Solar System revolves around its common centre of mass, or barycentre, which moves about a bit according to the position of the planets. Due to the Sun’s sheer size the centre is usually,

^a It’s quite sobering how straightforward, almost scientific, Genesis 1:14 sounds. It’s not as though God said, “*Go ye forth, gaze into the heavens, and come up with a shedload of ridiculous gods and animals.*” And yet the God of the Judeo-Christian scriptures is today less identified with science than with superstition, of which the Bible records endlessly that he disapproves! (E.g. *Isaiah 47:12,13*)

though not always, inside the Sun. So technically the Sun can no more be said to be the centre than the Earth. What is science for if not splitting hairs?

We have to remember that, to the medievals, the Solar System *was* the universe, just as our Milky Way galaxy was to Einstein, so it was all a massive deal to them. Armed with new knowledge, many scientists now believed that the Sun – rather than the Earth – was the centre of the universe; a scientific advancement which enabled the swapping of one erroneous belief for another.

- *Aeroplanes:*

Even the Big Bang is not the universe's 3-Dimensional centre. Artists' renditions of spectacular explosions are highly misleading because scientists now know that the universe has no unique physical centre. However (and this is where the confusion starts), this is not to say that the universe has no centre, because as a 4-Dimensional entity it has as many 'centres' as it has 'points'. You are looking out now from a centre, because every space-time location may be considered a unique vantage point from which the universe may be said to have arisen, bounded by an equal amount of surrounding universe, all with its own customised constellation view, adding up to every conceivable vantage point with every possible constellation permutation! This is not at all easy to wrap one's head around.

More on this as we go...

- *Cheese:*

Of course, heliocentrism says nothing whatsoever about God because nowhere does the Bible state that the Earth is at the centre of the universe. Any reference to the Sun going up, down or around is simply the kind of thing astronomers might say on holiday. But the medieval Church was patron to the scientific mainstream who were clinging on to a geocentrism which stemmed, not from the Bible, but the ancient Greek systems of Aristotle and Ptolemy.

The Church itself was less concerned with space than emphasising the significance of mankind in the eyes of God and by association their own pompous role, which led them, in the words of Pope John Paul II, "*unduly to transpose into the realm of the doctrine of the faith, a question which in fact pertained to scientific investigation.*"^a whereupon also unduly to confiscate telescopes, imprison astronomers if they complained, and burn them if they persisted. But it's ok, they said sorry, *in 1992!!* – although whether from true penitence or just an absurdly belated attempt at damage limitation only God may judge.

In the meantime... hair shirts all round.

Into the Void

The telescope transformed science, but today's astronomers still have a tough job with the universe. It's a far cry from simply looking into the sky and mapping out what they see. The speed of light complicates things because it is relatively slow as it traverses the vast expanse of space – if the Sun stopped

^a *The New York Times*, 1 Nov 1992, <http://www.nytimes.com/1992/11/01/world/vatican-science-panel-told-by-pope-galileo-was-right.html> - Accessed 12th Mar 2016



shining we wouldn't even know about it for 8 minutes! When we look at a star such as Sirius which is a mere 8.6 light-years away from us, we are viewing light that has taken 8.6 years to reach us. What this means is that we are seeing Sirius, not as it is now, but as it was 8 years and 7 months ago! I remember when I was a lad being fascinated to shine a torch up into the winter sky... the photons from that torch (assuming they survived the atmosphere and cosmic radiation) could be well past Sirius by now!

When we gaze in wonder into the night sky, the universe becomes a gigantic 'timescope'. In their book, *Bang!*, Brian May, Patrick Moore and Chris Lintott tell us that, because the light we see coming from the Pole Star right now left it in the early 1600s, *"...any astronomer there equipped with a sufficiently powerful telescope could look at the Earth and see England as it used to be in the time of Shakespeare."*^a

Amazing. But, like everything else, light *itself* only ever exists in the present. The light from Olde England leaves Shakespeare's 'present' and arrives in the Polaris astronomer's

'present', so wherever the light is all along its journey, it is the present. However, what we all *experience* as the present is a different matter. Because light takes time to travel, all around us our eyes view a range of 'moment nows', all of which are in the past. Even the light from this book left it in your past. Only your 'inner now' (whatever that is) coupled with all light currently registering in your brain may be thought of as the present. Therefore, as we look around us there is no visually simultaneous 'moment now' – instead there are 13.8 billion years-worth of them out there, all whizzing around the cosmos in every possible direction in the form of light, experiencing stuff like emission, absorption, reflection and deflection.

Reflection... In addition to this, Einstein showed that relative movement causes each one of us to perceive time in such a way that none of us is able to see happening a 'moment now' on which we can all agree! Relativity has buried forever any idea of universal simultaneity.

Light beams, made up of massless photons – which behave sometimes as a particle, sometimes as a wave – travel at just under 300,000 km per sec, covering a distance of 1 light-year in a year. Therefore, each year we might expect to see farther into the great void by a distance of one light-year, because we see an extra year's worth of light that has been travelling toward us since the beginning of time. However, although the distance into the universe we can see does increase at the speed of light, astronomers tell us it is compounded by the universe's expansion which stretches the travelling light waves themselves (redshift), resulting in an actual radius for the observable universe in the region of (not 13.8, but) 46.6 billion light-years! You will see from this that, according to the current model, over great distances the expansion of the universe outstrips the speed of light.

Who needs science fiction?!

^a Brian May, Patrick Moore, Chris Lintott, *Bang!*, Carlton 2012, P11

Bubble Trouble

We see light from space – variously coloured dots and smudges mostly – which is arriving at us from a certain direction, having travelled a certain distance, from which, by examining the light's spectrum, astronomers are able to glean huge amounts of information, such as whether the source is moving toward or away from us, its speed, and its chemical composition. This is not limited to visible light but extends right through the electro-magnetic spectrum from radio waves to gamma radiation. From this they have been able to accurately 3D map vast areas of the observable universe. And yet – as cosmologist Max Tegmark's graphic shows on P88 of *Our Mathematical Universe*^a – even these are still surprisingly 'local'. The website *Space.com*^b puts it well,

*'Like a ship in the empty ocean, astronomers on Earth can turn their telescopes to peer 13.8 billion light-years in every direction, which puts Earth inside of an **observable** sphere... The word "observable" is key; the sphere limits what scientists can see but not what is there.'*

Astronomers believe the universe to be far larger than the bit we see, but it's not quite as simple as not being able to see anything beyond a certain distance like straining our eyes beyond a distant mountain, because, as far as light is concerned, we live at the centre of a bubble. The observable universe is like a gigantic space-bubble – a sphere – all around us, and due to the finite speed of light the bit we see of the universe is not at all what it *actually* looks like today. The light speed limit means we can never know that. Instead, the farther we look, the farther back in time we see. Astronomers call this 'look-back time', and in the same way that Antarctic ice cores reveal the Earth's climate history, this 3-Dimensional cross-section through deep space cuts a swathe through the entire universe's history, with Polaris still looking Shakespearean, and the farthest objects like tiny faint light-fossils looking exactly as they did long, long, long before the dinosaurs!

Reflection... Light comes to us as information about the past – even the photons currently reflecting off your hand haven't yet reached your eyes. Photons carry all this information throughout the universe, and whatever you, Shakespeare, or the Emperor Nero have done is still there to be watched from somewhere, because the light is moving at the same speed as the unfolding of time itself. Although no-one can go physically back in time, in theory everything that has ever happened in the whole of cosmic history could still be seen happening, from somewhere^c.

The CMB

As a direct result of the speed of light, the extreme surface of this viewable bubble – its perimeter – is like a vast spherical snapshot of the beginning of time, spread like thin butter all around the distant void! Using radio telescopes we can actually still see the Big Bang, or at least detect light still arriving from its immediate aftermath – this is the cosmic microwave-background radiation, or CMB for short. Although accurately predicted in 1948 by Alpher and Herman, it was discovered accidentally by two telephone engineers in 1964 (for which the latter received the Nobel Prize!)

^a Max Tegmark, *Our Mathematical Universe*, Penguin 2015, P88

^b <http://www.space.com/24073-how-big-is-the-universe.html> - Accessed 24th Oct 2015

^c With the exception of black holes, which can't be seen from anywhere due to the fact that they trap the light.

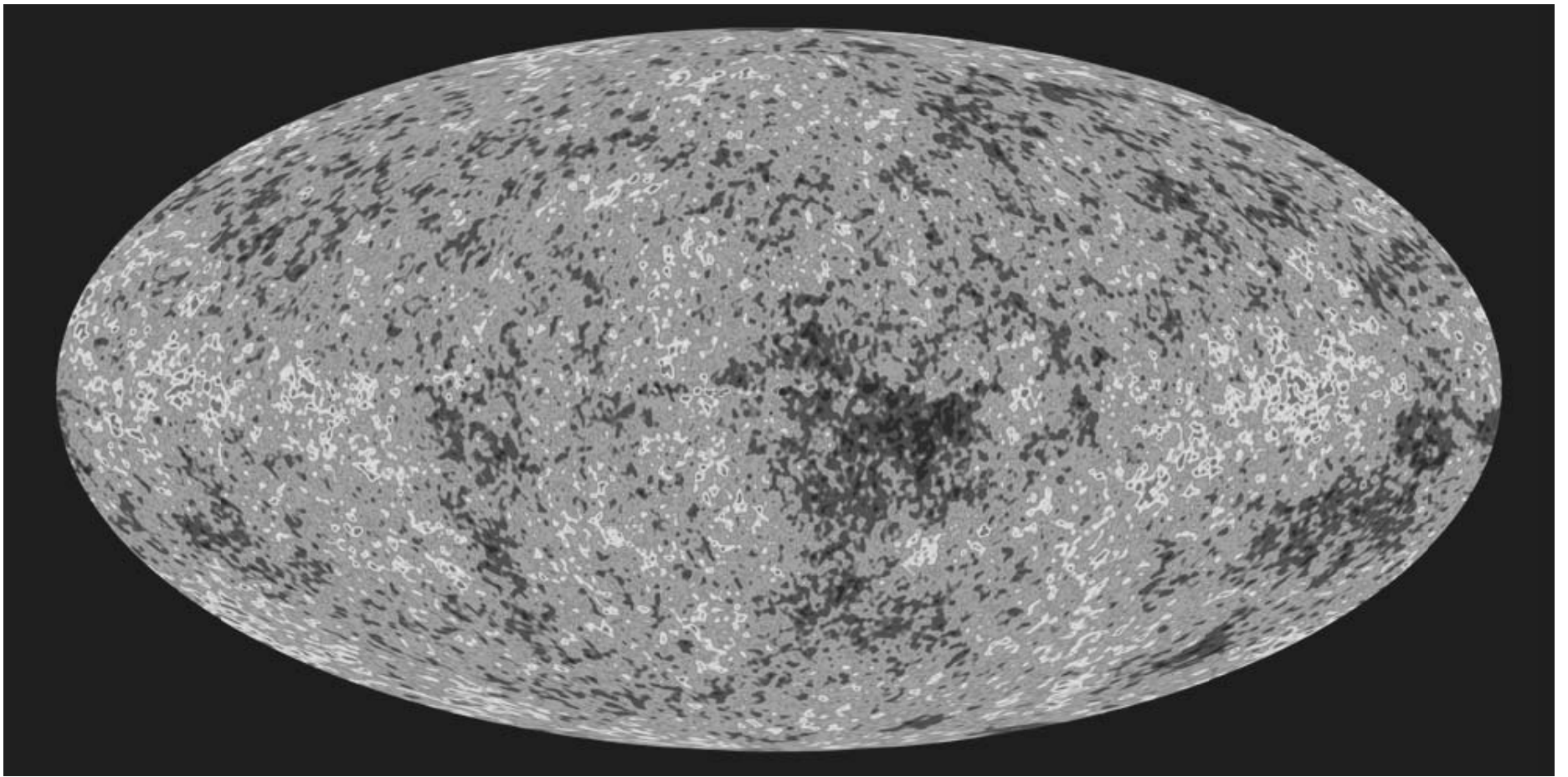


Fig.2 WMAP image of the CMB anisotropy^a.

The cosmic microwave-background radiation, or CMB, mapped over a period of nine years by NASA's WMAP satellite. The oval shape represents a view of the whole sky, with the varying shades exaggerating extremely slight temperature differences around 2.73° above absolute zero.

Also called 'relic radiation', the CMB represents the oldest light in the universe, the result of the release of trapped light in an event known as 'photon decoupling' that allowed the cosmos to become transparent a mere 380,000 years or so after its inception. And because photons everywhere were suddenly able to travel freely, this residual light of creation is everywhere, flying about in every direction and immersing us all like air in a room. The archived site of the Harvard Smithsonian Center for Astrophysics describes it well,

'...we can actually detect the light left over from the era of the Big Bang. The blinding light that was present in our region of space has long since traveled off to the far reaches of the universe. But light from distant parts of the universe is just now arriving here at Earth, billions of years after the Big Bang.'^b

As observers, we experience the CMB spherically all around us because it comes at us evenly from every direction in the sky. However, it has now cooled down to just above absolute zero as its wavelength has been stretched (redshifted), resulting in an extremely weak background 'glow' far below the visible spectrum.

^a "Ilc 9yr oll4096" by NASA / WMAP Science Team - http://map.gsfc.nasa.gov/media/121238/ilc_9yr_moll4096.png. Licensed under Public Domain via Wikimedia Commons -

https://upload.wikimedia.org/wikipedia/commons/c/c1/WMAP_image_of_the_CMB_anisotropy.jpg

^b <https://www.cfa.harvard.edu/seuforum/faq.htm#m10> - Accessed 11th July 2015

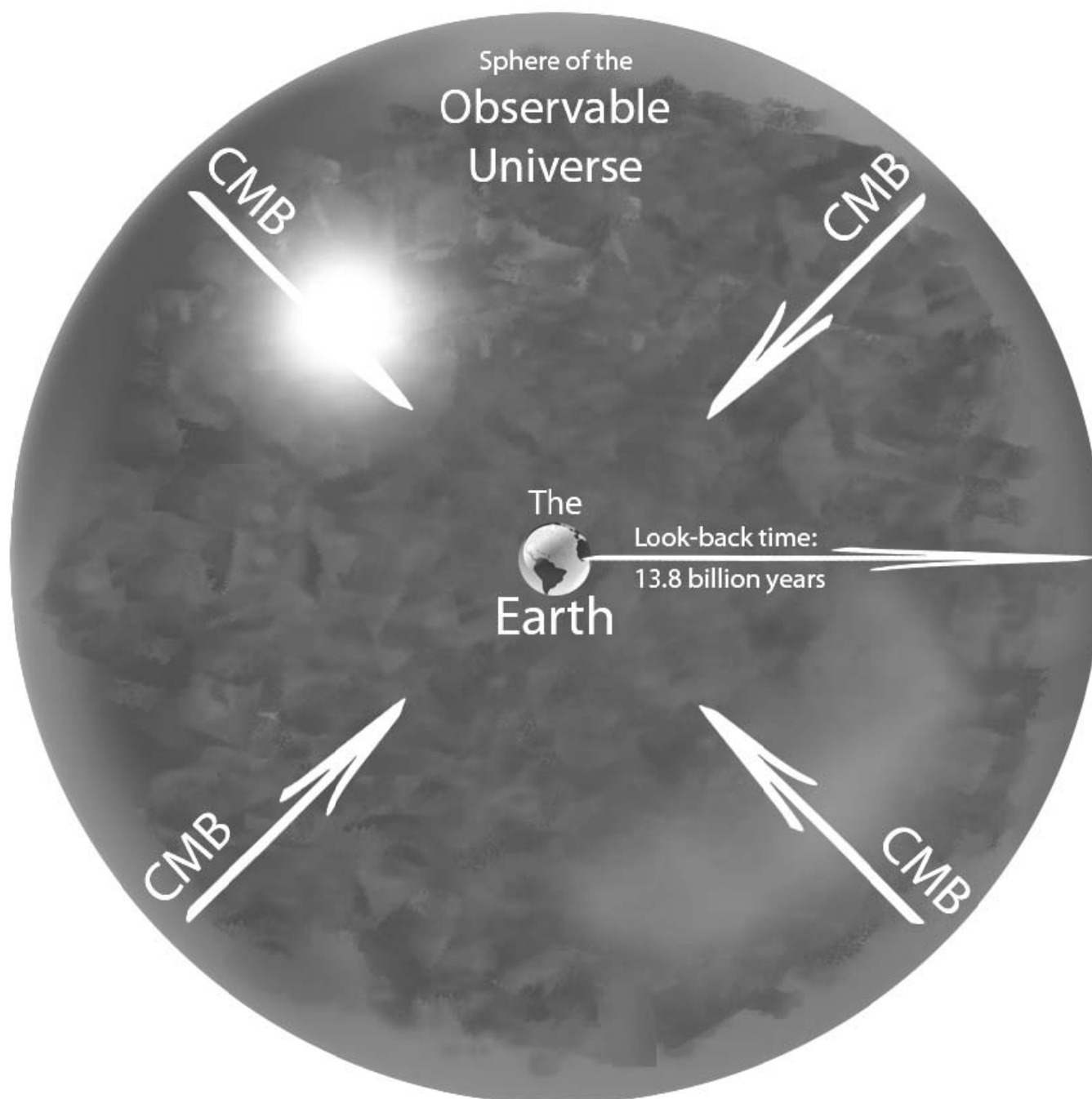


Fig.3 The Earth-bound observer's view of the cosmic microwave-background radiation which arrives from every direction in space – consisting of photons of light which have travelled from every point since the universe was a mere 380,000 years old.

Before this release, the universe consisted of an opaque, white-hot, hydrogen plasma fog. As such the CMB forms an observational barrier beyond which our only means of peering into the Big Bang itself may be through gravity waves. But all this raises more questions than it answers...

Reflection... It's amazing to think that the observable universe forms a light sphere all around us reaching right back to the Big Bang, and although visibility stops a little short due to the physics of that primordial moment, astronomers are able to reach into the beginning of time and observe it happening. What they are viewing may be a 3D spherical cross-section of our 4D 'time-shaped' universe, where time and the physical distance of space become aspects of the same thing.

You're Everywhere and Nowhere Baby

All this begs the question, '*How can light from the beginning of time still be reaching us... wouldn't it have overtaken the Earth long ago?*' Yes it did, it is now, and it always will, because, as the cosmologists tell us, the universe *itself* is not 3D, but in some sense 4D. The Big Bang 'location' happened in 4-Dimensions, and because it was the beginning of space itself, there *was* no outside it. Even the Earth – or the region now occupied by the Earth – was contained within that compacted all-powerful event.

All this is very hard to picture. The problem is it's impossible to imagine what the creation event would have been like at all because, to our knowledge, nothing else remotely comparable has happened. But it's important to understand that it was not an explosion in the traditional sense. Although the universe's origin *may be thought of* as having emerged from a single point – known as the Big Bang singularity – the universe's true 'shape' is 4-Dimensional, which means it happened a dimension up from anything we might picture. And this is the hard bit... that original point was all that existed, therefore, *the origin was everywhere.*

Professor Edgar Andrews, a world expert on explosives, writes,

*'...we need to understand that the big bang was **not** some kind of cosmic-scale explosion in space. If it had been, the universe would be expanding away from some central point at which the explosion occurred.'*^a

Concurring with Andrews, UK Astronomer Royal, Martin Rees informs us,

'The often-used analogy with an explosion is misleading inasmuch as it conveys the image that the Big Bang was triggered at some particular centre. But as far as we can tell, any observer – whether on Earth, on Andromeda, or even on the galaxies remotest from us – would see the same pattern of expansion. The universe may once have been squeezed to a single point, but everyone had an equal claim to have started from that point.'^b

Earlier, in Chapter 9, I concluded the discussion with the following:

because we are able to extrapolate up from Flatland's circle through Spaceland's sphere to Hyperland's hypersphere, the process tells us the shape of the universe. Much cosmological speculation is answered by the simple logic of EA Abbott's *Flatland*, which indicates that:
Our universe is geometrically equivalent to a 4-Dimensional hypersphere.

By applying the basic principles of *Flatland* to our everyday experience we were able to see why it is that each one of us looks out as observer from (not *the*, but) *a* centre of the universe. The earliest point is viewed at the greatest distance in every direction, therefore the observer's centre is, by necessity, the latest point that original light has reached. This is what we find in practice, that looking out into space as far as it is possible to see, the *CMB is always viewed coming at the observer from the perimeter.* And this earliest viewable point – our universe's origin – appears to us as though it were smeared across the inner surface of a sphere.

Reflection... All this results in our and ET's light sphere bubbles, together comprising trillions and trillions of uniquely 'observable universes'. As *Wikipedia* puts it, *'Every location in the Universe has its own observable universe, which may or may not overlap with the one centered on Earth.'*^c

Of course the beginning of the universe isn't really out there on the perimeter now; that's just how it appears after 14 billion years, and the earliest galaxies all probably look much like ours now. It's important to get hold of the fact that the universe *as observed* and the universe *as is* are two very different things, because the one we see is just the view from the centre of our bubble.

^a Edgar Andrews, *Who Made God?*, EP Books 2010, P104

^b Martin Rees, *Just Six Numbers*, Phoenix 2001, P74-75

^c http://en.wikipedia.org/wiki/Observable_universe - Accessed 5th June 2015.

Everyone has an *'equal claim'* because each one of us stands at the centre of our own personalised observational bubble on the surface of which all the light, energy and matter of the universe originated, even when that bubble was tinier than a pin-prick! Light arriving from the perimeter on the surface of the bubble emanated from the beginning of time and we can never see beyond it because *there is no beyond it* to be seen. Counter-intuitively – and this is the key – it is the perimeter where the explosion *begins!* And with the passage of time, as an observer at the spherical centre of one of many trillions of individual point-events *it is you who are getting farther away from that origin from which first light is forever travelling.*

This apparent paradox – that the observer at the centre should be receding from the perimeter (rather than the other way round, which would not offend our sensibilities) – will be examined as we go. The reason it appears not to make sense is because the universe is *actually* 4D, whereas our concept, like our view of it, is 3D – and because of this the Dimensionality of EA Abbott will have much to say. But we will go far toward overcoming this limitation by keeping in mind that all the 3D we see in the moment now is *just one single spherical cross-section* of a greater 4-Dimensional reality which is not directly accessible to the human imagination. We are located within it, therefore we experience the universe one dimension lower in 3D, in accordance with two of our *Flatland*-derived principles: the *Principle of Cross-Sections*^a and the *'Edge-On' Principle*^b.

But all this is just scratching the surface, because this idea of the observable universe as a cross-section of the universe 'proper' holds a treasure chest-load of explanatory power. Methinks the dragon is asleep... let us steal his gold.

^a *The Principle of Cross-Sections:* A lower dimension can experience higher dimensions only in cross-section as they pass through in consecutive slices.

^b *The 'Edge-On' Principle:* Each dimension is viewed from within itself one dimension lower.