Hypersphere Cosmology 2

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Abstract. The author proposes that a reinterpretation of cosmological redshift as arising from the small positive spacetime curvature of a 4-rotating Hyperspherical Universe of constant size can eliminate the current requirement for spacetime singularities, cosmic inflation, dark matter, and dark energy from cosmological models. This second paper further addresses angular diameter at low and high redshifts, and the constant metallicity of the universe.

Introduction. The estimated mass of ordinary baryonic matter in the observed universe equals ~ 10^{53}kg. This would prove sufficient to create a gravitationally closed Einsteinian hypersphere with an antipode length of about 13.8 billion light years. However a static hypersphere of this nature would implode under its own gravity.

Gödel developed a non-imploding version of such a universe stabilised by rotation. However Gödel's solution depended on an ordinary rotation of a sphere (a 3-sphere or 2-ball), and in the absence of any evidence of an axis of rotation his solution became discarded.

Since the discovery of cosmological redshift it has become the convention to attribute cosmological redshift to recession velocity in an expanding universe, and to attempt to interpret all subsequent observations and theories in terms of a universe expanding from some sort of a 'big bang' event.

However a hypersphere would more naturally undergo a 4-rotation in which all points within its 3d hypersurface 'rotate' back and forth to their antipode positions. Such a 4-rotation does not readily submit to visualisation and it does not have an obvious axis of rotation, and seems better described as a vorticitation.

A 4-rotating hypersphere of constant size will have a positive spacetime curvature which will manifest as the acceleration 'A'. This acceleration A arises from the fundamental parameters of the cosmic hypersphere, it creates cosmological redshift, it creates the CMBR, the cosmic microwave background radiation, it flattens galactic rotation curves, it distorts the apparent magnitudes of distant supernovae, giving rise to the illusion of a universe with an accelerating expansion, and, nearer to home it decelerates our spacecraft as seen in the residual Anderson deceleration of the Pioneer Anomaly.

Hypersphere Cosmology in a Nutshell

1a) The Universe consists of a Hypersphere (a 3-Sphere or 4-ball) where: -

$\frac{M}{L} = \frac{c^2}{G}$ also $r_h = \pi L$ also $r_h = \frac{GM}{\pi c^2}$

The Universe thus has an 'orbital' velocity of lightspeed and an escape velocity of $\sqrt{2c}$

Hyperspheres can never have a radius r_h of less than $r_h = \frac{Gm}{\pi c^2}$

Hyperspheres may form inside black holes but singularities do not exist.

1b) The magnitudes of G and c arise from the structure of the entire universe as in Mach's principle: -

G = $\frac{Lc^2}{M}$ also $c^2 = \frac{GM}{L}$

1c) The Anderson deceleration arises as a consequence of the gravity of the entire universe: -

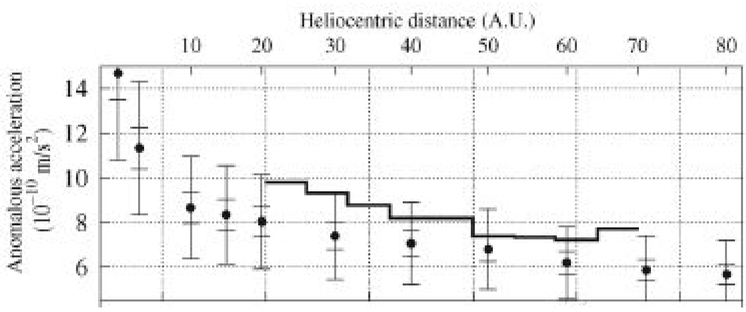
$\frac{GM}{L^2}$ = A and also A = $\frac{c^2}{L}$

The Anderson deceleration actually represents the small positive curvature of the Universe.

Key.

M = Mass of the Universe. L = Antipode length. A = Anderson deceleration. r_h = radius of hypersphere.

Anderson deceleration = Pioneer deceleration –Thermal Recoil. This model predicts that it will bottom out at around 6.9 x 10^-10 m/s^-2.



2a) The Universe undergoes a fourth dimensional rotation or 'vorticitation' which gives it an angular velocity W, shown by: -

$$W^2 = \frac{2\pi GM}{V_H}$$

This equation derives from Gödel, but for a hypersphere rather than a sphere, where V_H the volume of the 3d 'surface' of the hypersphere equals

$V_H = 2\pi^2 r^2$ also $V_H = \frac{2L^3}{\pi}$

2b) The Universe thus has a 'centrifugal' acceleration of $\frac{c^2}{L}$ which exactly balances its 'centripetal' acceleration, the Anderson deceleration, thus imposing an omnidirectional resistance to linear motion.

2c) The universe has a frequency f_v of vorticitation where: -

$$f_v = \frac{c}{2L}$$

This equates to the time taken for complete 4d 'rotation', during which the Universe rotates into an antimatter phase and back again. This implies an angular rotation of only 0.0056 Arcseconds per century only. We have not noticed this yet.

3) Redshift (Z) arises as the small positive curvature of the Universe resists the passage of light.

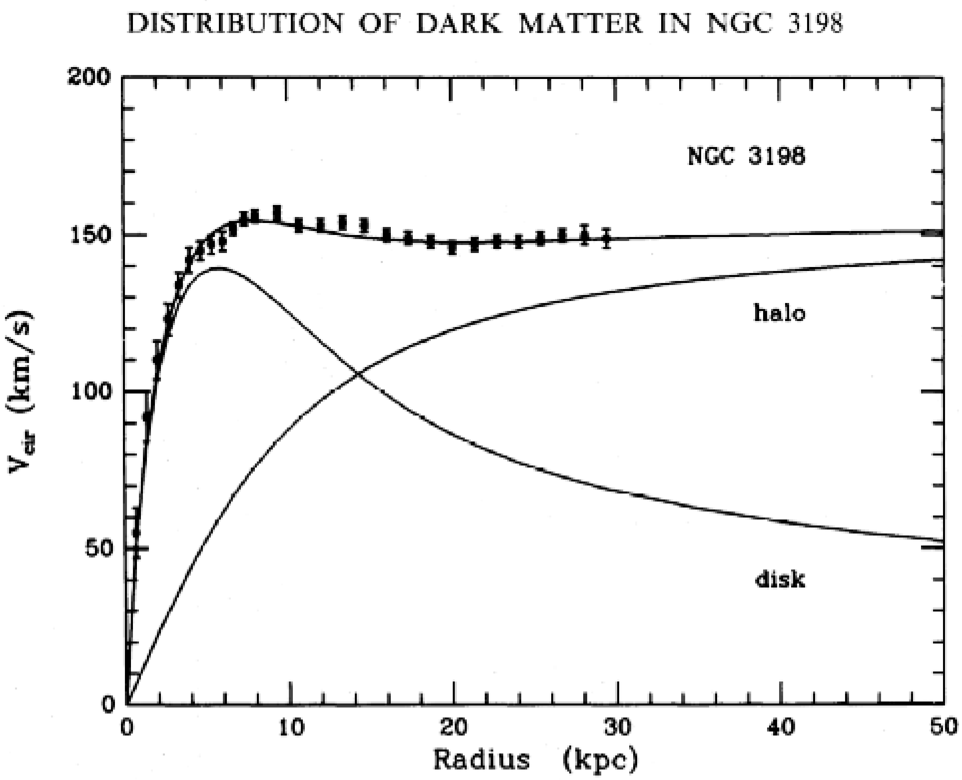
λ_0 = Observed wavelength. λ_e = Expected wavelength.

$$Z = \frac{\lambda_o}{\lambda_e} - 1 = \frac{c}{c - \sqrt{dA}} - 1$$

(d = astronomical distance, A = Anderson acceleration)

The Universe does not expand.

4) The positive spacetime curvature the Universe increases orbital velocity: -

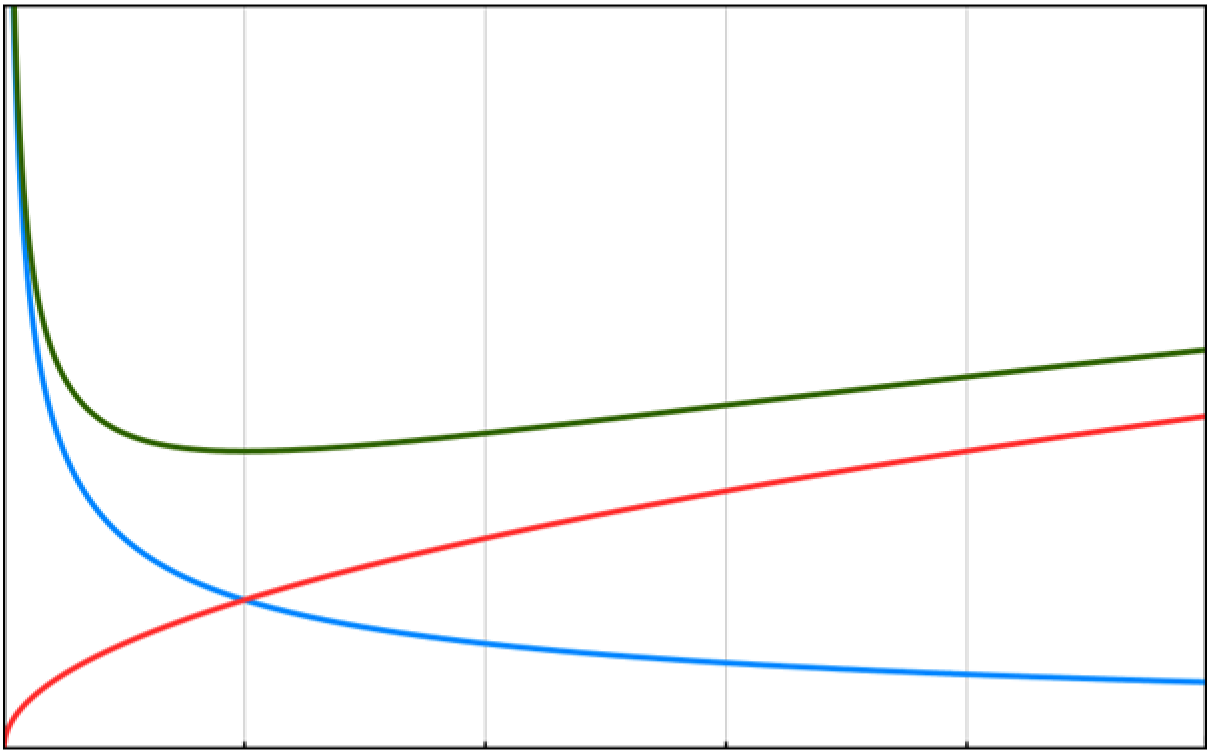


By the equation: -

$$V_o = \sqrt{\frac{Gm}{r}} + \sqrt{rA}$$

As the general form of disc galaxy rotation curves beyond the central bulge takes the form of v = sqrt(1/r) + sqrt(r) as below:-

Blue, v = sqrt(1/r). Red, v = sqrt(r). Green, v = sqrt(1/r) + sqrt(r))



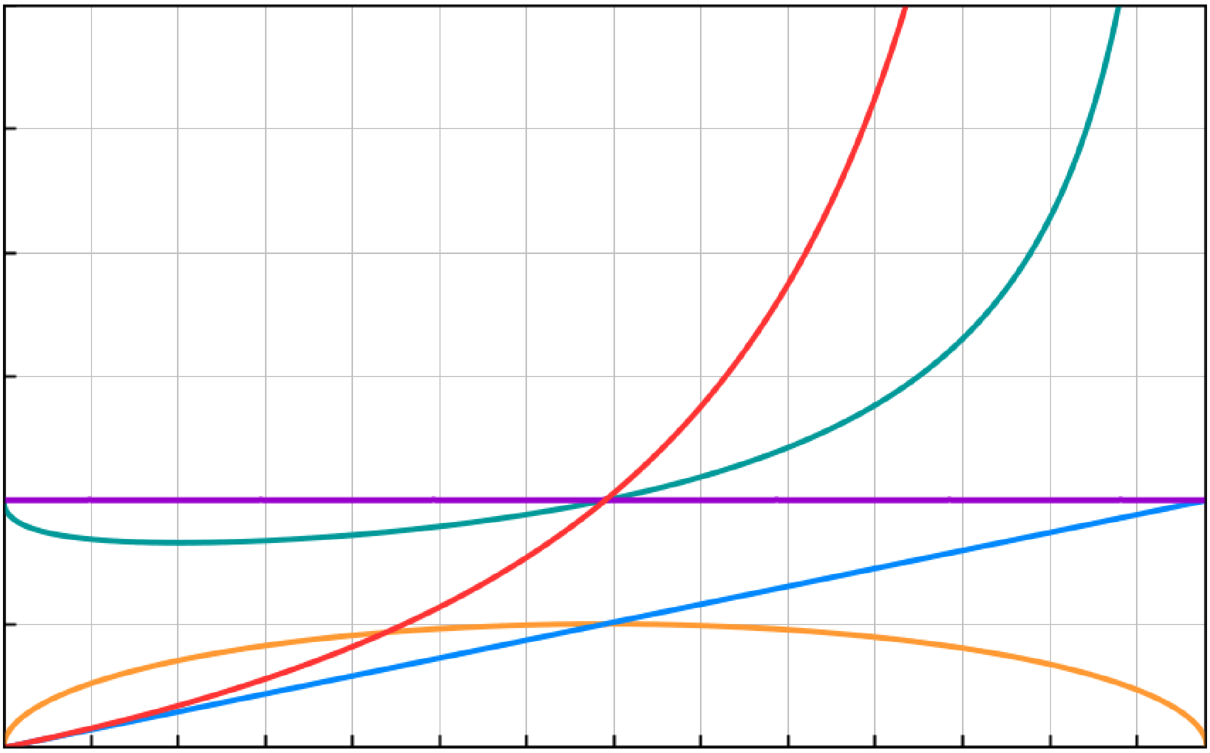
The positive spacetime curvature increases centripetal acceleration which increases orbital velocity, flattening galactic rotation curves, this repays the energy that the curvature takes from linear motions.

Dark matter does not exist.

5) The positive curvature of the Universe has a lensing effect on the passage of light across it: -

$$L_h = \frac{1}{1+\sqrt{d-d^2}-d}$$

Where L_h = hyperspherical lensing and d stands for the ratio a/L, astronomical distance over antipode distance. . The lensing distorts apparent magnitude and thus creates a mismatch with redshift leading to the dubious assumption of an expanding acceleration.



The vertical axis for a number of factors runs from zero to three, marked in divisions of 0.5 with the unity line highlighted in purple for clarity. The horizontal axis runs from observer to antipode.

The red line shows redshift Z, where Z = (c/(c-(dA)^0.5)-1 where d = astronomical distance.

Note that a redshift of 1 at about 7 billion light years denotes the halfway point to the antipode distance. Redshift climbs exponentially towards infinity at the antipode; observations become increasingly difficult up to redshift 10 and then virtually impossible beyond.

The yellow line represents schematically the hyperspherical geodesic from the observer to the observer's antipode; the curved path that light actually takes in the cosmic hypersphere.

The blue line represents schematically the observer's assumed sight line for flat space.

The green line represents schematically the difference between the actual and the assumed sight line, and thus the degree of Hyperspherical Lensing LH, that light becomes subject to at various distances. Note that in this revised version of the model, the line has the inverse configuration to previous models on this site and the equation governing it has the form

LH = 1/(1+((d-d^2)^0.5))-d) where here, d = astronomical distance/antipode distance.

The negative lensing at distances below 7 billion light years explains the anomalously low luminosity of type 1A supernovae without recourse to the hypothesis of an accelerating expansion driven by some mysterious dark energy.

The positive lensing at distances greater than 7 billion light years explains the increase in angular size of very distant structures without recourse to the hypothesis of an expanding universe at all.

Dark energy does not exist.

Thus the Universe consists of a hypersphere, finite but unbounded in both space and time and constant in size, and vorticitating with a small positive spacetime curvature, despite the apparent temporal and spatial horizons.

Inflation did not occur.

6) The Cosmic Microwave Background Radiation. The CMBR consists of trans-antipodal starlight which has gone right round the universe, perhaps many times, until it has become redshifted till it achieves thermodynamic equilibrium with the thin intergalactic medium.

7) Antimatter. The apparent absence of substantial quantities of antimatter in this universe arises because time rather than space separates matter from antimatter. Due to the 4d vorticitation of the Universe, all matter in the Universe will have an opposite sign to all matter after a time corresponding to the temporal horizon of the universe

8) Entropy. The entropy/information of the universe remains constant and proportional to its surface area in accordance with the Beckenstein-Hawking conjecture. The dimensions of the Universe all come out at the same multiple U, the ubiquity constant, of the Planck quantities: -

$$U = \frac{M}{m_p} = \frac{L}{l_p} = \frac{T}{t_p} = \frac{E}{e_p} = \frac{a_p}{A} \sim 10^{60}$$

The Universe thus has an information deficit leading to an effective quantisation of space and time at about: -

$l_p\sqrt[3]{U}$ and at $t_p\sqrt[3]{U}$

If we take T, the temporal horizon, as equivalent to the time elapsed since the big bang in conventional cosmology then the predicted quantisation of spacetime comes out at:-

Planck length and Planck time x 5.4 x 10^20.

Holometry experiments in progress may show this.

9) Metallicity and Black Hole build-up.

Cosmologists refer to all the chemical elements heavier than hydrogen (and sometimes helium as well) as 'metals' as the majority of them have metallic qualities. These elements get formed in stars by nuclear fusion (although according to BB theory a lot of the helium got made at the BB.) Now if stars continually fuse hydrogen to heavier elements and no mechanism to break those heavier elements back down exists, then the Perfect Cosmological Principle implied by a finite and unbounded universe hyperspherical in space and time that should appear pretty much the same on the large scale at all points in space and time, seems violated.

The Perfect Cosmological Principle also becomes violated if all the matter in the universe will eventually become sucked into black holes from which it can never escape.

Several observed and hypothesised phenomena may solve the metallicity and black hole problems.

Neutron stars almost certainly exist. Metallic elements falling into neutron stars will get broken back down into neutrons. Neutrons which escape into space rapidly undergo beta decay creating electrons and protons which recombine eventually to form hydrogen. But can they escape?

Pair-Instability Supernovae may well occur. In these events the gravitational collapse of a sufficiently heavy star results in a very powerful gamma ray flux in the core. The gamma rays interact with matter particles initiating electron-positron pair production; this causes the pressure to drop in the core and further collapse to occur. This initiates electron-positron (matter-antimatter) annihilation which explodes the star completely into space leaving no remnant core. Astronomers have observed several possible examples of such an event.

Neutrons may act as Marjorama rather than as Dirac fermions under extreme conditions. In other words they may act as their own antiparticles and annihilate to gamma rays under conditions of extreme compression and temperature.

We do not know what mechanism creates Gamma Ray Bursts, but about once a day one goes off somewhere in the universe. These titanic GRB explosions appear to liberate the energy equivalent of the masses of entire planets or entire stars in brief moments.

Massive and very dense objects of multiple solar masses seem to exist in the universe and most galaxies appear to contain objects of thousands or millions of solar masses at very high densities in their cores. Whether any of these objects have actually formed black holes remains undecided. The maths breaks down at black holes and we cannot directly observe them.

Black holes may not actually exist at all if some mechanism like the above or perhaps some other mechanism limits their maximum density and consigns them to eventually explode, endlessly recycling the matter of the universe.

(Note also that the abandonment of the BB nucleosynthesis model would solve the cosmic lithium abundance problem.)

10) Evidence for the non-expansion of the Universe. The average frequency of quasars at around 6bn light years matches that of quasars at around 10bn light years. If the universe had actually expanded then one would expect some time dilation. See http://phys.org/news190027752.html

http://iopscience.iop.org/1538-4357/553/2/L97/fulltext/

http://uk.arxiv.org/pdf/1004.1824

- "There is however surprisingly little direct evidence that the universe is expanding"

11) Conclusions.

The Hypersphere Cosmology model has the virtue of simplicity. It does not require an initial spacetime singularity, or cosmic inflation, or dark matter or dark energy as interpretations of existing observations; it just has a curved geometry and a topology that creates the optical illusion of such things.

It implies that mechanisms exist for reversing the conventionally expected increase of metallicity through nuclear fusion over time and the build-up of black holes in the universe.

It does not explain how the universe attained its present condition, but the initial conditions of the big bang theory remain similarly inexplicable. Hypersphere Cosmology may not even require initial conditions. We have no good reason to consider non-existence as somehow more fundamental than existence.

Appendix 1. Redshift from Curvature.

The alternative mechanism for redshift works as follows:

Redshift = Z = $\frac{\lambda_o}{\lambda_e}$ - 1

Where λ_o = observed wavelength, λ_e = expected wavelength, and the -1 simply starts the scale at zero rather than 1.

Now wavelength, λ , time frequency, f, still always equals lightspeed, c .

$\lambda_e f_e = \lambda_o f_o = c$

However

$\lambda_e f_o < c$

$\lambda_e f_o = c - \sqrt{dA}$

Where d = astronomical distance, A = Anderson acceleration. The Anderson acceleration (the small positive curvature of the hypersphere of the universe) works against the passage of light over the astronomical distance, d. It cannot actually decrease lightspeed but it acts on the frequency component.

So substituting $f_o = \frac{c}{\lambda_o}$

We obtain $\frac{c\lambda_e}{\lambda_o} = c - \sqrt{dA}$

Therefore Redshift, Z = $\frac{c}{c - \sqrt{dA}}$ - 1

Thus Z becomes just a function of d, astronomical distance, not recession velocity.

To put it in simple terms, redshift does not arise from a huge and inexplicable expansion of the underlying spacetime increasing the wavelength; it arises from the resistance of the small positive gravitational curvature of hyperspherical spacetime to the passage of light decreasing its frequency.

Appendix 2. 4D Vorticitation from 3D Rotation.

The Gödel 3d rotating universe has this solution derived from General Relativity: -

$W = 2\sqrt{\pi \mathrm{Gd}}$

"Matter everywhere rotates relative to the compass of inertia with an angular velocity equal to twice the square root of pi times the gravitational constant times the density." – Gödel. So, squaring and substituting mass over volume for d yields:

W^2 = 4πGm/v

Substituting 4/3 πr^3 for the volume of a sphere yields:

$W^2 = 3\pi^2 Gm / r^3$

Substituting $r = \frac{3Gm}{c^2}$ the formula for a photon sphere (where orbital velocity equals lightspeed) yields:

Taking the square root:

(1*) W = $\frac{\pi c}{r}$

Substituting L for r as we wish to find the solution for a hypersphere:

(2*) W = $\frac{\pi c}{L}$

Squaring yields:

Substituting GM/L = c^2 the formula for a hypersphere yields:

W= $\frac{2\pi \mathrm{Gm}}{\mathrm{V_h}}$

Which we can also express as:

W= $\sqrt{\frac{2\pi \mathrm{Gm}}{\mathrm{V_h}}}$ or as W = $W = \sqrt{2\pi G d}$

Substituting W = 2πf in (1*) and (2*), to turn radians into frequency we obtain:

$f = \frac{c}{2r}$ for a sphere and f = $\frac{c}{2L}$ for a hypersphere.

Centripetal acceleration a, where a = $\frac{v2}{r}$ for a sphere and a $= \frac{v2}{L}$ for a hypersphere, yields:

$a = \frac{c2}{r}$ = for a sphere and a = $\frac{c2}{L}$ = for a hypersphere.

Now for a hypersphere where $\frac{Gm}{L} = c^2$ a centrifugal acceleration a, of a = $\frac{Gm}{L^2}$ or more simply a = $\frac{c2}{L}$ will exist, to exactly balance the centrifugal effects of rotation.

In a hypersphere of about L = 13.8 billion light years, the rotation will correspond to about 0.0056 arcseconds per century. As this consists of a 4-rotation of the 3d ‘surface’, visualisation or measurement of its effects may prove problematical, the rotation should eventually cause every point within the 3d ‘surface’ to exchange its position with its antipode point, over a 13.8 billion year period, turning the universe into a mirror image of itself.

Note that if the universe does have the same number of dimensions of time as of space then it will rotate back and forth between matter and anti-matter as well.

Appendix 3. Hypersphere visualisation and lensing.

This paper provides a method of visualising the four dimensional hypersphere as a perspective construction in three dimensions, and it also shows how the curvature of hyperspherical space will distort images from distant galaxies and supernovae.

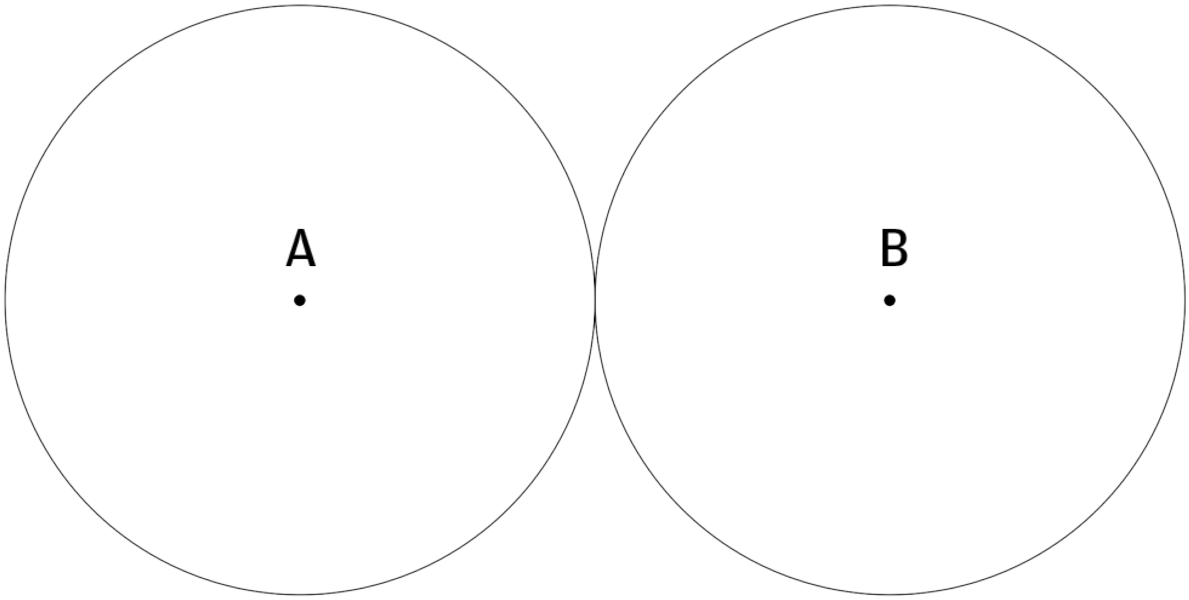


fig 1

Figure 1. Any attempt to project the surface of the Earth onto a flat surface necessarily leads to some kind of distortion. In addition to the usual Mercator projection that distorts distances towards the poles, we can also make a polar projection by cutting through the equator and then "photographing" each hemisphere from above the poles. Such a projection gives a good representation of distances near the poles but it leads to progressive distortions as we near the equator. Cartographers normally place the two halves of the polar projection in contact at some point, to remind us that all points around the equator of one hemisphere actually touch a corresponding point on the other hemisphere.

Similarly we can represent the 3-sphere or hypersphere as two spheres in which every point on the surface of one of the spheres corresponds to a point on the other sphere, despite that we can only represent them with a single point of contact. Now when we make a polar projection of the Earth's surface, convention dictates that we centre the projection on the poles, but we could chose any two opposite points and cut the sphere across a great circle other than the equator. An egomaniac might delight in a projection with his house at the very centre of the projection, but it would remain a valid projection.

Thus an observer A, in an hypersphere can define her map of it with herself at the centre of one of the spheres. This then defines a second point B, as her hyperspherical antipode, analogous to the point furthest away from her on the surface of the world. In a hypersphere it represents the furthest point you can travel to without starting to come back to where you started from.

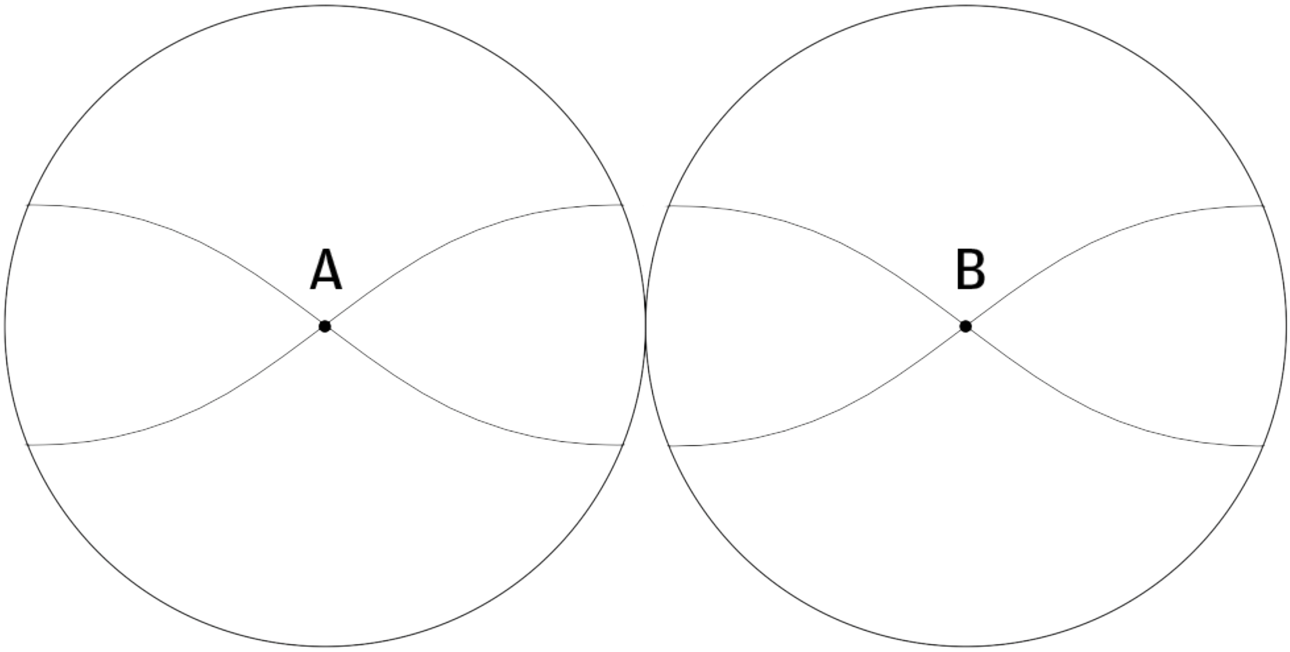


fig2

Figure 2 . An observer looking into the deep space of an hypersphere could in theory see an abject at her antipode point B, by looking in any direction, analogous to the way in which all routes from the North Pole lead to the South Pole on the Earth. Note that lines of sight curve within an hypersphere, in a way analogous to the way in which meridians curve around the surface of the Earth. Light follows geodesics in space, so if space curves, light has to follow the curvature. Theoretically our observer could see right past her antipode and catch sight of the back of her own head In practice light from near the antipode becomes so red-shifted by the time it gets to A, that A cannot even see quite as far as the antipode.

VHC argues that the curvature of the universe also causes the progressive red-shift of light travelling across it, and that conventional cosmology has mistaken this for recession velocity, an hypothesis which implies an expanding universe. This paper will attempt to show that the supposed acceleration of that expansion arises from the lensing effect of hyperspherical space.

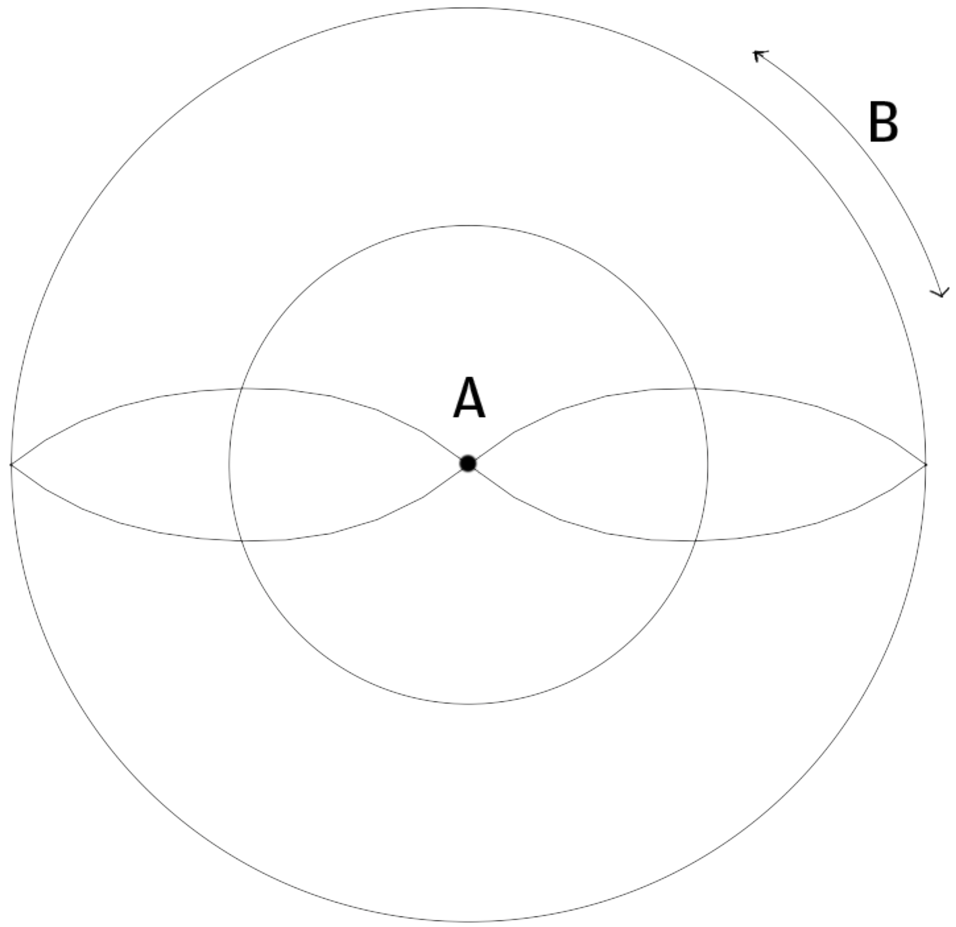


fig3

Figure 3. Imagine that we take the polar projection of the Earth and then roll the equator of the Southern Hemisphere around that of the Northern one. This will have the effect of stretching out Antarctica so that it goes all the way around the circumference of the whole map. We would then have a circular and highly topological map of the world with huge distance distortions towards the South Pole which itself now stretches around the entire edge.

With a little effort at visualisation we can do something analogous with the two sphere map of the hypersphere, by rolling one sphere all over the entire surface of the other so that all corresponding points come into contact. This will result in the antipode point becoming spread out over the entire surface of the resulting sphere.

Astronomers who assume a "flat" Euclidean universe will have effectively and unwittingly distorted their view of the universe in exactly this way if it does in fact have a hyperspherical geometry.

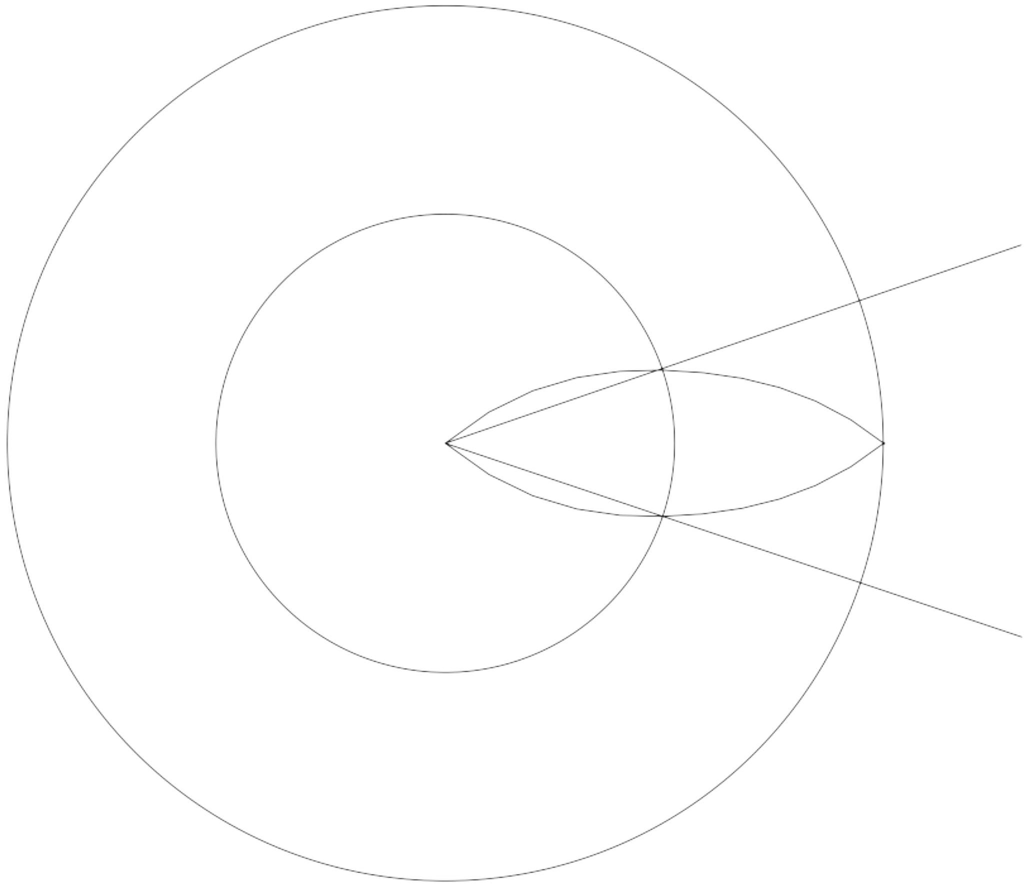


fig4
Figure 4. Astronomers who assume a flat universe with no curvature will assume that they can see in straight lines. If they look out into the apparent sphere of space that surrounds them, they will actually see along geodesics which curve relative to the assumed flat space of their maps.