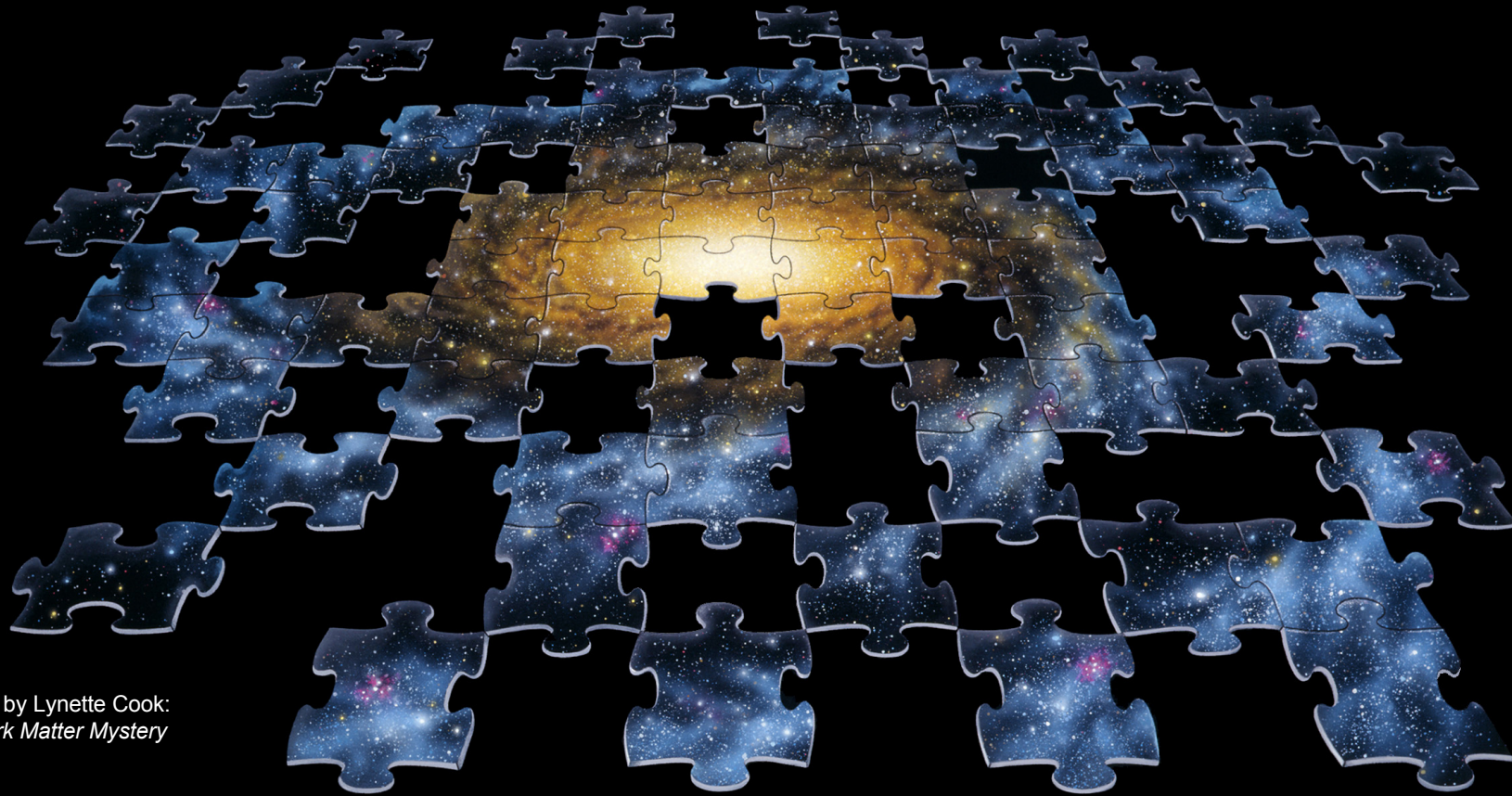


LECTURE 2

The Many Directions of Time

Solving the Cosmology Puzzle

Alexander Franklin Mayer



Artwork by Lynette Cook:
The Dark Matter Mystery

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www.alexandermayer.com
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Modern astrophysics and cosmology is in a state of complete disarray.

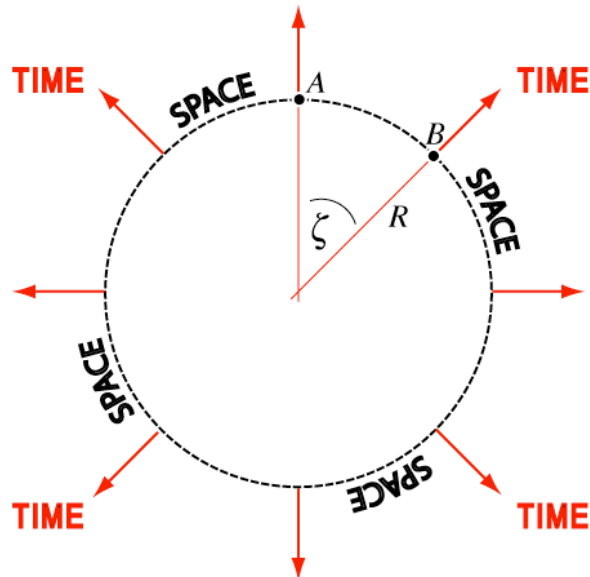
- The Universe is apparently “accelerating” and nobody knows how this could be happening.
- The Universe supposedly suddenly “jerked” from decelerating to accelerating for no apparent reason—this is ‘unphysical’ (it defies the laws of physics).
- “Dark energy” and “Dark matter”— these are arbitrary inventions to explain observations and nobody has offered any reasonable explanation of what they are.
- According to “lookback time”, populations of ancient galaxies are seen when the Universe was very young, which makes no sense.

One idea explains *EVERYTHING*...

The 'common sense' idea of linear, one-dimensional TIME.



We abandon this naïve concept of time for a superior relativistic model: *geometric, multidimensional TIME*.



This diagram shows a single closed dimension of cosmological space (a huge cosmic great circle) and many local 'directions' or dimensions of time. We may think of time in spacetime in much the same way that we think of the gravitational gradient on Earth; time is not a single *dimension* of spacetime, but rather a local *geometric distinction* in the manifold. Following Minkowski, it is the 'local vertical' to inertial 3-D space and must change 'direction' as space curves back on itself and closes. So, there are an *infinite* number of 'time dimensions' in the Universe and not just one.

Linear One-Dimensional TIME

This is the modern conventional concept of time in the context of science and cosmology.

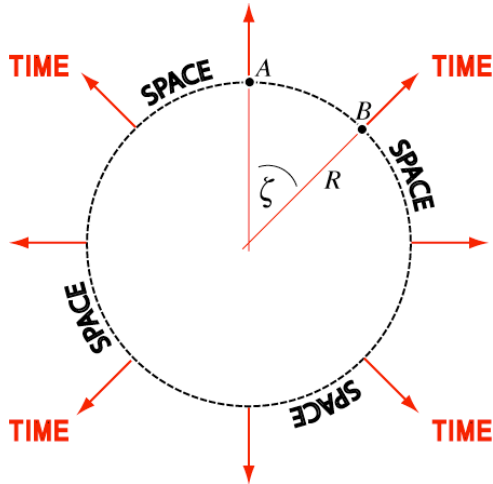


This model of time leads to the following *interpretations* of astrophysical observations:

- Time and space did not exist until the Big-Bang event (estimated to have occurred about 15 billion years ago).
- The contents of the entire Universe was once compressed into a point the 'size' of a single electron.
- The Universe must have initially "inflated" in size, expanding many times faster than the speed of light.
- After this "inflationary period", the expanding Universe was slowing down (decelerating) due to gravity.
- At some arbitrary moment, the cosmic expansion inexplicably "jerked" from decelerating to accelerating.
- An inexplicable 'force' named "dark energy" is causing the apparent accelerating expansion.
- The vast majority of the gravitating mass of galaxies is not made up of atoms, but rather "dark matter".
- The mysterious "dark matter" has no radiation signature whatsoever and is therefore undetectable.
- Most of our Milky Way Galaxy is made of "dark matter", yet none of it exists in our Solar System.
- Although 100% of our Solar System is made of atoms, only 4% of the Universe is made of atoms.

A simple change to this naïve model of time results in a 21st century revolution in science equivalent to Copernicus' overthrow of medieval ideas that dominated academic thought prior to the 17th century.

Geometric Multi-Dimensional TIME



The *boundary* of the circle (dashed line) represents a finite unbound (closed) single dimension of space; thus the *plane* of the circle represents *spacetime* and not space, per se. It follows that remote regions of the Universe (e.g., *A* & *B*) have their own geometrically distinct time coordinates in 4-D spacetime, similar to the fact that remote regions on the surface of a spherical body such as the Earth have their own geometrically distinct direction of gravity in 3-D space. So, we have to think of time in spacetime like we think of gravity in space—not as a single *dimension* of spacetime, but rather as a local *geometric distinction* in spacetime. Therefore, an infinite number of ‘dimensions’ of time exist in the Universe, not just one, and the Universe is a kind of “sum of histories”.

This model of time leads to the following understanding of astrophysical observations:

- Time has no beginning or end and time is a strictly local measurable quantity in the Universe.
- Finite yet unbound 3-D space is the curved volumetric ‘surface area’ of a Riemannian hypersphere.
- Both the energy content and the large-scale energy density of the Universe are constant.
- Neither “dark energy” nor “dark matter” exist; like the Solar System, 100% of the Universe is made of atoms.
- Apparent “luminosity evolution” of active galactic nuclei is an artifact of a faulty theoretical model.
- “Wormholes” play an essential role in galaxy formation and evolution, also preventing cosmic gravitational collapse.
- The cosmic microwave background radiation is a real-time product of all dynamical gravitational systems.
- Large symmetric clusters of galaxies are many orders of magnitude older than 10 billion years.
- The Universe is an eternal system in dynamic equilibrium that evolves locally, but not as a whole.
- The Universe is not expanding and never existed in a hot dense phase following a primordial singularity.

These assertions seem fantastic, even preposterous outside of the context of the following lecture. However, the idea of multidimensional time is so profound that it transforms the relativity theory and also the interpretation of existing empirical evidence, just as was true for the Copernican revolution. One simple idea trumps much of 20th century astrophysics...

The Universe is finite unbound

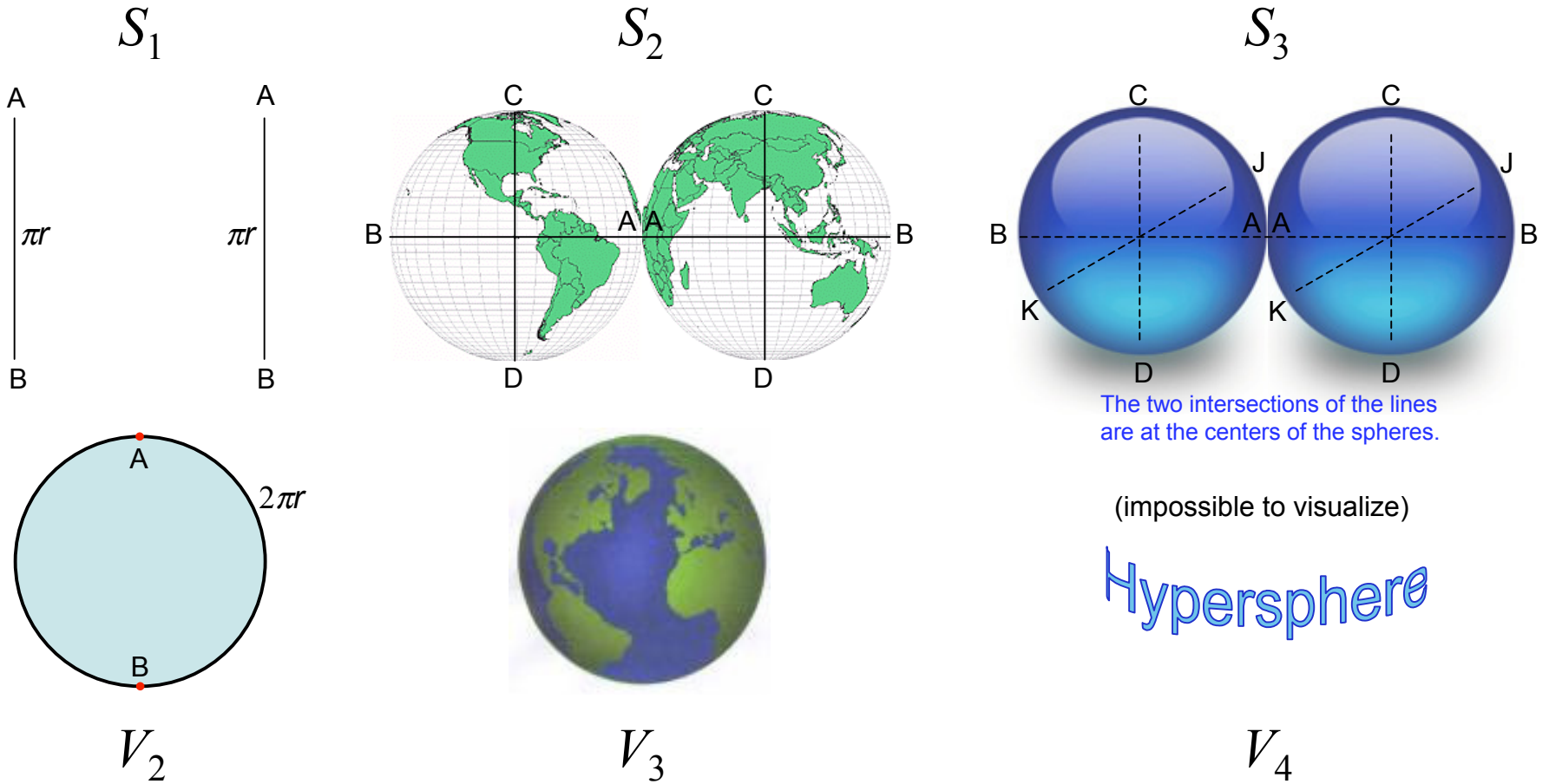
- There can be no cosmic boundary.
- If there is, what is on the other side?
- Cosmic geodesics must be closed.
- An infinite Universe is a naïve idea.
- We shall see that observations prove that the cosmos has a finite volume.



Cosmic geometry

- People used to think the Earth was flat.
- That was silly.
- People still think space is like a big box.
- This is equally silly.
- How can all geodesics close with no boundary if space is like a big box?
- Space is like the surface of a sphere only in 3 dimensions; this is called S_3 .

Understanding S_3



The two intersections of the lines are at the centers of the spheres.

(impossible to visualize)

Hypersphere

Mathematics allows one to generalize the common terms “volume” and “surface area”. A space or ‘volume’ V_n of n dimensions has a boundary or ‘surface area’ S_{n-1} of $n-1$ dimensions. The curved unbound surface of a sphere can be mapped with a projection in the form of two circles, (S_2). In the above diagrams, identical letters are identical points connecting closed geodesic paths (great circles). For the S_2 diagram, a jet that flies north to C in the left circle, continues by flying south from the identical point C in the right circle. The S_3 spheres have a one-to-one mapping between points on their respective surfaces, just as is true for points on the boundaries of the S_2 circles. The S_3 map of curved 3-D space shows us that **no matter what direction in all three dimensions a ‘spaceship’ travels in S_3 , it eventually returns to its starting point.**

S_3 is the 3-dimensional unbound 'surface area' of a Riemannian hypersphere

$$S_3 = \int_0^\pi d\psi \int_0^\pi \sin \psi d\phi \int_0^{2\pi} \sin \psi \sin \phi d\theta$$

$$S_3 = 4\pi \int_0^\pi \sin^2 \psi d\psi$$

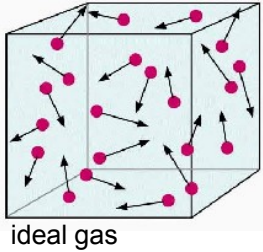
$$S_3 = 4\pi \left[\frac{\psi}{2} - \frac{\sin 2\psi}{4} \right]_0^\pi = 2\pi^2$$

Bernhard Riemann



Riemann (1826-1866)



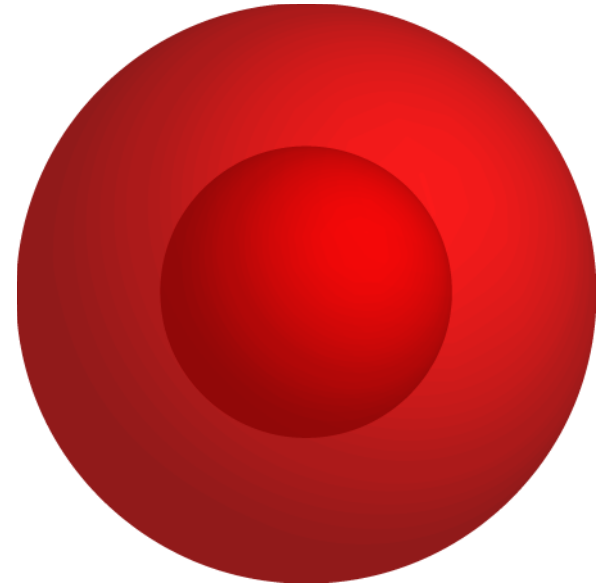


Galaxy Distribution

- On large scales, galaxies must be evenly distributed throughout the Universe, similar to the way molecules of an ideal gas are evenly distributed in a container.
- Mass-energy creates and shapes space like words that make up a sentence. Take away all the words (galaxies) and you have nothing, not even space that is empty. On a cosmic scale, there is no such thing as 'empty space', just as there is no such thing as an 'empty sentence' that has no words.
- While cosmic voids of various sizes exist, which are low-density 'bubbles' locally free of galaxy clusters, there can be no cosmic region of 'empty space' that is distinct from another region populated by galaxies.

Expected Galaxy Counts

- For concentric spherical shells, volume scales as the cube of the radius.
- At twice the radius, the outer shell has 7x more volume than the inner shell ($2^3 - 1^3$).
- The requirement of uniform average density implies that for large distances there should be 7x as many galaxies within the outer shell inside the same solid angle as the inner shell.
- Apparent brightness scales as the inverse square.
- Assumed “luminosity evolution” of quasars makes far ones *much* brighter than near ones, so in theory we see every AGN in the observable Universe.
- According to conventional wisdom, we expect to see more galaxies farther away out to significant distance than we see nearby.
- The last thing we would expect to see is a *steady exponential decline* in galaxy counts with redshift...

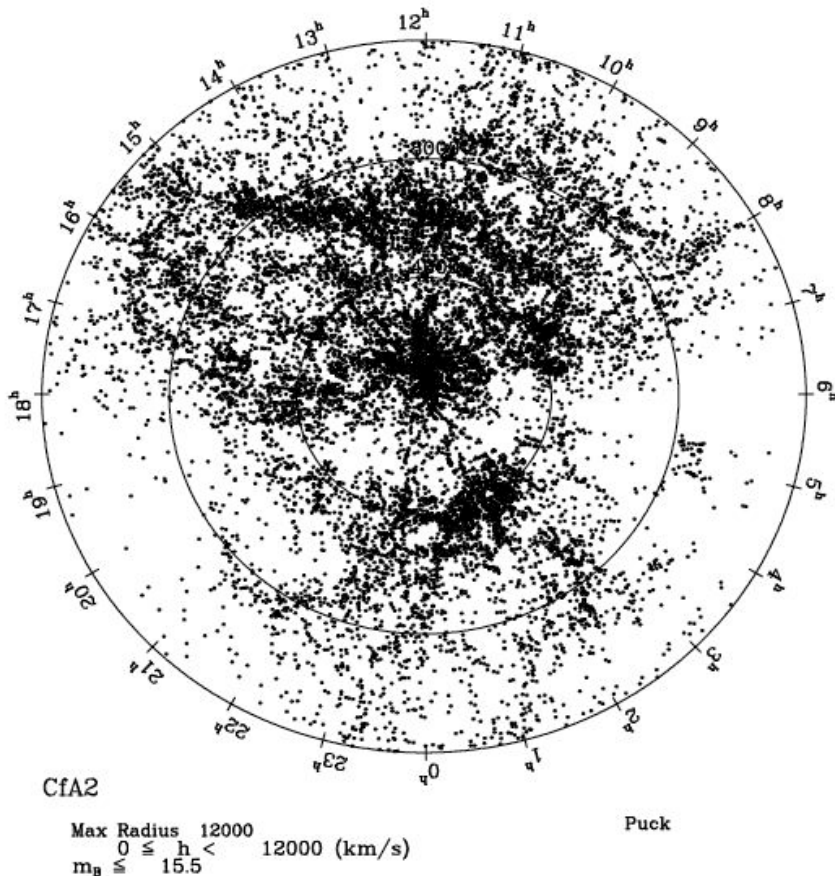


AGN – active galactic nucleus

Galaxy Redshift Surveys

- As will be shown in the following slides, redshift surveys exhibit a clear and consistent *exponential* decline of galaxy counts with redshift after about $z = 0.2$
- The only way to account for this observation is for the *rate of increase* in the volume of space with redshift to also be exponentially declining, so that the large-scale space density of galaxies remains constant.
- Therefore, the ‘common-sense’ idea that the volume of enclosed space increases with distance as the cube of the radius of a Euclidean spherical shell cannot be correct according to the observations.
- The confirmed scientific data needed to come to this conclusion was not available before 2005.

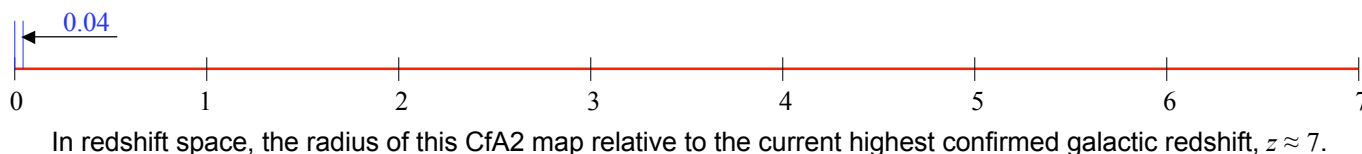
The CfA2 Redshift Survey (1994)



Courtesy John Huchra and Margaret Geller
 Copyright © 2001 Smithsonian Astrophysical Observatory

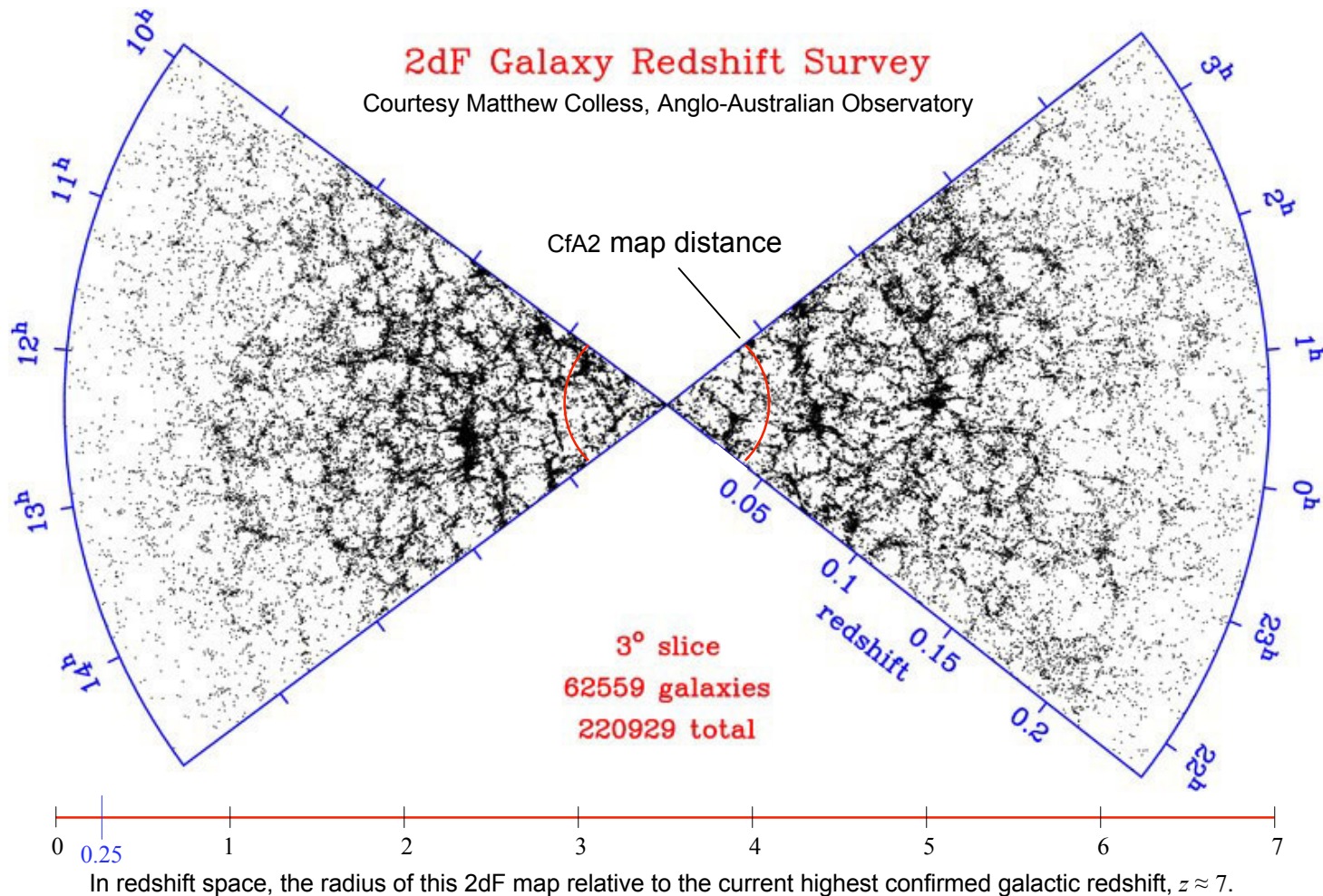
This galaxy map is from the pioneering second CfA (Center for Astrophysics) Redshift Survey started by John Huchra and Margaret Geller at Harvard in the winter of 1984 and completed over the next ten years. In this map of the survey, the redshifts of about 18,000 galaxies are measured in the northern sky out to $v = 12,000$ km/s (equivalent to $z = 0.04$). The z -axis into the plane represents a cylindrical height in redshift space also of $v = 12,000$ km/s, thus creating a volume similar in shape to a typical can of tuna or a thick 'hockey puck'. Sizeable regions almost devoid of galaxies clearly indicate the mass-distribution anisotropy of the Universe on short distance scales. Note that dimmer galaxies with an astronomical magnitude m_b of greater than 15.5 are not shown, so this represents a subset of the actual total galaxy population within the region.

For historical reasons dating back to the first star catalogue created by the Greek scholar Hipparchus of Rhodes (190-120 BCE) a *higher* magnitude unintuitively implies a *dimmer* object in astronomy.

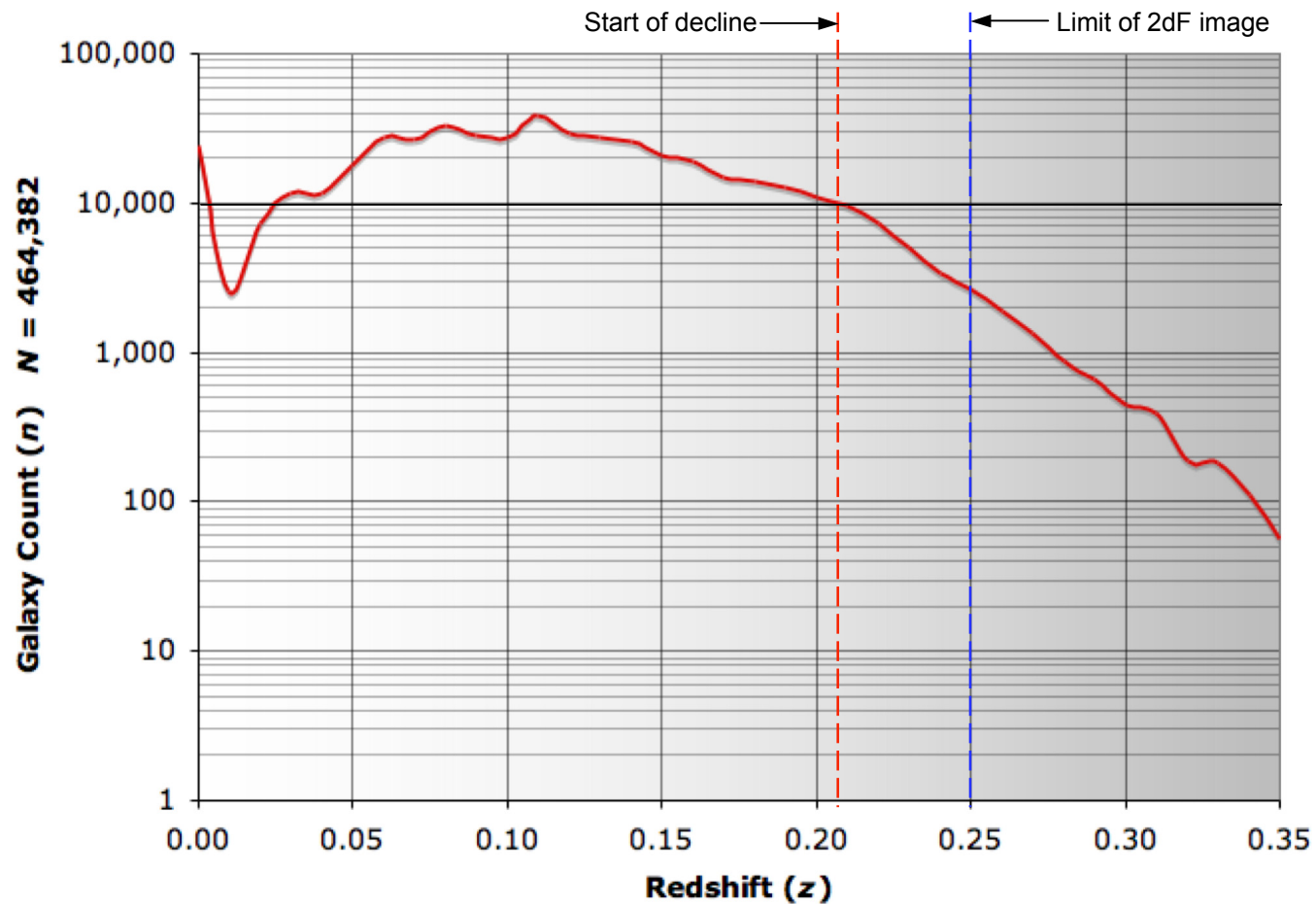


The 2dF Redshift Survey (2003)

The 2-degree Field (2dF) Galaxy Redshift Survey data set for observations of the southern sky goes out to $z = 3.5$, but the galaxy maps created from the data were all truncated at $z = 0.25$ due to the inexplicable paucity of objects at higher redshift. If this image were extended out just to $z = 0.35$, the outer regions of the map would be mostly empty white space. *The apparent relative emptiness of the Universe at increasing redshift discovered by this survey suggests that something is amiss with the conventional model of how the volume of space increases with redshift.*



The 2dF Survey exhibits an *exponential decline* in galaxy counts with increasing redshift.



SQL* query for the previous graph

<http://www.mso.anu.edu.au/2dFGRS/>

```
-- this query must be performed on a local database
-- after importing (best=1) z_helio data
SELECT
    ROUND(z_helio,2)
,    COUNT(1)
FROM
    TDFgg
WHERE
    best = 1          --best redshifts only
GROUP BY
    ROUND(z_helio,2)
HAVING
    COUNT(1) > 50    --truncate small bins at high z
ORDER BY 1
```

* SQL: Structured Query Language;
this is the standard protocol for retrieving information from a database.

Sloan Digital Sky Survey (SDSS)

Apache Point Observatory, New Mexico, United States

The Sky Survey will systematically map one-quarter of the entire sky, producing a detailed image of it and determining the positions and absolute brightnesses of more than 100 million celestial objects. It will also measure the distance to a million of the nearest galaxies, giving us a three-dimensional picture of the universe through a volume one hundred times larger than that explored to date. The Sky Survey will also record the distances to 100,000 quasars, the most distant objects known, giving us an unprecedented hint at the distribution of matter to the edge of the visible universe.

www.sdss.org

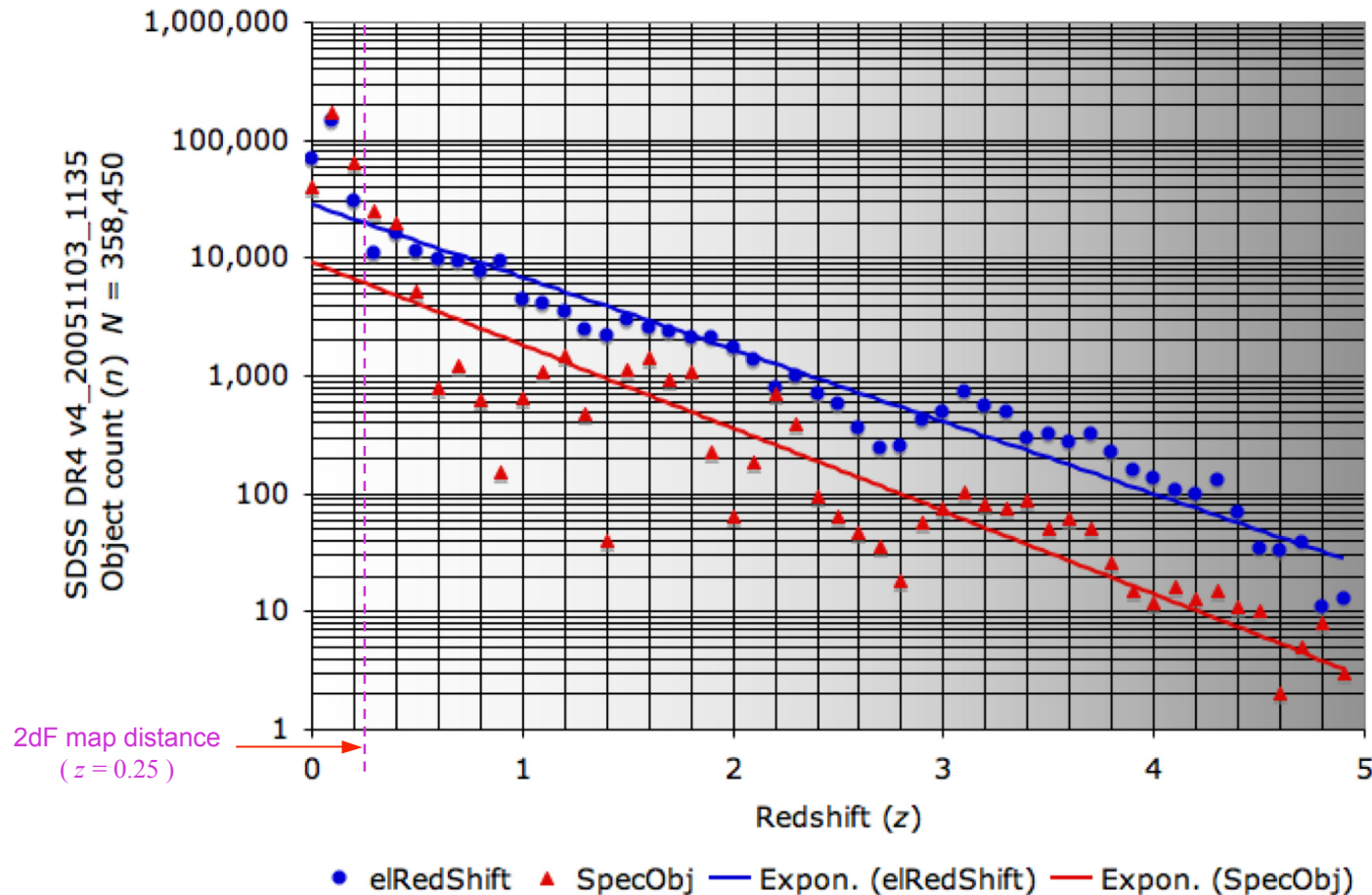
www.apo.nmsu.edu



SDSS galaxy counts (Nov. 2005)

Spectroscopic (U. Chicago) and **photometric** (Princeton) data sets are shown.

The exponential decline in galaxy counts (much faster than a Malmquist bias) must be interpreted in the context of Einstein's cosmological principle to imply a commensurate exponential decline in the volume of space as a function of redshift so that the large-scale local density of the Universe remains constant. The two data sets are different interpretations using distinct techniques of identical observations.



SQL queries for the previous graph

<http://cas.sdss.org/astro/en/tools/search/sql.asp>

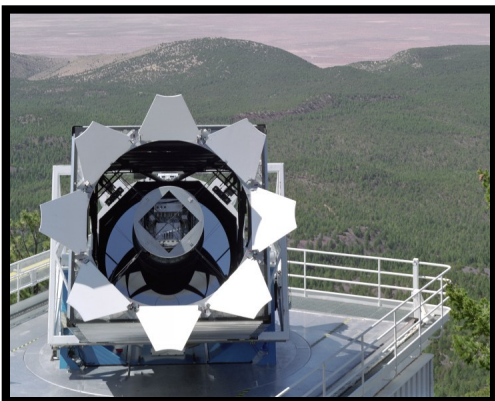
--Spectroscopic redshifts

```
SELECT
    ROUND(r.z,1) AS z
    ,
    COUNT(1) AS n
FROM
    elRedShift r
INNER JOIN SpecObj s
ON
    r.specObjID = s.specObjID
WHERE
    --galaxies and QSO only
    objType IN (0, 1)
    --redshifts only
    r.z > 0
AND
GROUP BY
    ROUND(r.z,1)
ORDER BY 1
```

--Photometric redshifts

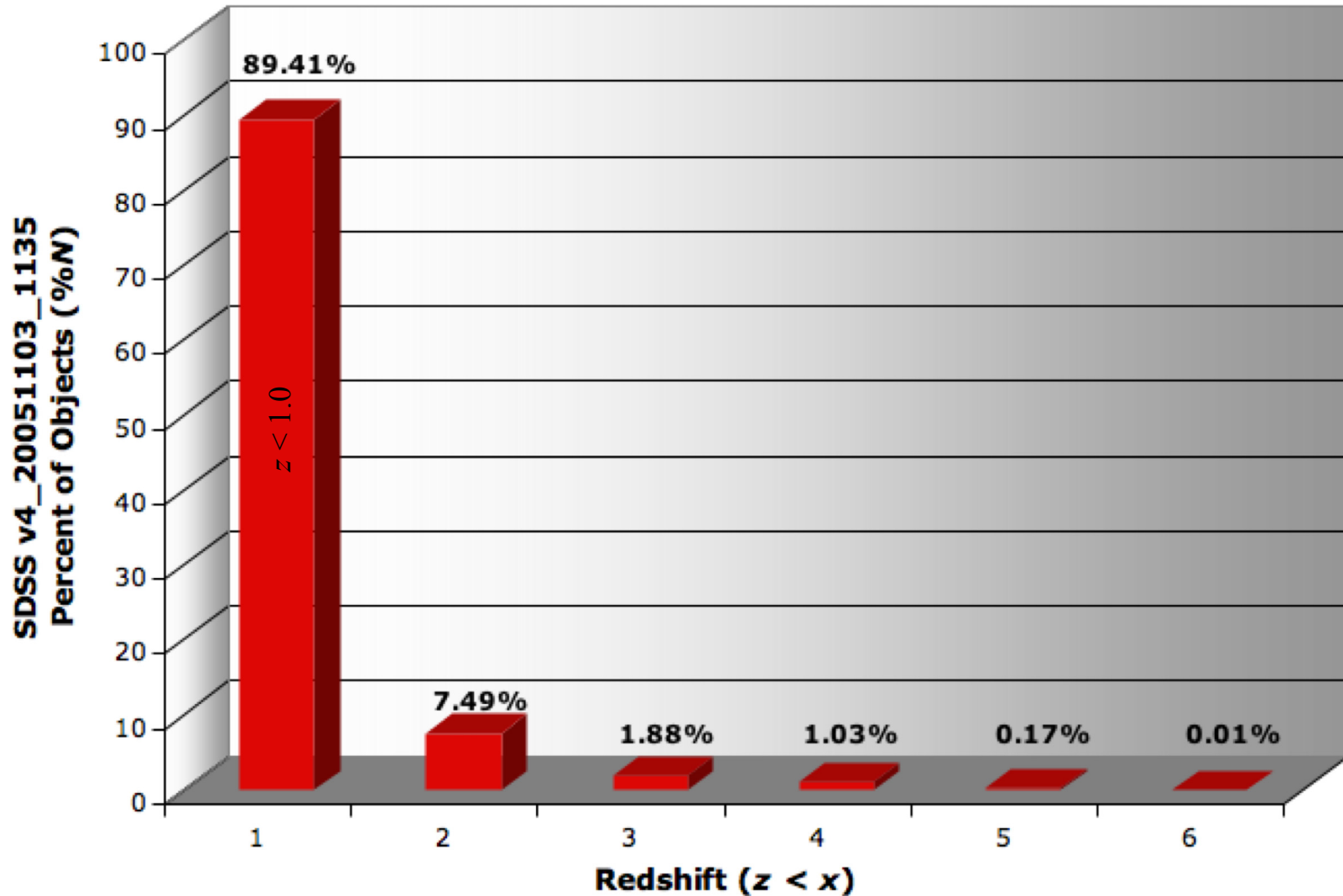
```
SELECT
    ROUND(z,1) AS z
    ,
    COUNT(1) AS n
FROM
    SpecObj
WHERE
    --galaxies and QSO only
    objType IN (0, 1)
    --redshifts only
    z > 0
AND
    --better than 99% confidence only
    zConf > 0.99
AND
    --good data only
    zStatus IN (3, 4, 6, 7, 9)
GROUP BY
    ROUND(z,1)
ORDER BY 1
--3 z determined from cross-correlation and emz are consistent.
--4 z determined from x-corr with high confidence.
--6 z from emz plus consistent xcorr redshift measurement.
--7 z determined from em-lines with high confidence.
--9 z determined "by hand" with high confidence.
```

Fermilab Visual Media Services



SDSS Survey Telescope

Sloan Survey Data Release 4 (DR4) galaxy counts binned by integer redshift



SQL query for the previous graph

<http://cas.sdss.org/astro/en/tools/search/sql.asp>

```
--Total of 358,450 spectroscopic redshifts binned by integer redshift

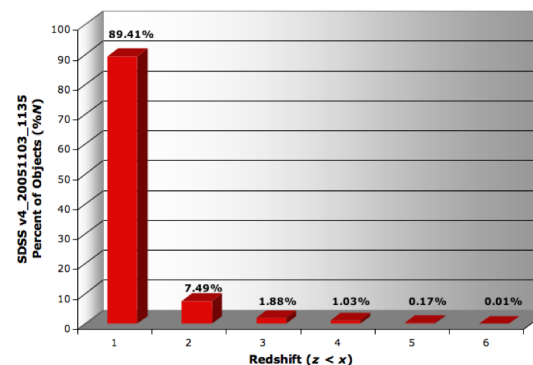
SELECT
    FLOOR(r.z) AS z
,    ROUND(COUNT(1)/3584.50,2)
FROM
    elRedShift r
INNER JOIN SpecObj s
ON    r.specObjID = s.specObjID
WHERE
    objType IN (0, 1)      --galaxies and QSO only
AND   r.z > 0             --redshifts only
GROUP BY
    FLOOR(r.z)
ORDER BY 1
```

Funding for the SDSS and SDSS-II has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Science Foundation, the U.S. Department of Energy, the National Aeronautics and Space Administration, the Japanese Monbukagakusho, the Max Planck Society, and the Higher Education Funding Council for England. The SDSS Web Site is <http://www.sdss.org/>.

The SDSS is managed by the Astrophysical Research Consortium for the Participating Institutions. The Participating Institutions are the American Museum of Natural History, Astrophysical Institute Potsdam, University of Basel, Cambridge University, Case Western Reserve University, University of Chicago, Drexel University, Fermilab, the Institute for Advanced Study, the Japan Participation Group, Johns Hopkins University, the Joint Institute for Nuclear Astrophysics, the Kavli Institute for Particle Astrophysics and Cosmology, the Korean Scientist Group, the Chinese Academy of Sciences (LAMOST), Los Alamos National Laboratory, the Max-Planck-Institute for Astronomy (MPA), the Max-Planck-Institute for Astrophysics (MPIA), New Mexico State University, Ohio State University, University of Pittsburgh, University of Portsmouth, Princeton University, the United States Naval Observatory, and the University of Washington.

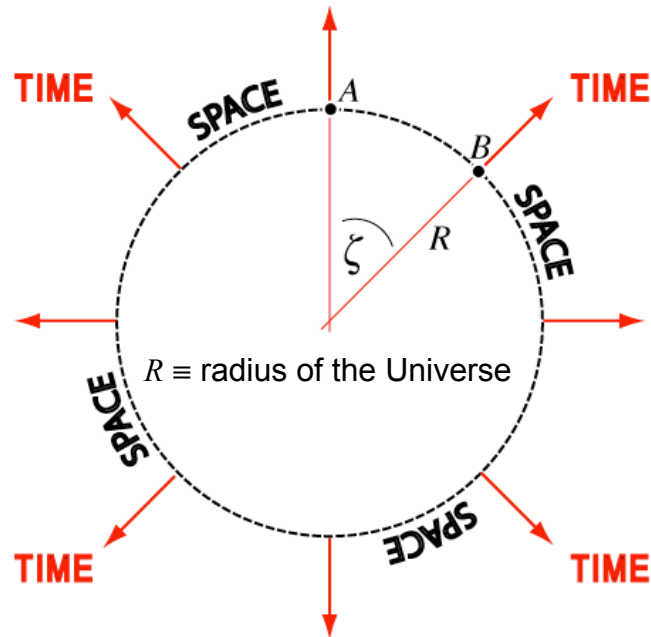
Implications of SDSS & 2dF

- $\sim 97\%$ of all the SDSS galaxies are within redshift $z < 2$.
- Therefore, most of the volume of the *observable* Universe is also within redshift $z < 2$.
- The task at hand is to derive a theoretical relationship between z and volumetric space $V(z)$ that is consistent with the empirical observations of the redshift surveys.
- We know that the graph of dV/dz has to look a lot like this SDSS bar graph.



Synthesis of two simple ideas

- For inertial reference frames, space and time are fundamentally orthogonal (Minkowski, 1908).
- The Universe is homogeneous, isotropic and has no boundary (Einstein, 1917).
- Put these two simple ideas together and you get this:



Local proper time is everywhere orthogonal to a closed unbound space. Think of time in the Universe like gravity on Earth; it is the same everywhere, but also 'different' everywhere, *relative to somewhere else*. The boundary of the circle represents a *single* spatial dimension of the finite unbound Universe of radius R . Time is a strictly *local* property represented by the vertical radial vector; there is no universally shared 'cosmic time' coordinate. Rather than a shared 'cosmic time' t , there are an infinite number of distinct local time coordinates t_n .

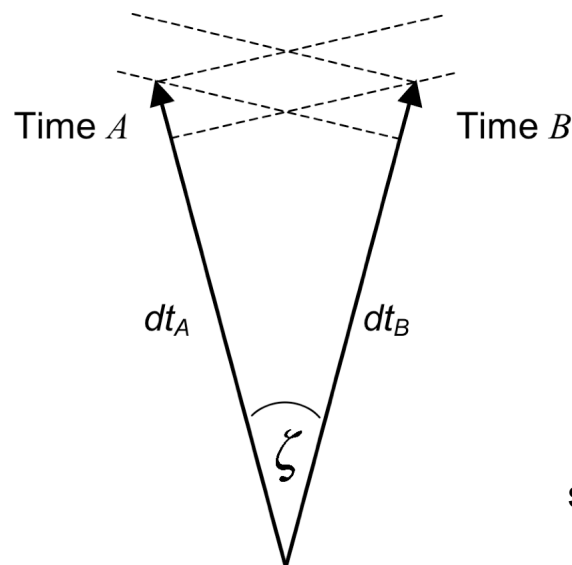
Time dilation implies a redshift

(in case this was not obvious)

- B measures the frequency of locally sourced radiation according to the local clock.
- If A experiences B 's clock to be slow relative to the local clock, then the the frequency of that radiation according to the local clock (A) is lower, because the same number of 'waves' are produced in a greater amount of time.
- A smaller measured frequency implies a larger wavelength, i.e, a redshift.

Geometric interpretation of relativistic temporal effects

Based on empirical observation of relativistic temporal effects, we abandon the idea that time is restricted to a single dimension of spacetime. We introduce the novel idea that time is properly modeled as a *geometric object*. In addition to the trivial directionality associated with past and future, time is associated with relative geometric directionality associated with measurement of time in distinct reference frames.



A is 'falling behind' *relative* to B 's measurement while B is 'falling behind' *relative* to A 's measurement.

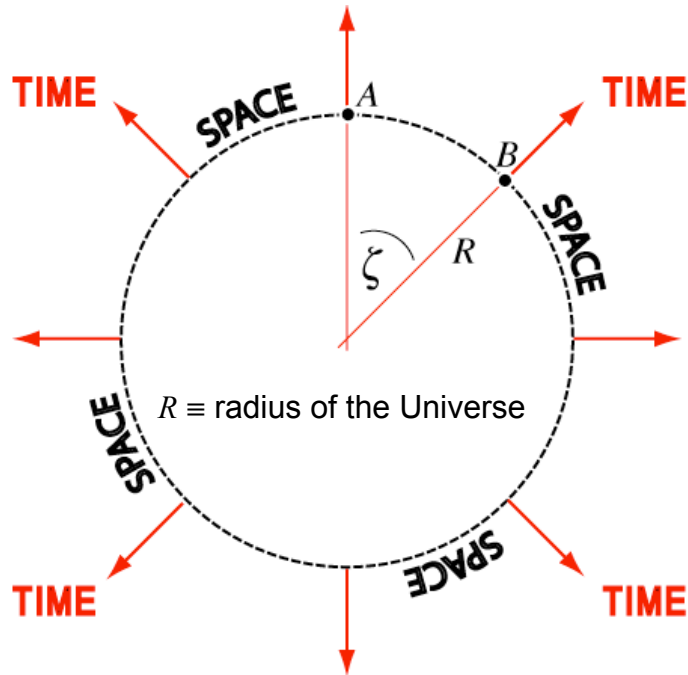
Time and space are equivalent; the familiar spatial concept of *relative geometric perspective* also holds for time measurement. While this idea is quite simple, it requires an adjustment in one's concept of time, which is typically restricted to a single dimension.

symmetric *relative* time dilation:
$$\frac{dt_A}{dt_B} = \frac{dt_B}{dt_A} = \sec \zeta \quad \left[0 \leq \zeta \leq \frac{\pi}{2} \right]$$

implied redshift:
$$z = \frac{dt_A}{dt_B} - 1 = \sec \zeta - 1 \quad \left[0 \leq \zeta \leq \frac{\pi}{2} \right]$$

The distance function

- What is the distance around the Universe? $2\pi R$
- What is the distance between A and B ? $\zeta \cdot R$
- As ζ is a known function of z , then the distance d is a known function of z with a coefficient R that must be observationally determined.



$$z = \sec \zeta - 1 \quad \rightarrow \quad \zeta = \cos^{-1} \frac{1}{z+1}$$

$$d = R \cdot \zeta = R \cos^{-1} \frac{1}{z+1}$$

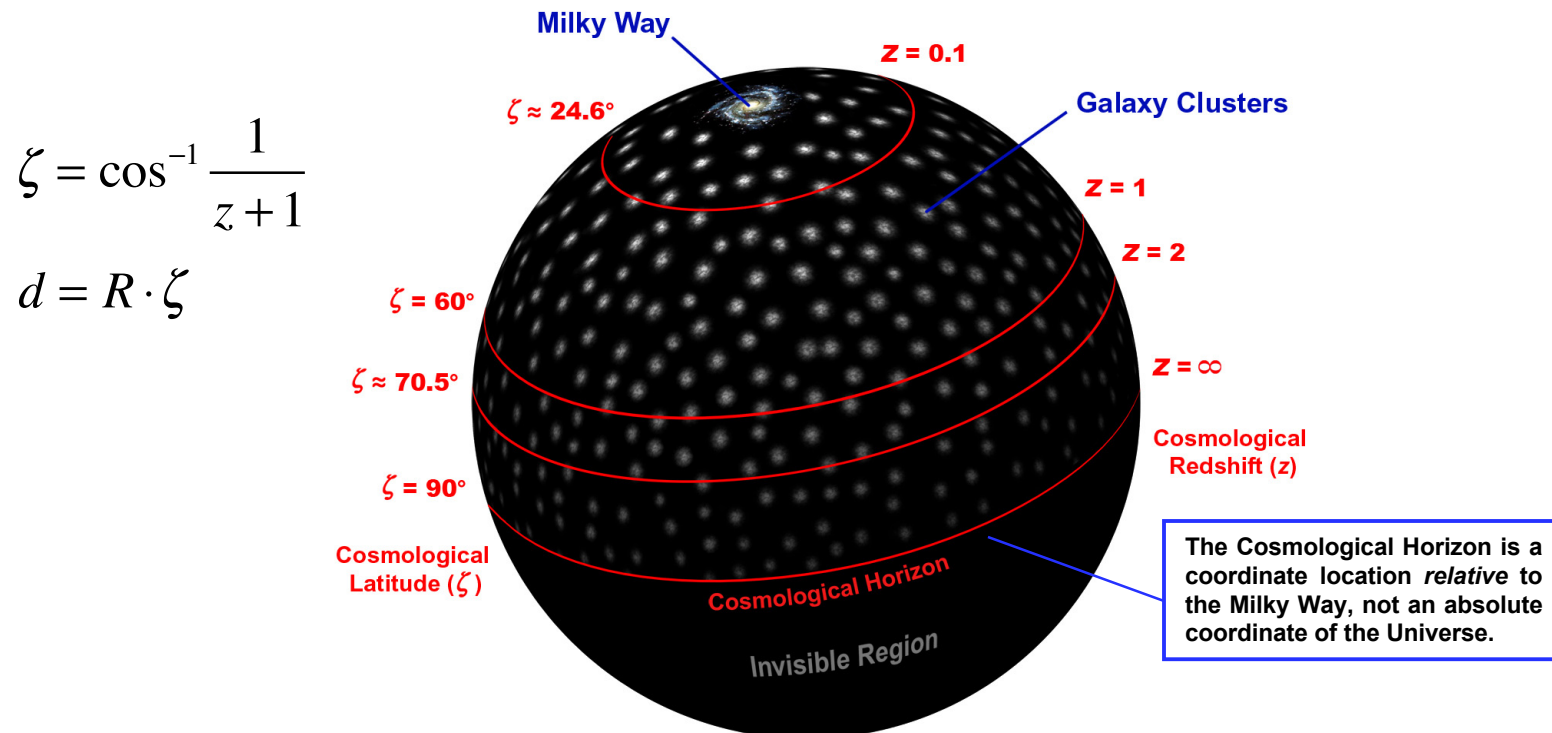
Note that the symmetric redshift z that exists between A and B is a function of the separation distance only and is not dependent on an expansion.

The cosmological horizon

- What happens at $\zeta = \pi/2$?
- Nothing special, but z is infinite at the distance $d = R\pi/2$ away from a telescope.
- No information is available from objects existing at that distance or beyond it.
- So, a *cosmological horizon* exists a finite distance away from any observation point.

The implied model of our Universe

This model is the astrophysical equivalent of the first terrestrial globe, that is, the first geometrically accurate map of the world ever created.



The sphere's surface represents a 2-dimensional 'slice of finite, unbound 3-D space. The local vertical to this curved surface at every point represents local proper time there.

The sphere's interior in this model has no physical analog; only its surface maps space. The size of the Milky Way and the galaxy clusters depicted clearly reflect artistic license.

The volume function

- The angle ζ is just the angle ψ in the equation for the S_3 'surface area' of a hypersphere.

$$\text{Recall (p. 9): } S_3 = 4\pi \left[\frac{\psi}{2} - \frac{\sin 2\psi}{4} \right]_0^\pi = 2\pi^2$$

$$\therefore S_3(\zeta) = 4\pi \left(\frac{\zeta}{2} - \frac{\sin 2\zeta}{4} \right) = 2\pi \left(\zeta - \frac{\sin 2\zeta}{2} \right)$$

What is the relationship between redshift (z) and volume (S_3) implied by the new model?

$$z = \frac{dt_A}{dt_B} - 1 = \sec \zeta - 1$$

$$\cos \zeta = \frac{1}{z+1}$$

$$S_3(\zeta) = 2\pi \left(\zeta - \frac{\sin 2\zeta}{2} \right)$$

$$\sin \zeta = \sqrt{1 - \cos^2 \zeta} = \left(1 - \frac{1}{(z+1)^2} \right)^{\frac{1}{2}}$$

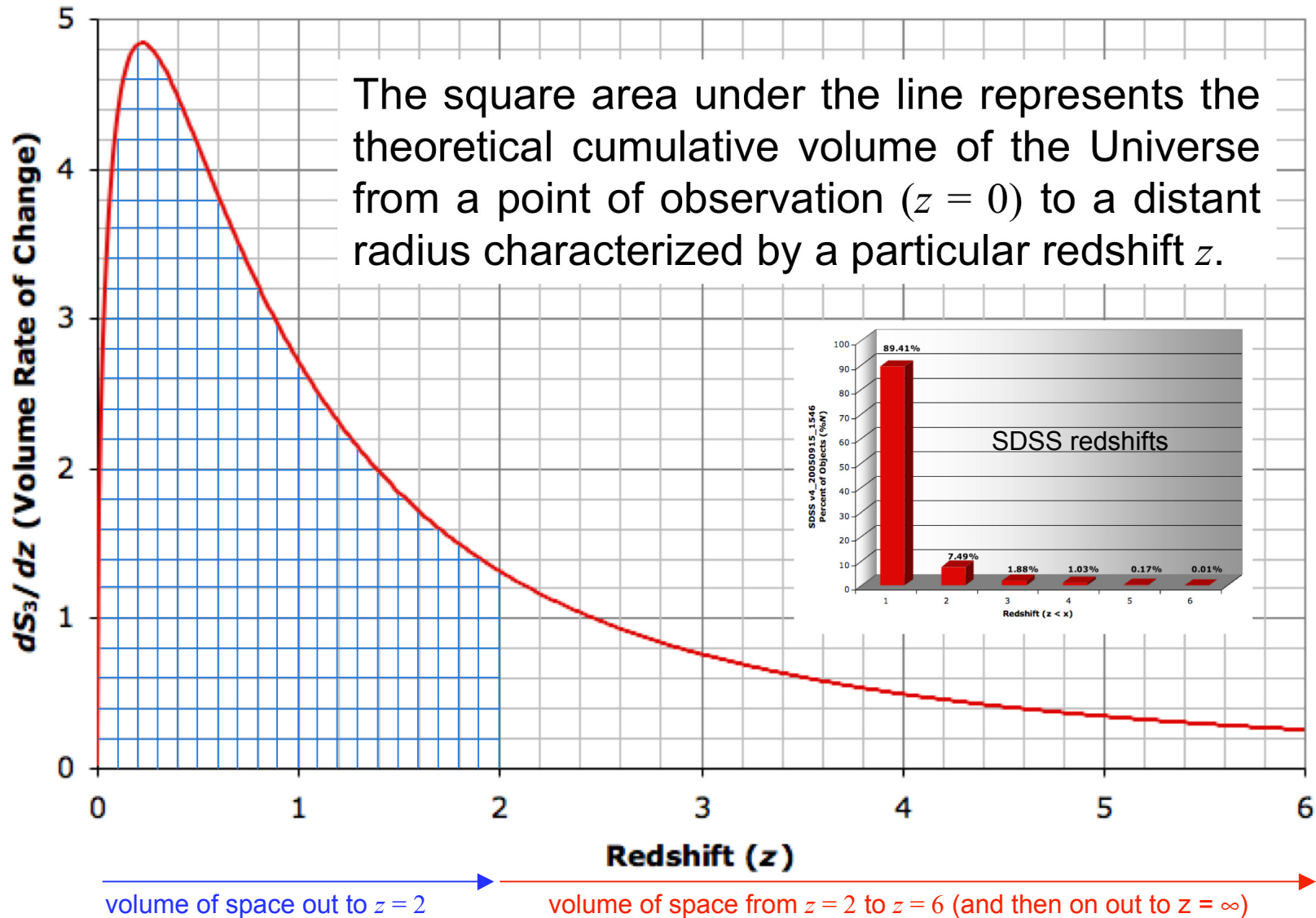
$$\sin 2\zeta = 2 \cos \zeta \sin \zeta = 2 \left(\frac{1}{z+1} \right) \left(1 - \frac{1}{(z+1)^2} \right)^{\frac{1}{2}}$$

$$S_3(z) = 2\pi \left[\cos^{-1} \left(\frac{1}{z+1} \right) - \left(\frac{1}{(z+1)^2} - \frac{1}{(z+1)^4} \right)^{\frac{1}{2}} \right]$$

Quod Erat Demonstrandum
"which was to be demonstrated"

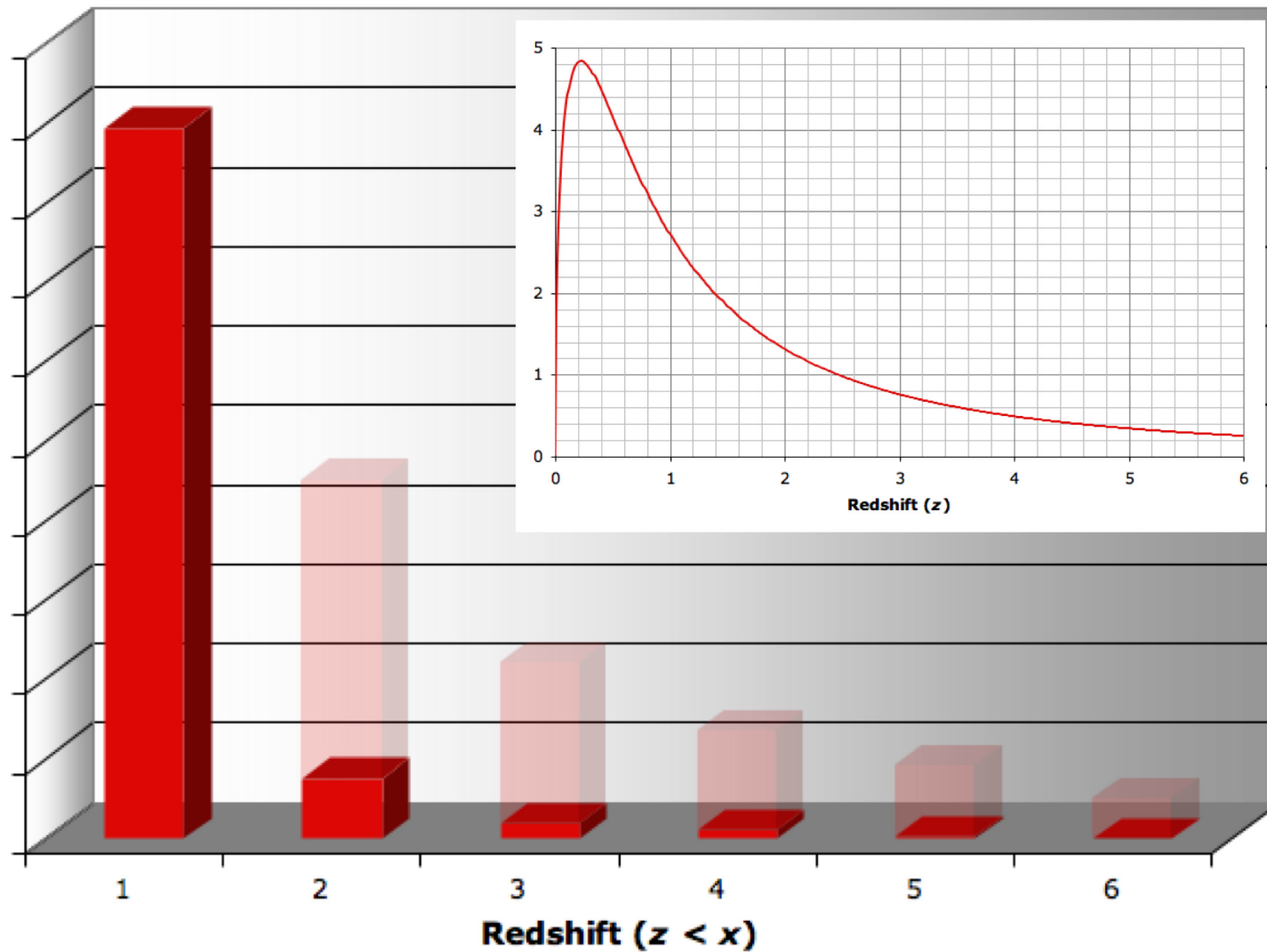
Q.E.D. $\frac{dS_3}{dz} = 2\pi \left[(z+1)^{-2} \left[1 - (z+1)^{-2} \right]^{-\frac{1}{2}} + \left[(z+1)^{-2} - (z+1)^{-4} \right]^{-\frac{1}{2}} \left[(z+1)^{-3} - 2(z+1)^{-5} \right] \right]$

Graph of the function dS_3/dz



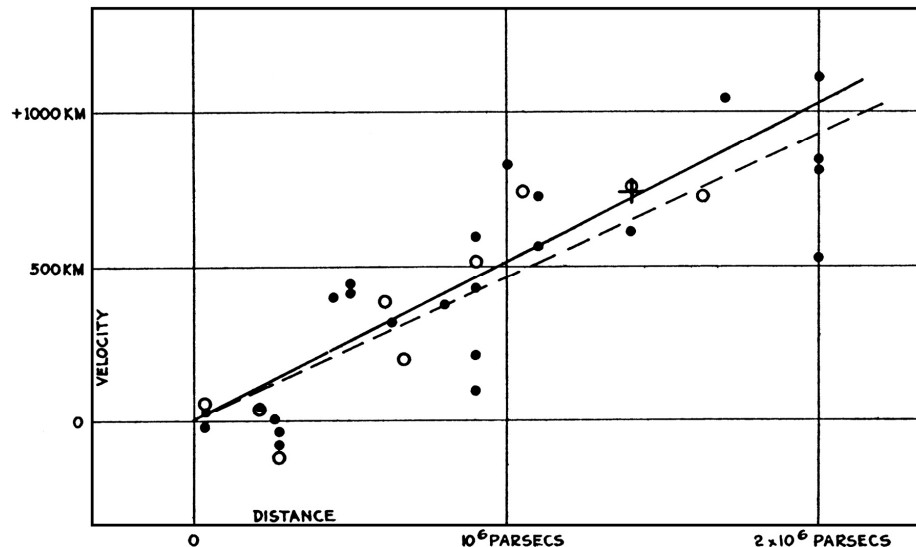
Confronting the theory with SDSS observations

The transparent bars show predicted increasing Malmquist bias.

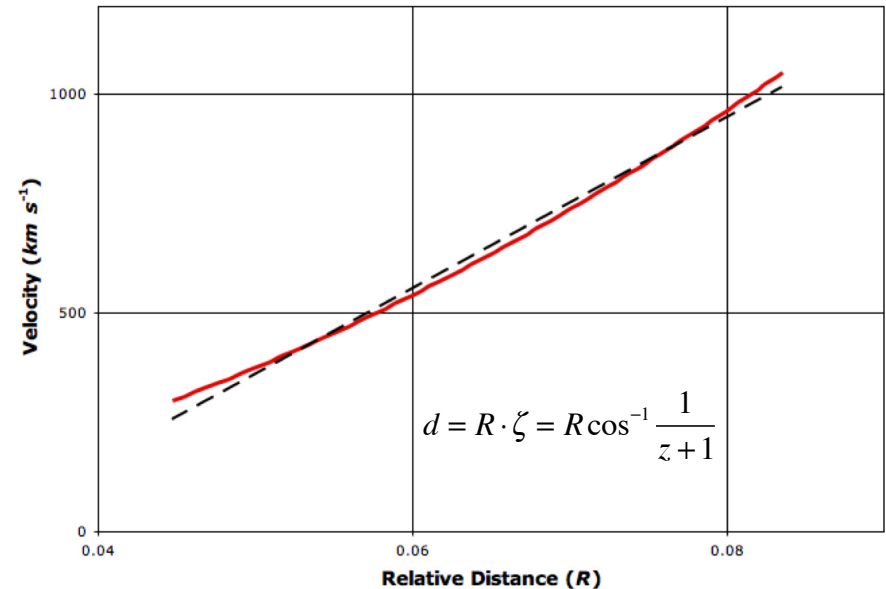


Comparison to 1929 Hubble Diagram

Original Hubble Diagram, 1929



The new model and its linear fit



Edwin Hubble, "A Relation Between Distance and Radial Velocity Among Extra-Galactic Nebulae",
Proceedings of the National Academy of Sciences **15**, 168-173 (1929).

The new model (right) shows that the redshift-distance relationship is close to being linear for the region $300 < v < 1000$ but the y-intercept of the linear fit (dashed line) is not $(0, 0)$. Hubble's graph (left) reflects the linear relationship in this region but also poor data and significant peculiar velocities in the local Universe. His initial estimate of 500 for the Hubble Constant was totally wrong, reflecting on his *assumption* of a y-intercept at the origin.

We need corroborating evidence.

One cannot introduce a new cosmological model that suggests an overthrow of the Hubble expansion based on the evidence presented so far. Corroborating empirical evidence from multiple very reliable sources is essential in order to motivate serious consideration, let alone to present an incontrovertible argument that the new theory is correct according to all the astrophysical observations.

The Very Large Array (VLA) in New Mexico, USA



Type Ia* Supernovæ (SNe Ia)

* “type one-a”

SNe Ia are gigantic explosions caused by thermonuclear disruption of hydrogen-deficient carbon-oxygen white dwarf stars in binary star systems.

- extremely luminous
- ~ uniform luminosity
- many observed: '95-'05

SNe Ia are unparalleled as precise distance indicators, serving as standard candles probing out beyond $z = 1.5$



Hubble Space Telescope (HST) image of Supernova 1994D near NGC 4526, a spiral galaxy at redshift $z = 0.0015$

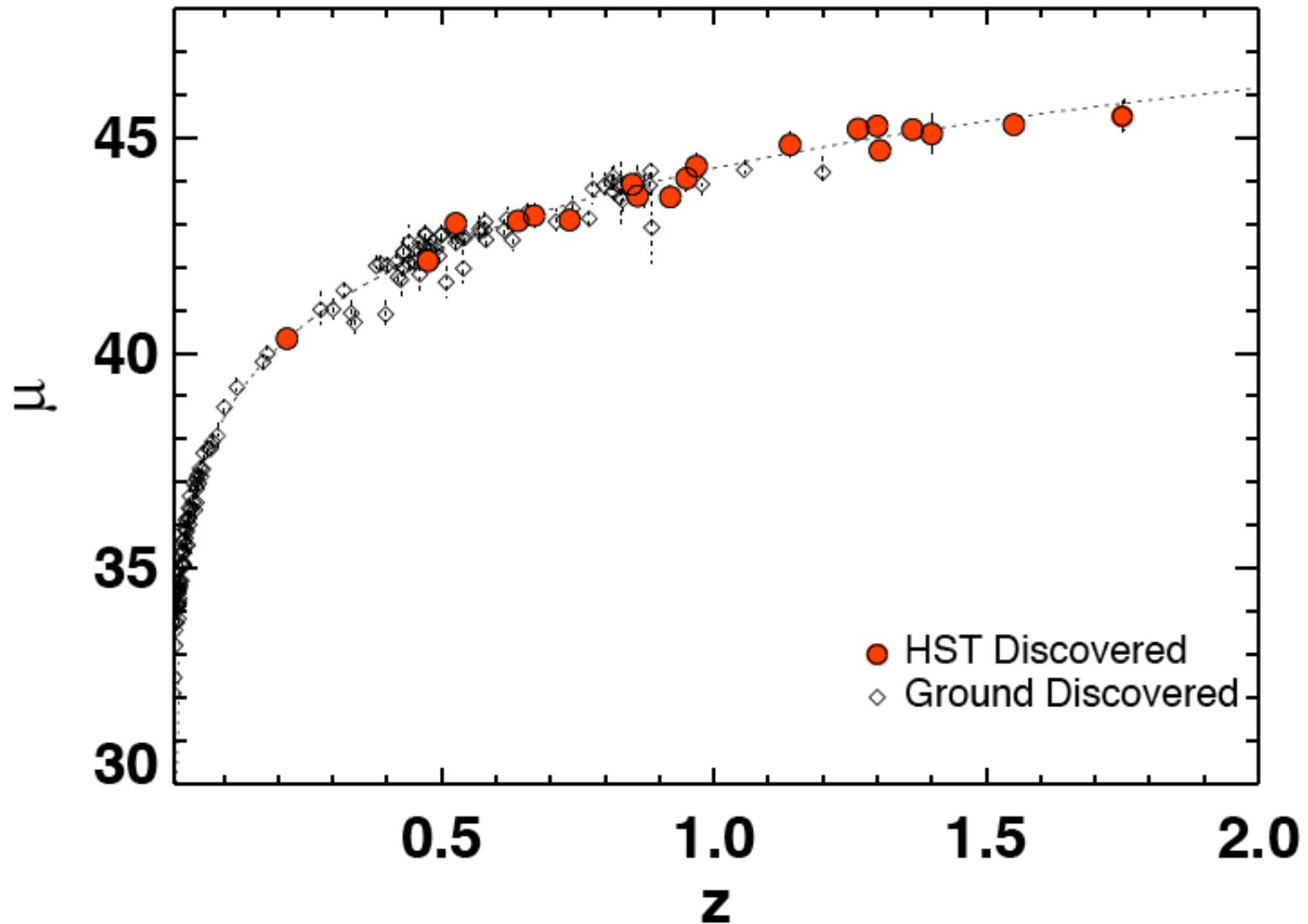
The distance modulus (μ)

- Apparent magnitude (m) : how bright a galaxy appears
- Absolute magnitude (M) : intrinsic galaxy luminosity
- Luminosity distance (d_L) : distance to the galaxy
- 5 magnitudes means 100 times more luminous
- A higher magnitude means *less* luminous

$$\mu = m - M = 5 \log d_L - 25$$

For SNe Ia, the absolute magnitude M is effectively constant, so the distance modulus μ parallels the apparent magnitude, only differing by a scale factor.

SNe Ia Hubble diagram: $\mu(z)$



Copyright 2004 *Astrophysical Journal*, Reproduced with permission of the AAS.

Courtesy Adam G. Riess *et al.*, *Astrophysical Journal* **607** 665-687(2004); arXiv: astro-ph/0402512 (p. 59)

Description of the $\mu(z)$ graph

A Euclidean rather than a Riemannian geometry is assumed.**

Distance estimates from SN Ia light curves are derived from the luminosity distance,

$$d_L = \left(\frac{L}{4\pi F} \right)^{\frac{1}{2}},$$

where L and F are the intrinsic luminosity and observed flux of the SN within a given passband, respectively. Equivalently, logarithmic measures of the flux (apparent magnitude, m) and luminosity (absolute magnitude, M) were used to derive extinction-corrected distance moduli, $\mu_0 = m - M = 5 \log d_L + 25$ (d_L in units of megaparsecs). In this context, the luminosity is a “nuisance parameter” whose value is unimportant for kinematic (and most cosmological) studies. We have used the MLCS2k2* method and the data described in [Tbl] 2 to derive accurate individual relative distance moduli for the sets of SNe described in [Tbl] 3.

Adam G. Riess *et al.*, “Type Ia Supernova Discoveries at $z > 1$ From the *Hubble Space Telescope*: Evidence for Past Deceleration and Constraints on Dark Energy Evolution”, *Astrophysical Journal* **607**, 665-687 (2004); arXiv: astro-ph/0402512 (p. 22).

** The unit area of a Euclidean sphere of radius d_L

$$1 = 4\pi d_L^2 \quad \rightarrow \quad d_L = \left(\frac{1}{4\pi} \right)^{\frac{1}{2}}$$

* Multicolor Light Curve Shape

The conventional interpretation of the SNe Ia data is problematic.

We have discovered 16 Type Ia supernovae (SNe Ia) with the Hubble Space Telescope (HST) and have used them to provide the first conclusive evidence for cosmic deceleration that preceded the current epoch of cosmic acceleration. ... A purely kinematic interpretation of the SN Ia sample provides evidence at the $> 99\%$ confidence level for a transition from deceleration to acceleration or similarly, [strong evidence for a cosmic jerk](#). Using a simple model of the expansion history, the transition between the two epochs is constrained to be at $z = 0.46 \pm 0.13$.

Adam G. Riess *et al.*, "Type Ia Supernova Discoveries at $z > 1$ From the *Hubble Space Telescope*: Evidence for Past Deceleration and Constraints on Dark Energy Evolution", *Astrophysical Journal* **607**, 665-687 (2004); arXiv: astro-ph/0402512 (abstract, p. 1).

This defies the laws of physics and requires 'dark energy', which is like invoking 'magic', but there seemed to be no alternative...

The redshift-luminosity relationship implied by the new cosmological model

$$S_3 = 4\pi \int \sin^2 \psi \, d\psi \rightarrow S_2 = 4\pi \sin^2 \psi$$

$$\sin \zeta = \sqrt{1 - \cos^2 \zeta} = \left(1 - \frac{1}{(z+1)^2}\right)^{\frac{1}{2}}$$

$$\rightarrow S_2(z) = 4\pi \left(1 - \frac{1}{(z+1)^2}\right)$$

Photon dispersion

$$\therefore F(z) = \frac{L}{4\pi \left(1 - \frac{1}{(z+1)^2}\right)}$$

Effects of time dilation

$$\rightarrow F(z) = \frac{L}{4\pi \left[(z+1)^2 - 1\right]}$$

- energy reduced by $(z+1)^{-1}$
- photons reduced by $(z+1)^{-1}$

Convert the flux $F(z)$ to $m_{bol}(z)$

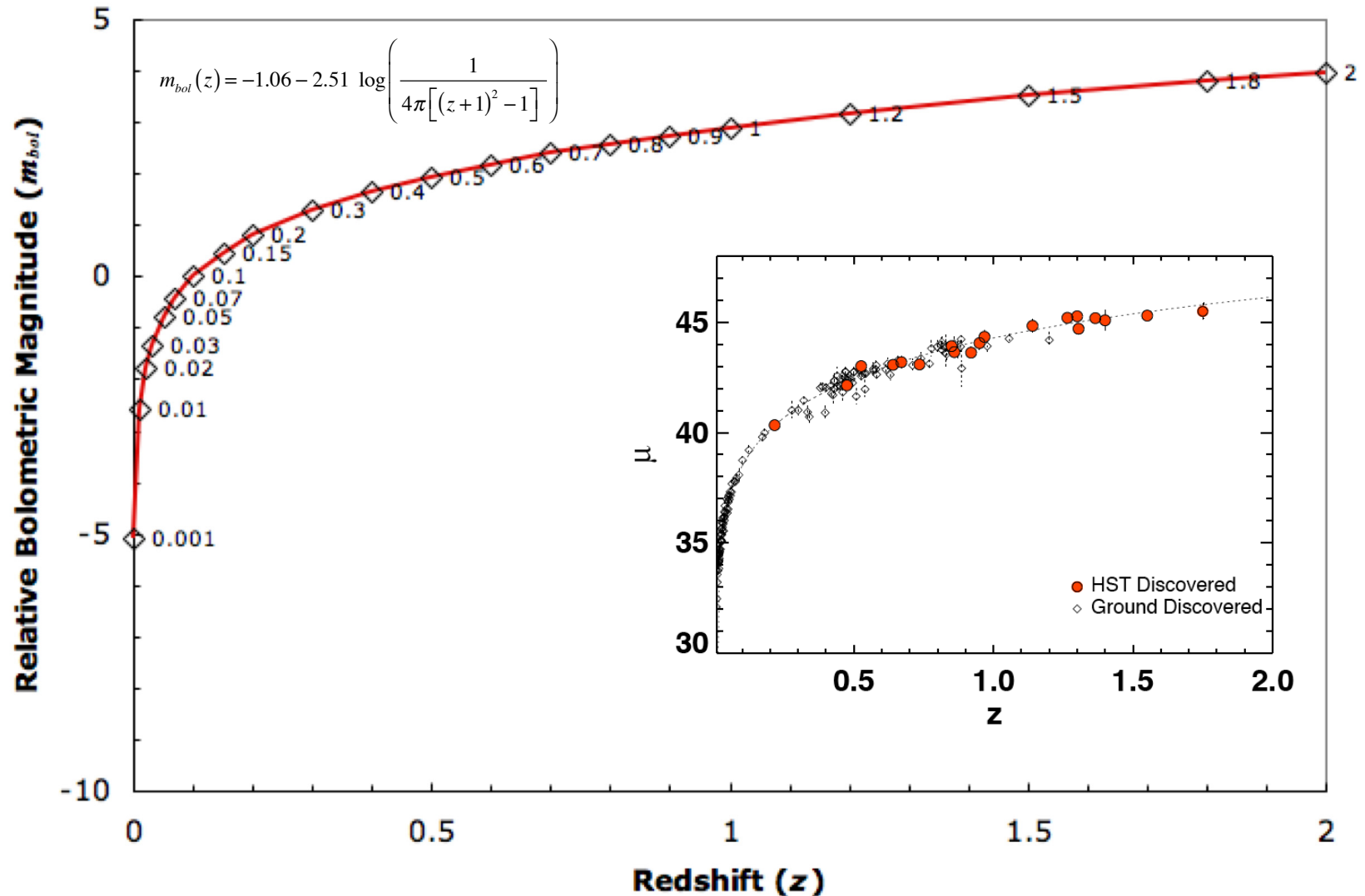
Bolometric apparent magnitude m_{bol} means that you measure flux across the entire frequency spectrum.

$$m_{bol}(z) = C - 2.51 \log \left(\frac{L}{4\pi [(z+1)^2 - 1]} \right)$$

Set the luminosity to a unit reference value and then choose C so that $z = 0.1$ is the convenient zero point.

Q.E.D. $m_{bol}(z) = -1.06 - 2.51 \log \left(\frac{1}{4\pi [(z+1)^2 - 1]} \right)$

Predicted redshift-luminosity $m_{bol}(z)$ relationship *less effects of extinction*



Account for extinction

Extinction is absorption of light due to intervening matter. Over cosmological distances, the intergalactic medium is assumed to be uniform in density over large distances, so that the corresponding extinction rate is closely approximated by a linear function of the light travel distance. As the distance is directly proportional to the cosmological latitude and the function $\zeta(z)$ is known, we can set the extinction constant ε according to observations. The linear model is only an approximation due to the fact that extinction is dependent on the wavelength of light; longer (redder) wavelengths penetrate the intergalactic medium better than shorter (bluer) wavelengths. Therefore, the light of nearby galaxies is disproportionately extinguished over the distance to them as compared to the redder light from more distant galaxies over that same nearby space.

$$A = \varepsilon \cdot \zeta = \varepsilon \cos^{-1} \frac{1}{z+1}$$

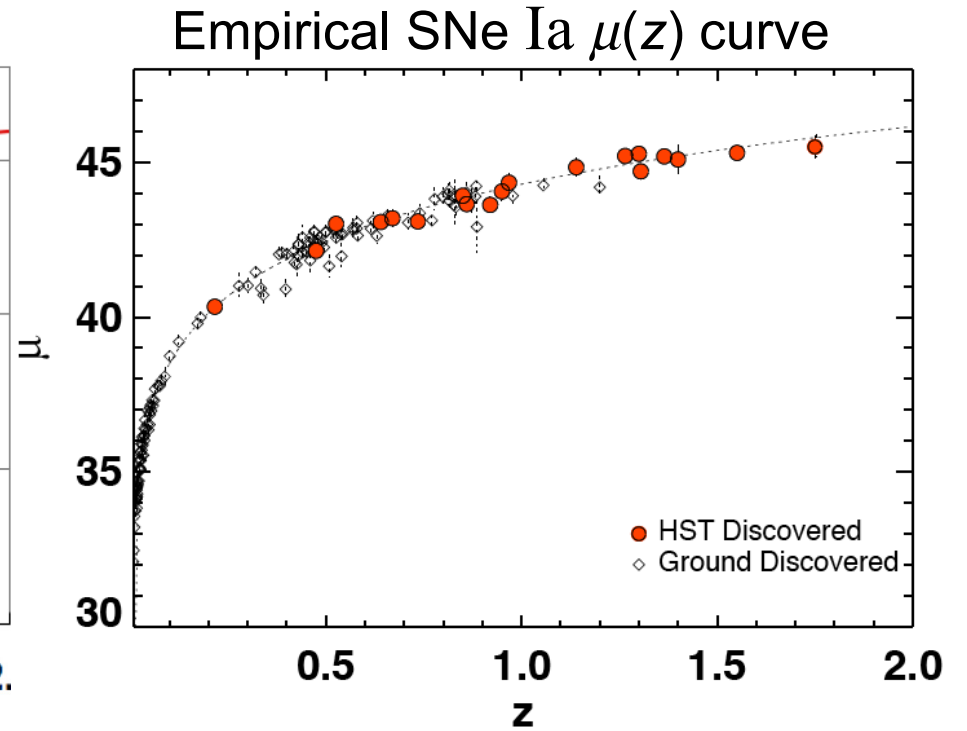
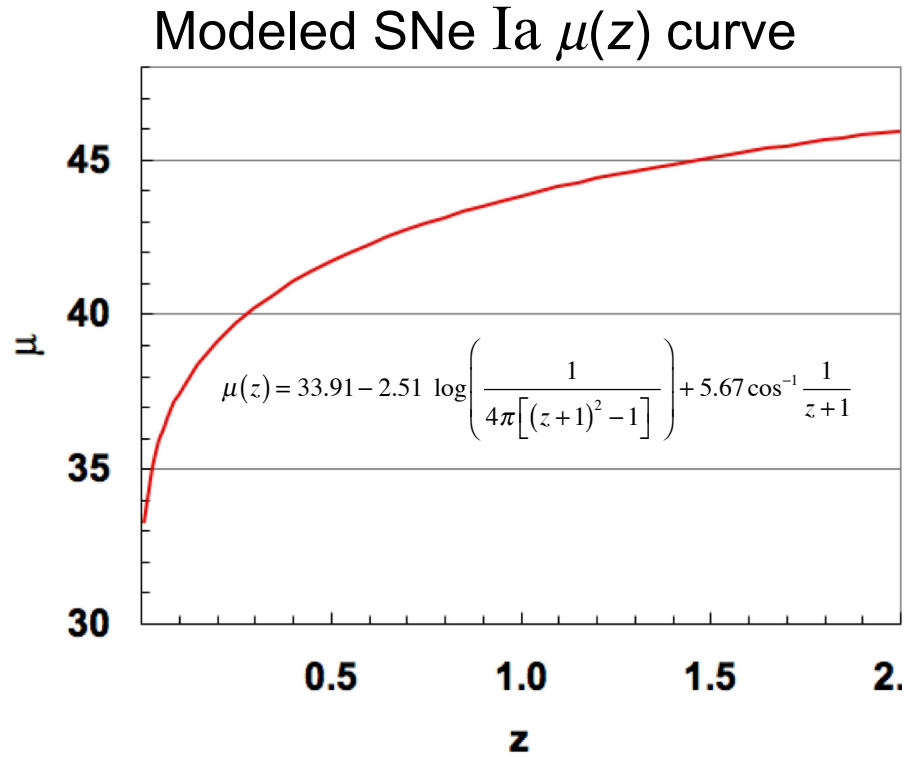
Q.E.D. $m_{bol}(z) = -1.06 - 2.51 \log \left(\frac{1}{4\pi [(z+1)^2 - 1]} \right) + \varepsilon \cos^{-1} \frac{1}{z+1}$

Convert for like comparison

- Range of (z, μ) is $(0.0104, 33.21)$ to $(1.755, 45.53)$
- Therefore the empirical $\Delta m(\Delta z)$ is 12.3
- Predicted $\Delta m(\Delta z)$ less extinction is 6.3
- To match the SNe Ia data requires an extinction of 6 mag.
- Add the extinction and calibrate to the μ -axis.
- Due to the approximation of a linear extinction rate, the resulting curve will be somewhat less steep at lower redshift than if we properly accounted for the wavelength-extinction dependency.

$$\mu(z) = 33.91 - 2.51 \log \left(\frac{1}{4\pi [(z+1)^2 - 1]} \right) + 5.67 \cos^{-1} \frac{1}{z+1}$$

Theory and observation correlate well

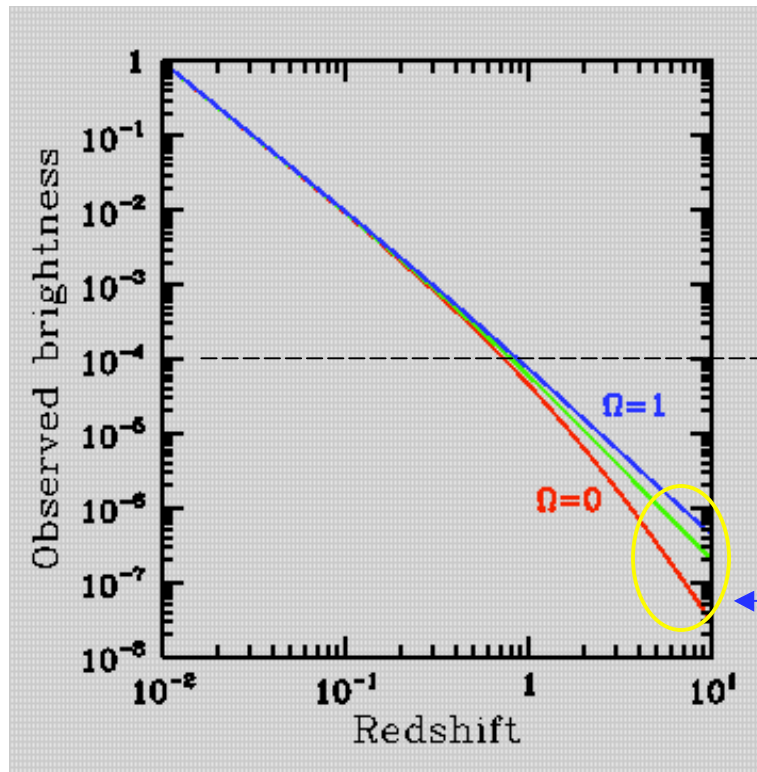


Observed brightness with redshift

The proposed cosmology suggests that the Hubble expansion cosmology models *observed* high-redshift objects to be 2-4 orders of magnitude* *brighter* than is true.

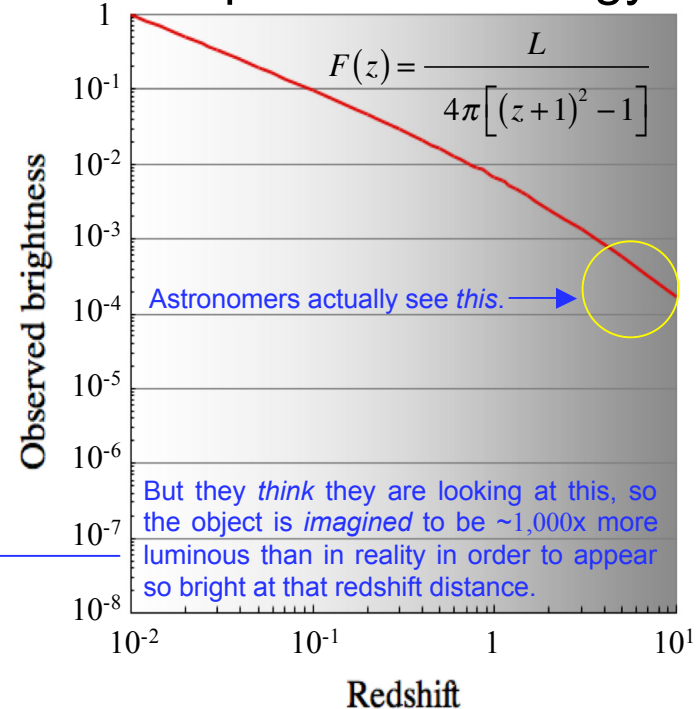
* Do not confuse the general term “orders of magnitude”, meaning factors of ten (10) with the astronomical magnitude scale, where five (5) *magnitudes* is equal to a factor one hundred (100) in brightness.

FLRW Cosmology

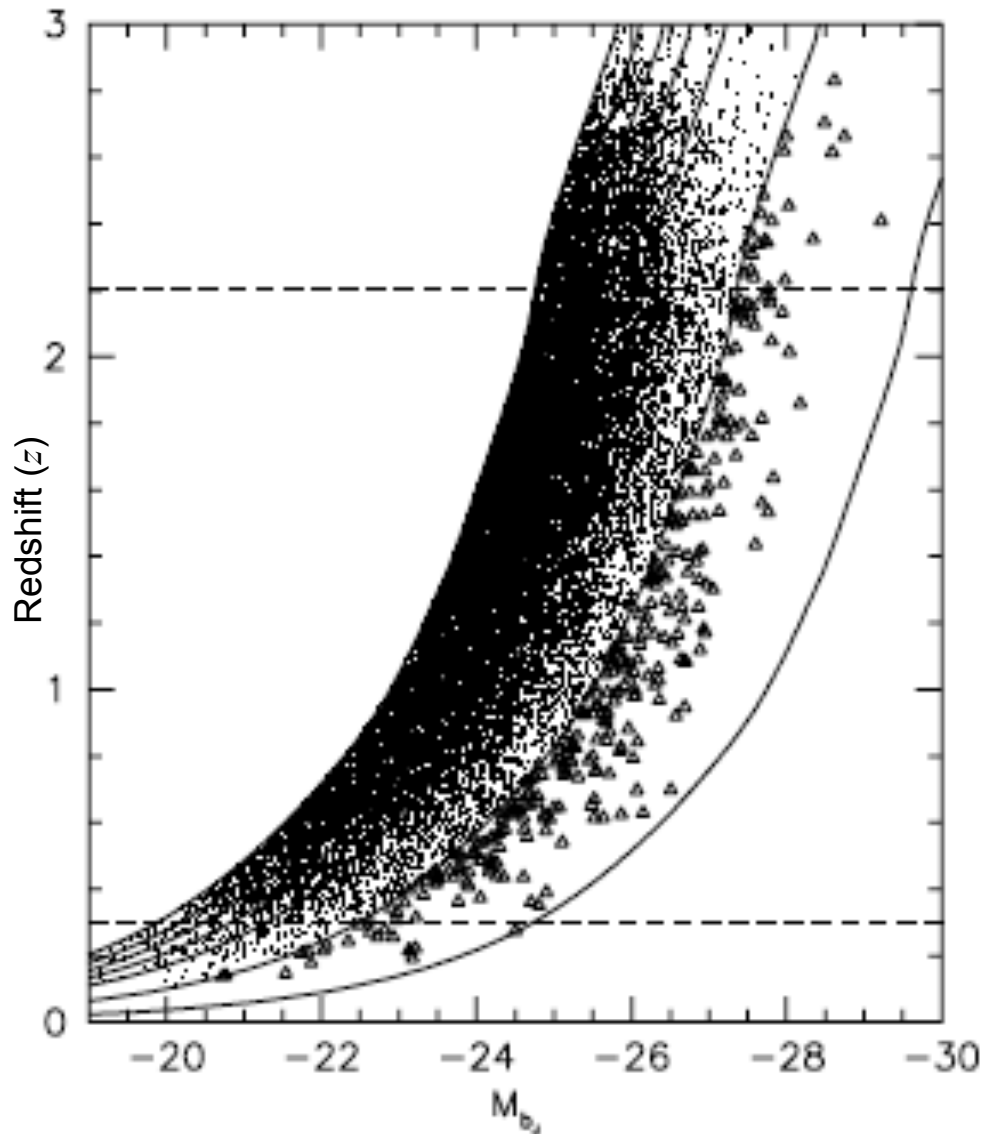


Graph courtesy Emad Iskander, Douglas Scott & Martin White
<http://cosmology.berkeley.edu/Education/Essays/hubble.html>

Proposed Cosmology



Deceptive QSO ‘luminosity evolution’



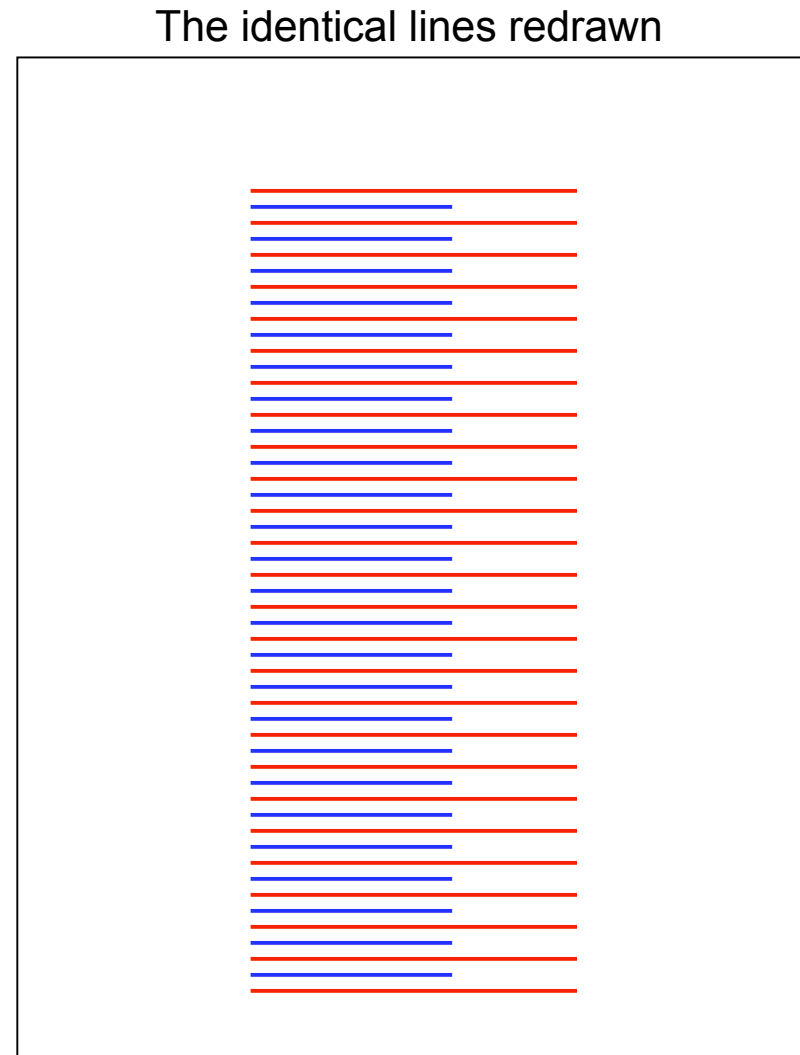
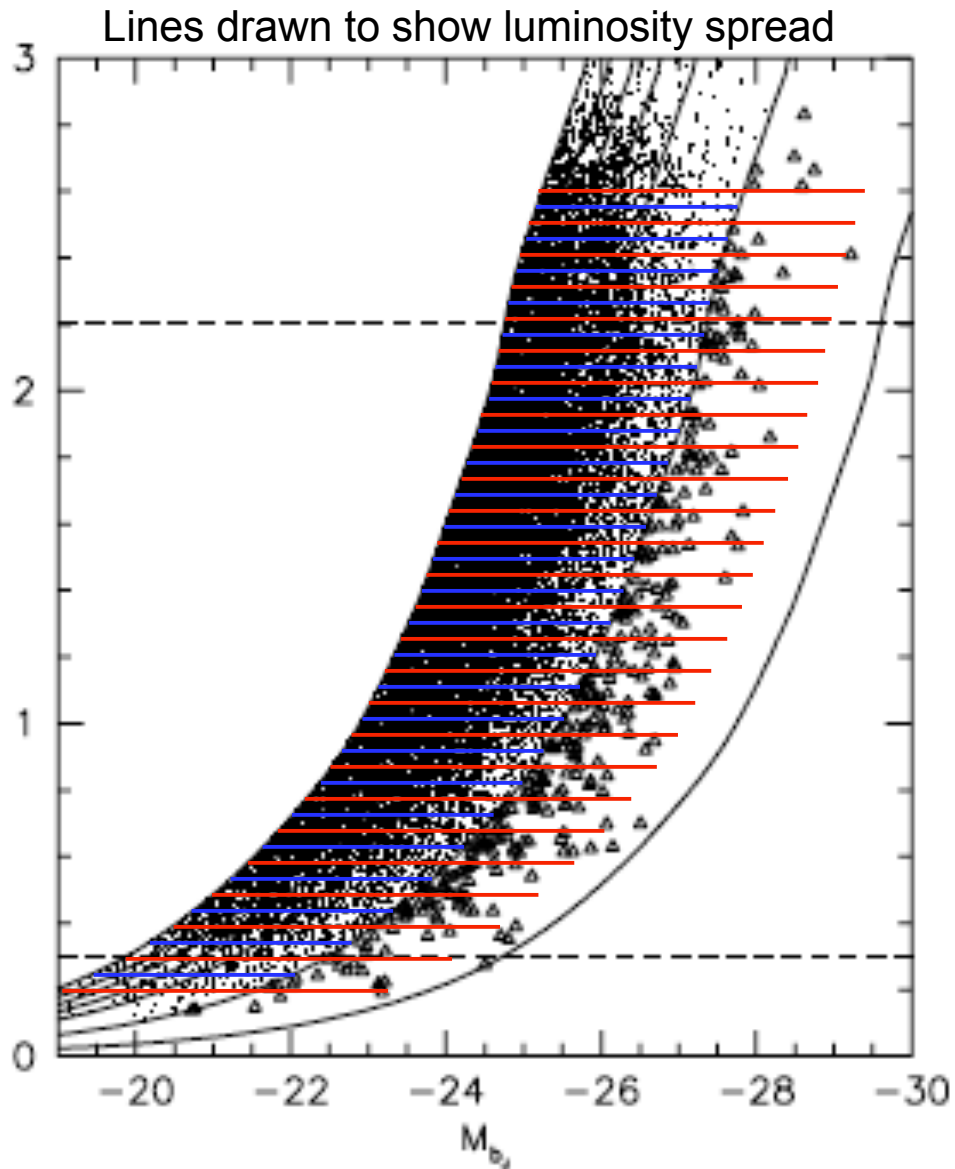
Caption in the source article (Figure 25):

The redshift-absolute magnitude distribution of 2QZ (small points) and 6QZ (triangles) QSOs used in our analysis. The solid lines denote the apparent magnitude limits applied to the data, while the dashed lines show the redshift range used. A WMAP/2dF cosmology is assumed.

The proposed cosmology implies that this effect is an artifact of a faulty model and that distant QSO are not intrinsically younger or different than nearby QSO. We assume that active galactic nuclei of various types and at various stages of evolution are ubiquitous, just like stars observed in galaxies. Therefore, time evolution is represented by the intrinsic luminosity spread along the M_b -axis. *This vital data set can confirm the new cosmological model because when the observed $m(z)$ data is applied to the new model, the same graph will yield a nearly perfectly vertical M_b column that implies a ubiquitous population of active galactic nuclei with no special properties at high redshift.*

Reproduced with permission from Scott M. Croom *et. al.*
 “The 2dF QSO Redshift Survey – XIV. Structure and evolution from the two-point correlation function”
Monthly Notices of the Royal Astronomical Society
 Volume 356 (2005) p. 434.
 Copyright (2005) The Royal Astronomical Society.

The apparent luminosity spread (Δm_z) of active galactic nuclei at a given z is ubiquitous. The implication is that the absolute magnitude spread (ΔM_z) is also ubiquitous, which can be confirmed by applying the observed QSO $m(z)$ data to the new model.



Lookback time

HUDF-JD2 at $z \sim 6.5$

Bahram Mobasher *et al.*, “Evidence for a Massive Post-Starburst Galaxy at $z \sim 6.5$ ”
arXiv: astro-ph/0509768

The finite speed of light c causes ‘lookback time’; we see objects as they were at the time the light began its journey, millions or even billions of years ago. The proposed cosmology implies that this lookback time does not imply *intrinsic* lookback, which means that there is no correlation between redshift and the time evolution of galaxies. Therefore, we can observe intrinsically very old objects even though they may be billions of light years away.

XMM-Newton X-ray Observatory: Quasar APM 8279+5255

APM 8279+5255 is 13.5 thousand million light years away [according to the conventional interpretation of its redshift of 3.91] ... XMM-Newton's data showed that iron was three times more abundant in the quasar than in our Solar System.

Since iron is released by exploding stars, according to precise physical phenomena, and scientists think it builds up across the Universe gradually with time. The Solar System formed just 5 thousand million years ago, so it should contain more iron than the quasar, [which is almost three times as old, according to interpretation of its redshift]. The fact that the quasar contains three times more iron than the Sun is therefore a major puzzle.

One possible explanation is that something is wrong with the way astronomers measure the age of objects in the Universe. The almost-holy red shift-distance-age conversion would therefore be wrong. Fred Jansen, ESA's project scientist for XMM-Newton, explains that this would mean rewriting the textbooks. "If you study the evolution of the Universe, one of the basic rules is that we can tie redshift to age. One distinct possibility to explain these observations is that, at the redshift we are looking at, the Universe is older than we think."

European Space Agency, "[Is the Universe older than expected](#)", *Science and Technology*, (9 July 2002)

See <http://www.mpe.mpg.de/Highlights/pr20020708.html>

XMMU J2235.3-2557

Combining observations with ESO's Very Large Telescope and ESA's XMM-Newton X-ray observatory, astronomers have discovered the most distant, very massive structure in the Universe known so far.

It is a remote cluster of galaxies that is found to weigh as much as several thousand galaxies like our own Milky Way and is located no less than 9,000 million light-years away.

The VLT images reveal that it contains reddish and elliptical, i.e. old, galaxies. Interestingly, the cluster itself appears to be in a very advanced state of development. ...

The discovery of such a complex and mature structure so early in the history of the Universe is highly surprising. Indeed, until recently it would even have been deemed impossible.

European Southern Observatory, ESO Press Release 04/05, (2 March 2005)
["Surprise Discovery of Highly Developed Structure in the Young Universe"](#)

See <http://www.astro.lsa.umich.edu/~cmullis/research/xmmuj2235/index.html>

Conclusions

- In the new model the observed cosmological redshift is convincingly explained as a relativistic time dilation that does not assume an expanding Universe.
- The model is consistent with SDSS galaxy counts, the SNe Ia Hubble Diagram, a ubiquitous population of AGN, and the observation of intrinsically ancient high- z objects.
- There is no need to assume an accelerating Universe, a “cosmic jerk”, “dark energy”, “luminosity evolution”, superluminal “inflation”, or a primordial “singularity”.
- Infinite redshift naturally correlates to a finite distance.
- There are no space or time boundary conundrums.
- Pending convincing explanation of the CMBR and 2H nucleosynthesis, it can be concluded that Hubble’s interpretation was wrong; the Universe is not expanding.

Geoffrey & Margaret Burbidge

“Facing nearly universal opposition, astronomer couple reject big-bang hypothesis”

On the wall of Geoffrey Burbidge’s office at UCSD is a black-and-white photograph of astronomers gathered for a meeting in the 1970s at Cambridge University in England.

Standing among Margaret and Geoffrey Burbidge are some of the towering figures of 20th-century astronomy – Hoyle, Fowler, Kip Thorne, Rees and a young Stephen Hawking.

It wouldn’t be quite accurate to say the Burbidges were in good company. They, after all, were among the most senior and accomplished of the group.

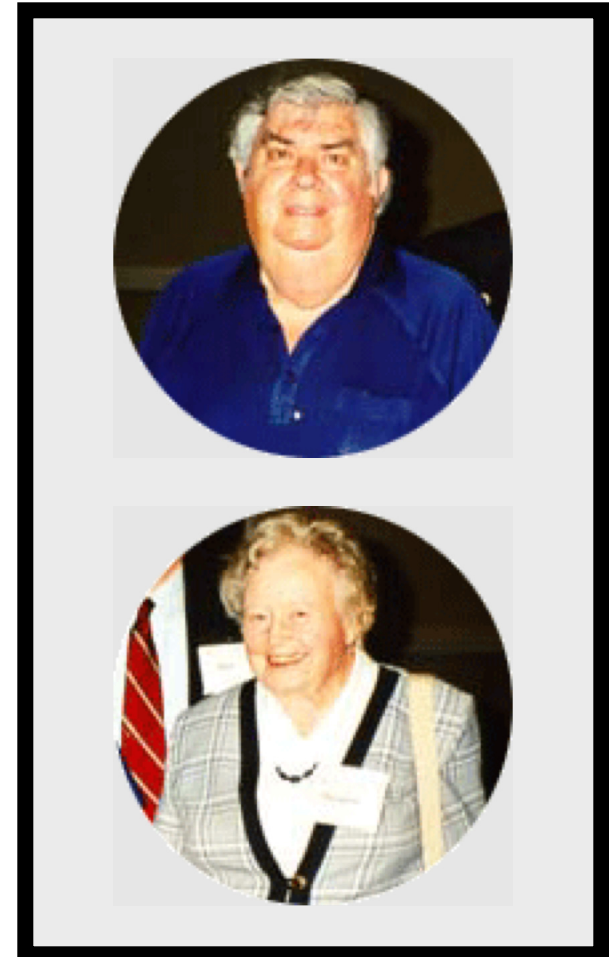
Bruce Lieberman, [The San Diego Union-Tribune](#), 16 February 2005.

The most iconoclastic reaction came from one of the grand old men of modern cosmological disputes, Geoffrey Burbidge of UC San Diego. On Friday, Burbidge and his wife, astronomer Margaret Burbidge, are scheduled to receive the British Royal Astronomical Society’s highest award, the Gold Medal for Astronomy, at a ceremony in London.

The 80-year-old Geoffrey Burbidge, a veteran foe of orthodox cosmology who calls himself an “elderly radical,” said he’s unsure what such puzzling discoveries as **HUDF-JD2** mean, but they don’t particularly surprise him.

“As you get older,” he said, “you realize that you really don’t know very much. Cosmology has progressed very slowly. [Mainstream cosmological theory is like the emperor who had no clothes.](#)”

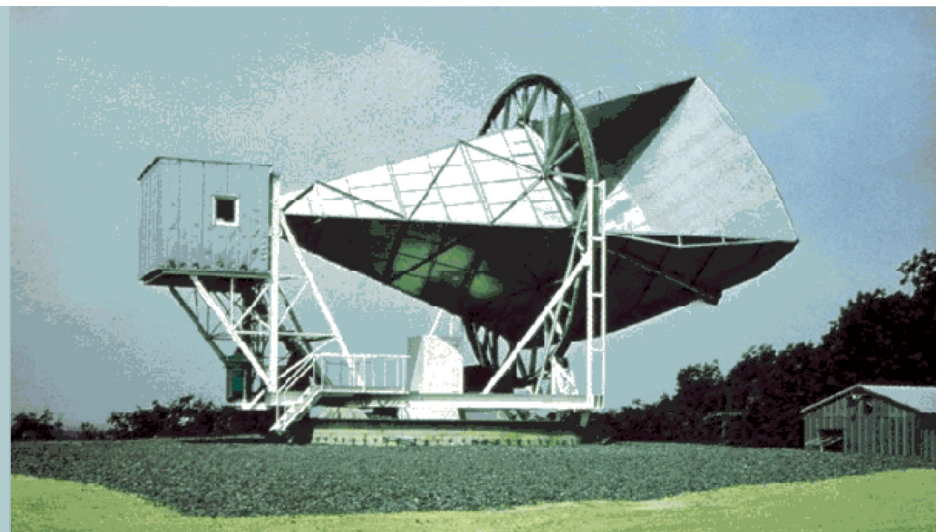
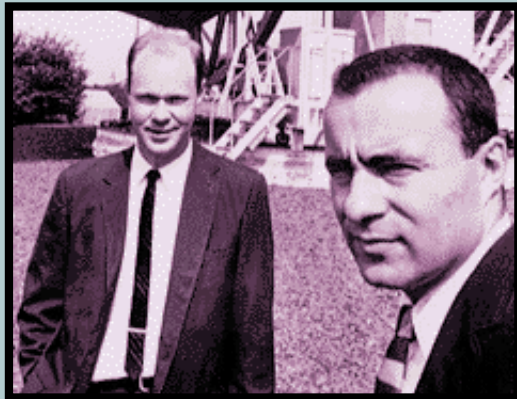
Keay Davidson, “Galaxy like a 3-year-old with bodybuilder physique”, [The San Francisco Chronicle](#), 10 October 2005.



Cosmic Microwave Background Radiation (CMBR)

Measurements of the effective zenith noise temperature of the 20-foot horn-reflector antenna (Crawford, Hogg, and Hunt 1961) at the Crawford Hill Laboratory, Holmdel, New Jersey, at 4080 Mc/s have yielded a value of about 3.5 K higher than expected. This excess temperature is, within the limits of our observations, isotropic, unpolarized, and free from seasonal variations (July, 1964 - April, 1965). [A possible explanation for the observed excess noise temperature is the one given by \[the Princeton University team of\] Dicke, Peebles, Roll, and Wilkinson \(1965\) in a companion letter in this issue.](#)

Arno Penzias & Robert Wilson, "A Measurement of Excess Antenna Temperature at 4080 Mc/s", *Astrophysical Journal* **142**, 419-421 (1965).





Dicke

The 1965 Princeton paper

Could the universe have been filled with blackbody radiation from this possible high-temperature state? If so, it is important to notice that **as the universe expands the cosmological redshift would serve to adiabatically cool the radiation, while preserving the thermal character**. The radiation temperature would vary inversely as the expansion parameter (radius) of the universe.

The presence of **thermal radiation remaining from the fireball** is to be expected if we can trace the expansion of the universe back to a time when temperature was of the order 10^{10} K ($\sim m_e c^2$)...

Without some knowledge of the density of matter in **the primordial fireball** we cannot predict the present radiation temperature. However, a rough upper limit is provided by the observation that black-body radiation at a temperature of 40° K provides an energy density of 2×10^{-29} gm cm³, very roughly the maximum total energy density compatible with the observed Hubble constant and acceleration parameter. **Evidently, it would be of considerable interest to attempt to detect this primeval thermal radiation directly.**

Robert H. Dicke, Philip James Edwin Peebles, Peter G. Roll & David T. Wilkinson,
 “Cosmic Blackbody Radiation”, *Astrophysical Journal* **142**, 414-419 (1965).

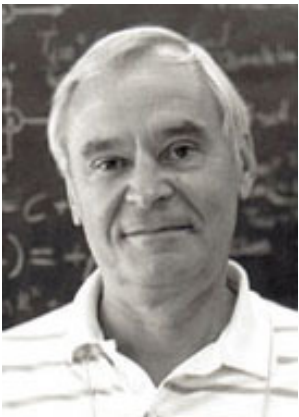
The qualitative mismatch between the theory and observations of galaxies leads me to suspect that the world is more complicated than the cold dark matter model.

“Problems with the Standard Cosmological Model”,
 Kavli Institute for Theoretical Physics Colloquia,
 Dr. Jim Peebles, Princeton University, 25 September 2002;
<http://online.itp.ucsb.edu/online/colloq/peebles1/>

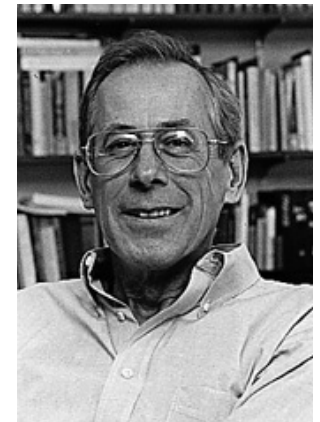


Roll

Wilkinson



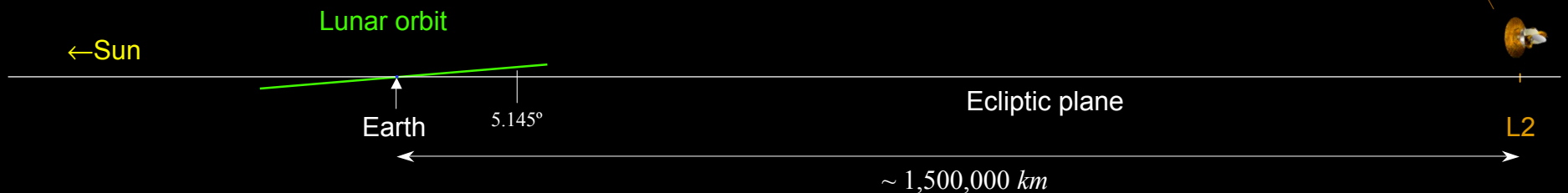
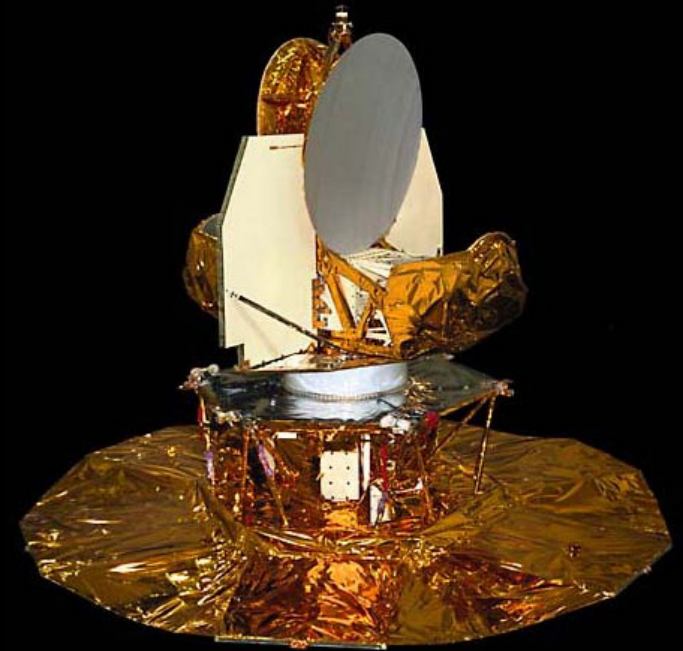
Peebles



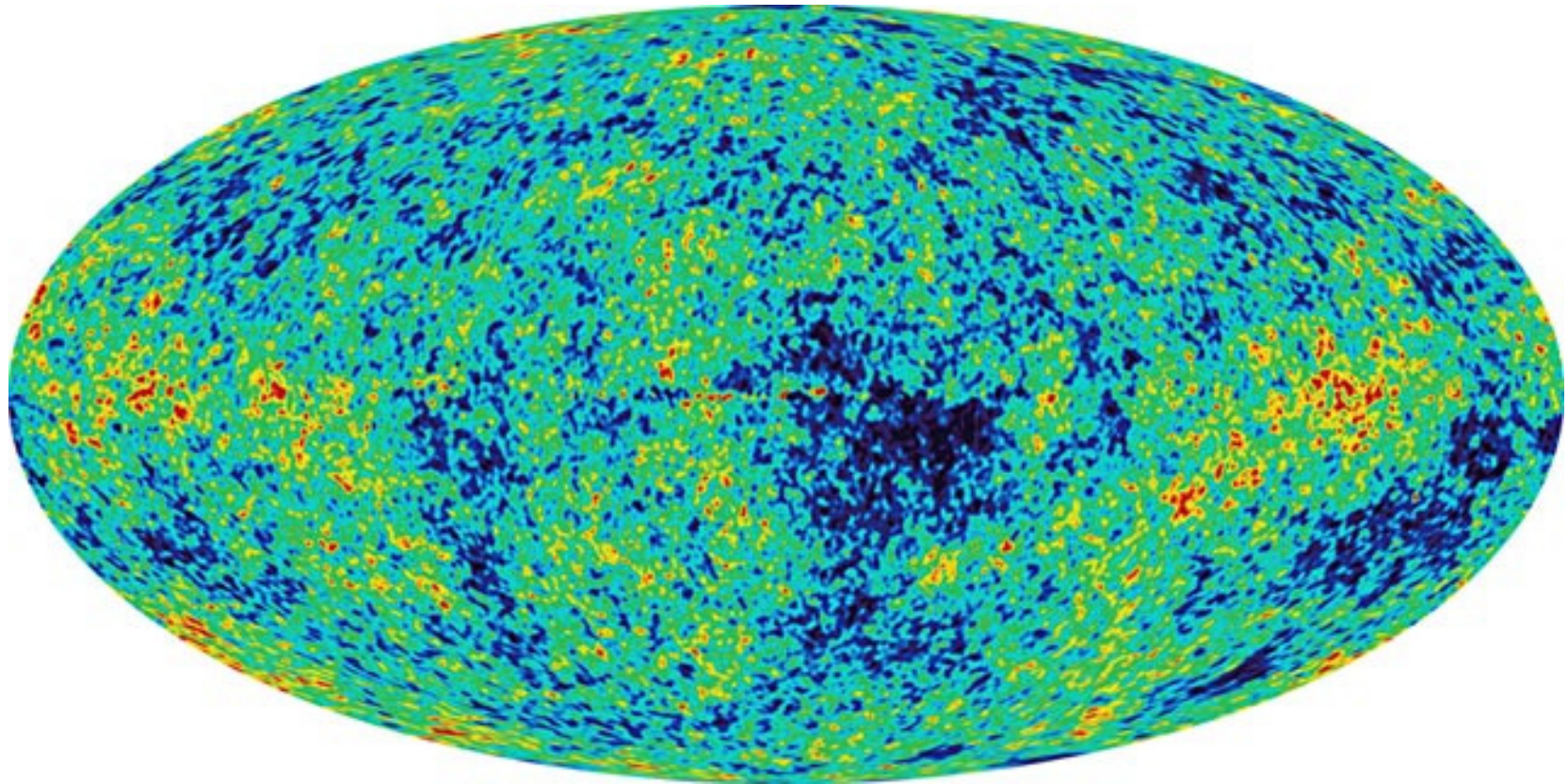
WMAP

The [Wilkinson](#) Microwave Anisotropy Probe (WMAP) was launched on 30 June 2001. Its mission is to create accurate full sky maps of the anisotropy variations in the CMBR. The first full sky observation was completed in April 2002 and the first data release occurred in February 2003. The spacecraft orbits the Sun at the L2 Sun-Earth Lagrange point with its instrumentation pointing away from the Earth and the Sun. The anticipated lifetime of the spacecraft is six years. The data gathered by this truly outstanding mission represents a major milestone in the history of scientific achievement.

[David Wilkinson \(1935-2002\)](#)



WMAP Internal Linear Combination Map

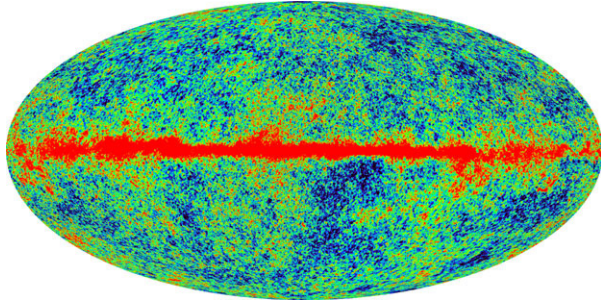


As the entire microwave radiation signature of the galaxy was removed, this 2003 image does not accurately reflect the actual WMAP data. However, it *subjectively* supports the 1965 Princeton theory WMAP was originally built to prove.

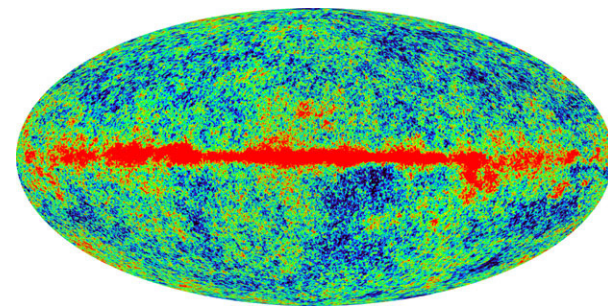
Robert H. Dicke, Philip James Edwin Peebles, Peter G. Roll & David T. Wilkinson,
“Cosmic Blackbody Radiation”, *Astrophysical Journal* **142**, 414-419 (1965).

WMAP full-sky temperature maps

W-Band (94 GHz)



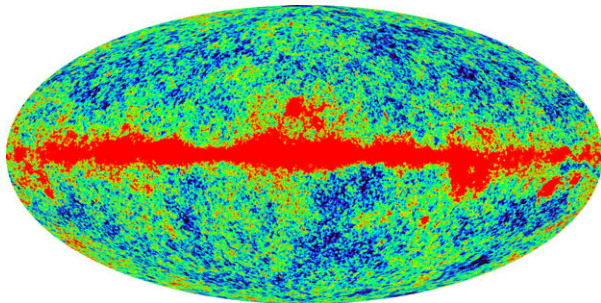
V-Band (61 GHz)



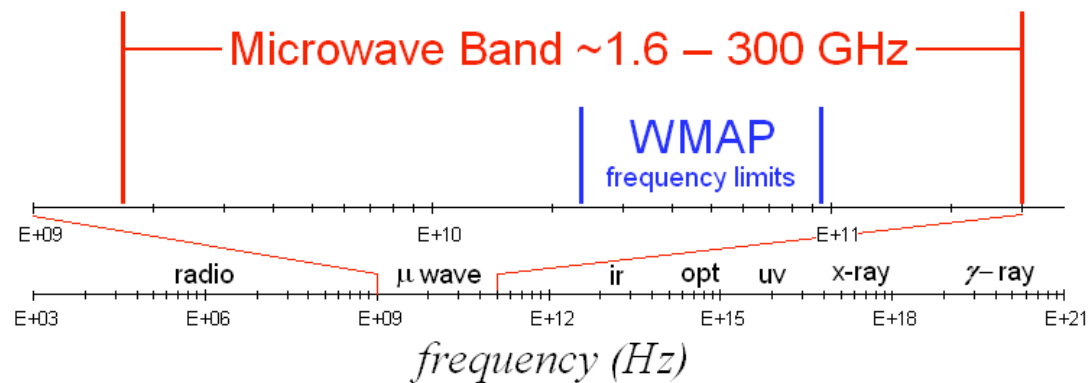
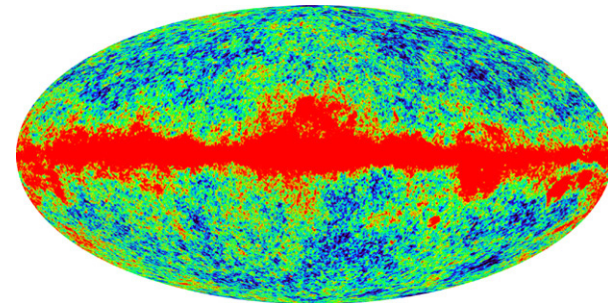
Linear scale -200 to 200 μK

Images: NASA/WMAP Science Team

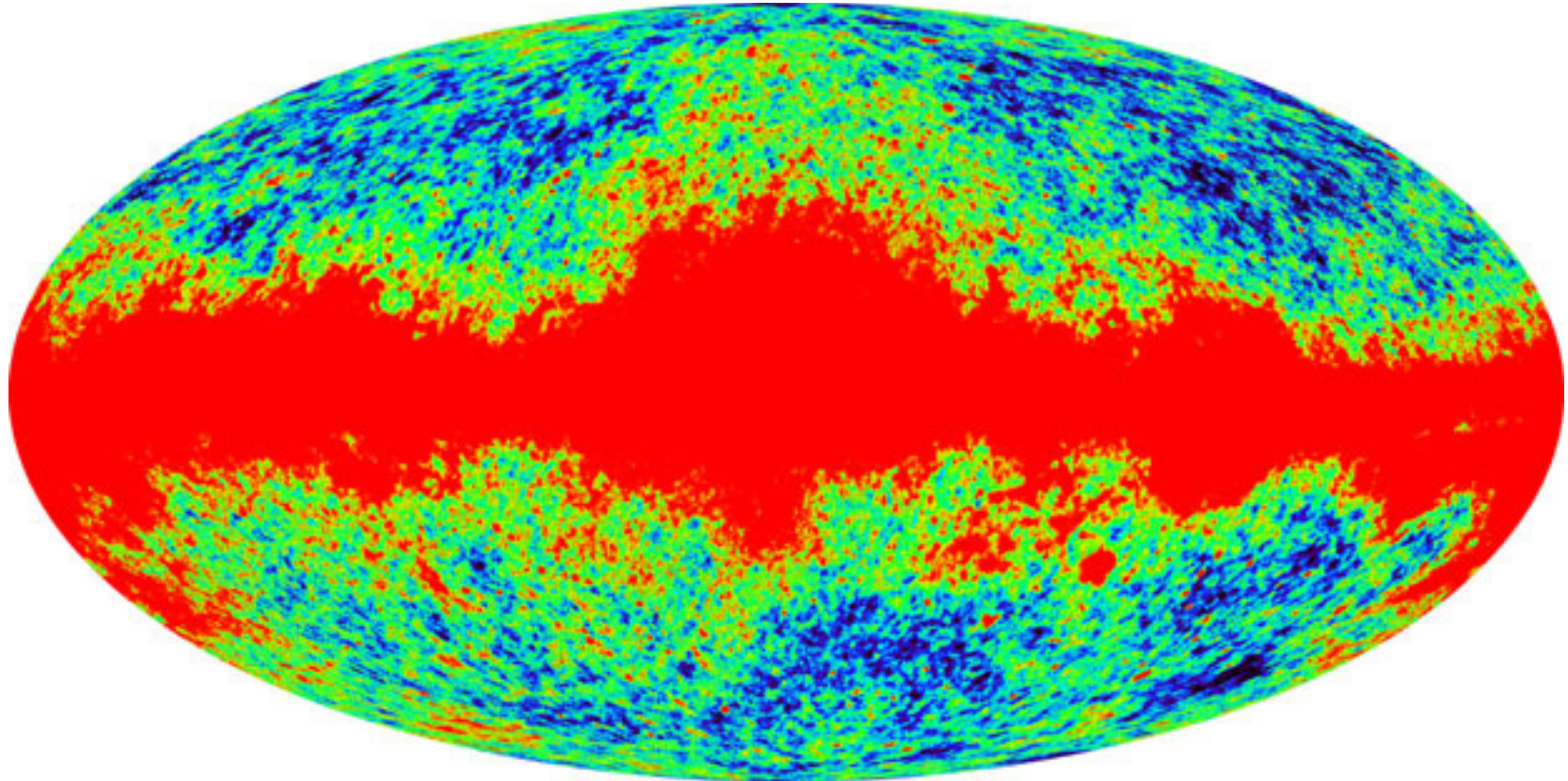
Q-Band (41 GHz)



K_a -Band (33 GHz)



WMAP K-Band Map (23 GHz)



As shown in this and the previous WMAP images, the foreground radiation signature, including synchrotron radiation, free-free radiation and thermal radiation from dust, changes with frequency, while the background does not, which is what allows the foreground to be removed. However, this feature does not necessarily imply that *all* of the foreground radiation is phenomenologically distinct from the background radiation.

The WMAP foreground is not so easily deleted from the picture

Princeton concedes that no conventional explanation exists for the “observed inner galaxy excess microwave emission”. This is a major discovery among many by the WMAP mission, but the theorists are unable to appreciate what the data means as their thinking is restricted by an overwhelming false paradigm.

The cause of observed inner galaxy excess microwave emission is [assumed](#) to be synchrotron emission from highly relativistic electron-positron pairs produce by [dark matter](#) particle annihilation as [more conventional sources have been ruled out](#).

David P. Finkbeiner, WMAP Microwave Emission Interpreted as Dark Matter Annihilation in the Inner Galaxy, arXiv: astro-ph/0409027 (8 January 2005).

David P. Finkbeiner, Microwave Interstellar Medium Emission Observed by the Wilkinson Microwave Anisotropy Probe. *Astrophysical Journal* **614**, 186-193 (2004).

4% Atoms?

It was premature to call these the “Winning Theories”

- Universe is 13.7 billion years old, with a margin of error of close to 1%
- First stars ignited 200 million years after the Big Bang
- Light in the WMAP picture is from 379,000 years after the Big Bang
- Content of the Universe:
 - 4% Atoms, 23% Cold Dark Matter, 73% Dark Energy.
 - The data places new constraints on the Dark Energy. It seems more like a “cosmological constant” than a negative-pressure energy field called “quintessence”. But quintessence is not ruled out
 - Fast moving neutrinos do not play any major role in the evolution of structure in the universe. They would have prevented the early clumping of gas in the universe, delaying the emergence of the first stars, in conflict with the new WMAP data
- Expansion rate (Hubble constant) value: $H_0 = 71$ (km/sec)/Mpc (with a margin of error of about 5%)
- New evidence for Inflation (in polarized signal)
- For the theory that fits our data, the Universe will expand forever. (The nature of the dark energy is still a mystery. If it changes with time, or if other unknown and unexpected things happen in the universe, this conclusion could change.)

WMAP Mission, “Some Theories Win, Some Lose”, http://map.gsfc.nasa.gov/m_mm/mr_limits.html

If the Universe is 4% atoms, how come 100% of the entire Solar System is made of atoms?

Significant WMAP Science

The WMAP data shows that the Cosmic Microwave Background Radiation (CMBR) exhibits no prominent signs of gravitational lensing by very distant galaxy clusters, which implies that **the observable is not a primordial background.**

Richard Lieu & Jonathan P.D. Mittaz, On the Absence of Gravitational Lensing of the Cosmic Microwave Background, *Astrophysical Journal* **628** 583-593 (2005); arXiv: astro-ph/0412276



The WMAP data shows that the CMBR fluctuations exhibit an aligned planar quadrupole and octopole moment, which are perpendicular to the dipole and the ecliptic. It can be concluded that at least **some portion of the radiation is sourced within the Solar System, itself.**

Dominik J. Schwarz, Glenn D. Starkman, Dragan Huterer & Craig J. Copi, "Is the Low-l Microwave Background Cosmic?", *Physical Review Letters* **93**, 22 (2004); arXiv: astro-ph/0403353

Gravitational Radiation



- The fact that an accelerated charge radiates *electromagnetic* (EM) energy should have a symmetric gravitational phenomenon.
- General relativity's predicted spin-two 'gravity waves' have never been detected by LIGO. Akin to the 1887 Michelson-Morley experiment, in which the expected result of an 'ether drift' was not found, this implies that they do not exist, rather than that they will someday be detected.
- The amendment to the general theory described in **Lecture 1** implies secular energy loss for all dynamical gravitational systems due to the gravitational transverse redshift effect (*GTR*). Energy conservation requires a balancing radiative phenomenon.

Lecture 1 is a prerequisite to following portions of this lecture.

Available for download at www.stanford.edu/~afmayer or www.alexandermayer.com

Spindown



- The Earth's observed secular loss of angular momentum increases the length of day by 2.3 milliseconds per century.
- This corresponds to a secular power dissipation in the current epoch of 3.6×10^{12} Watts, which is an order of magnitude greater than the power associated with the secular acceleration of the Moon (2.4×10^{11} Watts).
- It is well-known that pulsars and other stars similarly lose angular momentum at a rate that defies conclusive explanation.
- No *energy dissipation phenomenon* has been identified that balances the Earth's spindown energy budget.

Globular clusters



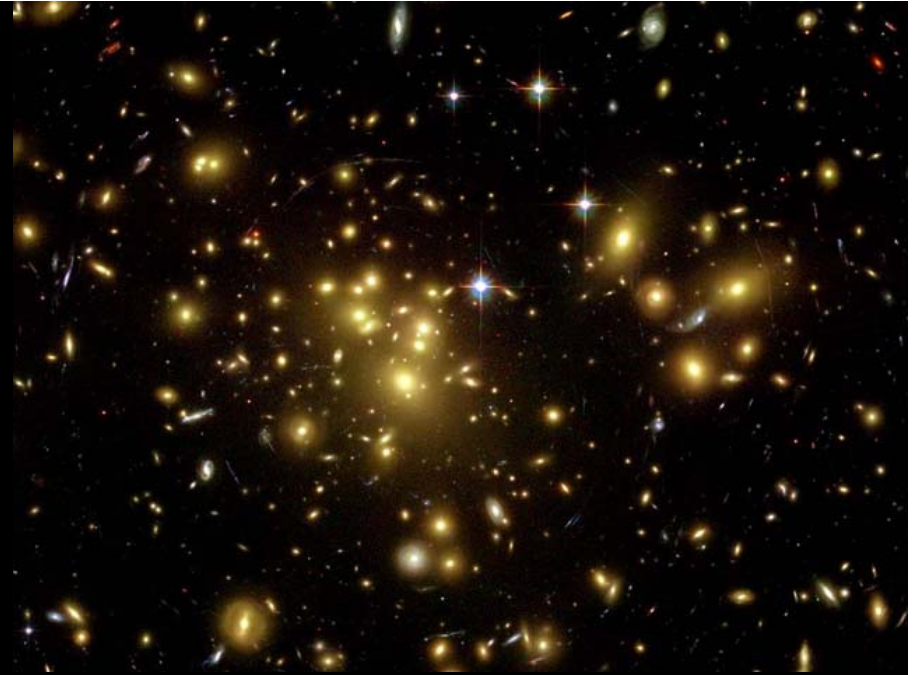
- Globular clusters, with a diameter of about 150 light years, are spherical clusters having on the order of one million typically very old stars held together by their mutual gravitational attraction.
- The galactic disk is $\sim 2,000$ light years thick; globular clusters orbit the galaxy, so they must have passed through this disk hundreds of times.
- Gravitational tidal forces encountered when globular clusters repeatedly pass through the galactic disk should tear them apart.
- The long-term dynamic stability of globular clusters is indicative of an *energy dissipation phenomenon* that counteracts the destabilizing gravitational forces.

Spiral galaxy disks



- Spiral galaxy disks have a flat velocity profile extending beyond the optical periphery.
- The amount of radiating matter observed in the galaxy implies that the centripetal acceleration at the disk's periphery is far in excess of the gravitational acceleration there.
- In order to prevent the the disk from disintegrating, it is assumed that an enormous invisible gravitating 'dark matter' halo exists to provide the required force for dynamic stability.
- Another possibility, which has never before been considered, is that an *energy dissipation phenomenon* exists that would induce the observed dynamic stability of the galaxy disks with no need to invoke the dubious proposition of 'dark matter'.

Galaxy clusters



- The estimated mass of galaxy clusters based on luminosity is much less than the estimated virial mass based on observed dynamical properties, so it appears that we are not seeing all the gravitating 'dark matter' that is there.
- Every effort has been made to observe and identify 'dark matter', however, it has no radiation signature whatsoever. *According to the known laws of physics, this means that it does not exist.*
- Rather than invoking a 'magical' *invisible* phenomenon that produces more gravity to account for the observations, we may invoke a readily observed *energy dissipation phenomenon* of all dynamical gravitational systems.



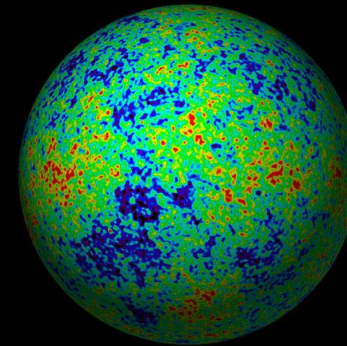
Dark Matter, a.k.a. “FAIRIE DUST”

The fanciful (unscientific) ideas for particles that have put forward as possible candidates for ‘dark matter’ have been categorized by an anonymous pundit as “Fabricated Ad hoc Inventions Repeatedly Invoked in Efforts to Defend Untenable Scientific Theories” (FAIRIE DUST).

Of all the outstanding descriptions of ‘dark matter’ this will have proved to be the most accurate.

Synthesis

- ‘Dark matter’, i.e., ‘more gravity’, is the wrong idea.
- We are looking for a single unifying phenomenon that *dissipates energy* in dynamical gravitational systems.
- An observed *phenomenon (GTR)*
 - Spins down the Earth
 - Spins down pulsars and other stars
 - Holds globular clusters together
 - Holds galaxy disks together
 - Holds galaxy clusters together
- The observed energy dissipation must be *conserved*, so it must be observable in another form.
- That energy is the Cosmic Microwave Background and WMAP data will prove it beyond any doubt!



Association of the CMBR with large-scale mass concentrations

Since all dynamical gravitational systems actively produce the cosmic microwave background radiation, then large mass concentrations (galaxy clusters) are predicted to be associated with warmer regions of the true CMBR while voids with a paucity of galaxies should be associated with cooler regions of the cosmic microwave background maps. Such evidence has already been reported. See:

Niayesh Afshordi, Yeong-Shang Loh, David Spergel, Michael Strauss, "Cross-Correlation of the Cosmic Microwave Background with the 2MASS Galaxy Survey: Signatures of Dark Energy, Hot Gas, and Point Sources of the Cosmic Microwave Background", American Astronomical Society Meeting 203, #69.07, (December 2004); www.cfa.harvard.edu/~nafshordi/index_files/Talks/CROSS.ppt

Energy conservation due to spindown

- According to the amended gravitational theory, particles moving *transverse* to the gravitational gradient must lose energy.
- For a rotating (self-gravitating) body, this will manifest as an unmodeled secular spindown.
- Energy conservation requires the dissipated kinetic energy to manifest in another form that is radiated away. The geographic profile of the radiation flux is necessarily linked to the tangential velocity profile of the body, which produces an observable distinctive ‘spin’ radiation signature.
- As is commonly observed for other stars, the Sun must be slowly spinning down due to the *GTR* effect and the energy it loses due to this phenomenon will be radiated away in the microwave region of the spectrum.

$$Q = \Delta K_{\omega} = \frac{1}{2} I (\omega_1^2 - \omega_2^2)$$

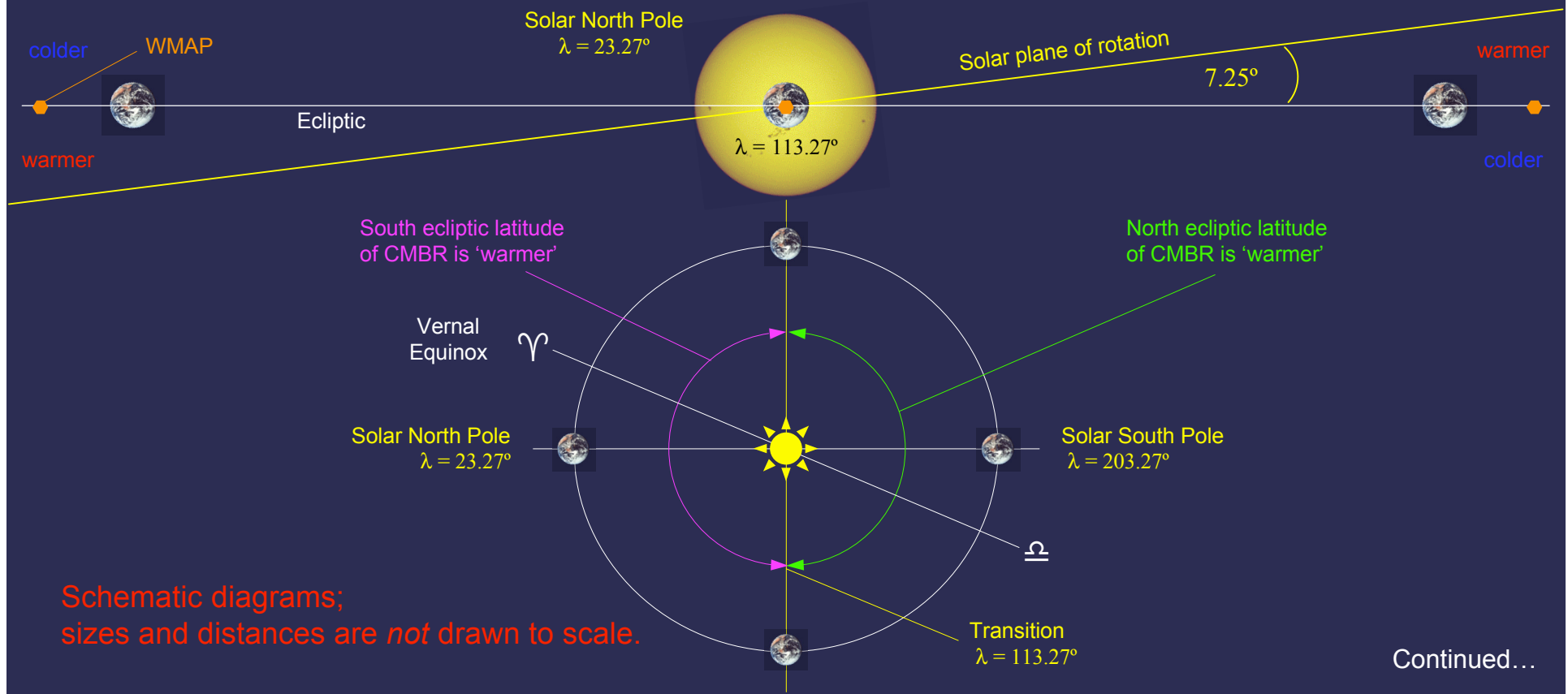
Continued...

WMAP solar *GTR* spin signature

As the Sun dominates the gravitational signature of the Solar System, its *GTR* spin signature can also be expected to dominate the observable local contribution of Solar System dynamical gravitational systems to the cosmic microwave background radiation. There should be a noticeable anisotropy in the CMBR that is associated with the obliquity of the Sun's spin to the Ecliptic. The Solar North Pole has right ascension $\alpha_0=286.13^\circ$ (ecliptic longitude $\lambda = 23.27^\circ$) so an anisotropy in the WMAP data is predicted to be associated with the spacecraft's (Earth's) location relative to the solar plane of rotation.

But what was most surprising was that the pair of hemispheres that were the most different were the ones lying above and below the ecliptic, the plane of the earth's orbit around the sun. This result was the first sign that the CMB fluctuations, which were supposed to be cosmological in origin, with some contamination by emission in our own galaxy, have a solar system signal in them—that is, a type of observational artifact.

Glenn D. Starkman & Dominik J. Schwarz, "Is the Universe out of Tune?", *Scientific American*, 48-55 (August 2005).



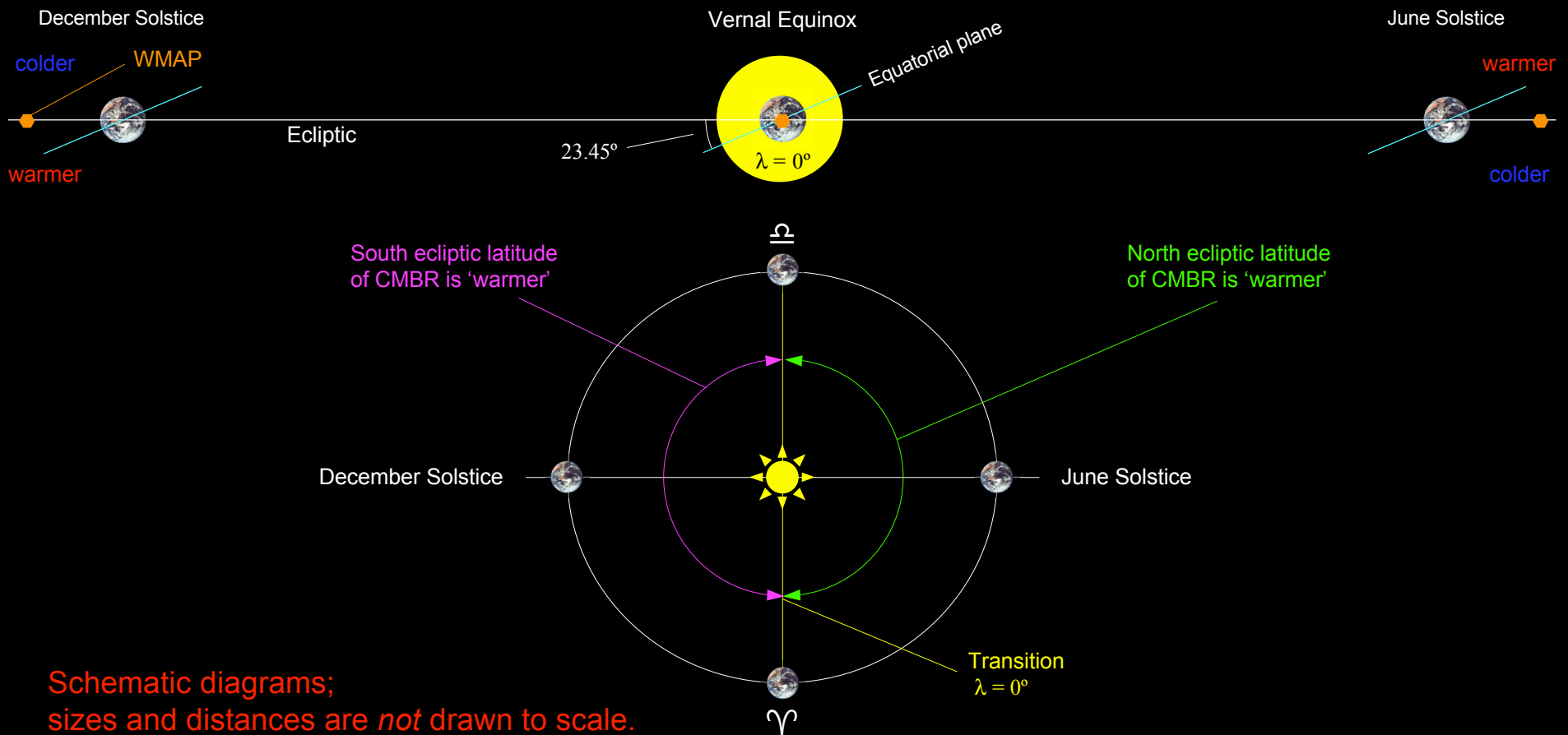
Continued...

WMAP terrestrial *GTR* spin signature

The mass of the Earth is on the order of a million times less than the mass of the Sun. On the other hand, it is about 100 times closer to the WMAP spacecraft than the Sun. Because WMAP orbits anterior to the Sun at L2, the Earth's spin signature as perceived by the spacecraft's sensors will vary with the Equinoxes. The independently time varying solar and terrestrial signatures may be distinguishable in the data, once it is known that these features should be looked for.

Several of the vectors lie surprisingly close to the ecliptic plane. Within that plane, they sit unexpectedly close to the equinoxes—the two points on the sky where the projection of the earth's equator onto the sky crosses the ecliptic.

Glenn D. Starkman & Dominik J. Schwarz, "Is the Universe out of Tune?", *Scientific American*, 48-55 (August 2005).



Schematic diagrams;
sizes and distances are *not* drawn to scale.

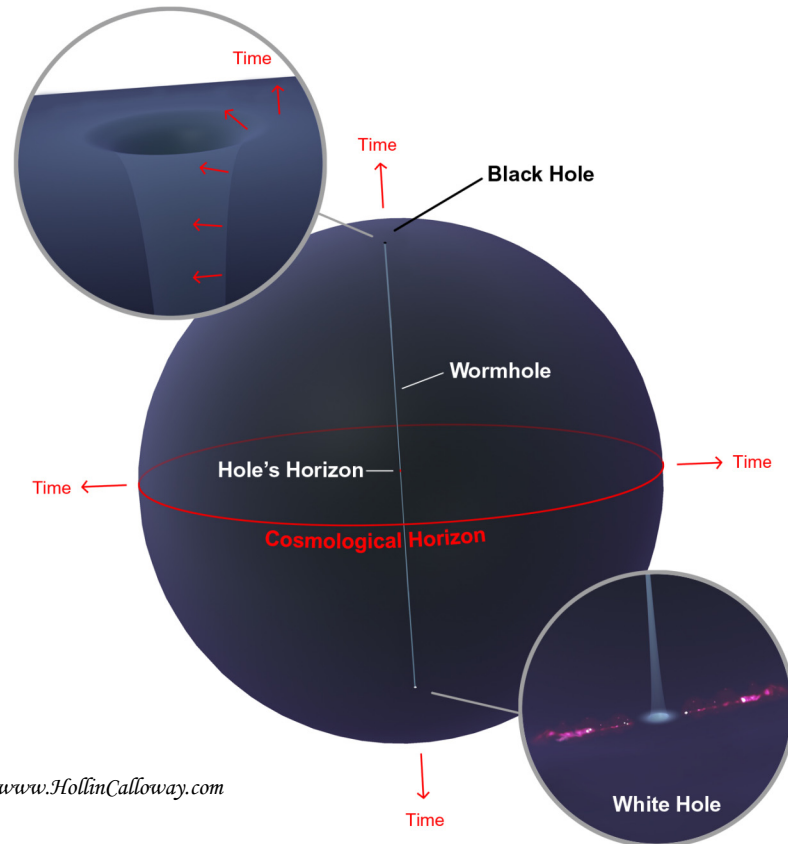
Dynamical analysis of WMAP data

- The CMBR was supposed to have been primordial heat left over from the Big-Bang so no one suspected that it would have *dynamic* anisotropies due to the motion of the Earth around the Sun.
- Assuming the WMAP data can be partitioned into time segments, then it should reveal the dynamic behavior shown on the previous two slides.
- The north Ecliptic hemisphere will be ‘warmer’ during part of the year and the south Ecliptic hemisphere will be ‘warmer’ during another part of the year.
- Four distinct transition points may be evident: 0° , 113.27° , 180° , and 293.27°

A black hole really is a 'hole'

In mathematical terms, Einstein's 1909 mistake is directly related to the ratio of the characteristic escape velocity of a gravitational field to the speed of light. In other words, when that ratio is very small, Einstein's mistake is empirically also very small. However, when the gravitational escape velocity is near to the speed of light, there is a predictable consequence; the mathematics becomes meaningless. Unfortunately this also means that almost everything written about black holes for the past forty years has no correlation whatsoever to empirical reality.

The new metric has a simple and intuitive interpretation in the strong field limit. As one may expect in a rational Universe, spacetime is smooth and continuous everywhere. There is no such thing as a singularity where "the laws of physics break down." This was just the naïve 20th century astrophysical equivalent of the medieval dragon-infested 'edge of the world'. In other words, all prior 'black hole theory' is incorrect.



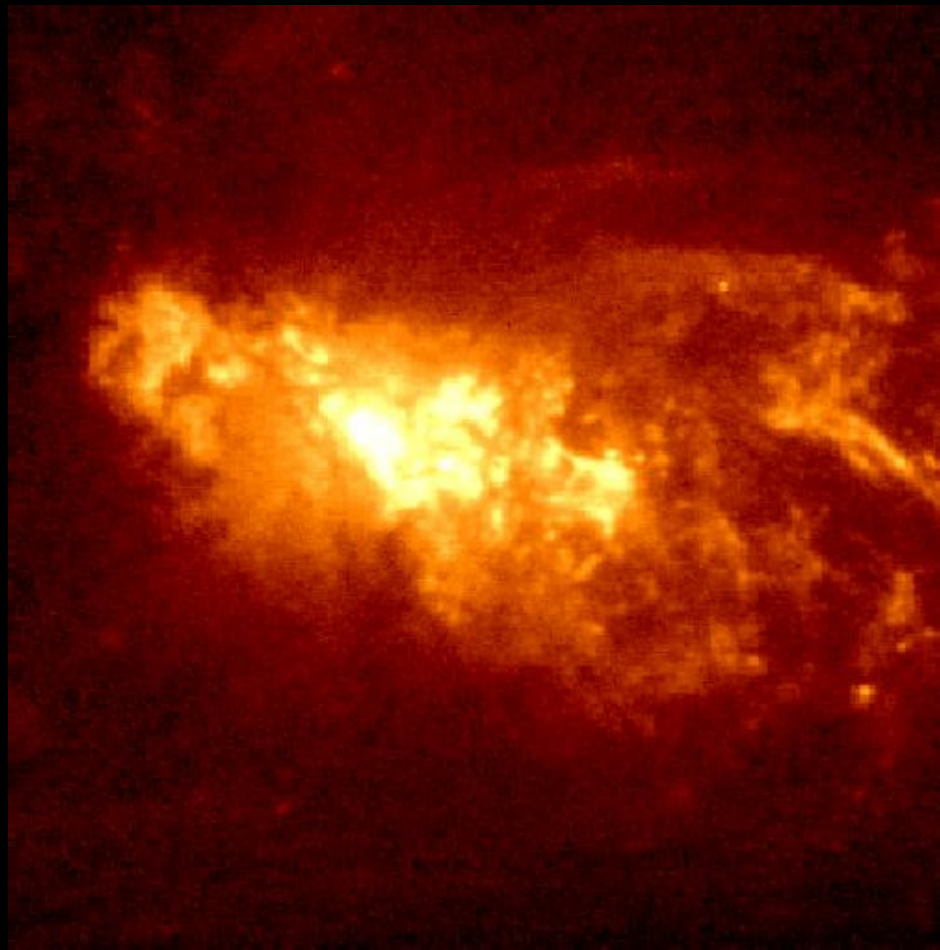
On the left is a simple updated model of the strong field limit of gravity based on the new metric and cosmological model. Because radically curved spacetime should be unstable, there is arguably no such thing as an isolated black hole created by the implosion of a large star, which instead may create a gamma ray burst or GRB (a very brief 'mini white hole') as a complementary remote phenomenon to a supernova. A *constant flow* of mass-energy is required to maintain the unstable spacetime geometry of a wormhole. Due to the *GTR* effect, black holes receive a huge influx of matter, because the angular momentum of orbiting stars and gas is not conserved as was previously thought. It should be clear that black holes are therefore marked by copious 'gravitational radiation' in the form of microwaves that will typically redshift into the radio region of the spectrum.

Perhaps with rare exception, black holes exist exclusively at the cores of galaxies, feeding distant white holes that manifest as efflux-type active galactic nuclei, giving birth to new galaxies. The fractal architecture in the distribution of galaxies, which was first observed by William Tifft, is a natural result of wormholes being the dynamic regeneration mechanism of the Universe.

Prevention of cosmic gravitational collapse

The mass-energy that falls into the central black hole of a mature galaxy is not *locally* conserved (local cosmic mass-energy density is decreased) but it is universally conserved because it comes out of a distant complimentary antipodal 'white hole', which is generally the active galactic nucleus (AGN) of a Seyfert galaxy. Thus, the Universe prevents too much mass-energy from accumulating in any particular location by redistributing it using 'wormholes'.

This Hubble Space Telescope image of the core of Seyfert galaxy NGC 1068 is what a 'white hole' looks like.



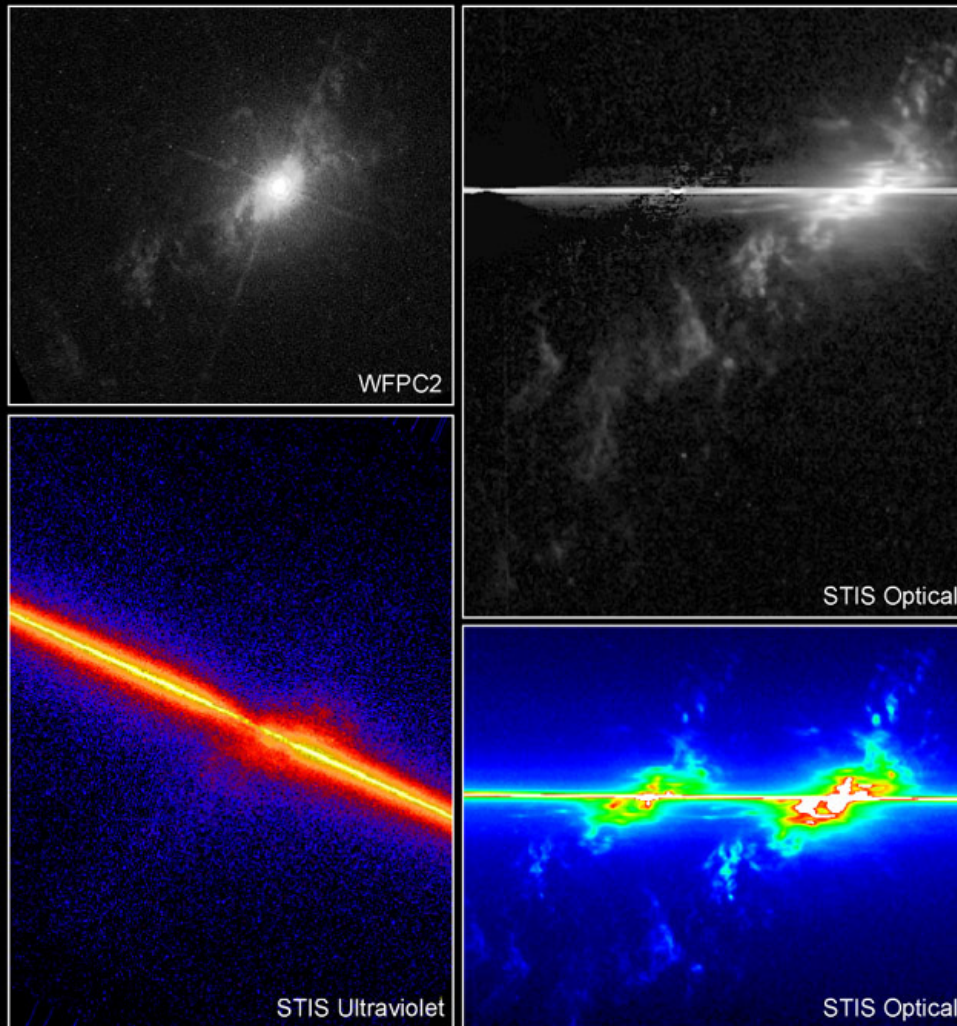
Nucleosynthesis of the light elements

Thanks to fundamental nuclear physics, we know the basics.

- A very high temperature plasma ($\sim 10^9\text{K}$ or $\sim 0.1\text{MeV}$) of free protons and neutrons that cools rapidly is required for the reaction sequence.
- The high temperatures required for the reaction sequence to take place are *not* found in stars.
- Typical stellar evolution involves destruction of deuterium (^2H), not production.
- Deuterium production requires an environment of high energy coupled with low density.

Starting with George Gamov in the 1940s, everyone thought you needed a primordial Big-Bang to get the right conditions.

Rapid free expansion of a high-pressure jet provides the two essential requirements for deuterium production:
rapid cooling in a low density environment.



NASA Caption:

The Hubble telescope's imaging spectrograph simultaneously records, in unprecedented detail, the velocities of hundreds of gas knots streaming at hundreds of thousands of miles per hour from the nucleus of [Seyfert galaxy] NGC 4151.

This is *not* evidence of a black hole as conventionally thought. It is evidence of a *white hole*, the *perfect* environment for deuterium nucleosynthesis.

Seyfert Galaxy NGC 4151

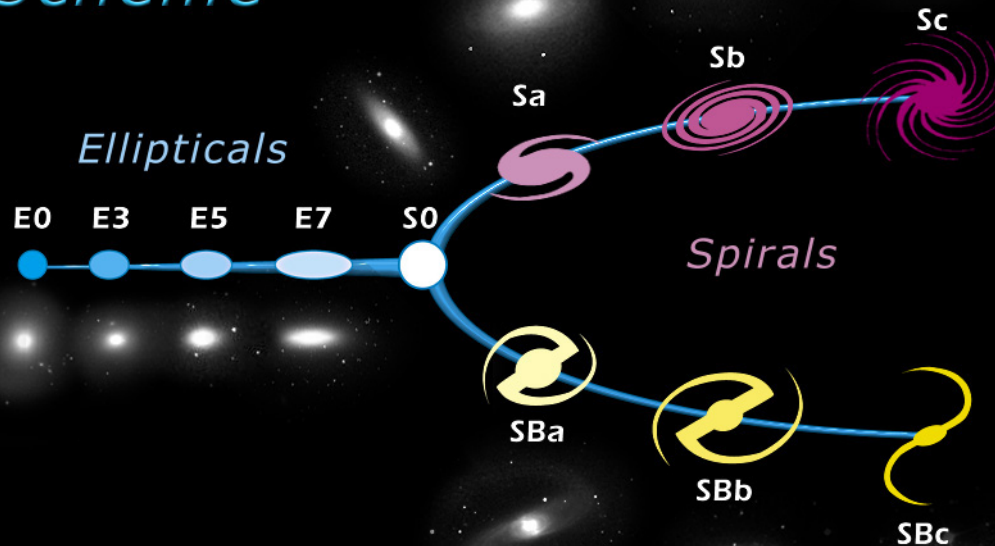
HST • STIS • WFPC2

PRC97-18 • ST Scl OPO • June 9, 1997
 B. Woodgate (GSFC), J. Hutchings (DAO) and NASA

Galaxy evolution

Speculation on the lifecycle of galaxies began in 1926 when Edwin Hubble put forward his famous 'tuning fork' diagram including the explicit proposition that galaxy evolution takes place starting from 'early types' on the left of the diagram and evolving to 'late types' on the right. A clear distinction was drawn between two apparent evolutionary paths in the creation of spirals, those exhibiting a bar through their center (SB-type) and those that do not (S-type). Modern observational evidence implies that Hubble's idea that 'late-type' spiral galaxies evolve from 'early-type' elliptical is precisely the opposite of the actual evolutionary sequence. It is now well known that spiral galaxies exhibit profuse amounts of gas and dust with the characteristic arms harboring stellar 'nurseries' of active new star formation. In contrast, elliptical galaxies have a characteristic paucity of gas and dust and spectroscopic studies indicate a more mature system with minimal new star formation.

Edwin Hubble's Classification Scheme



Galaxy formation

Observations have now made it quite clear that younger galaxies are typically spirals with a characteristic flat disk. How do these disks form? The answer is obvious based on what we see.—Similarly, the historical fact of continental drift is rather obvious when one considers that the continents of Africa and South America quite clearly fit together at some time in the past. Yet, although Alfred Wegener proposed the obvious theory of continental drift in 1912, it took the academic world of that time over half a century to accept plate tectonics. In the fast-paced and competitive global academic environment of the 21st century, with considerable public oversight, similar behavior would now be 'career-limiting'.

It is virtually certain that jets of effluent matter emanating in a plane from a typical active galactic nucleus build the plane disks of spiral galaxies from the inside out. These disks were most certainly not formed by gravitational collapse of a gas cloud, first because the Big-Bang that was supposed to have created all the protogalactic hydrogen gas clouds never occurred and second because gravitational collapse tends to create spherically shaped things, not flat disks. However, jets from a central source, will quite naturally create a self-gravitating rotating plane disk of matter over time and we know that such enormous effluent jets exist because we actually see them.

spiral galaxy
M104

New, youthful spiral galaxies are observed in the local Universe all the time; they are called Seyfert galaxies, which are generally associated with massive star formation and make up about 2 to 3 percent of the local galaxy population. Moreover, we see these same nascent galaxies all over the Universe. — As was made clear earlier, QSO or 'quasars' are just distant AGN of the local variety that have been misinterpreted to be a distinct class of object orders of magnitude brighter than they are in reality due to a faulty redshift-distance scale.

'Baby' galaxies

We argue that the narrow-line regions (NLRs) of Seyfert galaxies are powered by the transport of energy and momentum by the radio-emitting jets. This implies that the ratio of the radio power to jet energy flux is much smaller than is usually assumed for radio galaxies. This can be partially attributed to the smaller ages of Seyferts compared to radio galaxies, but one also requires that either the magnetic energy density is more than 1 order of magnitude below the equipartition value or, more likely, that the internal energy densities of Seyfert jets are dominated by thermal plasma, as distinct from the situation in radio galaxy jets where the jet plasma is generally taken to be nonthermally dominated. If one assumes that the internal energy densities of Seyfert jets are initially dominated by relativistic plasma, then an analysis of the data on jets in five Seyfert galaxies shows that all but one of these would have mildly relativistic jet velocities near 100 pc in order to power the respective narrow-line regions. However, observations of jet-cloud interactions in the NLR provide additional information on jet velocities and composition via the momentum budget

Geoffrey V. Bicknell, Michael A. Dopita, Zlatan I. Tsvetanov & Ralph S. Sutherland, "Are Seyfert Narrow-Line Regions Powered by Radio Jets?", *Astrophysical Journal* **495**, 680 (1998).

Seyfert galaxy NGC 7742

'Adolescent' galaxies

M51



NGC 1300



The current state of observational astronomy, which has benefited from late 20th century advances, implies that galaxy evolution is radically different from what Hubble imagined. The spiral arms of barred galaxies typically emanate from the ends of the bar (evidence of primordial jets) and most spiral galaxies exhibit some of the characteristics of the barred variety with the SB-types merely representing the more extreme examples, so Hubble's broad distinction between the two is almost certainly incorrect. Based on Doppler data that will now have to be revised inclusive of the *GTR* effect, the average rotation period for a spiral galaxy is short relative to the age of its constituent stars, therefore, many rotations must have occurred for a typical spiral galaxy. The spiral arms are currently understood to manifest due to the systematic radial change in the orientation of elliptical galactic orbits of stars and gas. This creates natural spiral-shaped density waves creating periodic enhancements in the background stellar distribution and regions of enhanced star formation. However it is clear that primordial jets emanating from the core created the initial morphology prior to this secondary phenomenon. Galaxies with conspicuous central bulges tend to have more tightly wound spiral arms and the 'earlier' the stage (the older the galaxy) the larger the fraction of light sourced from the bulge. With rare exception, the spiral arms are trailing, i.e., stellar orbits are counterclockwise for M51 and clockwise for NGC 1300 in these images.

'Adult' galaxies

Like marriage partners, spiral galaxies NGC 2207 and IC 2163 are in the process of merging.

$$z \approx 0.009$$



Plus ça change, plus c'est la même chose.

In this distant galaxy cluster, billions of light years away, the galaxy mergers we see are no different from what is observed in the local Universe. Tens of billions of years passed for those galaxies to have formed and matured. In that time, the natural process of gravitational attraction has caused the neighboring galaxies to merge, just as the Milky Way and M31 (Andromeda) will one day merge.



Galaxy Cluster MS1054-03

HST • WFPC2

PRC99-28 • STScI OPO • P. van Dokkum (University of Groningen), ESA and NASA

'Middle-aged' galaxies

Elliptical galaxies have a characteristic paucity of gas and dust and spectroscopic studies indicate a more mature system with minimal new star formation. Giant cluster-dominating (cD) elliptical galaxies, which may exhibit multiple galactic nuclei, are typically found at the centroid of rich galaxy clusters, surrounded by smaller ellipticals such as M59, portrayed here, and a halo of outlying spiral galaxies. Size, morphology and stellar velocity profiles strongly suggest that elliptical galaxies have typically formed over time from the merger of other galaxies, generally spirals, but ellipticals must also merge with one another in a natural evolutionary progression.

The Big-Bang paradigm suggested that galaxies originally all formed at approximately the same time on a shared cosmic time scale from the gravitational collapse of protogalactic masses of hydrogen gas. There are so many confrontations between this idea and empirical observations as well as basic theoretical considerations that it is difficult to believe that it was seriously considered for so many decades. Primarily, the idea cannot explain the various structures observed which cover the scale extending from globular clusters of stars in galactic halos to gigantic superclusters that tie together numerous smaller clusters of many galaxies. The huge variation in the intrinsic ages of these structures based on dependency relationships is immediately apparent, i.e., elliptical galaxies are formed by the merger of old fully-formed spiral galaxies, elliptical galaxies merge to form still more massive ellipticals, jagged galactic clusters become more symmetrically shaped by gravitation over eons, etc. However, the social and cultural blinders of the dominant paradigm were so effective during the 20th century that the overwhelming empirical evidence against the Big-Bang was essentially disregarded.



Elliptical galaxy M59 in Virgo

'Grandfather' galaxies

Fritz Zwicky, who worked at Caltech and who was undoubtedly one of the 20th century's greatest astronomers, coined the terms 'supernova' and 'neutron star'. He did not know about the *GTR* effect, but seems to have anticipated it. His age estimates may then be reduced, but certainly by no more than perhaps a few orders of magnitude, implying that his estimate of 10^{15} years is not unreasonable. Lest we forget, prior to the advent of geology through the work of James Hutton (1726–1797) particular historical interpretations of Biblical creationist themes that colored scientific thought had given an age for the Earth of about 6,000 years. Though generally accepted throughout a not unsophisticated academia of the times (Cambridge, Oxford, Göttingen, Académie des Sciences, University of Bologna, Harvard, etc.) it was off by about six orders of magnitude.—Pictured here is M87, a typical example of a gigantic 'cannibalistic' cluster-dominating (cD) galaxy that is clearly several orders of magnitude older than the Milky Way.

The age of 10^{18} years for rich compact clusters of galaxies may be shortened somewhat by considering certain interactions between galaxies that lead to more inelastic and resonant encounters between galaxies. Unless, however, **far greater efficiency for the transfer of energy and momentum is postulated for such interactions** than is compatible with our present-day knowledge of physical phenomena, the age of rich spherically symmetrical and compact clusters of galaxies is clearly greater than 10^{15} years.

Fritz Zwicky, "The Age of Large Globular Clusters of Galaxies", *Pub. Astron. Soc. Pacific* **72**, 365 (1960).

Cd galaxy M87 in Virgo

Although it is not obvious from comparing the respective images, M87 is much larger than M59 on the previous slide.

Conclusion

Given the new perspective provided by the ideas presented herein, observations imply that the Universe does not have an age; 'old' does not even begin to describe it. The Universe is apparently a rational, observable and understandable physical manifestation of eternity, which is a newly emergent scientific fact that has profound implications. We must now concede that the 'Big-Bang' never happened and never could have happened; the 'expansion of the Universe', was a case of mistaken interpretation of the observations. Thus, "one of the great intellectual achievements of the 20th century" was not the accomplishment it has been lauded to be. It was actually complete nonsense, and yet became in recent decades a typical example of what author Michael Crichton has called politicized "consensus science" rather than being subject to appropriately open scientific debate. [1]

With the verifiable understanding that the observed cosmological redshift is a relativistic time dilation effect and not an effect due to expansion, the entire premise for the primeval explosion of a singularity giving birth to the Universe some few billions of years ago vanishes, completely and irrevocably. It has been established that in the context of the new cosmology, a finite age to the Universe does not have meaning. As concerns the passage of time according to a local clock, we can speak meaningfully about various components of the Solar System, the Milky Way Galaxy, the Local Group and the more local clusters of galaxies. On a larger scale than that, the collective concept of a shared time scale starts to lose its meaning. According to our new understanding, distant ideal clocks at relative rest tick more slowly as compared to a similar local clock; the farther away a galaxy is from us, the slower it ages from our point of view, independent of any contribution to time dilation due to relativistic motion. When we are looking at redshift $z = 1$, then for ten billion years of local time for our galaxy, only five billion years have passed for those remote galaxies. At redshift $z = 9$, the same ten billion years of local time correspond to only one billion years for a galaxy there. Conversely, from the point of view of distant observers, it is our region of the Universe that is growing older more slowly than theirs. This may seem paradoxical but it is a natural consequence of temporal relativity in which the primitive concept of absolute time is abandoned.

What this implies is that when we see something at very high redshift that is also intrinsically very old, such as a giant elliptical cD galaxy, then several times its intrinsic age have passed for a clock in the local Universes over the intrinsic lifetime of that object. Our galaxy very likely did not even exist yet when that old galaxy was already in late middle age. At and beyond our cosmological horizon, there is apparently no meaningful relationship between the local passage of time and the passage of time there. That may seem impossibly strange to most people, but then again, so are various observable quantum phenomena.

In a very short time, ideas concerning the age of our Milky Way galaxy that became prevalent in the late 20th century will seem preposterous. Although observable properties imply that it is comparatively young compared to some other galaxies such as M87 in Virgo, the Milky Way is probably at least one to two orders of magnitude older than the estimate of about 10^{10} years currently given in university textbooks for the age of the entire Universe. Many previously puzzling astrophysical observations in addition to those already discussed, such as the metallicity of stars in the Milky Way as well as the metallicity of stars in far distant galaxies now make sense, where before they did not.

The newly emergent modern cosmology is aligned with the comforting thematic idea that the heavens are eternal. It is not concerned with the finite history of our planet, which is the subject of various anachronistic but still popular Creation stories. Bringing a satisfying peace of mind to people of all faiths, including those who may choose a secular perspective, the new more accurate 21st century cosmology brings scientific and spiritual perspectives together harmoniously. It is a cosmology that can be seen by the faithful to provide a model of the physical Universe that is a fitting corollary to ancient ubiquitous spiritual belief in a time-transcendent Creator, who is both ultimately mysterious and yet also somehow knowable.

1. Michael Crichton, "Aliens Cause Global Warming", [Caltech Michelin Lecture](#), (17 January 2003). [recommended reading]

In memory of Sir Frederick Hoyle (1915-2001) Plumian Professor of Astronomy, Cambridge University

Tongue in cheek, Fred actually coined the term “Big-Bang” because he knew that the idea of an expanding Universe that started from a point of nothing a few billion years ago was inane.

**“Every cluster of galaxies, every star, every atom...had a beginning, but the Universe, itself, did not
—Fred Hoyle**



Also in memory of
Stanford Professor Jeffrey Alan Willick
My interests are in the area of cosmology and
the large-scale structure of the Universe. My
work addresses the “big questions” facing
contemporary cosmology—

Ars longa, vita brevis

SEDS

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Created by Peter Diamandis, then a student at MIT...



also creator and Chairman of the the X-Prize Foundation...



and creator of International Space University.

Dr. Peter Diamandis, M.D.

Our modern media culture seems to have confused the distinction between entertaining and important.

Sports stars are entertaining, but not *important*.
Hollywood stars are entertaining, but not *important*.
Rock stars are entertaining, but not *important*.

Creative leaders are important.

OUR FUTURE DEPENDS ON THEM.



THANK YOU

I would like to thank you for taking the time to go through my lectures. I know that many people will be faced with the need to abandon ideas and work that can no longer be considered fruitful. However, for every door that now closes, many more will be opened to you, offering opportunities to make significant new contributions to science. As is true for individuals, civilization does not advance and mature without making many mistakes along the way. Mastery in life is achieved by developing a process of constant and rapid correction, rather than the illusory goal of freedom from error; accomplished musicians, aviators and athletes know this. History and experience have shown that to let go of the past and move on to the future is the only path of survival, whether it is a rapid decision in the cockpit of an aircraft or abandoning an idea that has permeated a collective cultural consciousness. Everything is to be gained by boldly applying new efforts in the right direction.

to the phenomenal Google Team;
I could not have done this without you.



to Apple



to the Harvard-Smithsonian
Center for Astrophysics



“Imagine what Einstein could have done in his life with Google on top of $E = mc^2$.”

–Thomas L. Friedman

to the entire NASA Team, all the contractors,
and especially the Pioneer Navigation Team



to Stanford University



to Cmdr. Louis Jerome Fabbri
for his friendship and support.

