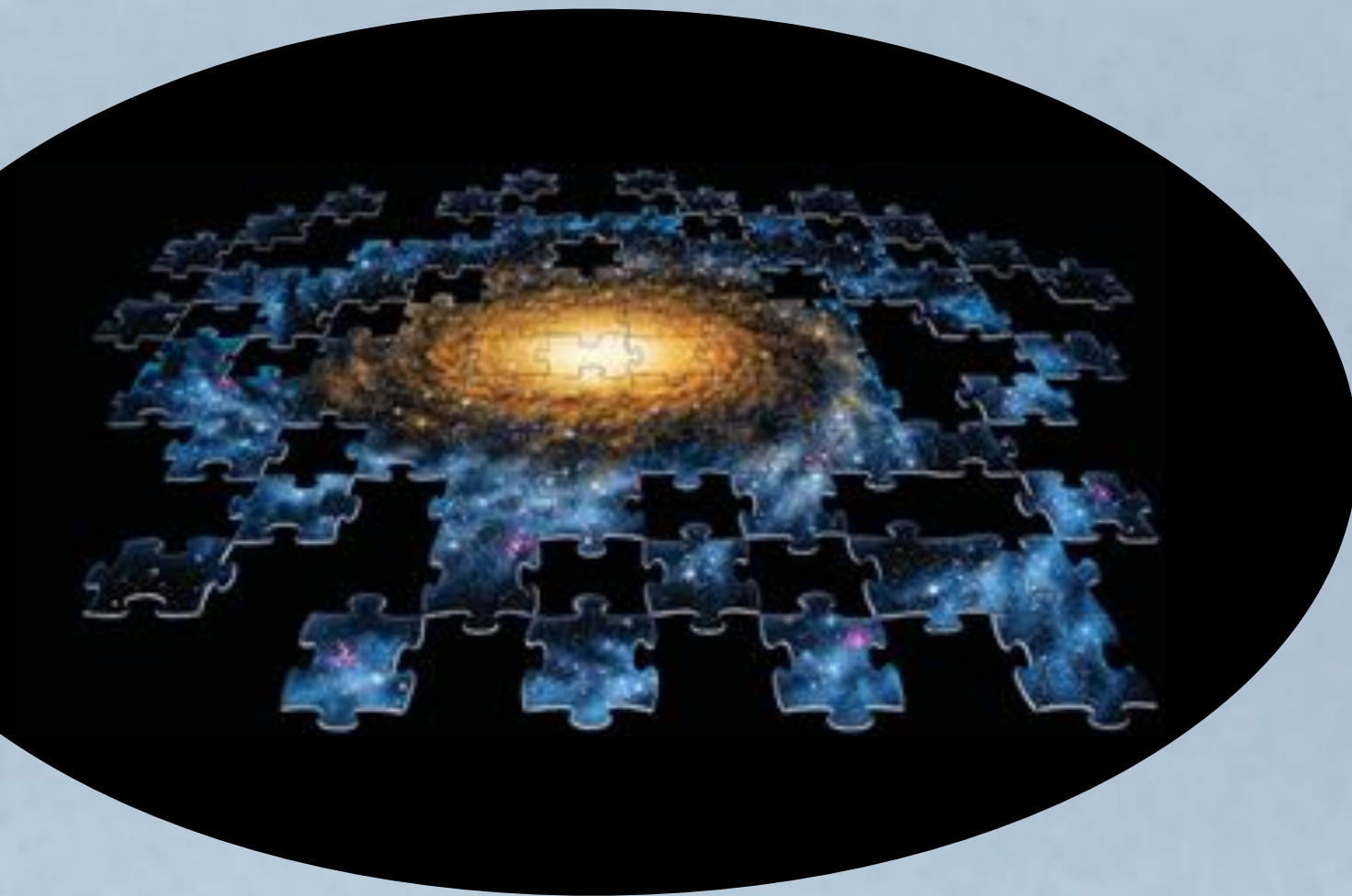


Cosmology & Antarctica 🐧 2024

Cosmologica24 – agenda & inclusive discussion

ein Wendepunkt der Geschichte

To view [links](#), download the PDF — do not view in browser.



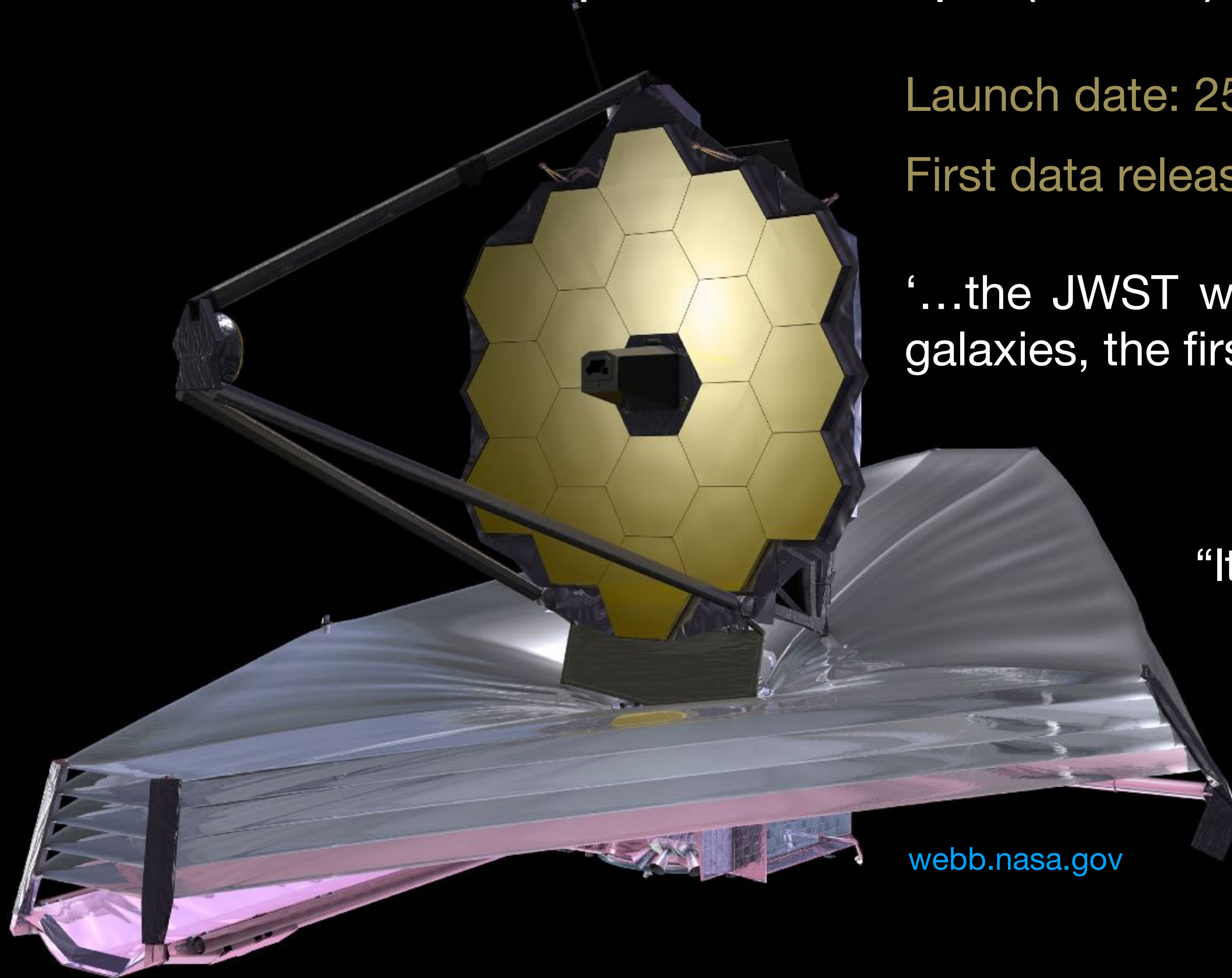
amayer@alum.mit.edu • SensibleUniverse.net

photo credit:
Alexander F Mayer (25 Feb 2024)
Fish Island, Antarctica (66° 01' S , 065° 26' W)
Apple iPhone 15 Pro Max – Telephoto Camera
ISO 50 491 mm f/2.8 1/990 s

Adélie Penguins.

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James Webb Space Telescope (JWST)



Launch date: 25 Dec 2021

First data release: 2 July 2022

‘...the JWST will have the capability to study “baby” galaxies, the first galaxies that formed in the Universe.’

– [esa potw1819a](#) (7 May 2018)

“It will be an explosion of new knowledge.”

– Prof. Jacob Bean, [Univ. of Chicago](#)

webb.nasa.gov

Image credit: NASA (Artist Impression)

Throughout this presentation:

Internet links appear in light blue.

Focal points appear in magenta.

JWST Discovers Enormous Distant Galaxies That Should Not Exist

JWST has discovered giant mature galaxies that seem to have filled the universe shortly after the big bang, and astronomers are puzzled

By Tereza Pultarova, SPACE.com on February 23, 2023

Nobody expected them. **They were not supposed to be there.** And now, nobody can explain how they had formed.

Galaxies nearly as massive as the Milky Way and full of mature red stars seem to be dispersed in deep field images obtained by the James Webb Space Telescope (Webb or JWST) during its early observation campaign, **and they are giving astronomers a headache.**

[→ FULL ONLINE ARTICLE ←](#)

“Difficulties are just things to overcome, after all.”

– Ernest Shackleton



amayer@alum.mit.edu • SensibleUniverse.net

photo credit:
Alexander F Mayer (24 Feb 2024)
Antarctica (64° 38' S , 062° 33' W)
Apple iPhone 15 Pro Max – Main Camera
ISO 64 94 mm f/1.78 1/2179 s

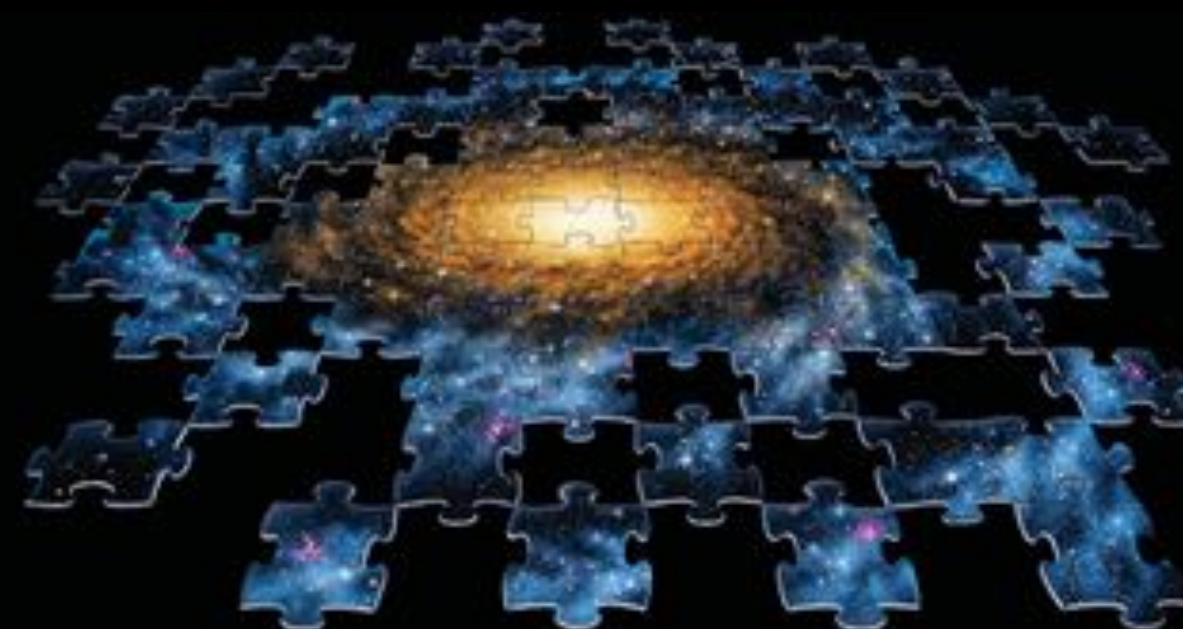
Lectures held daily in the Observation Lounge.

M/V [Hondius](#), Antarctica Mainland

This preliminary talk is aimed at a mixed audience of *topic experts*, as well as a *general technical audience* familiar with interpreting graphed data in medicine, biology, chemistry, math, engineering, etc. **Confronting predictive models with empirical data initiates on p. 31.**

It is established beyond doubt that the answer to the following is **YES**:
New JWST Results: Is the Current Tension in H_0 Signaling New Physics
– Wendy L Freedman, Univ. Chicago, **APS April Meeting (6 April 2024)**

“Physics is the law; everything else is a recommendation.” – Elon Musk (X)



extrasolar.spaceart.org

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dynamic PDF
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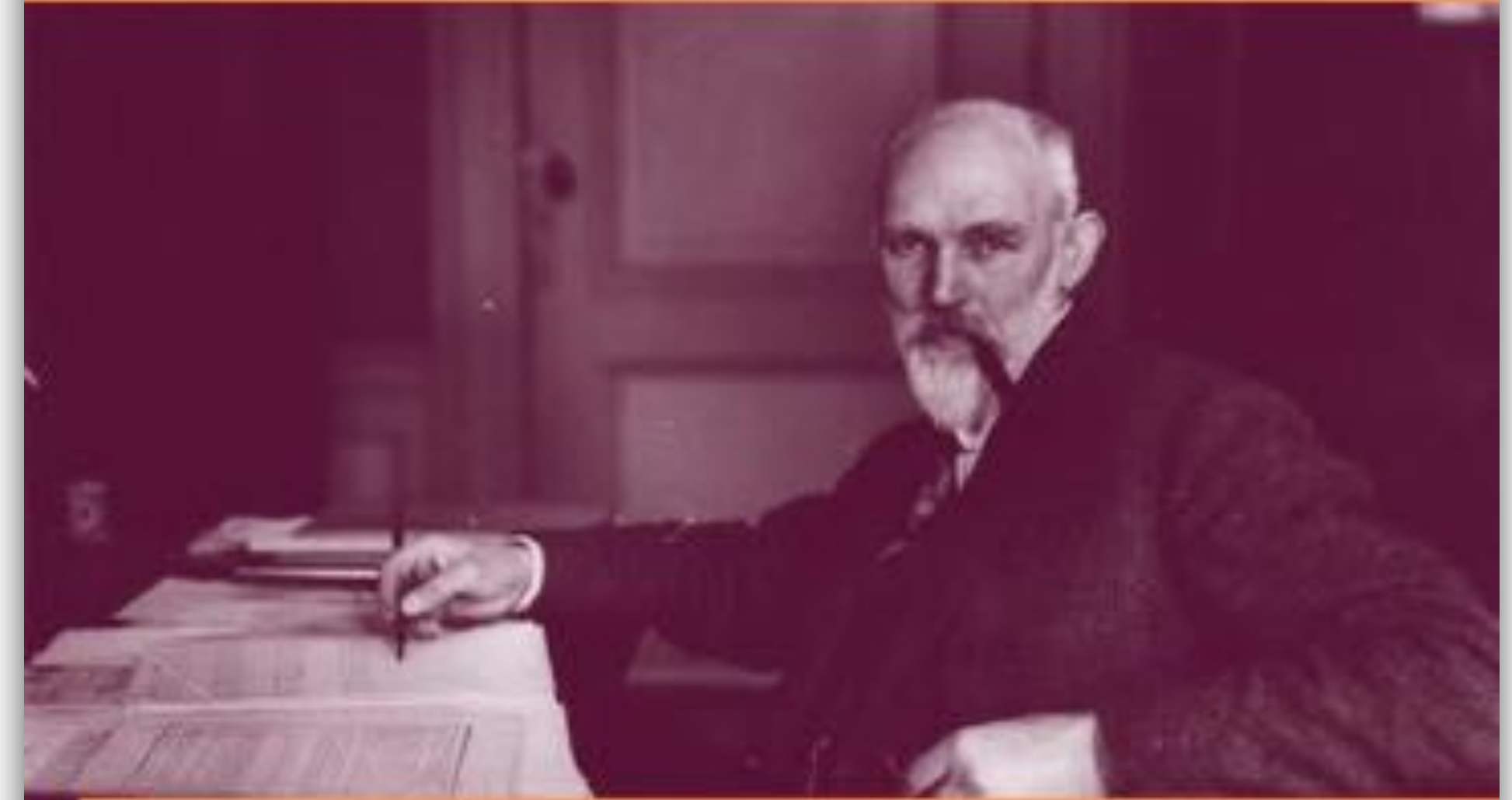
**World-Class Mathematical Physicist
&
Director of the [Leiden Observatory](#)**

NETHERLANDS



Einstein and [Willem de Sitter](#) established the field of cosmology, which was then led astray by *pathological science* for nearly a century. Herein, de Sitter re-emerges as being among the most significant scientific minds in history.

Springer Biographies



Willem de Sitter

[1872–1934]

Einstein's Friend and Opponent

JAN GUICHELAAR

 Springer

Linked graphic

We will present some equations, so let us be clear how to react to that...
If one is not literate in Chinese, one cannot read this; hopefully, nobody is afraid of being judged harshly, just because they cannot read Chinese!
Thanks to Google Translate, we learn that **this means *Foreign Language*.**

Pure mathematics is, in its way,
the poetry of logical ideas.

– Albert Einstein (1935)

外語

For most people, sophisticated mathematical equations are just as cryptic as these wonderful Chinese characters — *all that is needed is a translation...*

If one is not literate in differential geometry, specifically in the context of Einstein's General Theory of Relativity (GR), one similarly cannot read this; **one needs a translation** because the **maths** is a foreign language. Today, no astronomer possesses de Sitter's preeminent proficiency with the mathematics of GR; in practice, they also rely on such translations.

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu}$$

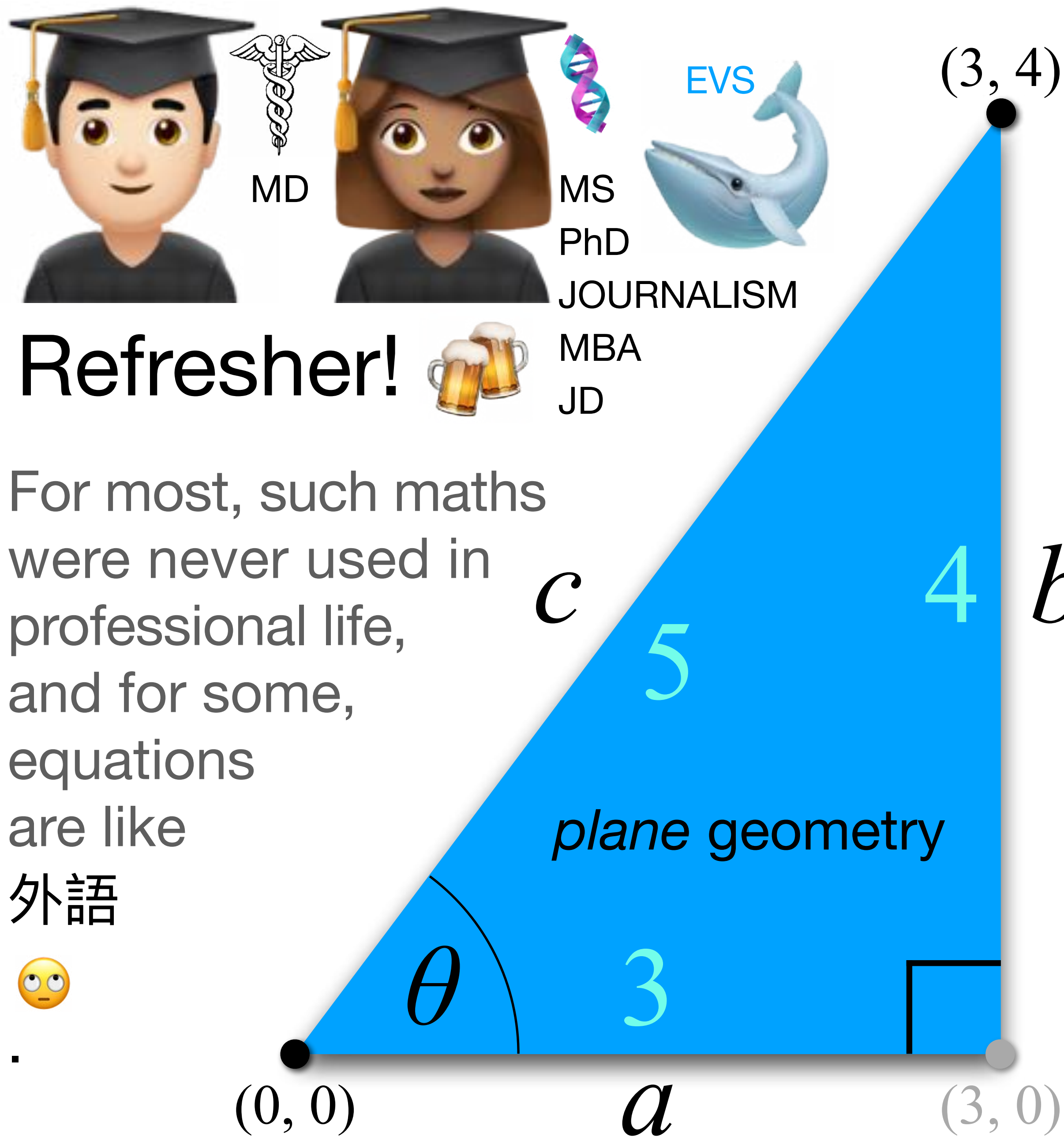
This is the compact form of the Einstein Field Equations (EFE); translation: **“Mass tells space how to curve, and space tells mass how to move.”** Basically, **this cryptic equation describes THE GEOMETRY OF GRAVITY.** It has yielded a number of accurate predictions, and **GPS depends on it.**

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$$ds^2 = - dt^2 + a^2(t) \left[\frac{dr^2}{1 - kr^2} + r^2 \underbrace{(d\theta^2 + \sin^2 \theta d\phi^2)}_{\substack{\theta-\phi \text{ Physics convention} \\ \text{as per ISO-8000-2-17.3 (2019)}}} \right]$$

'Now': $a = 1$
 $t \sim 13.7\text{Gyr}$

This one is the [Friedmann-Lemaître-] **Robertson-Walker metric**; translation: **“The Universe is expanding.”** Going back in time ($t \rightarrow 0$), space containing $\sim 10^{12}$ galaxies contracts ($a \rightarrow 0$), theoretically to smaller than a proton; **it is possible for formulas to be *Ptolemaic*, making *illogical* ideas seem credible.**



Refresher!



For most, such maths were never used in professional life, and for some, equations are like 外語



$$a^2 + b^2 = c^2$$

Euclidean [flat-space] “metric” (i.e., a *distance* measurement)

$$\sin \theta = \frac{b}{c} \quad \frac{\text{opposite}}{\text{hypotenuse}}$$

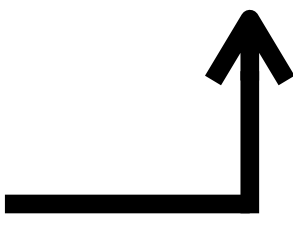
For some majors, this is

MATHEMATICS • PHYSICS • ASTRONOMY • ENGINEERING

$$\cos \theta = \frac{a}{c} \quad \frac{\text{adjacent}}{\text{hypotenuse}}$$

The EFE are not practically useful, per se; it is ***solutions to the EFE*** that are practically useful, meaning that they **produce accurate predictions of measurable physical phenomena**. Here is one exact solution, a metric that calculates a kind of cosmic ‘distance’ using “spherical coordinates”. For many, this is unintelligible mathematics, so we will need a translation...

$$ds^2 = \underbrace{-dr^2 - R^2 \sin^2\left(\frac{r}{R}\right) \left[d\psi^2 + \sin^2(\psi) d\theta^2 \right]}_{\text{space part}} + \underbrace{c^2 dt^2}_{\text{time part}}$$

Note that this is an angle, so in there are **3 angles** in the space coordinates. 

ψ - θ Mathematics convention, as per de Sitter's papers

Experts, you know the basics; feel free to jump ahead to [page 12](#).

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Diagrammatic annotations: Pink arrows point to the differentials ds^2 , dr^2 , $d\psi^2$, $d\theta^2$, and dt^2 . The variables r , ψ , and θ are highlighted in cyan. The terms $c^2 dt^2$ are highlighted in red.

- First, the d means “differential”, an infinitesimal change to sum.

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↑ r ↑ ψ ↑ θ ↑ c

First, the d means “differential”, an infinitesimal change to sum.

► In physics, c is the symbol for the *speed of light* ($\sim 3 \times 10^8 \text{ m} \cdot \text{s}^{-1}$).

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↑ underline ds^2

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► The ds is a length; in relativity it is called a “**spacetime interval**”.

The EFE are not practically useful, per se; it is *solutions to the EFE* that are practically useful, meaning that they produce accurate predictions of measurable physical phenomena. Here is one exact solution, a metric that calculates a kind of cosmic ‘distance’ using “spherical coordinates”. For many, this is unintelligible mathematics, so we will need a translation...

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Incidentally, this initial solution was Einstein's, published in a 1917 paper that effectively gave birth to the field of cosmology.

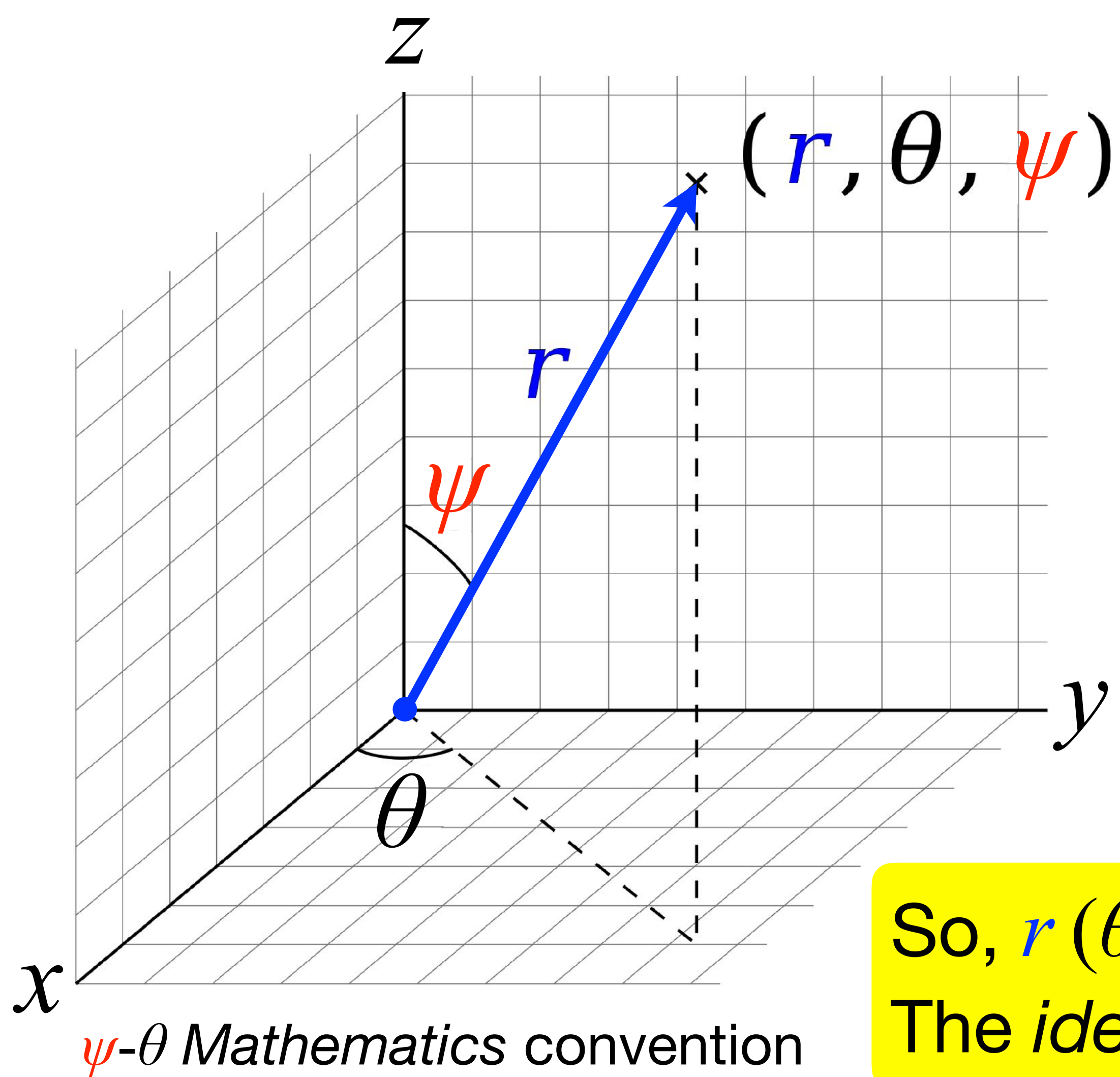
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$dt = 0$: In the above formula, ignore time (just for now).

OK, let's *translate*...

Instead of cartesian coordinates (x, y, z) , spherical coordinates — the r is an arbitrary radius from an origin in 3-dimensional space.



$$0 \leq \theta \leq 2\pi$$

$$0 \leq \psi \leq \pi$$

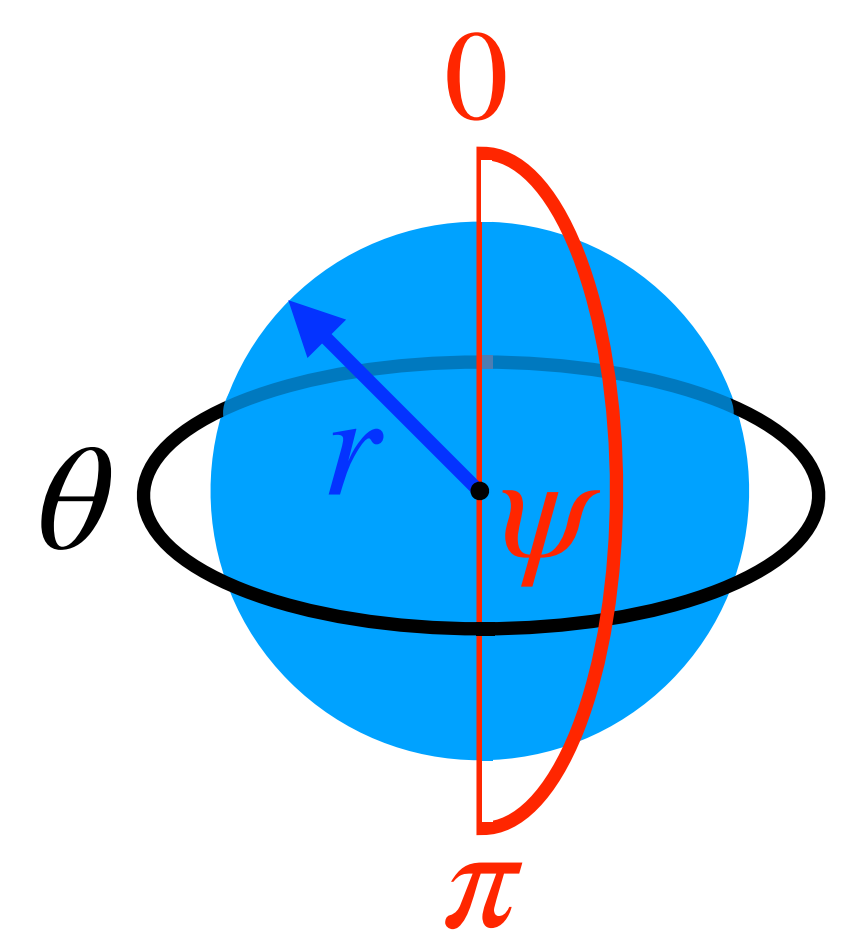
radians

$$2\pi = 360^\circ$$

$$2\pi i$$

theta ~ longitude

psi ~ latitude

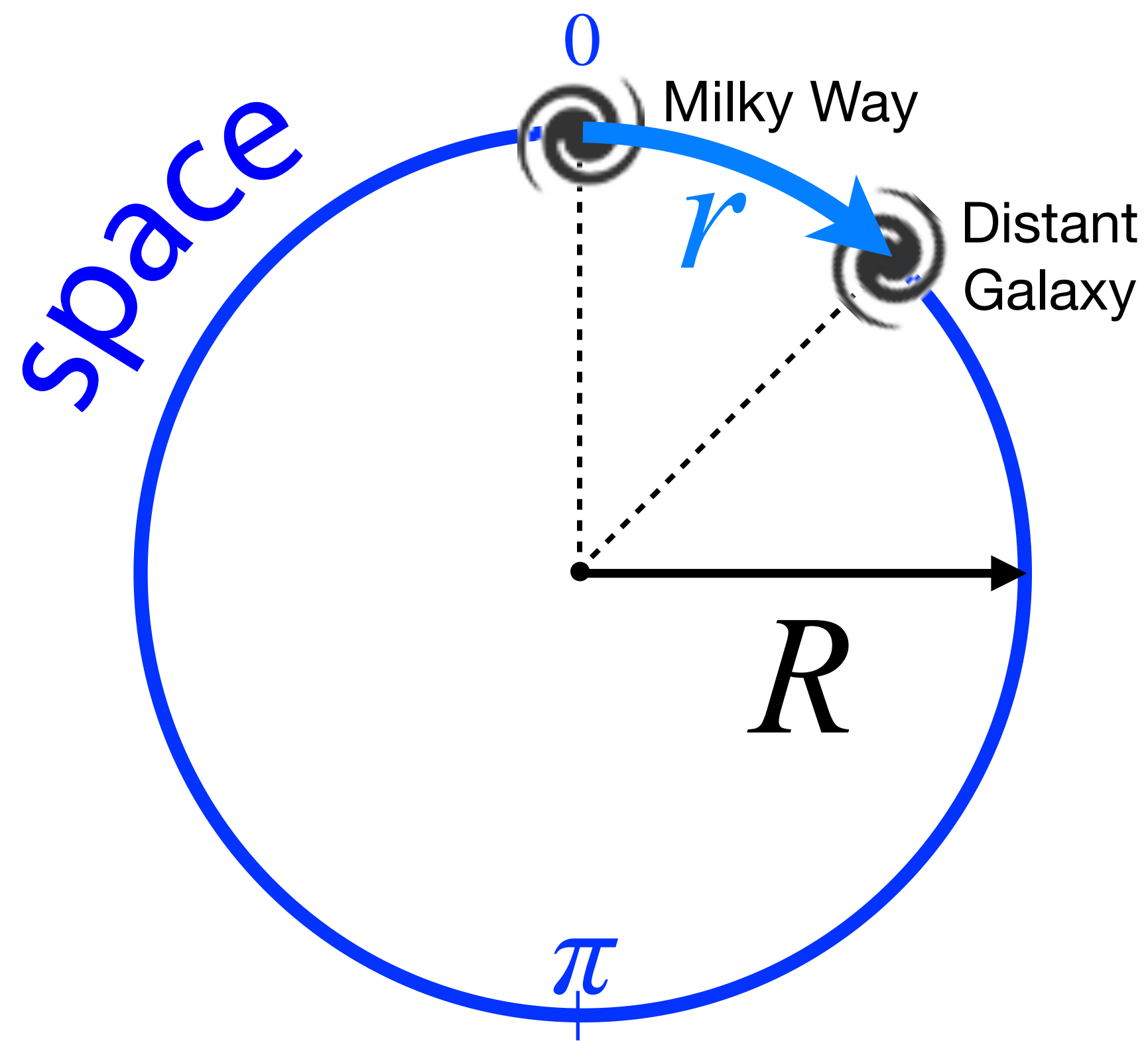


So, $r(\theta, 0)$ points *straight* in the z direction. The *identical* r is shown on the next slide...

Recall that there is also a big R in the equation; so, what does that mean? It means that r is measured on the *surface* of a cosmic “3-sphere” (S^3) such that, regardless the direction in 3-dimensional (3D) space, progress in a ‘*straight line*’ results in traversing a full circle of radius R , the effectual cosmic radius.

$$\left(\frac{r}{R} \right)$$

The interpretation of the metric’s 3rd angle is unambiguous.



► S^3 designates a *volumetric surface* of a 4D manifold.

The EFE tell us that cosmological space *must be* **finite without boundary**.

In topology, this is also known as a “compact manifold”.

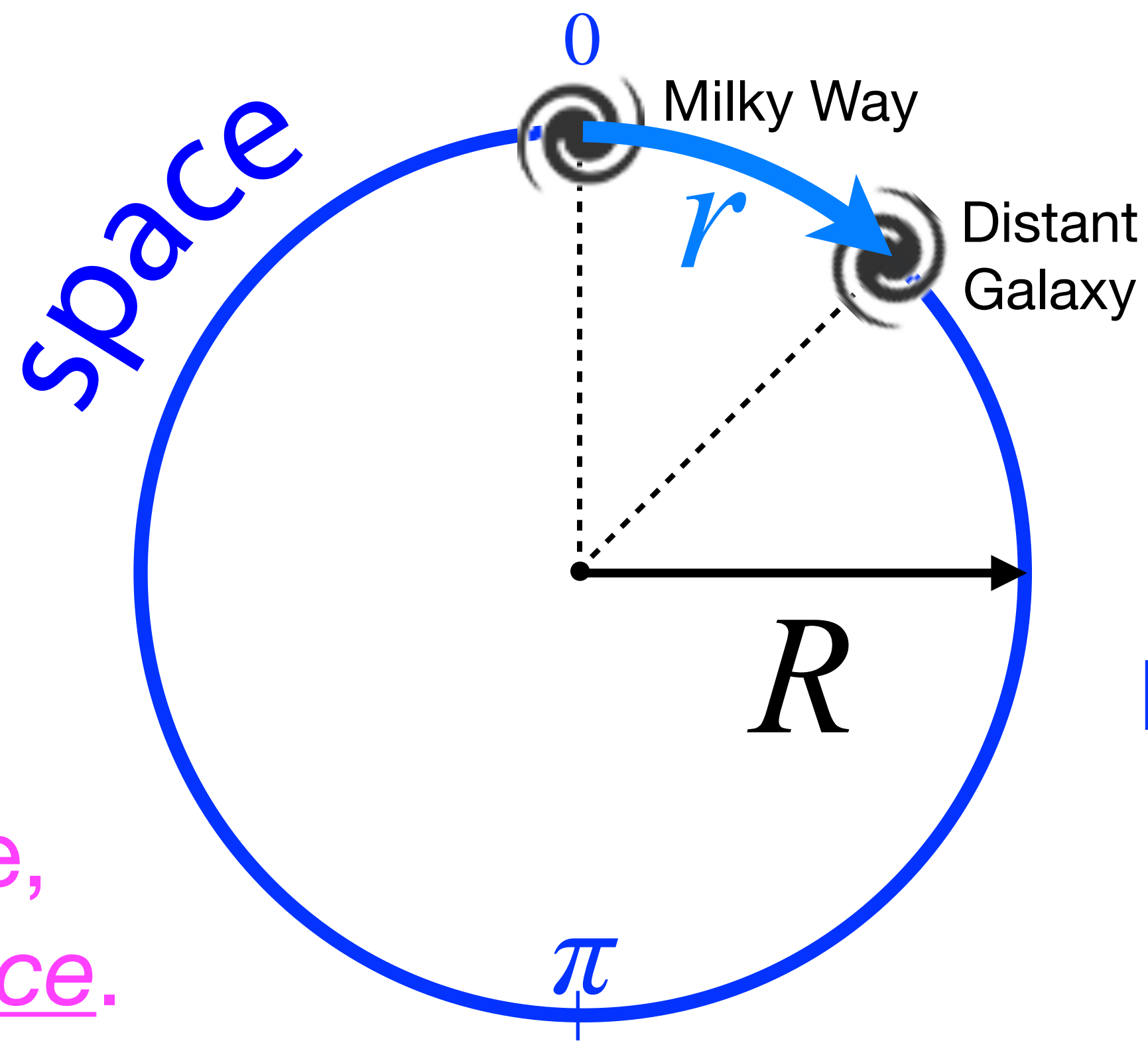
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$$d\psi = 0 :$$

2 space dimensions are not depicted; the **circle** solely denotes \mathbb{R}^1 of \mathbb{R}^3 dimensions.

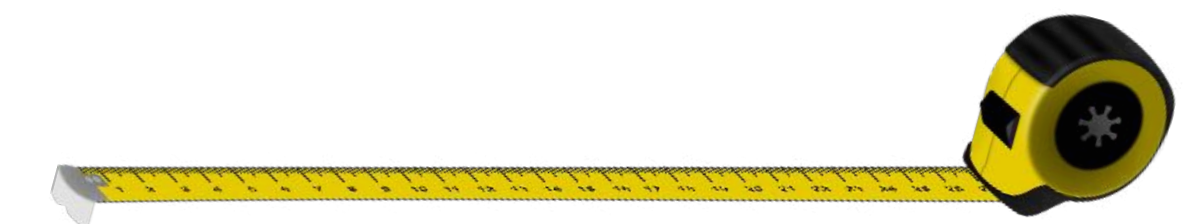
$$R \notin \mathbb{R}^3 ; R \perp \mathbb{R}^3 ; R \in \mathbb{R}^4$$

R is not physical space, yet it has an equivalence.



► S^3 designates a *volumetric surface* of a 4D manifold.

$\mathbb{R}^3 \equiv$ 3D *physical* space
(*measurable* in meters)



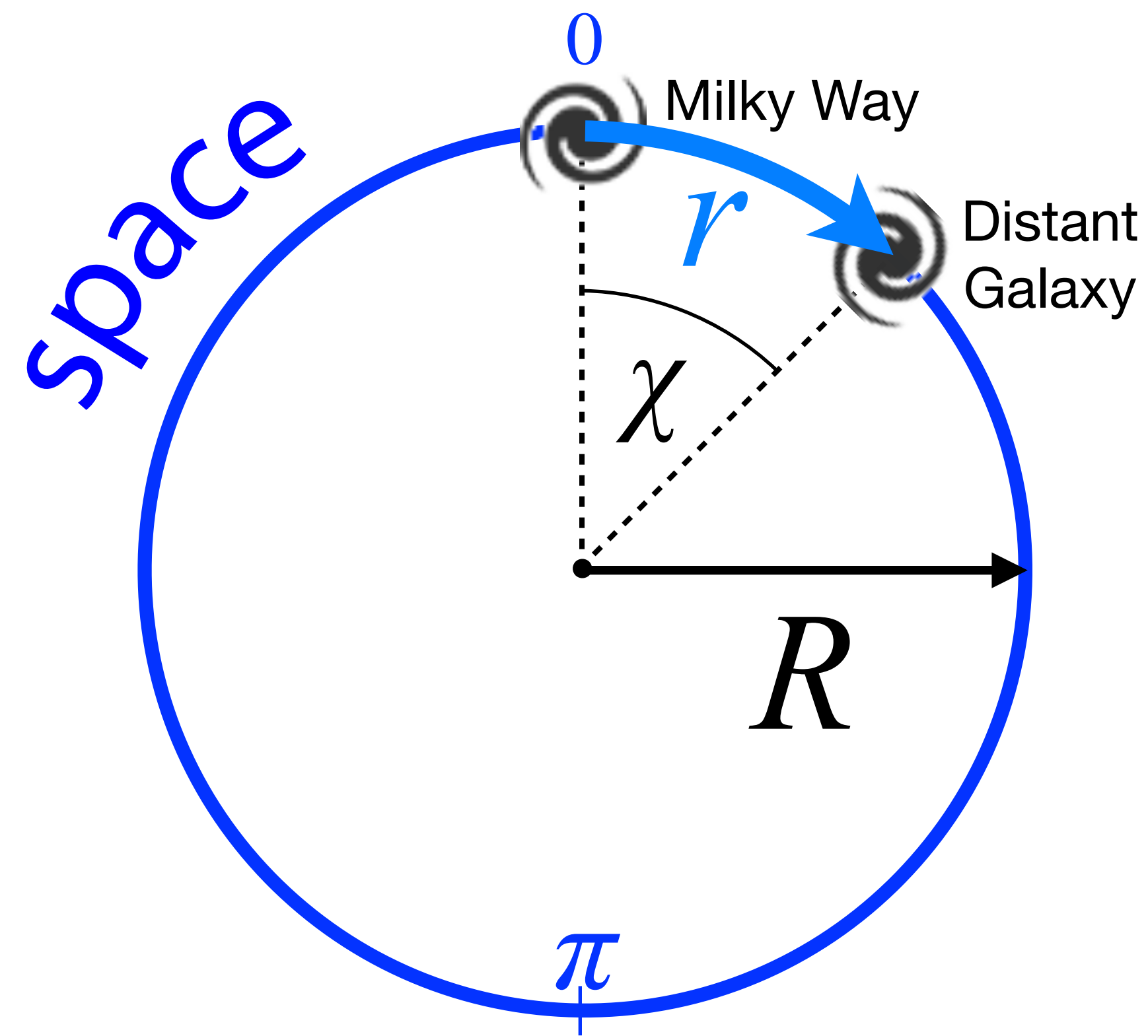
The EFE tell us that cosmological space *must be* **finite without boundary**.

In topology, this is also known as a “compact manifold”.

Relative to the Milky Way galaxy, which is an arbitrary cosmic origin, every other galaxy has some **COSMIC ANGULAR COORDINATE, χ** . This is similar to measuring distance in nautical miles (nm) because a 1-degree geodesic* (60' great arc) in latitude is precisely 60 nm. ⚓

$$\chi_{\text{chi}} \equiv \left(\frac{r}{R} \right)$$

$$r = \chi R$$



A geodesic in \mathbb{R}^3 (r) is defined by the path of light in vacuum.

* A geodesic is a minimum-distance route, typically on a curved surface.

Model (“System”) A

Einstein’s metric — an exact solution of the Einstein field equations

A. Einstein, “Cosmological Considerations in the General Theory of Relativity”,
SPAW, 142 (1917).

$$ds^2 = - dr^2 - R^2 \sin^2 \left(\frac{r}{R} \right) \left[d\psi^2 + \sin^2 (\psi) d\theta^2 \right] + \underbrace{c^2 dt^2}_{\substack{\text{coordinate} \\ \text{time}}}$$

$c \equiv$ speed of light ($\sim 2.998 \times 10^8 \text{ m} \cdot \text{s}^{-1}$)

$\frac{\text{m}^2}{\cancel{\text{s}^2}} \cdot \cancel{\text{s}^2} = \text{m}^2$
units of measure

As consistent units are required, coefficient c expresses time in meters; accordingly, 1 m of time is equivalent to $\sim 3.34 \text{ ns}$ (nanoseconds; 10^{-9} s).

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$$ds^2 = -dr^2 - R^2 \sin^2\left(\frac{r}{R}\right) \left[d\psi^2 + \sin^2(\psi) d\theta^2 \right] + c^2 dt^2$$

This equals zero.

coordinate time

$+ c^2 dt^2$

$c \equiv$ speed of light ($\sim 2.998 \times 10^8 \text{ m} \cdot \text{s}^{-1}$)

$\frac{\text{m}^2}{\cancel{\text{s}^2}} \cdot \cancel{\text{s}^2} = \text{m}^2$
 units of measure

As consistent units are required, coefficient c expresses time in meters; accordingly, 1 m of time is equivalent to $\sim 3.34 \text{ ns}$ (nanoseconds; 10^{-9} s).

Scientists and mathematicians seek to eliminate weakness or inadequacy in an argument, similar to how predators thin populations of prey species...

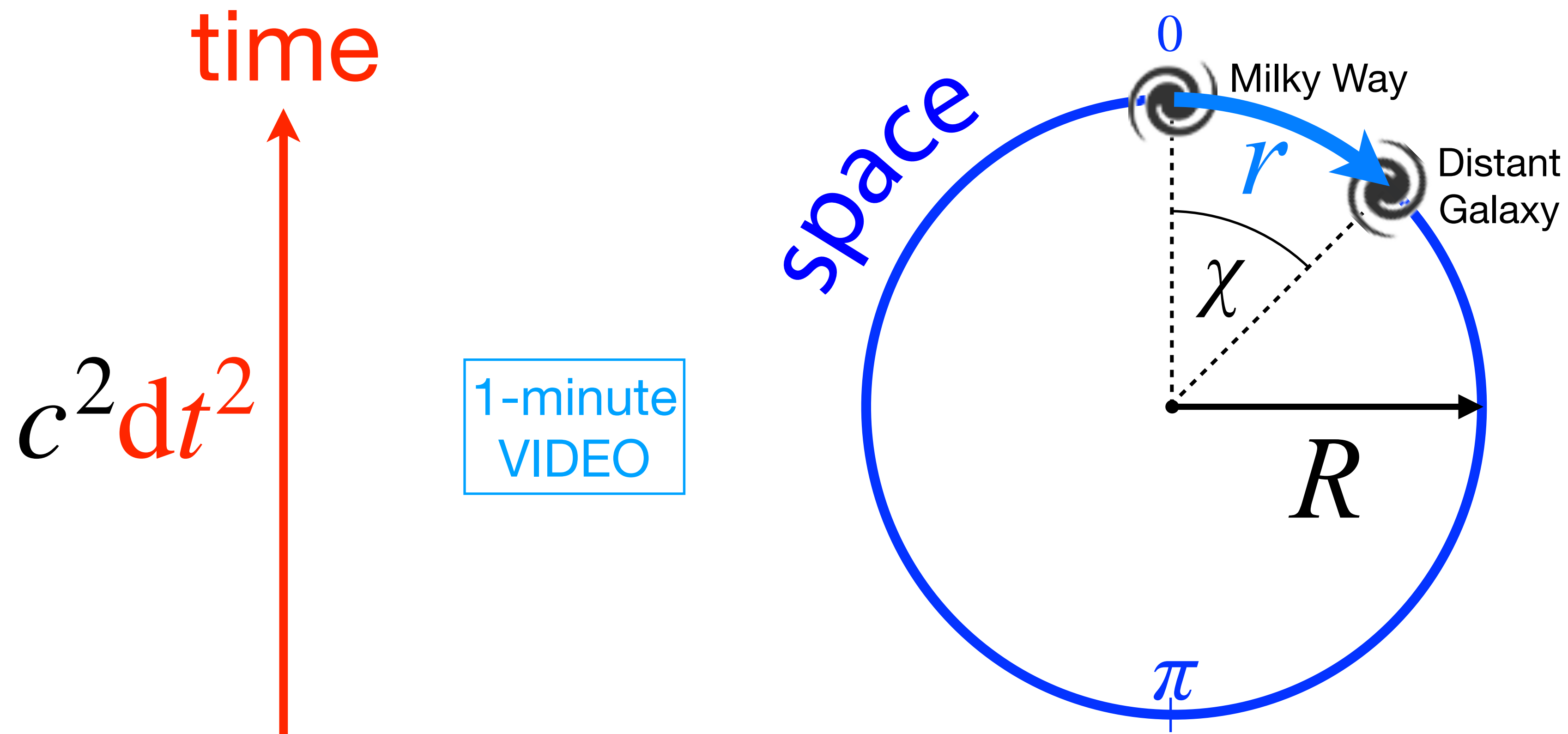


Leopard seal, Antarctica

up to 3.5 m and 600 kg

photo credit:
Alexander F Mayer (27 Feb 2024)
Pleneau Island, Antarctica ($65^{\circ} 06' S$, $064^{\circ} 02' W$)
GoPro 7 video frame (cropped) © 2024 A. F. Mayer

In Einstein's solution of the EFE, which produced a cosmological metric, the time coordinate (dimension) is *independent* of the space coordinates.



Diplomatically, Willem de Sitter found this to be “somewhat contradictory”, actually pointing out a salient logical inconsistency requiring rectification...

Referencing Einstein's metric on p. 14, expressed using $x_4 \equiv t$

“We thus find that in the $\overbrace{\text{System } A}$ the time has a separate position. That this must be so, is evident a priori. For speaking of *the* three-dimensional world, if not equivalent to introducing an absolute time, at least implies the hypothesis that at each point of the four-dimensional space there is one absolute coordinate x_4 which is preferable to all others to be used as “time”, and that at all points and always this one coordinate is actually chosen as time. Such a fundamental difference between the time and the space-coordinates seems to be somewhat contradictory to the complete symmetry of the field-equations...”

– Willem de Sitter (31 March 1917)

Note: modern notation uses $x_0 \equiv t$,
where $(x_1, x_2, x_3) \equiv (x, y, z)$.


W. de Sitter, “On the relativity of inertia. Remarks concerning Einstein's latest hypothesis”, *KNAW Proceedings* **19**(2), 1217 (1917).

Model B

Willem de Sitter's metric — a different exact solution of the EFE

W. de Sitter, "Einstein's theory of gravitation and its astronomical consequences. Third paper", *MNRAS* **78**, 3 (1917).

$$ds^2 = - dr^2 - R^2 \sin^2 \left(\frac{r}{R} \right) \left[d\psi^2 + \sin^2 (\psi) d\theta^2 \right] + \cos^2 \left(\frac{r}{R} \right) c^2 dt^2$$



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$d\psi = 0$ simplifies to 1D space (\mathbb{R}^1).

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This equals zero.

proper time @ r

$c^2 d\tau^2$

↑

$\chi \equiv \frac{r}{R}$ $d\tau^2 = \cos^2(\chi) dt^2$

There is now a distinction between the local-reference “coordinate time” (dt) and the “proper time” ($d\tau$) of a clock at a distance r from the observer.

Adapted from the French: “Mon propre temps” meaning “my own time”.

Pedantic controversy aside, Eqs. (1) and (2) can be interpreted to impose local orthogonality of the time coordinate with respect to space for any inertial reference frame. Rather than a mere mathematical abstraction, that is a *physical* interpretation, which is also consistent with the physical interpretation of de Sitter's metric (p. 20), having the *cosine* function in the temporal component.

$$(1) \quad ds^2 = - dr^2 + c^2 d\tau^2 \quad (d\psi = 0)$$

Click me...

$$(2) \quad \begin{aligned} e^{i\phi} &= \cos \phi + i \sin \phi \\ e^{i\frac{\pi}{2}} &= i, \quad e^{i\pi} = -1 \end{aligned}$$

This maths is intended for topic experts; if this is unfamiliar, [don't worry about it.](#)

Pedantic controversy aside, Eqs. (1) and (2) can be interpreted to impose local orthogonality of the time coordinate with respect to space for any inertial reference frame. Rather than a mere mathematical abstraction, that is a *physical* interpretation, which is also consistent with the physical interpretation of de Sitter's metric (p. 20), having the *cosine* function in the temporal component.

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Click me...

$$(2) \quad \begin{aligned} e^{i\phi} &= \cos \phi + i \sin \phi \\ e^{i\frac{\pi}{2}} &= i, \quad e^{i\pi} = -1 \end{aligned}$$

According to the principle of relativity, no absolute *physical interpretation* is permitted for the four distinct coordinates of \mathbb{R}^4 spacetime: Frame A is the spacial **neighbourhood** V of a point p in \mathbb{R}^3 ; the *time coordinate* \mathbf{t} in A is the *local vertical to* V at a in \mathbb{R}^4 . However, the **geometric object** \mathbf{t} represents some abstract **geometric mixture of space and time** for a different frame B .

Similarly, \bar{g} is a local distinction in \mathbb{R}^3 that is geometrically distinct for discrete points on Earth's S^2 surface.

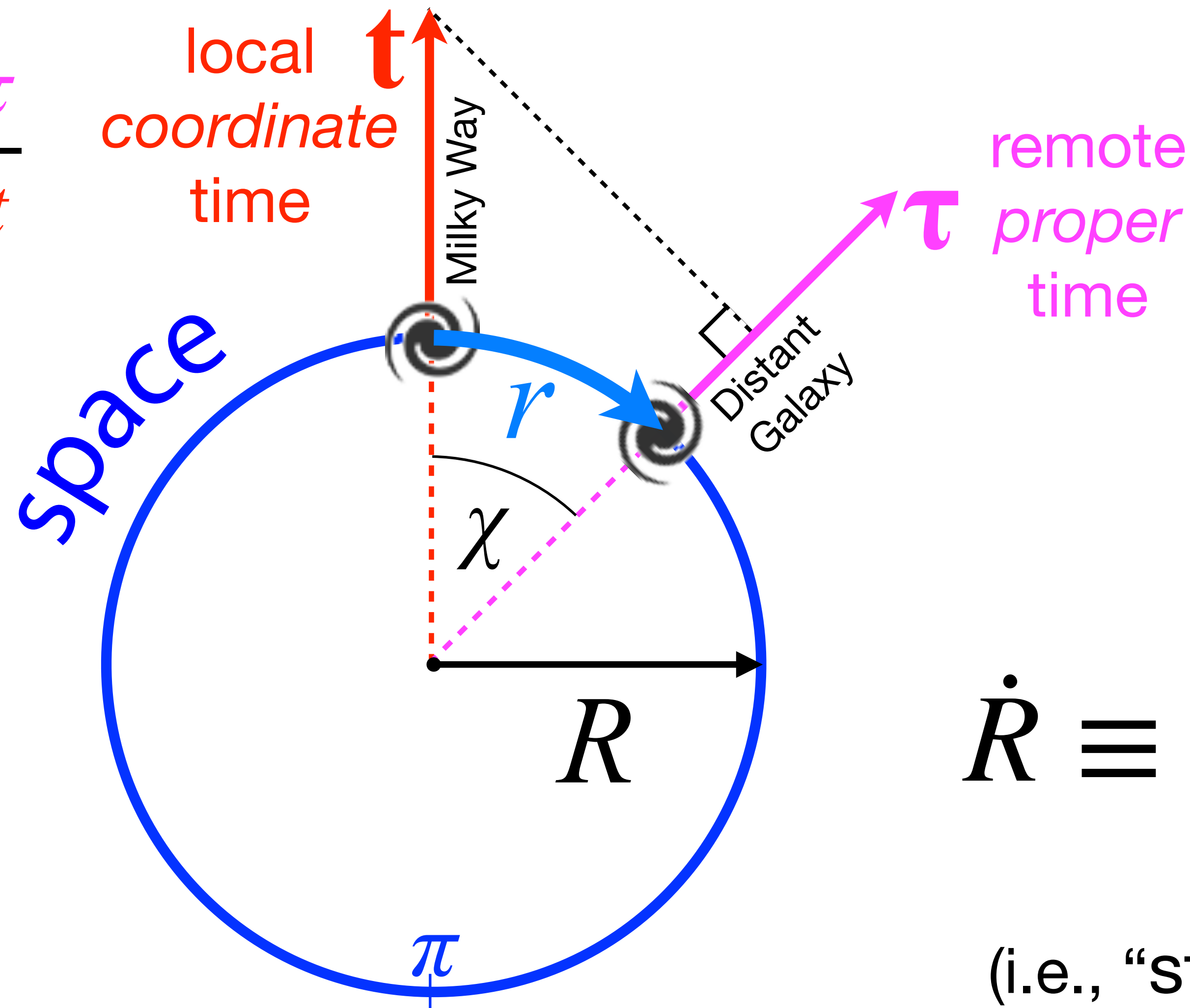
The time coordinate is *dependent* on the space coordinate; a **distant clock** ticks slower than a **local ideal reference clock** *exclusively* as a function of r .
 A distance-induced time dilation is modeled, absent cosmic expansion (\dot{R}).

$$\cos\left(\frac{r}{R}\right) = \cos\chi = \frac{d\tau}{dt}$$

$$d\tau = \cos\chi dt$$

$$\sec\chi \equiv \frac{1}{\cos\chi}$$

$$\sec\chi = \frac{dt}{d\tau}$$



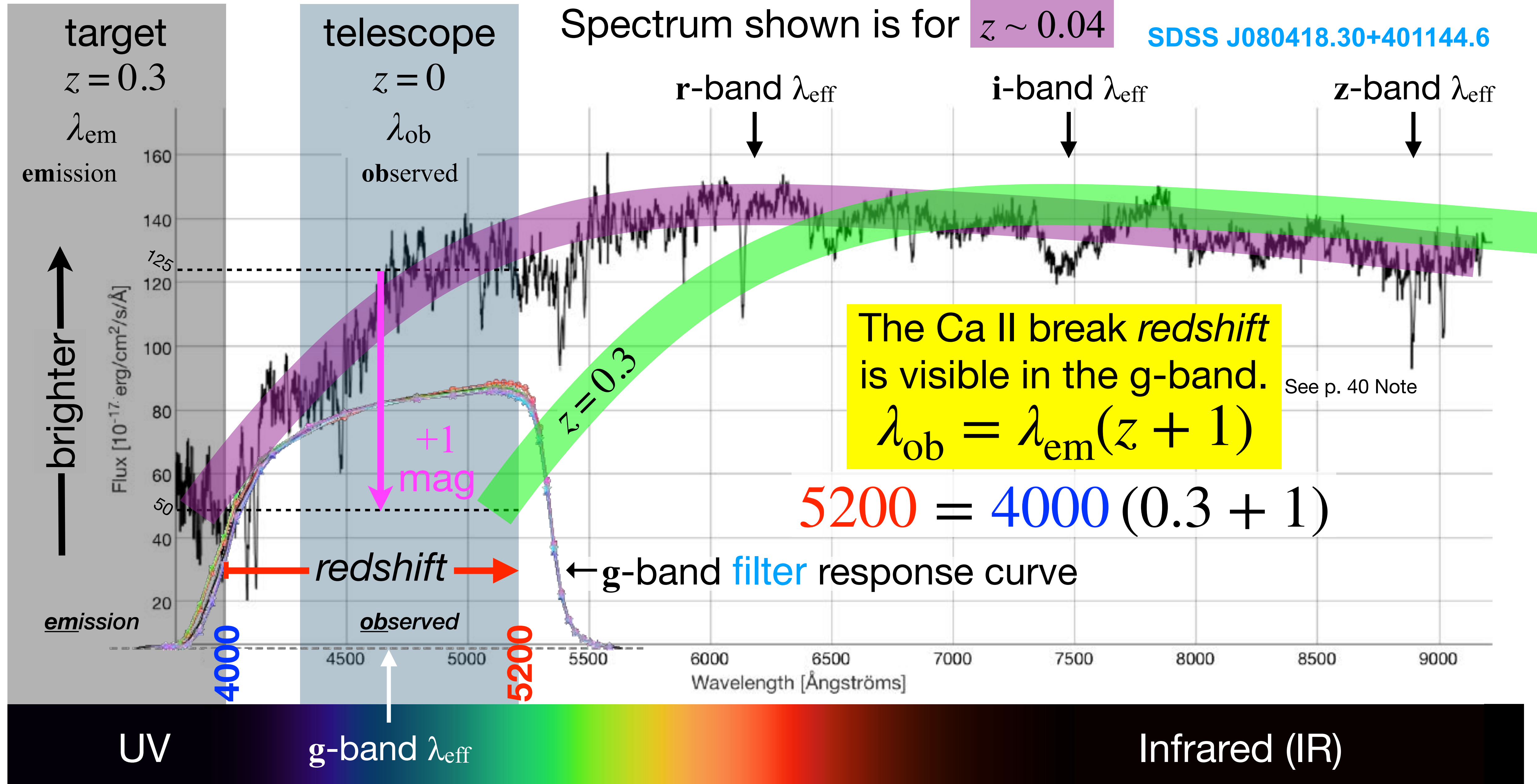
$$\dot{R} \equiv \frac{dR}{dt} = 0$$

(i.e., “steady state”)

REDSHIFT (z)

Galaxy spectrum demonstrating **4000-Å (Ca II) break**

Spectrum shown is for $z \sim 0.04$ **SDSS J080418.30+401144.6**



The Ca II break *redshift* is visible in the g-band. See p. 40 Note

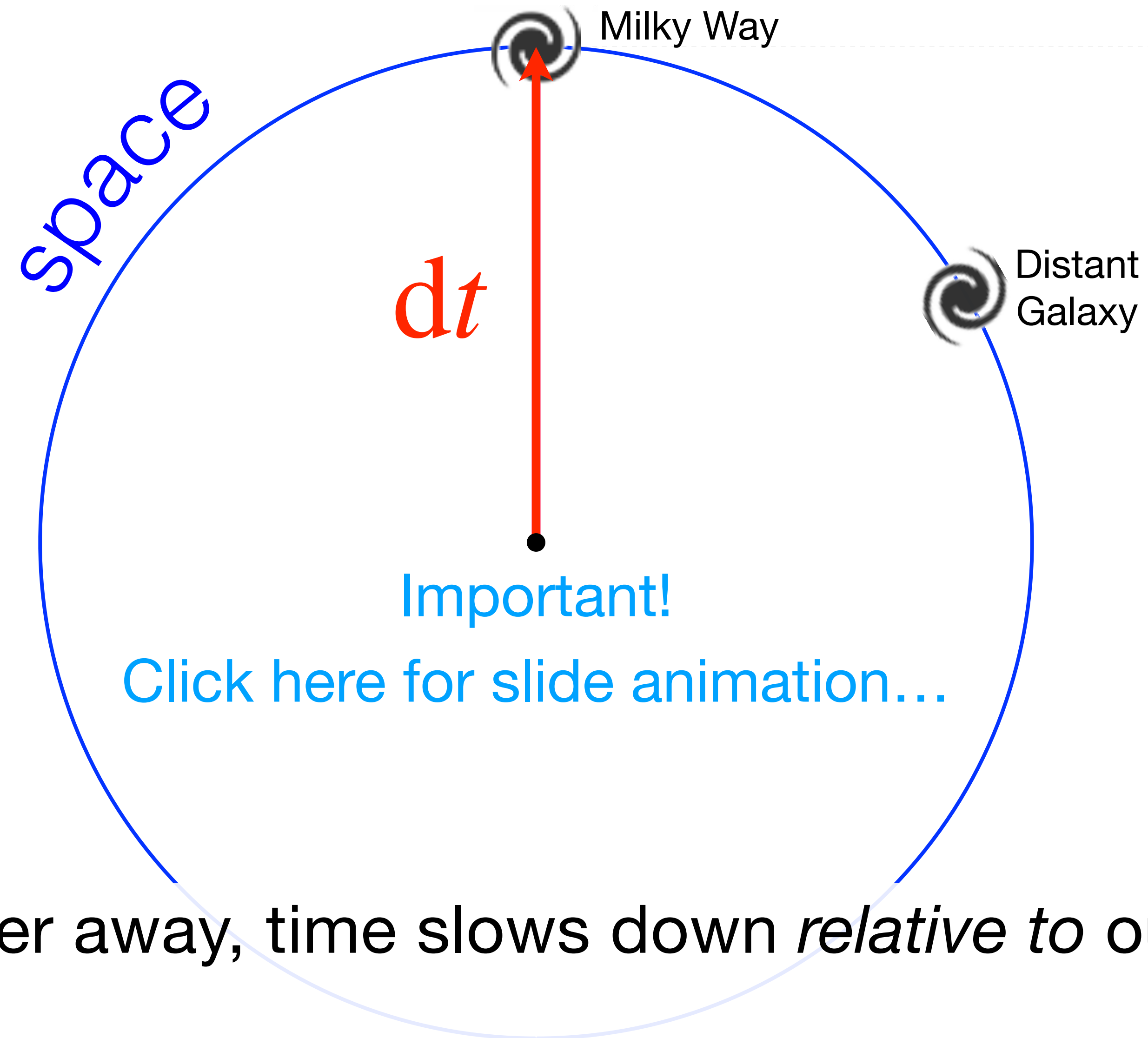
$$\lambda_{\text{obs}} = \lambda_{\text{em}}(z + 1)$$
$$5200 = 4000(0.3 + 1)$$

UV

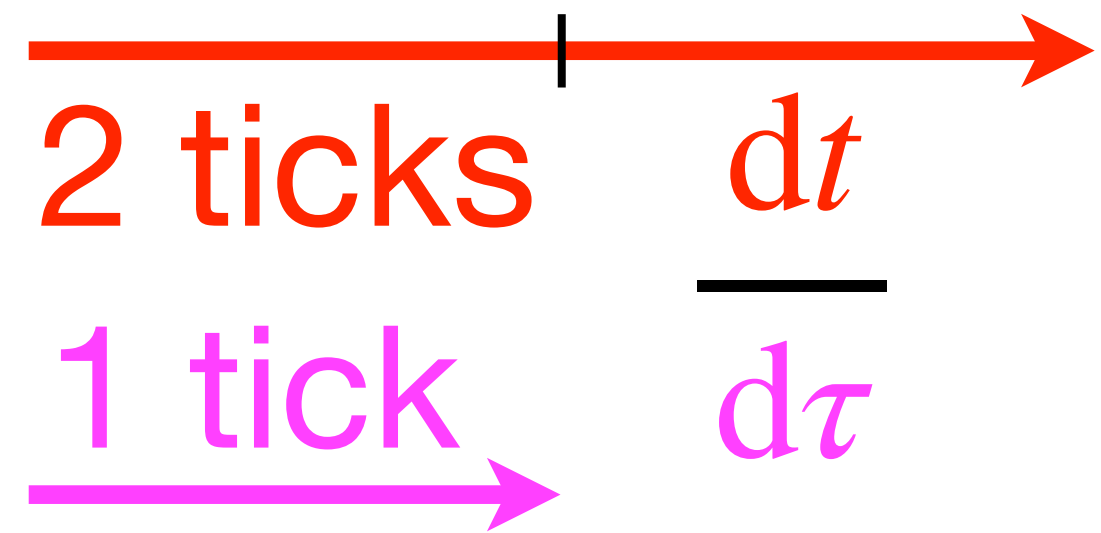
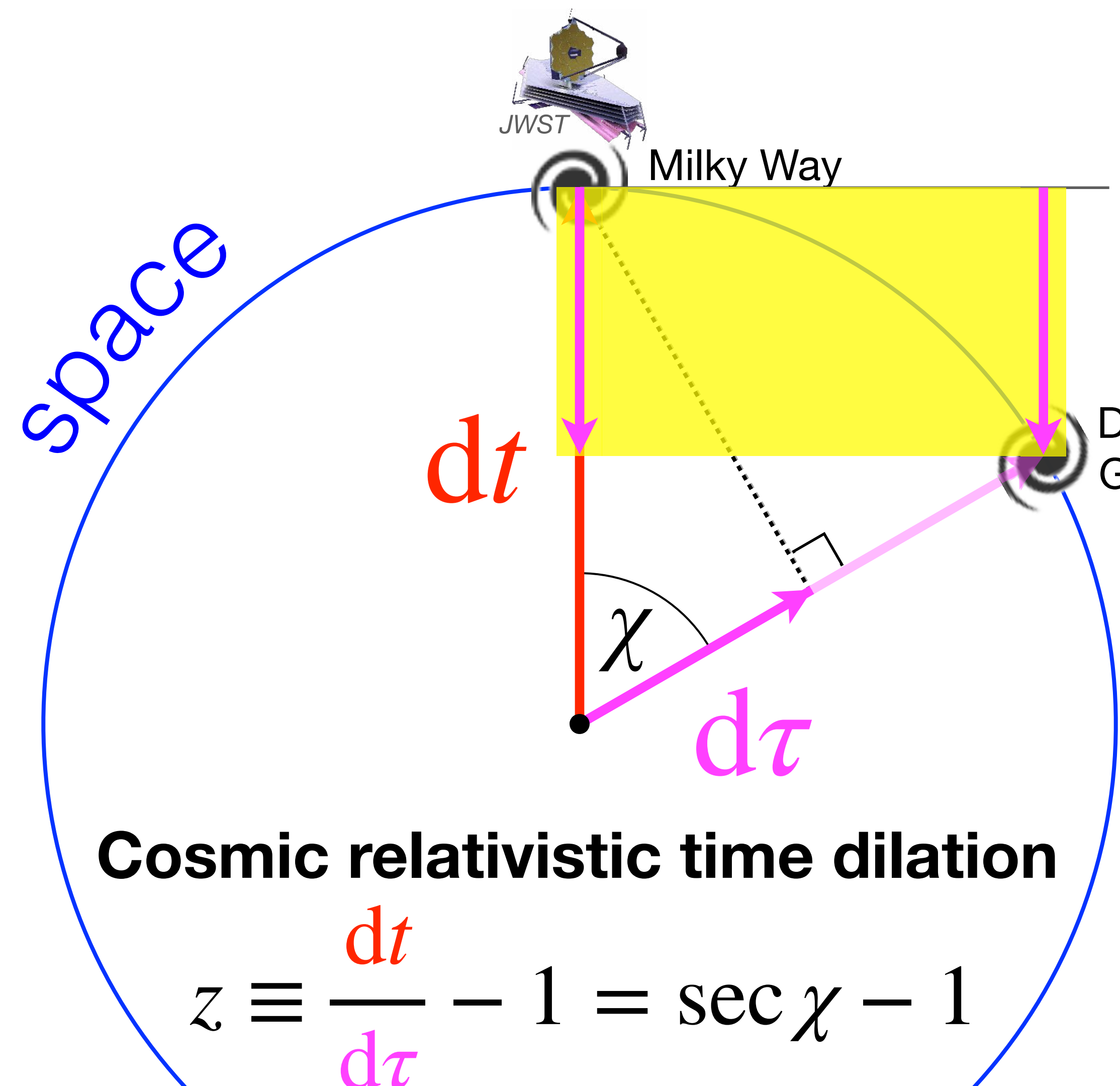
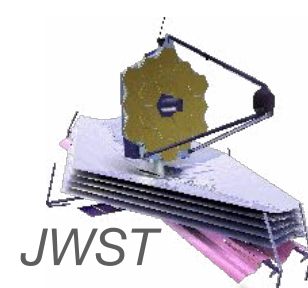
g-band λ_{eff}

Infrared (IR)

The meaning of de Sitter's solution to the Einstein Field Equations



As we look farther away, time slows down *relative to* our **local clock**...



$$\frac{dt}{d\tau} = 2 = \sec \chi$$

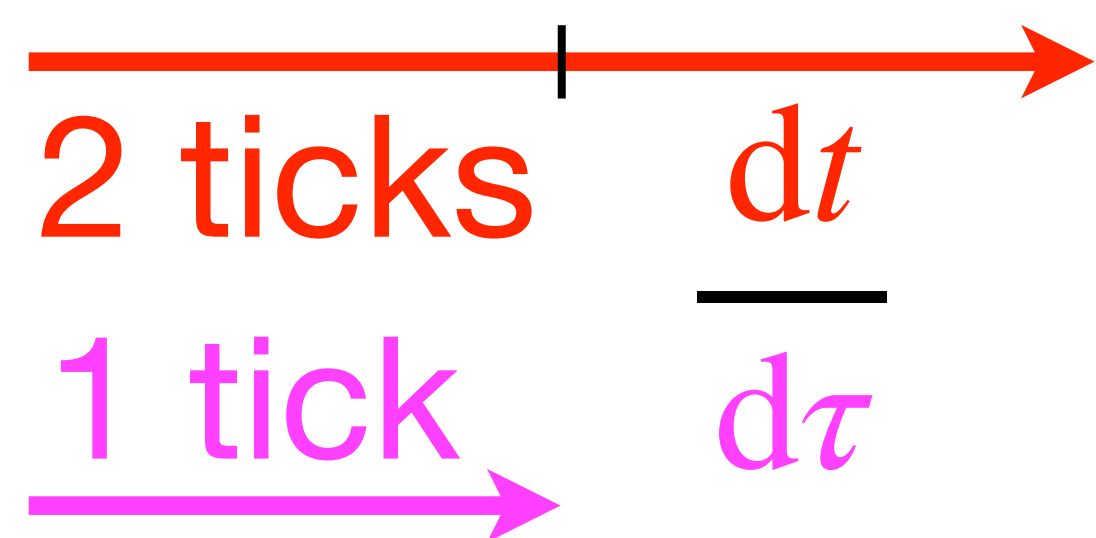
$$\chi = \frac{\pi}{3} = 60^\circ$$

Cosmic relativistic time dilation

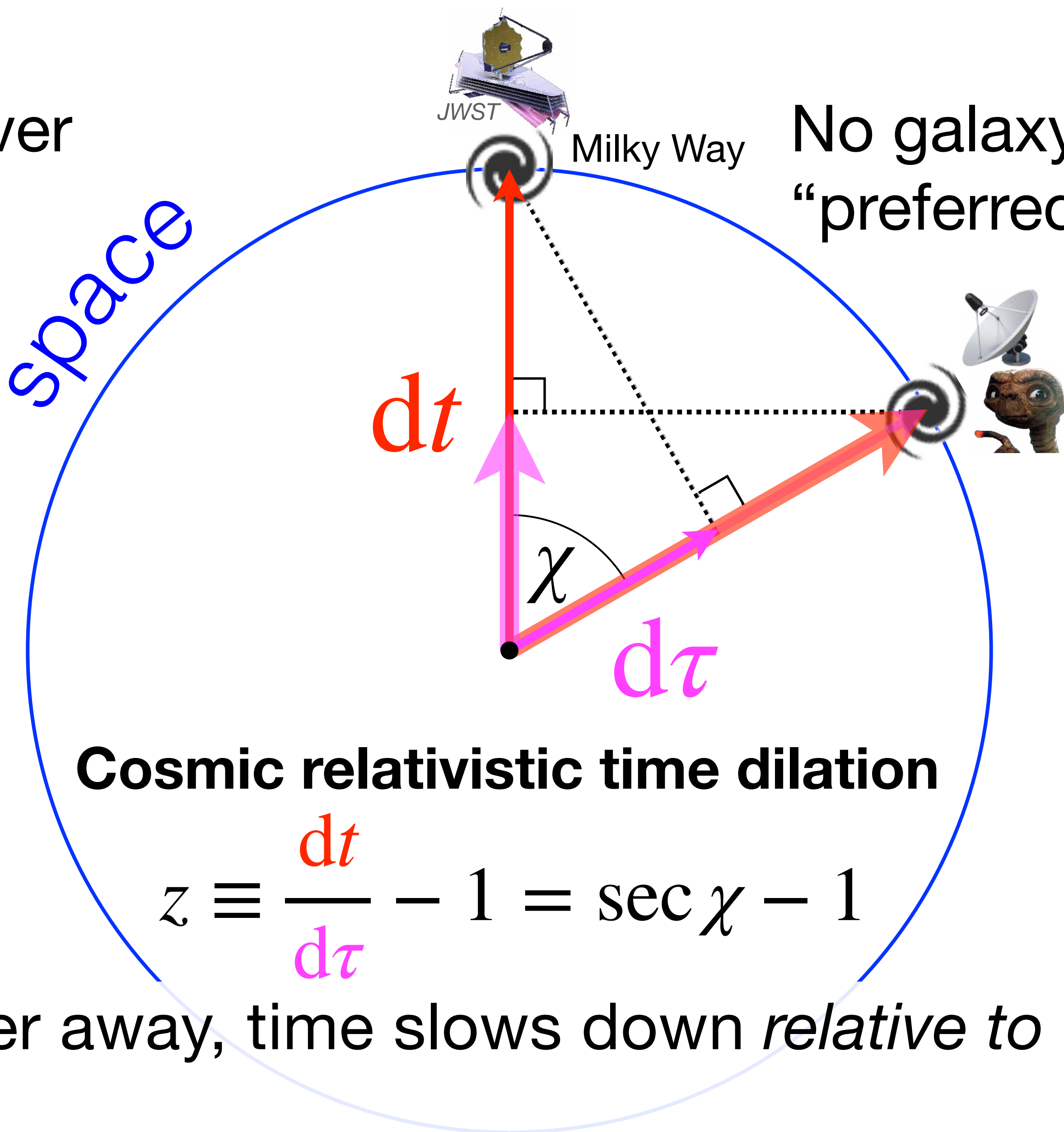
$$z \equiv \frac{dt}{d\tau} - 1 = \sec \chi - 1$$

As we look farther away, time slows down *relative to* our **local clock**...
 @ $z = 1$, the distant clock ticks once for 2 ticks of the observer's clock,
 so, *relative to* the local clock, the remote clock is falling behind in time.

Any cosmic observer may use the *local* clock as *reference coordinate time*.



Space



No galaxy constitutes some “preferred” reference frame.

@ $z = 1$

$$\frac{dt}{d\tau} = 2 = \sec \chi$$

Cosmic relativistic time dilation

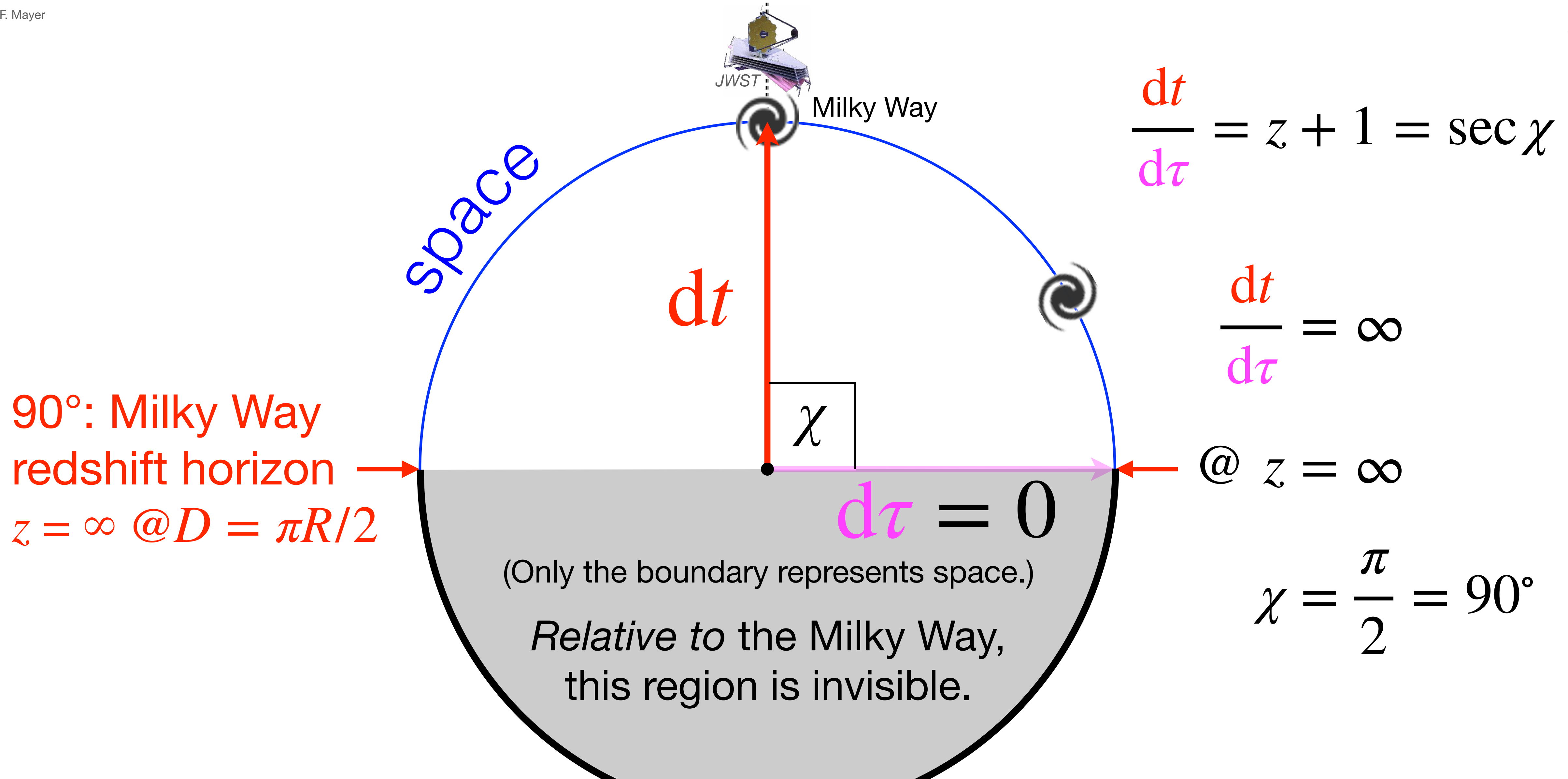
$$z \equiv \frac{dt}{d\tau} - 1 = \sec \chi - 1$$

$$\chi = \frac{\pi}{3} = 60^\circ$$

As we look farther away, time slows down *relative to our local clock*...

Effect is bilateral; the remote observer perceives our clock to be slow.





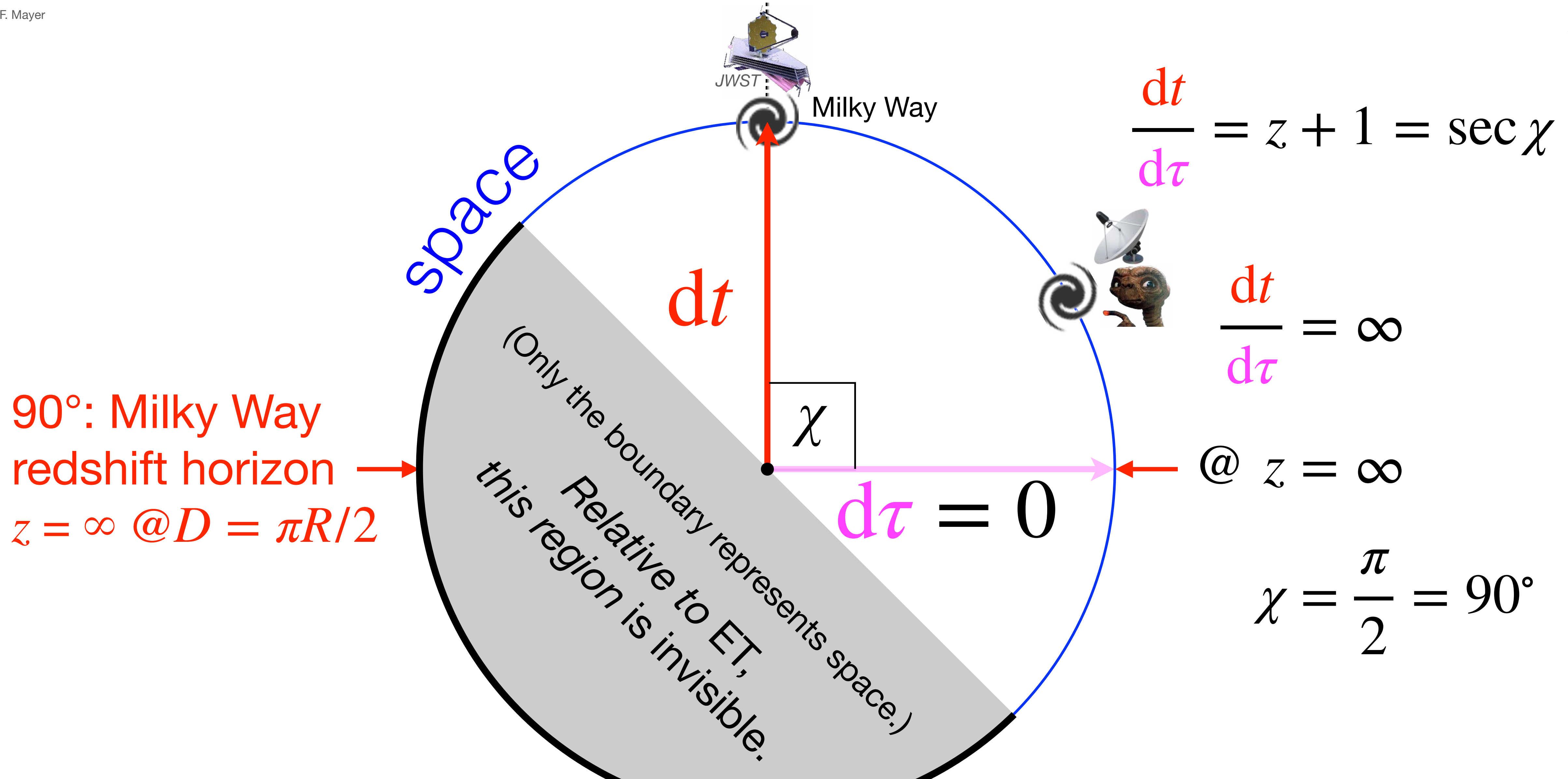
$$\frac{dt}{d\tau} = z + 1 = \sec \chi$$

$$\frac{dt}{d\tau} = \infty$$

@ $z = \infty$

$$\chi = \frac{\pi}{2} = 90^\circ$$

@ $z = \infty$, the distant clock is not correlated to the observer's clock, and the antipodal cosmic half is not visible; it is beyond the redshift horizon.



$$\frac{dt}{d\tau} = z + 1 = \sec \chi$$

$$\frac{dt}{d\tau} = \infty$$

@ $z = \infty$

$$\chi = \frac{\pi}{2} = 90^\circ$$

90°: Milky Way redshift horizon
 $z = \infty @ D = \pi R/2$

(Only the boundary represents space. Relative to ET, this region is invisible.)

$$d\tau = 0$$

@ $z = \infty$, the distant clock is not correlated to the observer's clock, and the antipodal cosmic half is not visible; it is beyond the redshift horizon.

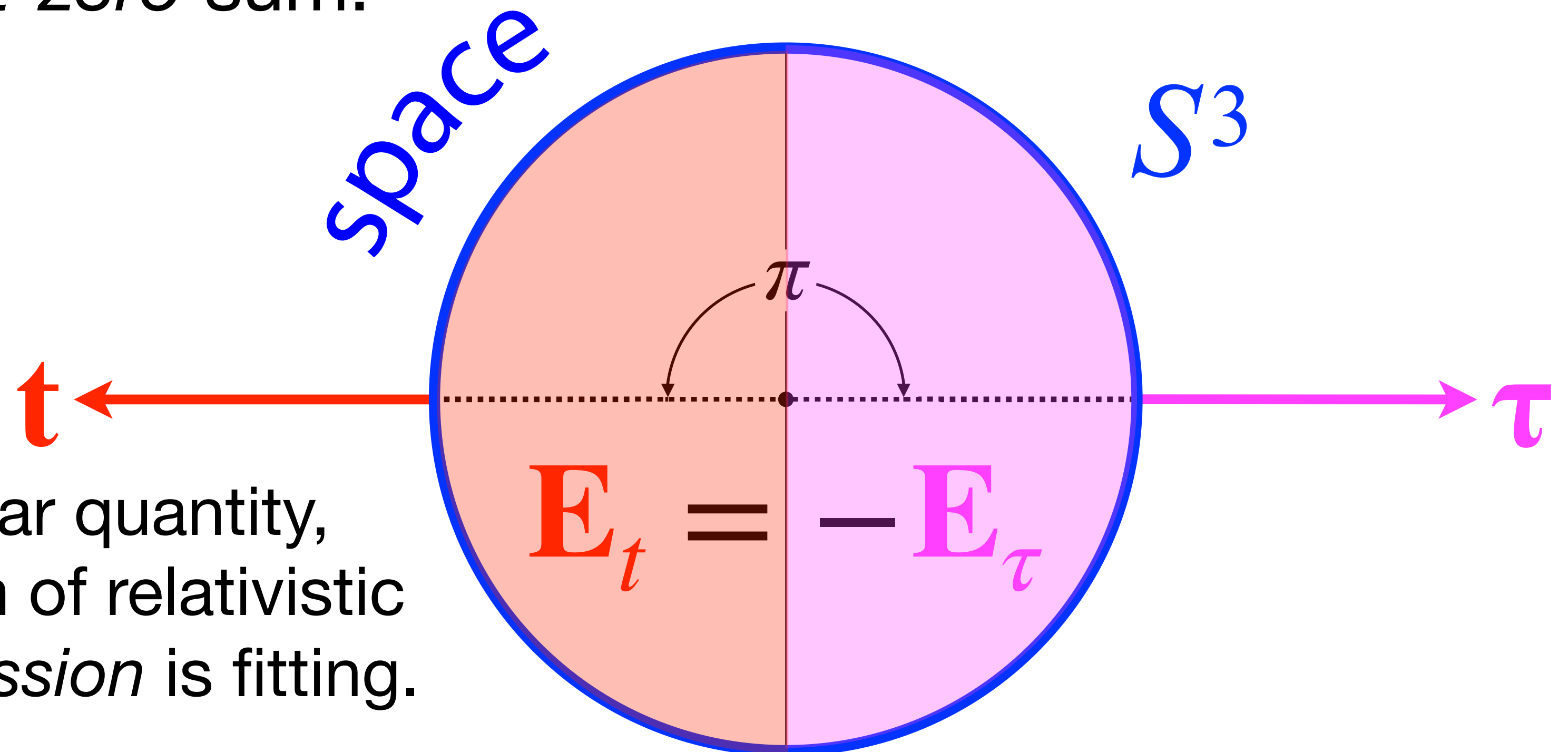
A unique peculiarity of de Sitter's solution to the EFE is that it requires the total energy density of the Universe to be *zero*,* which *seemed* unphysical. With his solution newly interpreted in the context of *temporal geometry*, that feature proves to be a physically-rational mathematical *necessity*. As per the cosmological principle, antipodal cosmic 'hemispheres' (S^3) encompass identical mass-energy, E . Relativistic time reversal, imparting negative energy, yields a *net-zero* sum:

$$E + (-E) = 0 \quad \therefore \rho_0 = 0$$

* " ρ_0 is the average density of the world-matter."

See [de Sitter \(11/1917\)](#), Eqs. (6, 9B)

Conventionally, energy is a scalar quantity, yet in the atypical consideration of relativistic time reversal, this **vector** expression is fitting.

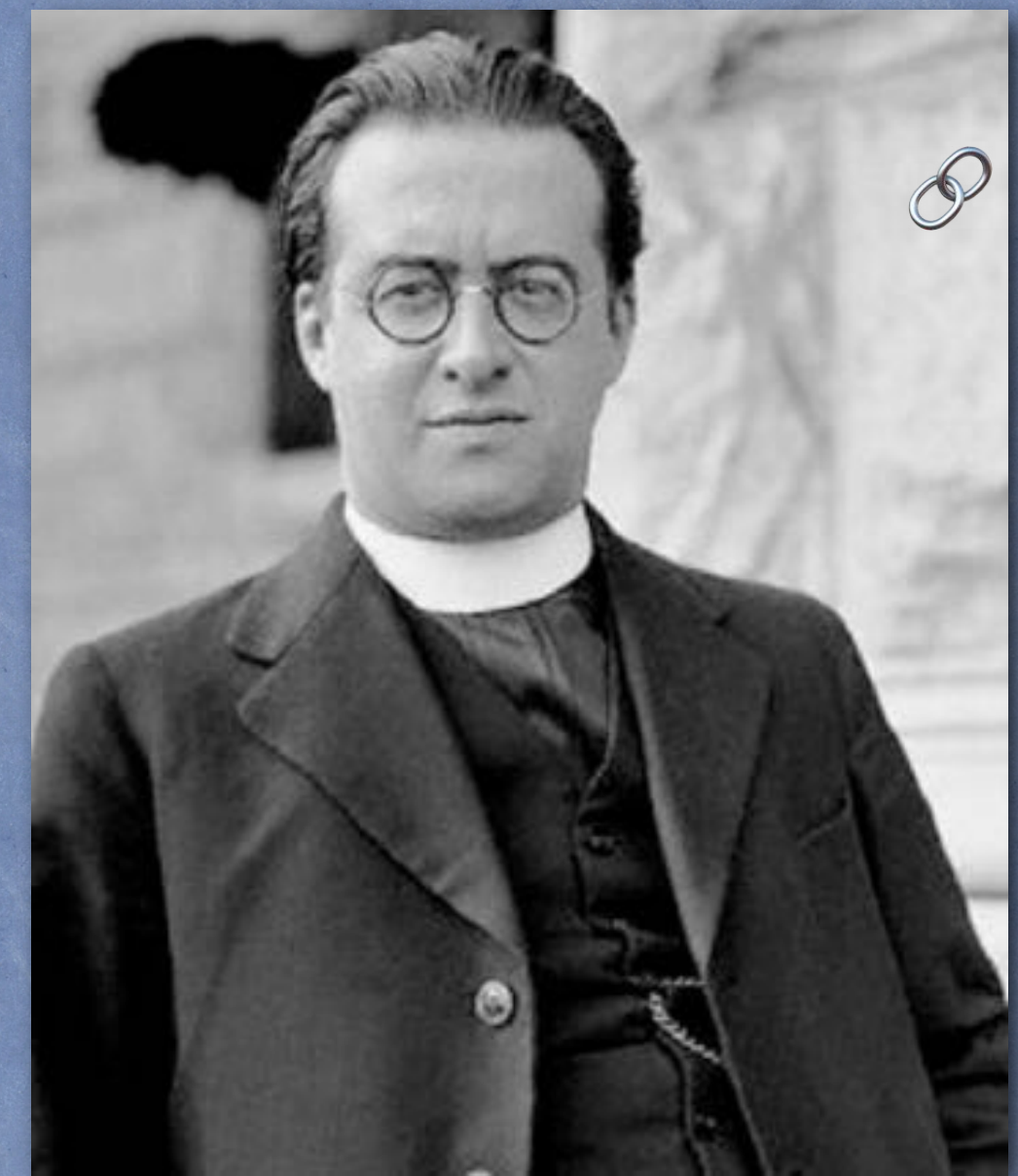


Things you didn't know about the [Hubble Diagram](#)

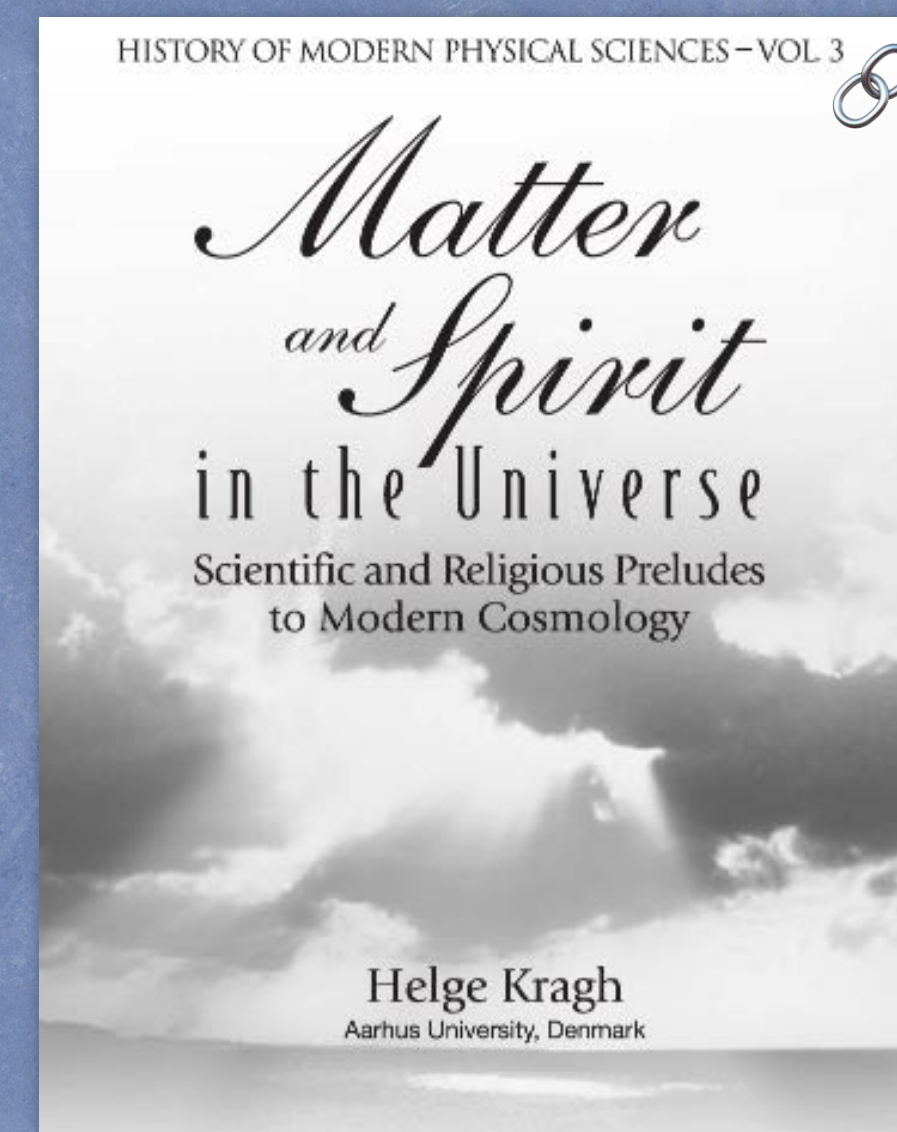
In 1921, a young Belgian mathematics postdoc and seminarian by the name of Georges Henri Lemaître wrote an essay entitled *God's First Three Declarations*.* The author stated that this 1921 essay was “an attempt to describe scientifically the first verses of Genesis.” That formative [hermeneutic](#) essay, discovered in the archives of the Catholic University of Leuven in the late 20th century, is the actual root of the Big-Bang theory. Lemaître (July 1894 – June 1966) was ordained as a Catholic priest in 1923.

* Footnotes: “Les trois premières paroles de Dieu.” The manuscript is reproduced in Stoffel (1996), pp. 107–111. Lemaître’s religious views are discussed in Lambert (1997). Source: [Helge Kragh, Matter and Spirit in the Universe PDF](#) | [\(Imperial College Press, London, 2004\), p. 141.](#)

Click the cover for a book review by E. McMullin in *Journal for the History of Astronomy* (2005).



Georges Lemaître

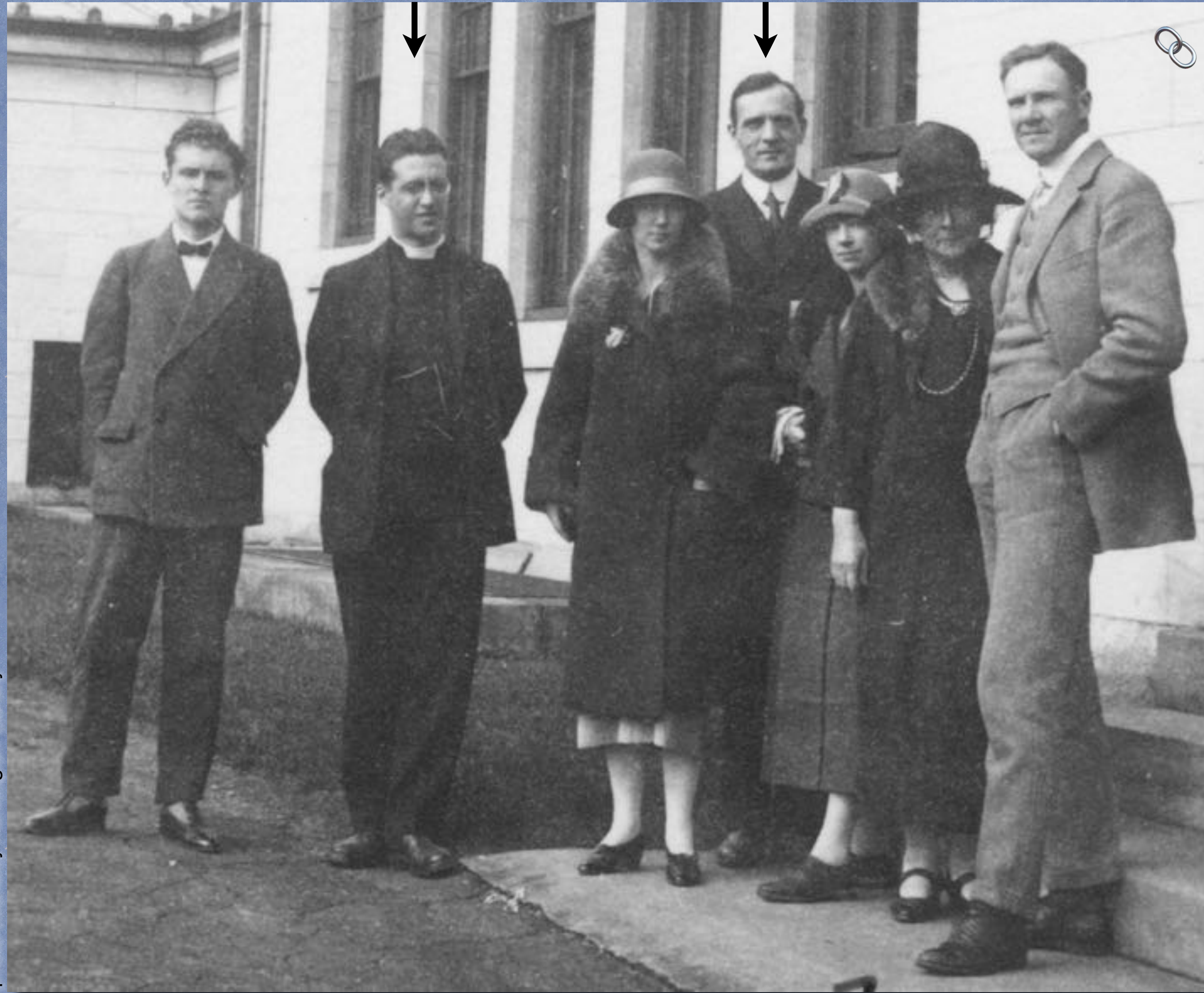


Professor
Université Catholique
de Louvain
(1925 – 1966)

Pontifical Academy
of Sciences
(1936 – 1966)

PAS President
(1960 – 1966)

In June 1925, Lemaître met with Hubble at Mt. Wilson.^{1,2}



1. references Mt. Wilson (a)
2. references Caltech (b)

They also met at the 1928 IAU conference in Holland.³

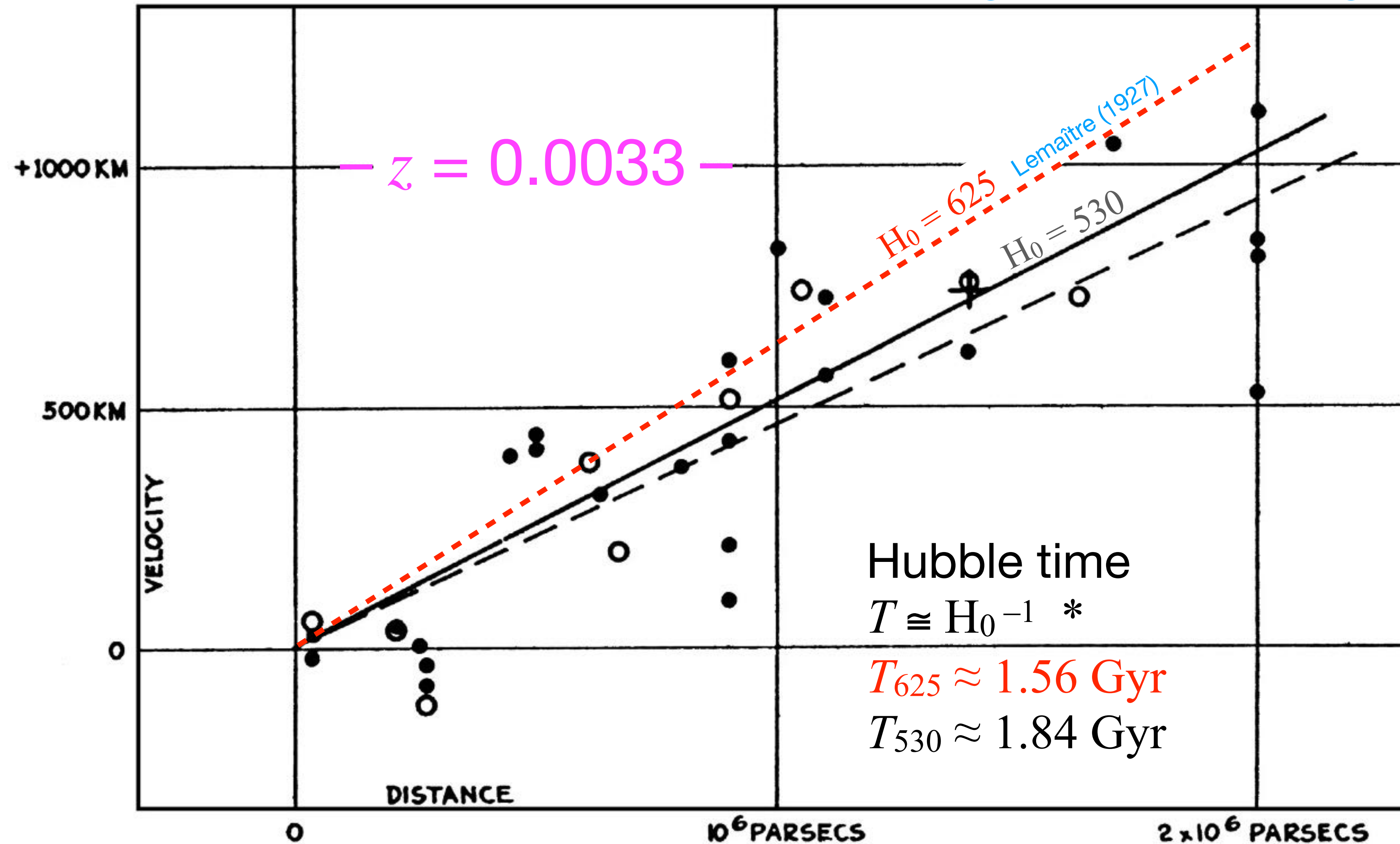
Edwin Hubble's biographies all note that he was idiosyncratic: he was a **pathological liar** and inclined to self-aggrandizement based on fictional exploits.

1. John Farrell, *The Day Without Yesterday: Lemaître, Einstein, and the Birth of Modern Cosmology*, New York: Thunder's Mouth Press, 2005, p. 78.

2. Jeremiah P. Ostriker & Simon Mitton, *Heart of Darkness: Unraveling the Mysteries of the Invisible Universe*, Princeton: Princeton Univ. Press, 2013, p. 68.

Hubble diagram (1929) — annotated

The historical foundation of the ‘expanding-universe’ paradigm



Hubble constant
 H_0 units:
 $\text{km s}^{-1} \text{ Mpc}^{-1}$

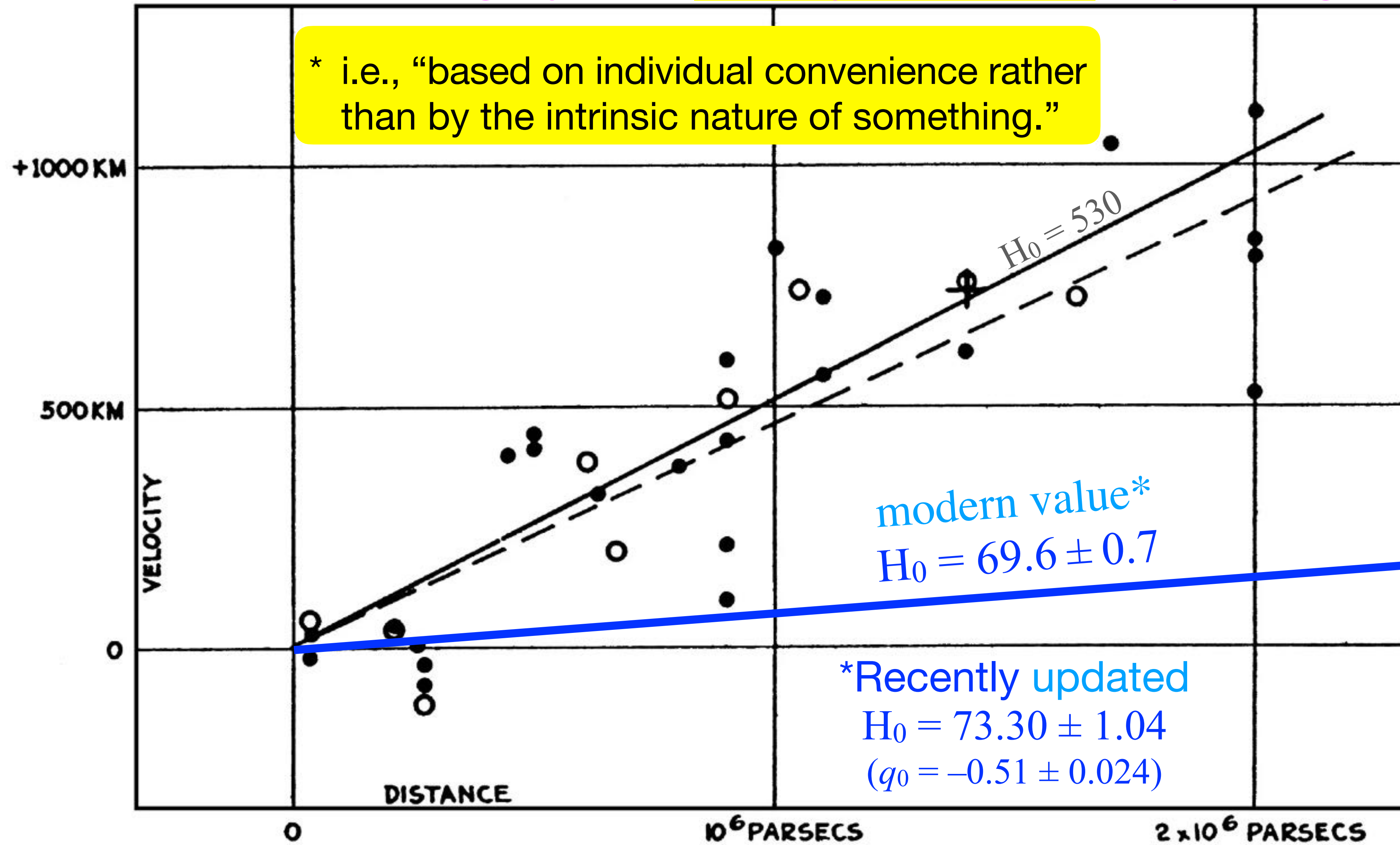
* Modeled age
of Universe
($\Omega = 0$)

E. Hubble,

“A Relation between Distance and Radial Velocity among Extra-Galactic Nebulae”, *PNAS* **15**, 168 (1929).

Hubble diagram (1929) – annotated

The modern legacy of an **arbitrary*** correlation 95 years ago

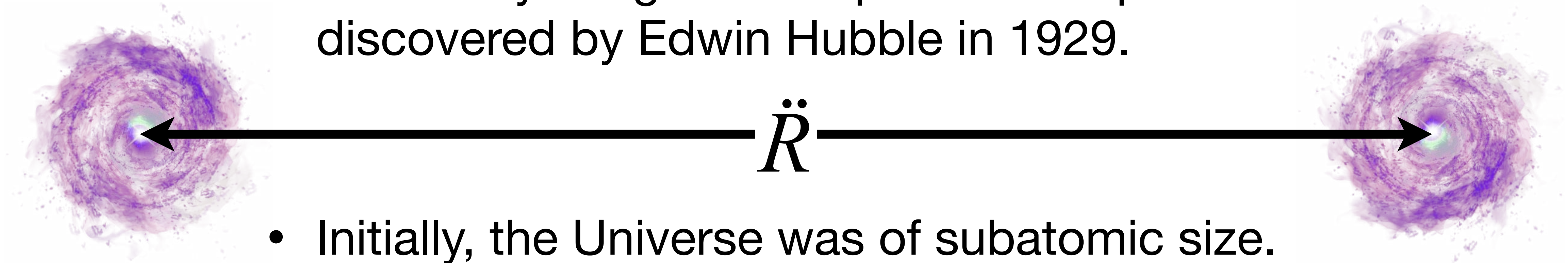


$$T_{73.3} \approx 13.0 \text{ Gyr} \quad T_{69.6} \approx 13.7 \text{ Gyr} \quad (\Omega = 1)$$

Modern Conventional Textbook Cosmology

(Big-Bang “ Λ CDM” Expanding-Universe Model)
 “Lambda Cold Dark Matter”

- Observed galaxy redshifts are definitively caused by the general expansion of space discovered by Edwin Hubble in 1929.



- Initially, the Universe was of subatomic size.
- Cosmic expansion started with $v \gg c$ ‘inflation’.
- That expansion is now inexplicably accelerating.
- Most of the Universe is *undetectable* ‘dark stuff’.
- Galaxy superclusters formed over about 10 Gyr.
- Anomalous JWST observations are annoying...

Es ist immer angenehm, über strenge Lösungen einfacher Form zu verfügen.

“It is always pleasant to have exact solutions in simple form at your disposal.”

– [Karl Schwarzschild](#), “On the Gravitational Field of a Mass Point According to Einstein’s Theory”;
In: [Proceedings of the Royal Prussian Academy of Sciences Meeting \(Berlin\), 1916, p. 189.](#)

English translation: [arXiv:physics/9905030 \[physics.hist-ph\]](#)



The Complete Set of Empirically-Accurate Cosmological Predictive Equations Relativistic Temporal Geometry (RTG) model

A logically consistent set:

(1) Theta-z

to be shown...

$$\theta(z) = C_R \left(1 - \frac{1}{(z+1)^2} \right)^{-\frac{1}{2}} \text{ radians}$$

(1 \Leftrightarrow 2 \Leftrightarrow 3)

1 iff 2 iff 3

C_R, C_V, C_M are empirically-related constants of proportionality; they are not “free parameters”.

(2) Redshift-volume

to be shown...

$$S^3(z) = C_V \cdot \left[\cos^{-1} \left(\frac{1}{z+1} \right) - \left(\frac{1}{(z+1)^2} - \frac{1}{(z+1)^4} \right)^{\frac{1}{2}} \right] \text{ arbitrary units}$$

These equations rest on first principles and Riemann.

(3) Redshift-magnitude

to be shown...

$$m(z) = C_M - 2.5 \cdot \log \left(\frac{1}{4\pi [(z+1)^4 - (z+1)^2]} \right) + \underbrace{\epsilon_\lambda \cos^{-1} \left(\frac{1}{z+1} \right)}_{\text{IGM extinction}^*} \text{ mags}$$

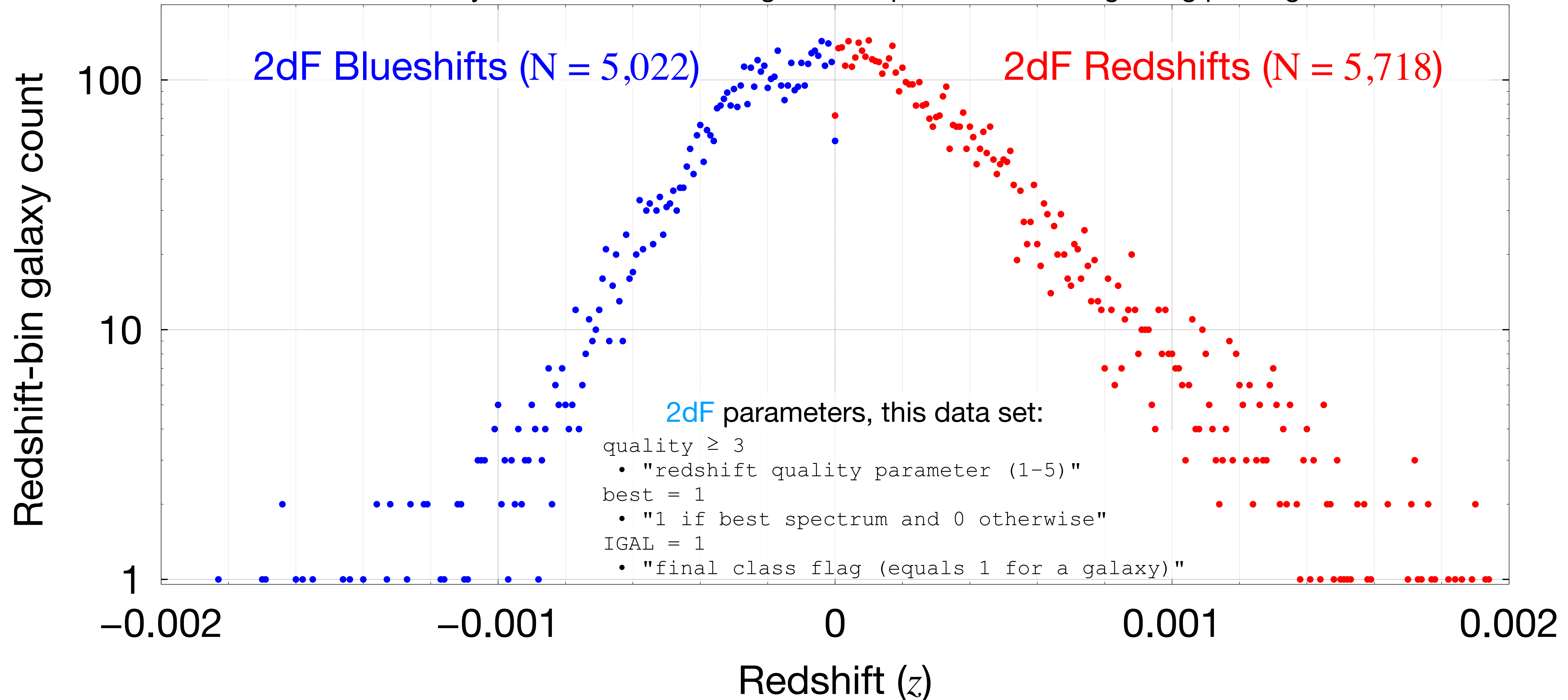
* $\frac{d\epsilon_\lambda}{dz} = 0$ yields a linear approximation.

IGM extinction*

Approximately-equal numbers of galaxy redshifts and blueshifts

The rough symmetry between redshifts and blueshifts within a sample population of $>10k$ galaxies in the nearby Universe ($|z| \leq 0.002$) is indicative of random galactic velocities.

This data is obviously inconsistent with the general expansion of the Big-Bang paradigm.



Theta-z log-log plot of half-light radius (petroR50) for ~800k SDSS galaxies

Galaxy.petroR50_gri (half-light radius 3-band average in arcsec)

Measured apparent radius (arcsec)

Theta-z ≡ "apparent size versus redshift"

Blue dot	1 galaxy
Cyan dot	2 galaxies
Yellow dot	4 galaxies
Red dot	8 galaxies

Color scaling is log₂.

↑
LARGER

↓
SMALLER

$z = 0.01$ $z = 0.02$ $z = 0.08$ $z = 0.32$ $z = 1$

Low-z
← *NEARER*

BLUE DOT REPRESENTS ONE GALAXY
BLUE: sparser data → **RED**: denser data

High-z
FARTHER →

0.005 0.01 0.02 0.03 0.04 0.05 0.1 0.2 0.3 0.4 0.5 1

SpecPhoto.z (redshift)

~2.4 × 10⁶ Empirical Measurements

Apparent size vs. redshift

Too many measurements to “massage” the data according to confirmation bias.

Galaxy.petroR50_gri (half-light radius 3-band average in arcsec)

~2.4 MILLION measurements

$z = 0.01$ $z = 0.02$ $z = 0.08$ $z = 0.32$ $z = 1$

There are 795,838 galaxies (data) represented in this graph, and each datum represents the average of 3 distinct (g, r, i) radius measurements.

0.005 0.01 0.02 0.03 0.04 0.05 0.1 0.2 0.3 0.4 0.5 1

SpecPhoto.z (redshift)

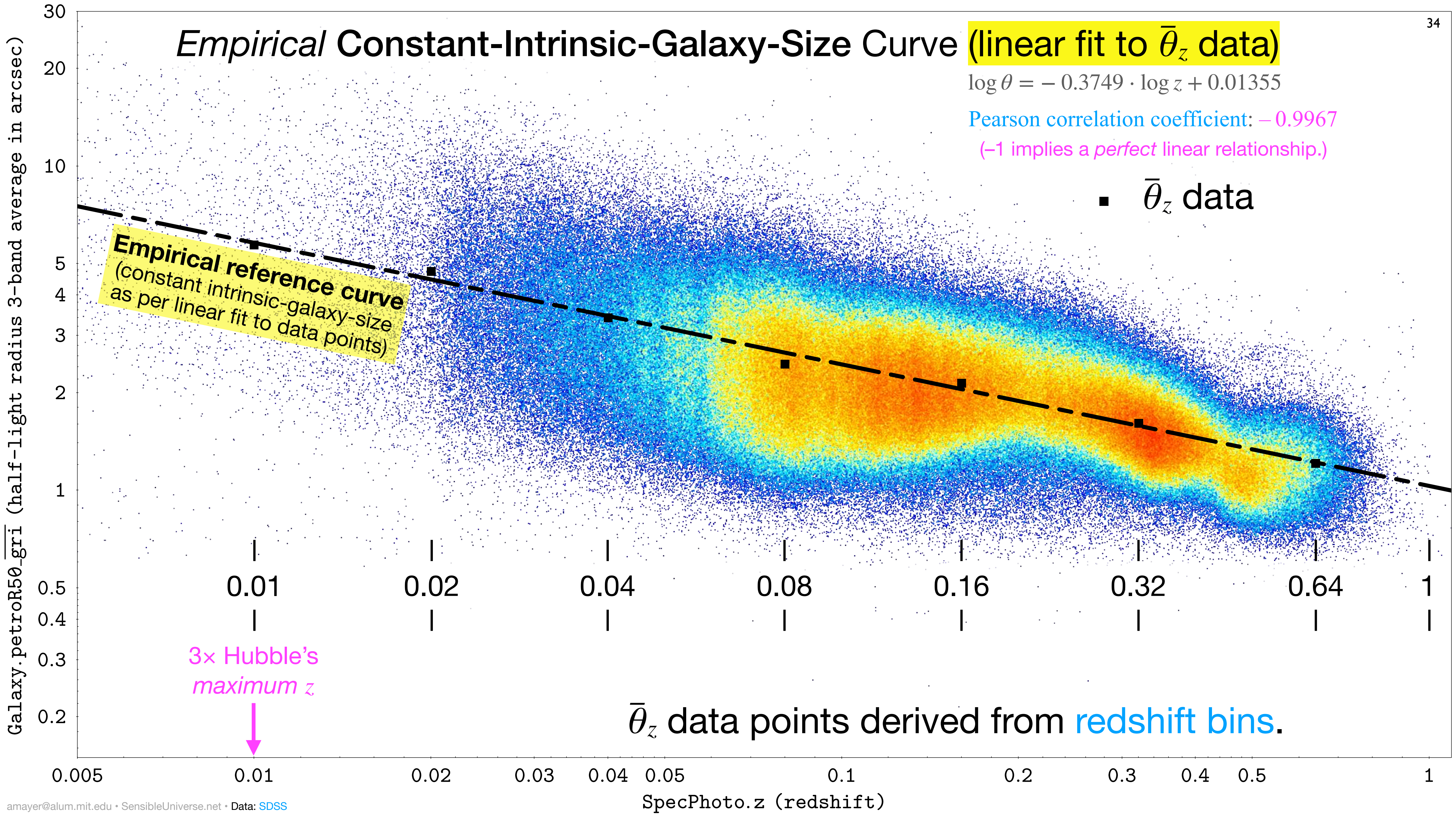
Empirical Constant-Intrinsic-Galaxy-Size Curve (linear fit to $\bar{\theta}_z$ data)

$$\log \theta = -0.3749 \cdot \log z + 0.01355$$

Pearson correlation coefficient: -0.9967
(-1 implies a *perfect* linear relationship.)

■ $\bar{\theta}_z$ data

Empirical reference curve
(constant intrinsic-galaxy-size
as per linear fit to data points)

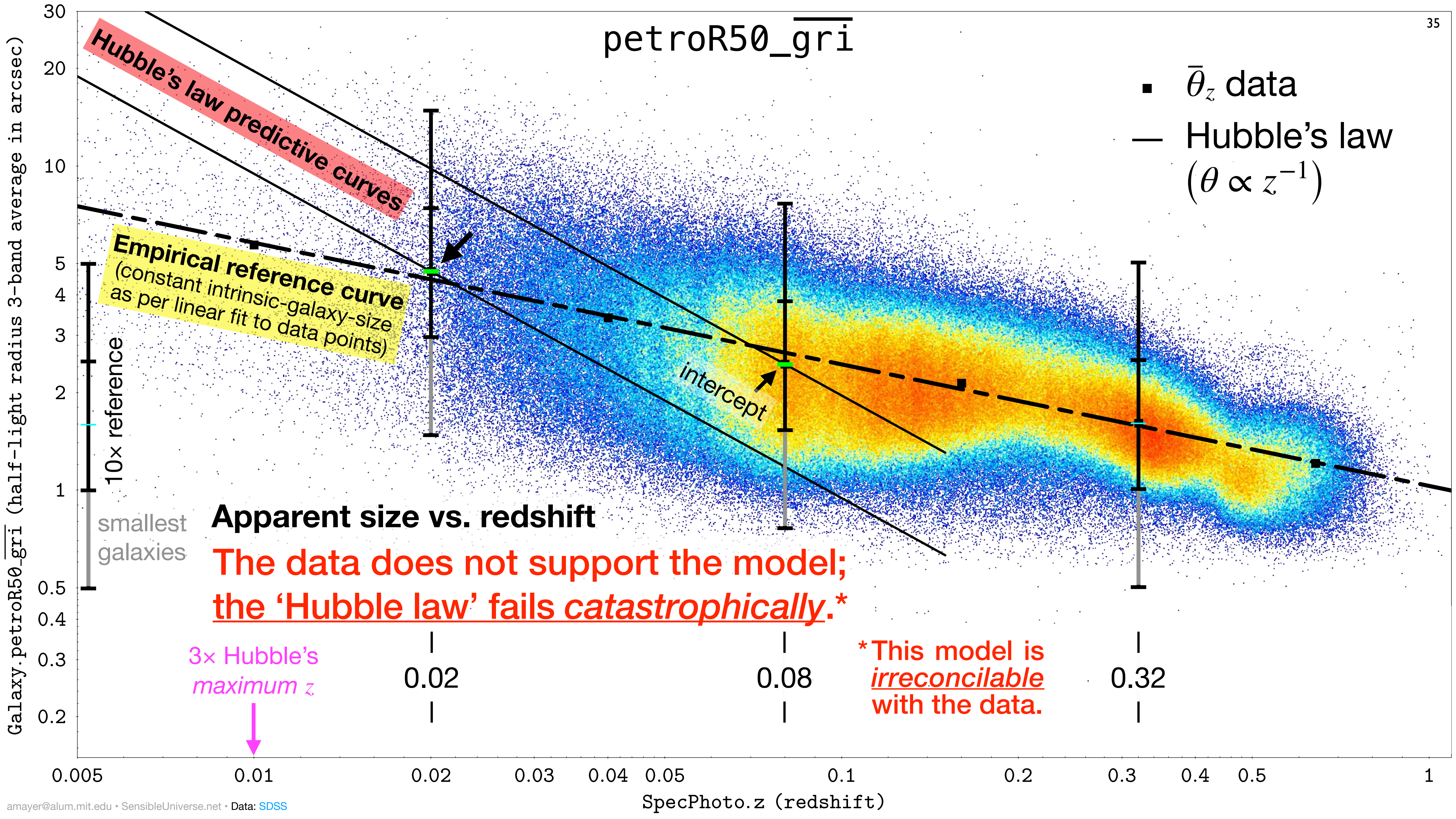


3x Hubble's
maximum z



$\bar{\theta}_z$ data points derived from **redshift bins**.

petroR50_gri



- $\bar{\theta}_z$ data
- Hubble's law ($\theta \propto z^{-1}$)

Hubble's law predictive curves

Empirical reference curve
(constant intrinsic-galaxy-size as per linear fit to data points)

intercept

10x reference
smallest galaxies

Apparent size vs. redshift
The data does not support the model; the 'Hubble law' fails catastrophically.*

3x Hubble's maximum z

***This model is irreconcilable with the data.**

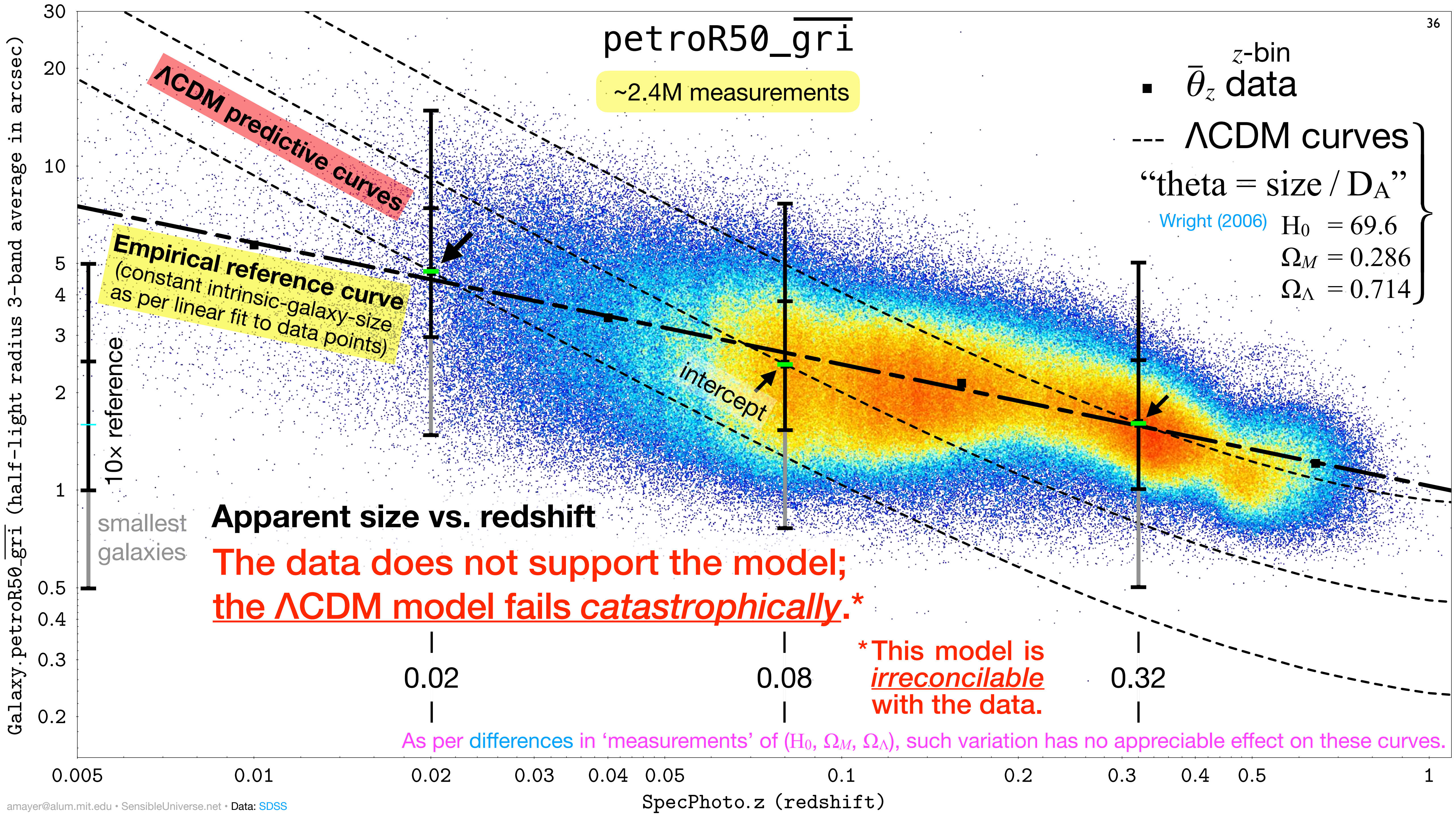
0.02

0.08

0.32

0.005 0.01 0.02 0.03 0.04 0.05 0.1 0.2 0.3 0.4 0.5 1

SpecPhoto.z (redshift)



petroR50_gri
~2.4M measurements

z-bin
 ■ $\bar{\theta}_z$ data
 --- Λ CDM curves
 “theta = size / D_A ”
 Wright (2006) $H_0 = 69.6$
 $\Omega_M = 0.286$
 $\Omega_\Lambda = 0.714$

Empirical reference curve
 (constant intrinsic-galaxy-size
 as per linear fit to data points)

Λ CDM predictive curves

intercept

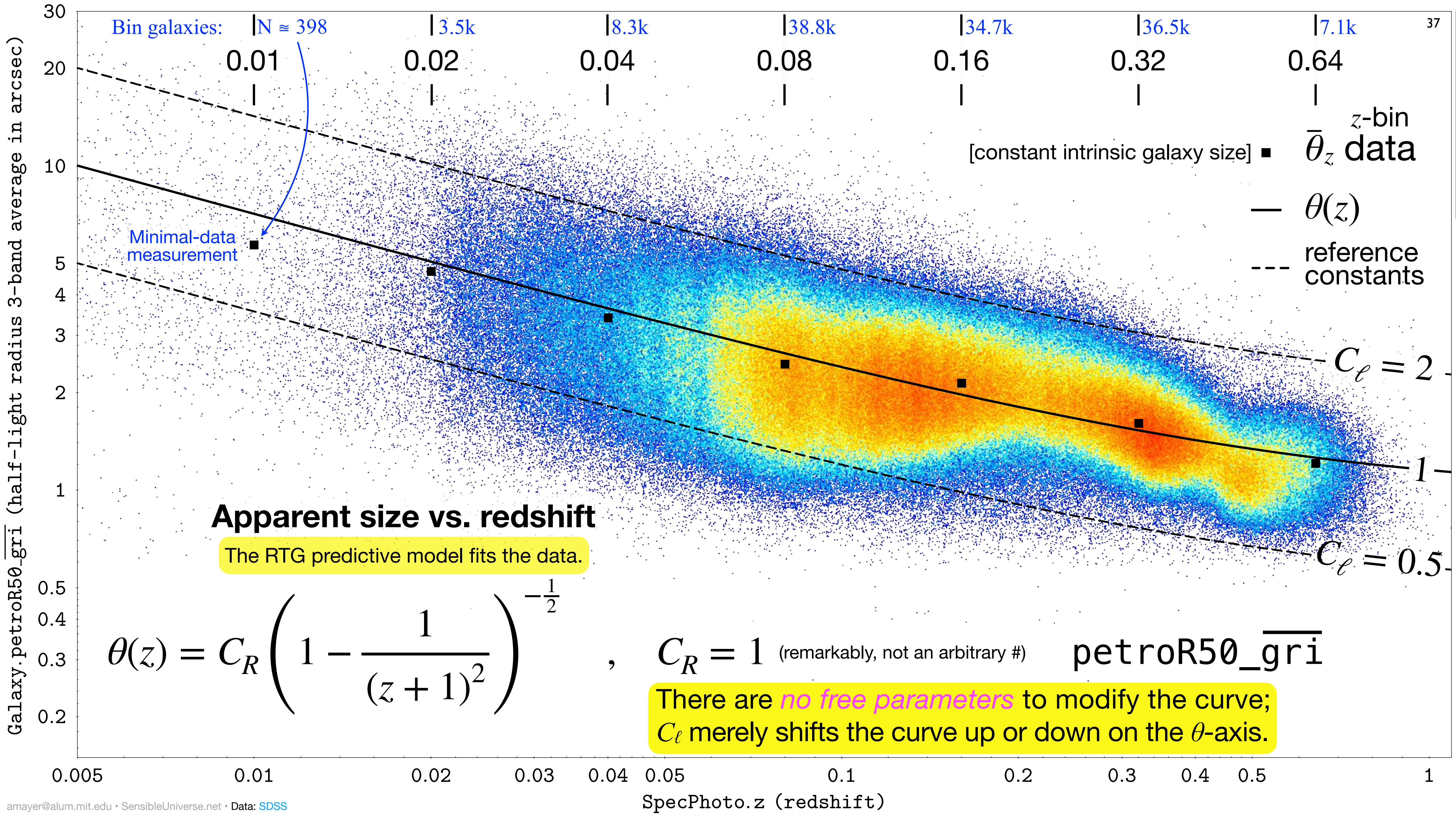
10x reference
 smallest galaxies

Apparent size vs. redshift

The data does not support the model;
 the Λ CDM model fails catastrophically.*

*This model is
 irreconcilable
 with the data.

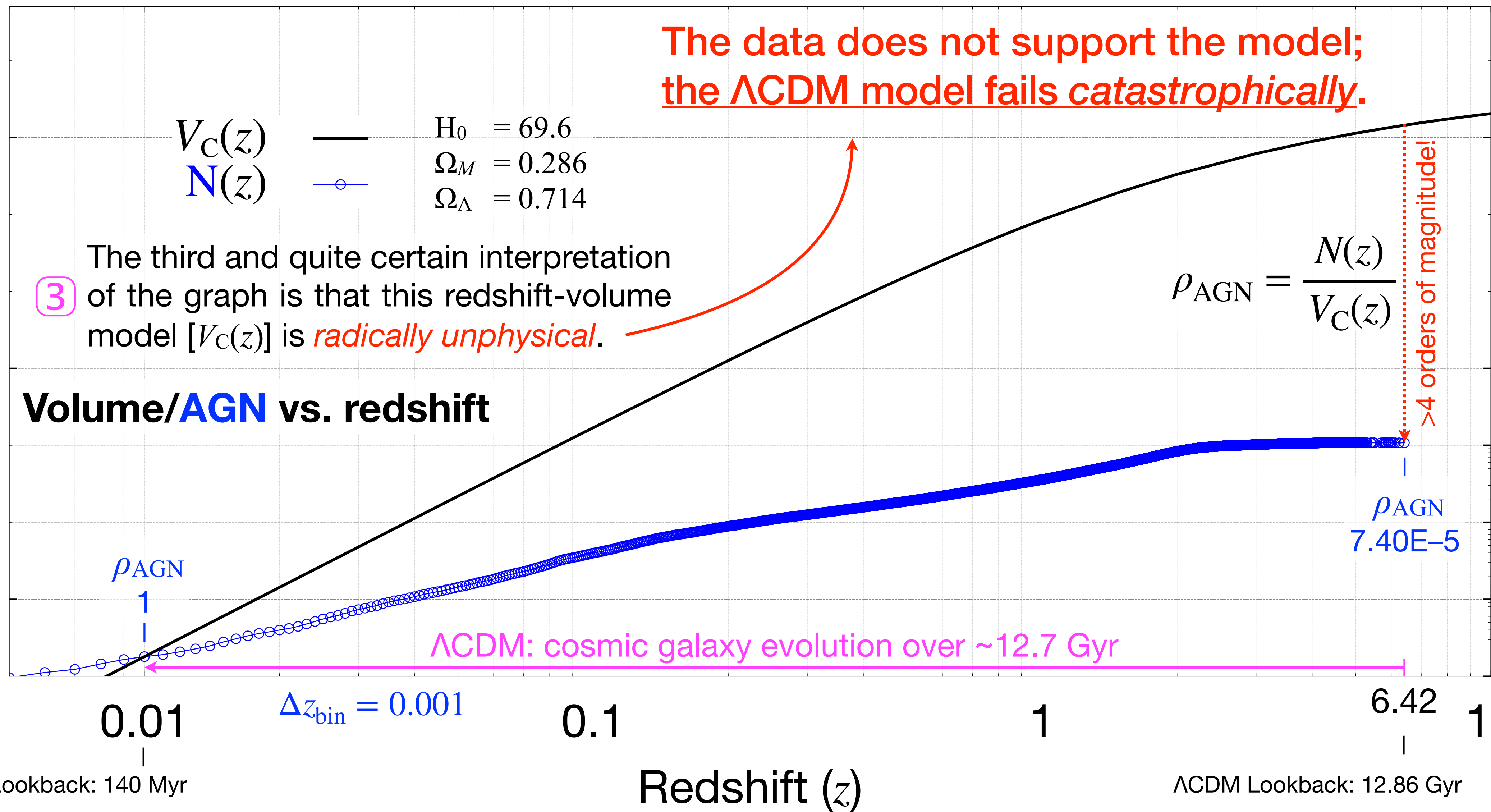
As per differences in ‘measurements’ of $(H_0, \Omega_M, \Omega_\Lambda)$, such variation has no appreciable effect on these curves.



① Λ CDM: over time, AGN space density increases by >4 orders of magnitude.

② Another possible interpretation of the graph, is that $\lll 1\%$ of AGN that exist at higher redshift are observed and counted by the various astronomical surveys.

Comoving volume V_C [arbitrary units]



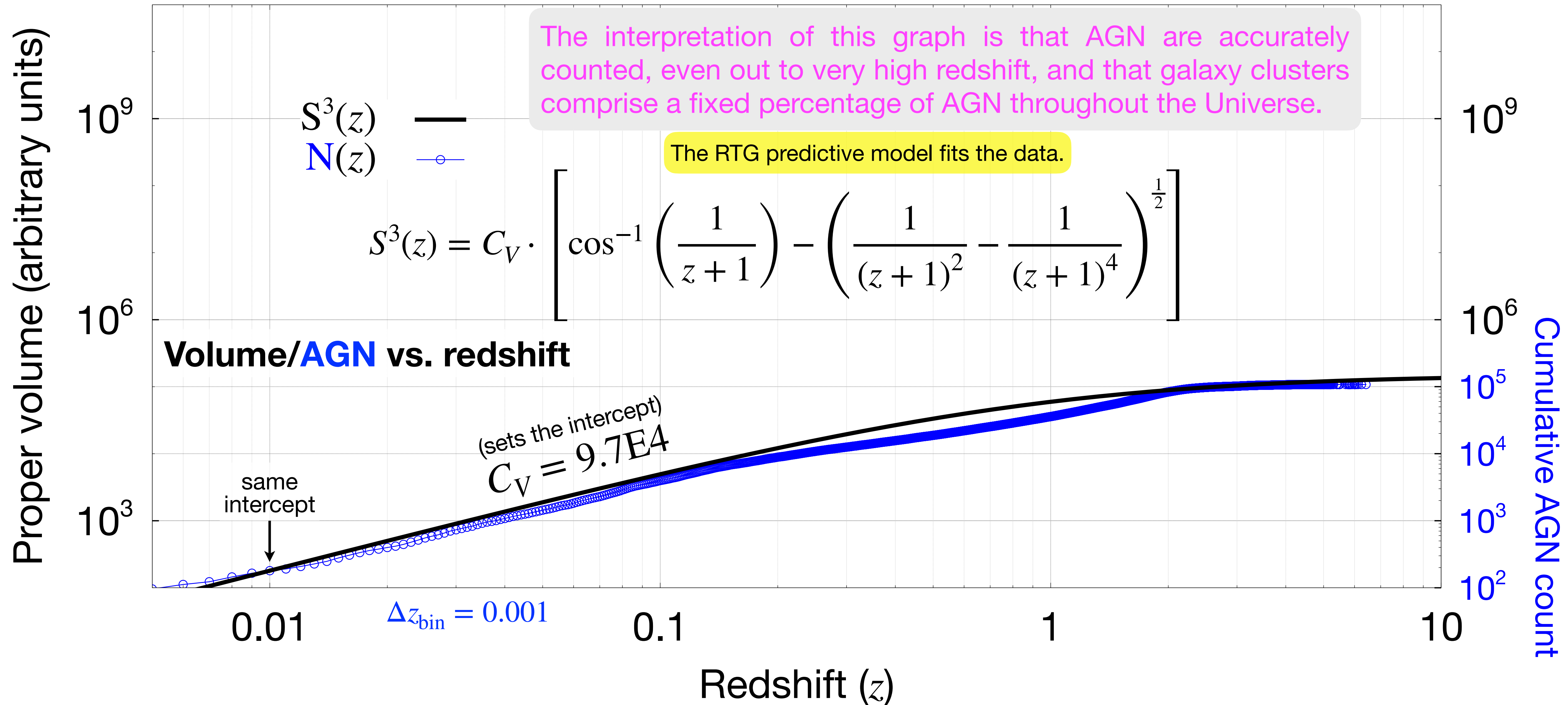
③ The third and quite certain interpretation of the graph is that this redshift-volume model [$V_C(z)$] is *radically unphysical*.

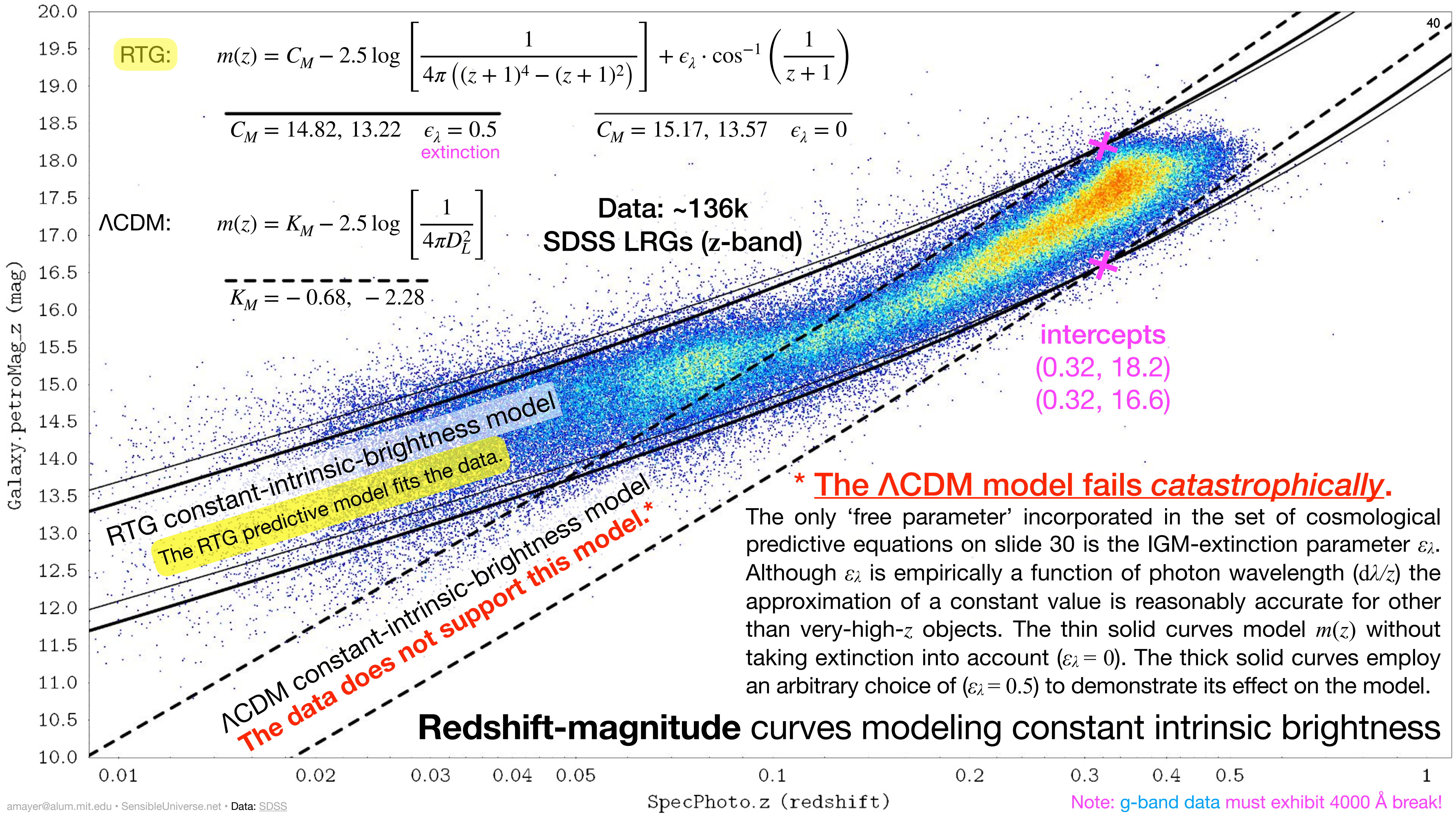
The data does not support the model; the Λ CDM model fails catastrophically.

Cumulative AGN count

S^3 represents the volumetric 'surface' of a Riemannian 3-sphere

The fit of this a priori theoretical predictive curve to the empirical AGN population data is equally remarkable to that for the theta- z data; **there are no free parameters available to achieve this fit.**





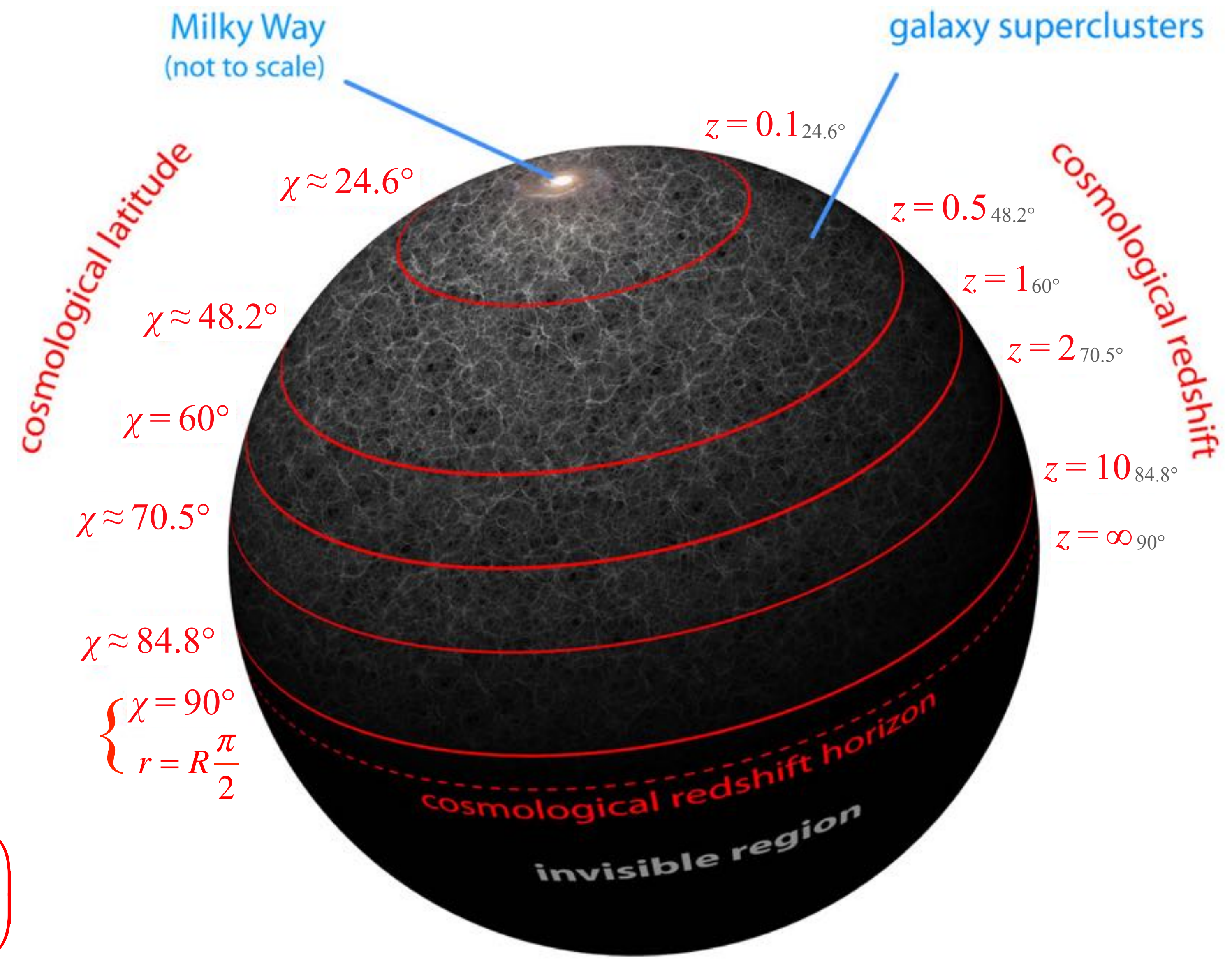
A complete cosmological map of the S^2 surface *locally* defined by Galactic latitude $b = 0$ (i.e., the Galactic plane)

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

$$z = \frac{1}{\cos \chi} - 1$$

$$\chi \equiv \frac{r}{R}$$

$$r = R \cos^{-1} \left(\frac{1}{z+1} \right)$$



$$\begin{cases} \chi = 90^\circ \\ r = R \frac{\pi}{2} \end{cases}$$

$z = \infty$
@ horizon
($\chi = \pi/2$)

Graphic by Fabio Basile after an original rendering by Hollin Calloway.

Catastrophic Failure of the Λ CDM Model

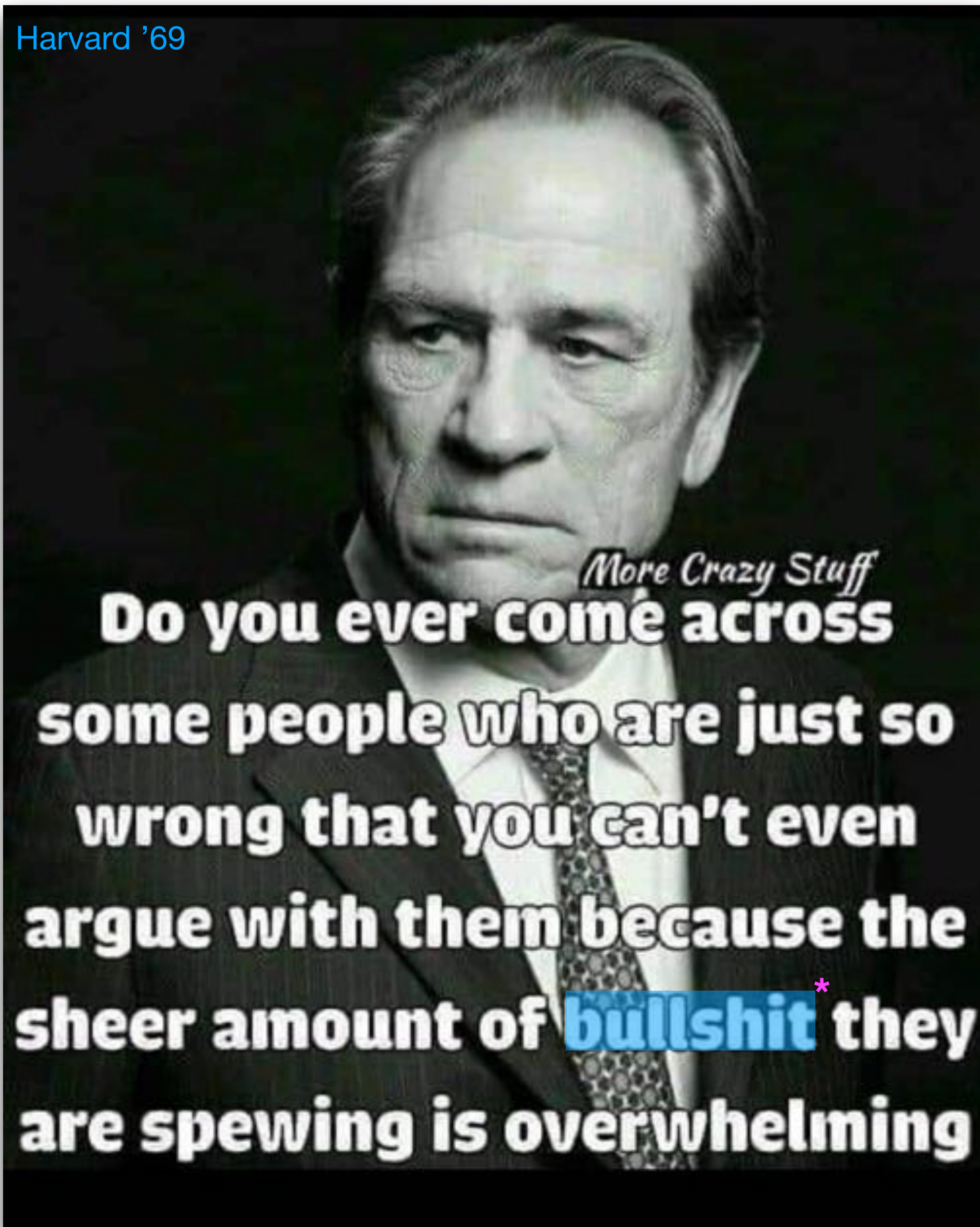
IRREFUTABLE EMPIRICAL FACT: The Universe is *not* expanding.

A professional in the field who denies this fact is gaslighting: “Gaslighting is a form of psychological manipulation in which the abuser attempts to sow self-doubt and confusion in their victim’s mind. Typically, gaslighters are seeking to gain power and control over the other person, by **distorting reality** and forcing them to question their own judgment and intuition.”* They try to invalidate your own powers of reasoning — that is psychological **malware**.

*source: [Newport Institute](#)

Ignoring facts, pretending that they do not exist, is similarly abusive.

Internet meme



* "bollocks" 🇬🇧

So...

the Big-Bang theory, the 'Hubble law', the 'Hubble constant', 'Hubble time', 'dark energy', 'dark matter', etc. are *all*

“...not even wrong.”

– Wolfgang Pauli

That was Pauli's expression for “half-baked”.

“Lies don't end trust in false authority — the *truth** does.”

* (p. 50)

Re: 'dark matter' — GravitySim



"It may be wrong, but it's how I feel."

«И не только гордость ума, а глупость ума. А главное — плутовство, именно плутовство ума. Именно мошенничество ума», — повторил он.

Лев Толстой, *Анна Каренина* (1878) §8-12



“And not only the [pride of the intellect](#), but the stupidity of the intellect. And most importantly — cheating, namely cheating of the intellect. It is the fraud of the intellect”, — he repeated.

Leo Tolstoy, *Anna Karenina* (1878) §8-12

photo credit:
Alexander F Mayer (29 Jan 2020 • 06:52:00)
[Bajo de Caracoles](#), Santa Cruz, Argentina
SONY ILCE-6000 + EE 55-210mm F4.5-6.3 OSS
ISO 160 210 mm f/6.3 1/400 s

View NW to Parque Nacional Patagonia, Chile.

A man may imagine things that are false, but he can only understand things that are true, for if the things be false, the apprehension of them is not understanding.



Truth is ever to be found in simplicity, and not in the multiplicity and confusion of things.

– Isaac Newton



photo credit:
Alexander F Mayer (11 Mar 2024)
New Island (51° 42' S , 061° 16' W)
Apple iPhone 15 Pro Max – Telephoto Camera
ISO 50 312 mm f/2.8 1/3344 s

Black-browed Albatross, >2 m wingspan



Jeff Bezos on TRUTH (52s video clip)

For additional technical details, download [this PDF](#).

photo credit:

Alexander F Mayer (26 Feb 2024 • 08:44 AM)
Detaille Island, Antarctica ([66° 52' S](#), [066° 47' W](#))
Apple iPhone 15 Pro Max – Telephoto Camera
ISO 50 120 mm *f*/2.8 1/99 s

Giant icebergs about 1 km offshore.

This lecture is dedicated to the memory of

Sir Fred Hoyle, British Astronomer Royal

(1915–2001), English astrophysicist and writer. He was one of the proponents of the steady state theory of cosmology, and, mainly with US physicist William A. Fowler (1911–95), described the processes of nucleosynthesis inside stars.

It was Fred who flippantly coined the term “Big Bang”, in poking fun at an unlikely theory of cosmic origins...

“Now, cosmology is supposed to be the *Queen of the Sciences* because everything has to fit under that umbrella. But, if cosmology is wrong, misinformation is being fed down to all of the sub-disciplines and sub-sub-disciplines with the result that the thing, as I said, ‘Science is a mess.’ And you’ll notice also, common sense goes out the window immediately with the Big Bang.”

– Wallace W. Thornhill (1942–2023)



Cosmology / Logic / Antarctica / 2024

Cosmologica24



photo credit:
Alexander F Mayer (6 Mar 2024)
South Georgia (54° 08' S , 036° 49' W)
Apple iPhone 15 Pro Max – Main Camera
ISO 64 108 mm f/1.78 1/1238 s
King Penguins at Anchorage Bay.