The Pivot Universe solution to Hubble's crisis

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Abstract

The Hubble crisis refers to the persistent discrepancy between the locally measured Hubble constant (H0≈73 km s^1 Mpc^-1) and the value inferred from early-Universe observations of the cosmic microwave background (H0≈67 km s^-1 Mpc^-1 within the standard ΛCDM framework. This crisis challenges the assumption that a single, spatially uniform expansion rate characterizes the Universe at all epochs and locations.

The Pivot Universe (PU) model resolves this discrepancy by abandoning the notion of a global Hubble constant. In PU, the observable Universe resides in a rotating Kerr-like spacetime generated by a massive central Pivot. Cosmological redshifts are interpreted primarily as gravitational and frame-dragging effects rather than metric expansion. The quantity identified observationally as the Hubble constant becomes a position-dependent effective parameter, Heff(r), which varies with radial distance from the Pivot according to Kerr frame-dragging dynamics.

In this framework, the Hubble crisis is resolved without invoking new fields, modified gravity, or early dark energy, but by reinterpreting cosmological redshift within standard general relativity applied on a global Kerr background.

1. Core Postulate

The Pivot Universe (PU) model describes the Universe as a stationary, rotating, finite-mass system centered on a compact object called the Pivot. All cosmological observations—such as redshift, the Hubble law, and large-scale structure—arise from rotation and gravity, not from spacetime expansion.

2. The PU structure

The Pivot is a supermassive, slowly rotating neutron-star-like object that dominates the gravitational field of the Universe in this model.

A schematic of the universe is (dimensions are not to be scaled):

Pivot Universe -Schematic
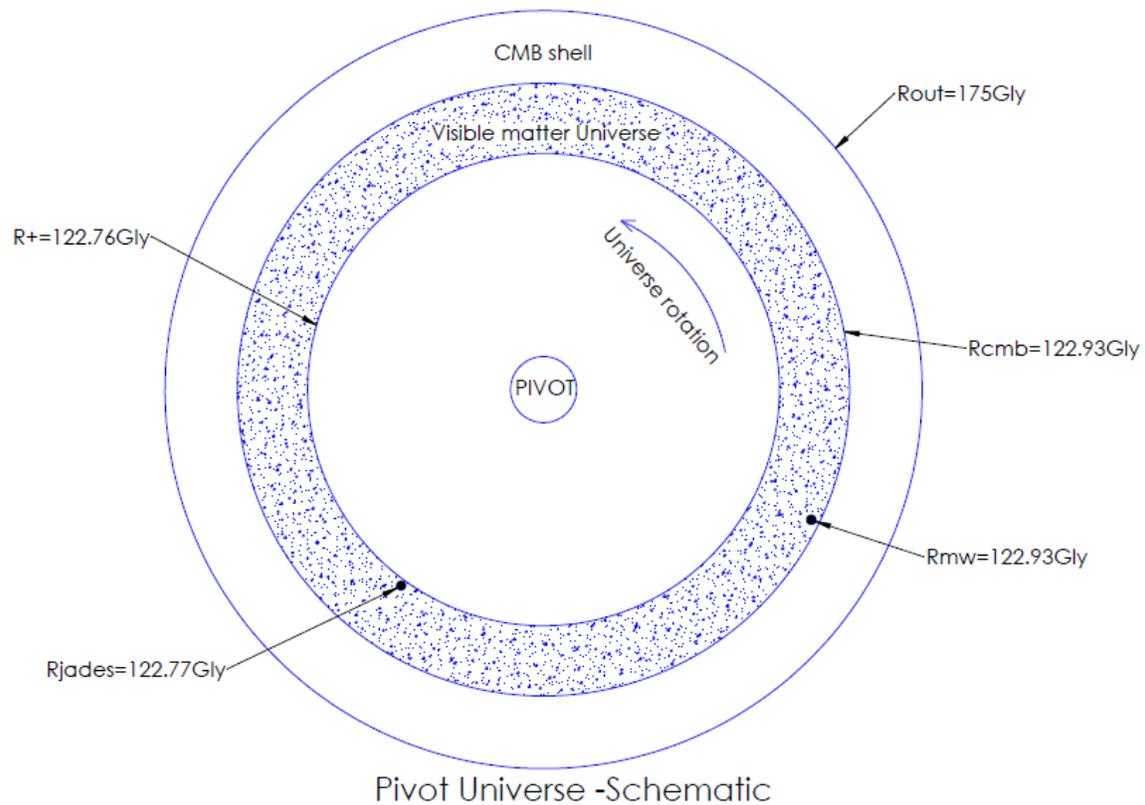
It is to be noted that, according to Kerr space time:

1) Matter at r<R+(Kerr) cannot exist in stable a form,
   and cannot be observed by any observer at r>R+(Kerr).
2) Matter may exist for r>RCMB, but it cannot be observed from r<RCMB.
3) Milky Way is close to Rcmb. Jades is close to R+

The following parameters are based on [The structure of the Pivot Universe](#)

• Mass of Pivot: $M_P \approx 7.8 \times 10^{53}$ kg

• Angular momentum of Pivot: $J_P \approx 10^{87}$ J·s

• Specific angular momentum (spin parameter): $a = J_P / (M_P c)$

• Outer radius of PU: $R_{out} \approx 175.5$ Gly

• Radius Milky Way: Rmw=122.36 Gly (based on ΩBirch=0.3905x10^-13rad/yr)

3. Gravitational Geometry and Horizons

The gravitational field of the Pivot is modeled by a Kerr-like spacetime. In such a rotating geometry, the radial structure is controlled by the function $\Delta(r) = r^2 - (2GM_P / c^2) r + a^2$. The roots of $\Delta(r) = 0$ define two characteristic radii, usually interpreted as horizons.

The two radii are:

$R\pm = (GM_P / c^2) \pm \text{sqrt}[(GM_P / c^2)^2 - a^2]$.

3.1 Event Horizon R+

The event horizon R+ is defined as:

$R+ = (GM_P / c^2) + \text{sqrt}[(GM_P / c^2)^2 - a^2]$.

In the Kerr-like interpretation, R+ plays the role of the true event horizon. It is a causal boundary: no signal originating from r < R+ can escape to larger radii. In the PU model, matter does not reside inside this radius; instead, the visible Universe is located at radii just outside R+.

With the PU parameters, R+ is found to be approximately 122.76Gly. The Milky Way's orbital radius is close to this value, which makes the gravitational potential and its radial derivative very large in this vicinity. Consequently, the gravitational redshift and the local effective Hubble parameter Heff(r) become extremely sensitive to small changes in r near R_+.

This strong gradient is used in the PU framework to align the Milky Way's location with an effective Hubble constant $H\_0 \approx 73$ km/s/Mpc, while other galaxies at slightly different radii naturally experience different local Heff values.

3.2 Region of visible matter

The physically relevant region of the PU is the band R+ < r < Rcmb. In this domain:

• Spacetime is significantly affected by rotation (frame-dragging).

• Stable or quasi-stable circular orbits for galaxies can exist.

• The effective Hubble function Heff(r) is determined by the radial gradients of the gravitational potential and the drag-induced velocity field.

All galaxies, including the Milky Way, Andromeda, JADES, CEERS-2112, and the Lynx supercluster, are assigned specific orbital radii r within this band. Their observed redshifts depend on their positions relative to R+.

4. Orbital Dynamics of Galaxies

Galaxies follow approximately circular orbits around the Pivot. The orbital angular frequency $\Omega(r)$ is modeled as

$$\Omega(r) = \text{sqrt}(GM\_P / r^3) + \Omega\_\text{drag}(r),$$

$$v(r) = r\,\Omega(r).$$

Here, $\Omega\_\text{drag}(r)$ represents the contribution of frame-dragging (or an effective vacuum-viscosity model) and is often taken in the form:

$$\Omega\_\text{drag}(r) \approx 2GJ\_P / (c^2 r^3).$$

This additional term encodes how the rotation of the Pivot transmits angular momentum to the surrounding vacuum and, indirectly, to the orbiting matter.

5. Origin of Cosmological Redshift in PU

In the PU model, cosmological redshift is not due to expansion of space. Instead, it is the product of a gravitational redshift factor and a kinematic (Doppler) factor:

$$1 + z(r) = (1 + z\_\text{grav}(r))\,(1 + z\_\text{kin}(r)).$$

The gravitational term is approximated (in a Kerr-like equatorial slice) by:

$$1 + z\_\text{grav}(r) \approx [1 - 2GM\_P / (c^2 r) + a^2 / r^2]^{(-1/2)}.$$

The kinematic term arises from the orbital speed $v(r) = r\,\Omega(r)$:

$$1 + z\_\text{kin}(r) = \gamma\,(1 + \beta), \text{ with } \beta = v(r)/c \text{ and } \gamma = 1 / \text{sqrt}(1 - \beta^2).$$

High-redshift galaxies are interpreted as objects located at smaller orbital radii r, closer to the inner horizon R+. Their large redshifts result from the combined gravitational and kinematic effects rather than from great cosmic distances in an expanding space.

## 6. Effective Hubble Function and Hubble Tension

An effective Hubble function Heff(r) is defined in terms of the radial derivative of the orbital velocity or, equivalently, the redshift profile:

$$\text{Heff}(r) = (1/r)\,(dv/dr) = d(z\,c\,/\,r)\,/\,dr.$$

Each galaxy, located at a specific $r = r\_\text{gal}$, has its own local effective Hubble constant:

$$H\_0(\text{gal}) = H\_\text{eff}(r\_\text{gal}).$$

Because the gradient of $z(r)$ is particularly steep near the horizon R+, small differences in orbital radius between galaxies can lead to significantly different inferred H_0 values. In this way, the PU model interprets the observed Hubble tension as a natural geometric and dynamical effect of living in a rotating, horizon-structured Universe rather than as evidence for new dark energy physics.

$H_{eff}(r)$ (blue) and $z(r)$ (red), with $R_{CMB} = 122.935$ Gly; 122.7–123.0 Gly
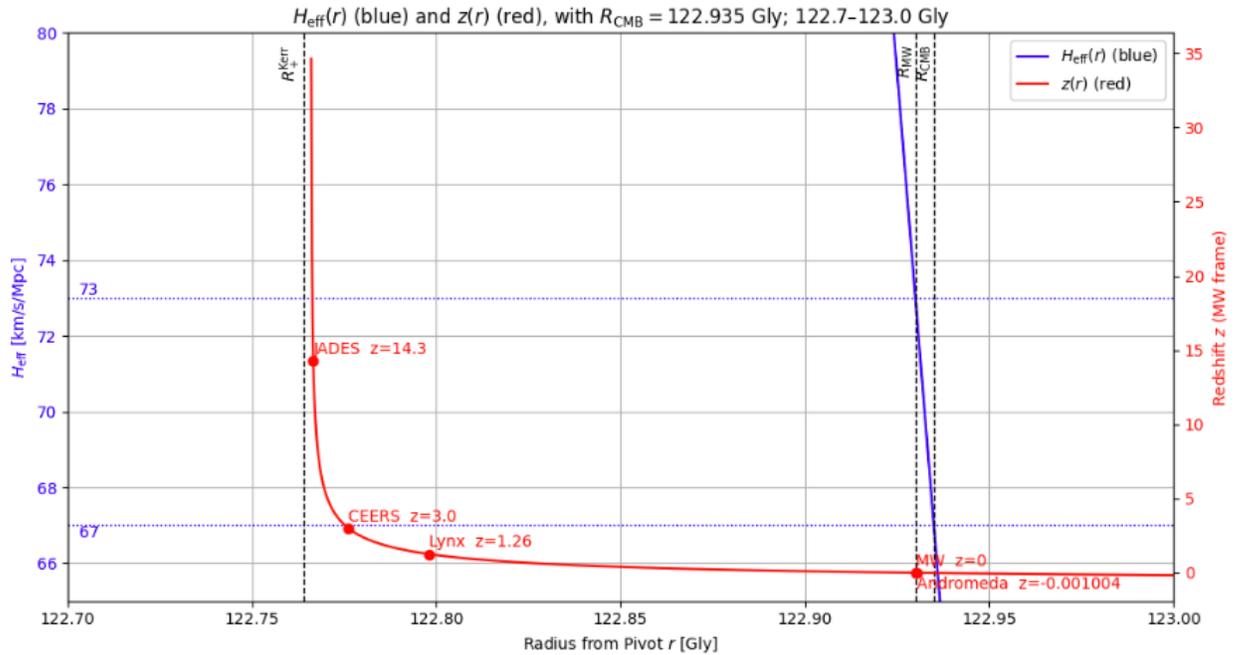
Note: calculations and plot by ChatGPT

In this plot:

- R+=122.76405 Gly

- RMW=122.93 Gly (vertical line)

- RCMB=122.935 Gly (vertical line)

- RJADES=122.76661 Gly, with z=14.3

- RCEERS=122.77615 Gly, with z=3.0

- RLynx=122.79800 Gly, with z=1.26

- RAndromeda=122.93033 Gly, with z=−0.001004 (very near MW)

Final conclusion

The Hubble crisis is not a failure of observations, but a misinterpretation of a position-dependent gravitational redshift as universal expansion. **In the Pivot Universe**, **both values of the Hubble constant are correct**, **but neither is universal**.