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The Time-Dependent Lambda Parameter in Haug-Tatum $R_H = ct$ Cosmology Appears Consistent with Recent DESI Findings

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Abstract

Based on the Haug-Tatum $R_{H_t} = ct$ cosmology model redshift formula, $z = \sqrt{\frac{R_{H_0}}{R_{H_t}}} - 1 = \sqrt{\frac{H_t}{H_0}} - 1$, we demonstrate that the time-dependent Lambda parameter as a function of z must be $\Lambda_t = \Lambda_0 (1+z)^4$. This equation is also consistent with the Haug and Tatum formula, $\Lambda_t = 3\frac{H_t^2}{c^2} = 3\left(\frac{\mho T_t^2}{c}\right)^2$ and the observation-based relation, $T_t = T_0 (1+z)$. We also show how H_0 predicted by the Haug-Tatum model is most consistent with the DESI-based H_0 estimates from the $\omega_0 \omega_a$ CDM model that allows for dynamic dark energy.

Keywords

Cosmological Constant, DESI, Hubble Parameter, Time-Dependent Lambda, $R_H = ct$ Model, Dynamic Dark Energy, Cosmological Redshift, Cosmological Entropy, Black Hole Cosmology

1. Introduction and Background

The Haug and Tatum cosmology model is rooted in a series of discoveries that fit together nicely in a consistent theory. Tatum *et al.* [1] suggested in 2015 the following formula for the Cosmic Microwave Background (CMB) temperature:

$$T_{cmb} = \frac{\hbar c}{k_b 4\pi \sqrt{R_H 2 l_p}} \tag{1}$$

where $\hbar = \frac{h}{2\pi}$ is the reduced Planck constant, k_b is the Boltzmann constant, R_H is the Hubble radius, and l_p is the Planck length. Furthermore, one assumes an $R_H = ct$ cosmology. Haug and Wojnow [2] [3] subsequently proved that this formula could be derived from the Stefan-Boltzmann law. It is important to note here that observations have already confirmed that the CMB spectrum is that of a nearly perfect black body; see, for example, Muller *et al.* [4], who, based on COBE satellite observations, stated:

"Observations with the COBE satellite have demonstrated that the CMB corresponds to a nearly perfect black body characterized by a temperature T_0 *at* $z = 0$*, which is measured with very high accuracy,* $T_0 = 2.72548 \pm 0.00057\ \mathrm{K}$*."*

Haug and Tatum [5] [6] have discussed and mathematically demonstrated how the CMB temperature can be derived by simply assuming that it is the geometric mean temperature of the maximum and minimum possible temperatures in the Hubble sphere. Specifically, $T_{cmb} = \sqrt{T_{\max} T_{\min}} = \frac{\hbar c}{k_b 4\pi \sqrt{R_H 2l_p}}$ where $T_{\min} = \frac{\hbar c}{k_b 4\pi R_H}$ is the minimum possible Hawking temperature anywhere in the Hubble sphere, and $T_{\max} = \frac{\hbar c}{k_b 8\pi l_p}$ is the maximum possible Hawking temperature anywhere in the Hubble sphere. It is unlikely to be a coincidence that both the geometric mean temperature calculated in this way and the Stefan-Boltzmann law lead to exactly the same CMB temperature prediction. The Stefan-Boltzmann law is rooted in fundamental thermodynamics, and the geometric mean temperature is linked to Carnot theory. The CMB temperature Equation (1) can also be solved for H_0. Since the CMB temperature is the most precisely measured cosmic parameter, this leads to a much more precise prediction of H_0 than any other known method; see, for example, Tatum *et al.* [7] for further details. In addition, Haug and Tatum [8] demonstrated that a thermodynamic Friedmann equation, which links the CMB temperature with the density of the universe, can also be derived from Equation (1). They have shown how this leads to a much more precise estimate of the density of the universe than other competing theories can provide. Again, the reason for this is the direct link Equation (1) allows for between the CMB temperature and other cosmic parameters.

Furthermore, Haug and Tatum [9]-[11] have also derived their cosmological redshift formula as:

$$z = \sqrt{\frac{R_{H_0}}{R_{H_t}}} - 1 = \sqrt{\frac{H_t}{H_0}} - 1 \tag{2}$$

if one wants to be consistent with the observation-based [12]-[14] $T_t = T_0(1+z)$ relation. The Haug-Tatum model is also, to our knowledge, the only model wherein the $T_t = T_0(1+z)$ relation is derived directly from model assumptions.

Key model assumptions and derivations with respect to Equation (2) are clearly given in [9]. In the standard Λ-CDM model, $T_t = T_0(1+z)$ comes only from observations. In the Haug-Tatum model, by contrast, it comes from derivations that have subsequently been supported by observations. Equation (2), therefore, also means:

$$H_t = H_0(1+z)^2 \tag{3}$$

Most current researchers in cosmology work on the Λ-CDM model. Our model is within the class of $R_H = ct$ cosmologies. One of the best-known models in this class is the Melia *et al.* [15]-[18] $R_H = ct$ model. Melia [19] [20] has compared his model to the Λ-CDM model and demonstrated that it outperforms Λ-CDM when compared across many types of observational studies. However, the Melia model is likely not compatible with Equation (1) and is also not compatible with the Haug-Tatum redshift. The Haug-Tatum model gives far more precise estimates of cosmological parameters, such as H_0 and R_H, than both the Λ-CDM model and the Melia model. We have compared our model to the Λ-CDM model and demonstrated that it performs better in a long series of observational studies. Naturally, extraordinary claims require extraordinary evidence, so another recent direct comparison of the Haug-Tatum model and the Λ-CDM model can also be found here [21]. That said, there are naturally outstanding research questions concerning all of these models. For example, one of the multiple outstanding questions is whether Lambda should be a constant over time or evolve over time. This paper clearly demonstrates that, within the Haug-Tatum model, Lambda must evolve over time. Furthermore, this appears to be consistent with the recent DESI observations.

2. Time-Dependent Lambda

While deriving their new thermodynamic type Friedmann equation mentioned above, Haug and Tatum pointed out that the Lambda term in their $R_{H_t} = ct$ cosmology must be a time-dependent parameter according to:

$$\Lambda_t = 3\frac{H_t^2}{c^2} = \frac{3}{R_{H_t}^2} \tag{4}$$

Interestingly, Einstein [22], in 1917, suggested a "cosmological constant" $\Lambda = \frac{1}{r^2}$. However, without a time-varying r, he actually introduced his Lambda in order to preserve a steady state universe. This was in keeping with his simplifying assumption, at the time, of a universe which neither contracted nor expanded. Lambda in the standard Λ-CDM model is still assumed to be a constant of the form $\Lambda = 3\frac{H_0^2}{c^2}\Omega_\Lambda$, thus constant throughout the lifetime of the universe. Unfortunately, the recent DESI observations appear to contradict this assumption.

Furthermore, based on the time-dependent Lambda in the Haug-Tatum cosmology model (HTC), we must naturally also have:

$$\Lambda_t = 3\frac{1}{t_t^2 c^2} \tag{5}$$

where $t_t = \frac{1}{H_t}$ is the Hubble time of $R_{H_t} = ct$ cosmology.

Substituting the H_t expression from Equation (3) gives:[1]

$$\Lambda_t = 3\frac{\left(H_0(1+z)^2\right)^2}{c^2} \tag{6}$$

and also:

$$\Lambda_t = 3\frac{(1+z)^4}{t_0^2 c^2} \tag{7}$$

which means we must have:

$$\Lambda_t = \Lambda_0 (1+z)^4 \tag{8}$$

Haug and Tatum [8] have additionally linked their time-dependent Lambda to the current CMB temperature by:

$$\Lambda_t = 3\left(\frac{\mho T_t^2}{c}\right)^2 = 3\frac{\mho^2 T_t^4}{c^2} = 3\left(\frac{\mho T_0^2 (1+z)^2}{c}\right)^2 \tag{9}$$

where our composite constant $\mho = \frac{k_b^2 32\pi^2 G^{1/2}}{c^{5/2}\hbar^{3/2}}$. Since the current CMB temperature has been measured much more precisely than the Hubble parameter (see [24]-[27]), this also means that they have constrained the current value of Lambda much more narrowly than the Λ-CDM model, as also shown in [8]. The entire purpose of our paper is to provide our **Figure 1** and **Table 1** so that the derivations made from our model can be compared to current and future observational data.

3. Predictions with Respect to Cosmological Redshift and Cosmic Entropy

Figure 1 shows how the time-dependent Lambda varies with observed cosmological redshift in HTC. This result appears to be in line with DESI observations [28] [29], in that Lambda cannot be a constant. Haug and Tatum have already demonstrated that they get a perfect match to the full distance ladder of SNe Ia observations without the need for accelerated expansion of the universe. So, it appears to be likely that the universe is either expanding at a constant velocity according to $R_{H_t} = ct$, or that it is in a steady state and yet somehow gives the same predictions as $R_{H_t} = ct$ as a consequence of following an extremal universe model; see [30].

[1] Wojnow [23] in a recent working paper suggests: $\Lambda_t = \Lambda_0 (1+z)^2$. However, this is incompatible with the observation-based CMB temperature relation $T_t = T_0 (1+z)$ inside $R_{H_t} = ct$ cosmology, as demonstrated by Haug and Tatum. Instead, the relations presented in this paper are fully consistent with this observation-based CMB temperature versus redshift relation.

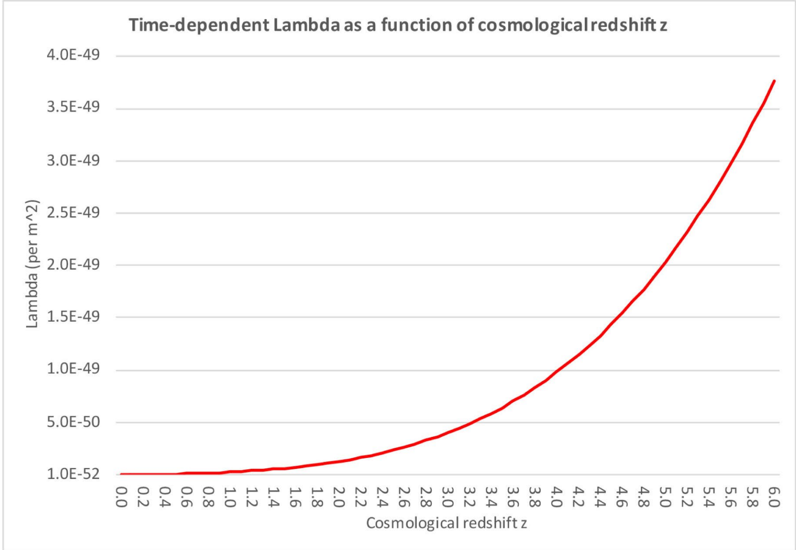

Figure 1. HTC time-dependent Lambda as a function of cosmological redshift.

We can also express time-dependent Lambda as a function of cosmic entropy. Haug and Tatum [11] have previously derived:

$$z = \left(\frac{S_{BH,0}}{S_{BH,t}}\right)^{\frac{1}{4}} - 1 = \sqrt{\frac{H_t}{H_0}} - 1 \tag{10}$$

Therefore, time-dependent Lambda can also be written as:

$$\Lambda_t = \Lambda_0 \left(1+z\right)^4 = \Lambda_0 \frac{S_{BH,0}}{S_{BH,t}} \tag{11}$$

where the number of entropic states (defined according to the Bekenstein-Hawking black hole entropy formula [31] [32]) within HTC is given by:

$$S_{BH,t} = \frac{4\pi R_{H_t}^2}{4 l_p^2} \tag{12}$$

following $R_{H_t} = ct$, where $l_p = \sqrt{\frac{G\hbar}{c^3}}$ is the Planck length, as defined by Max Planck [33] [34]. See also Tatum and Haug [35], which discusses how a time-dependent entropy in $R_{H_t} = ct$ cosmology could be directly linked to a dynamic dark energy without necessarily requiring acceleration in the expansion of the universe. We have also demonstrated [11] that, within HTC $R_{H_t} = ct$ cosmology, one must have:

$$z = \left(\frac{\rho_{cr,t}}{\rho_{cr,0}}\right)^{\frac{1}{4}} - 1 \tag{13}$$

Therefore, we can also express time-dependent Lambda in HTC as:

$$\Lambda_t = \Lambda_0 \left(1+z\right)^4 = \Lambda_0 \frac{\rho_{cr,t}}{\rho_{cr,0}} \tag{14}$$

where $\rho_{ct,t} = \frac{3c^4}{R_{H_t}^2 8\pi G}$.

4. Hubble Constant Predicted by the HTC Model Compared to DESI Study Results

Haug and Tatum have used the full distance ladder of SNe Ia to extract $H_0 = 66.8943 \pm 0.0287$ km/s/Mpc. In addition, Tatum *et al.* [7] have, using only the CMB temperature, found the same value for H_0. The reason for obtaining the same H_0 value from SNe Ia redshift observations and the current CMB temperature is the exact mathematical relationships between the current CMB temperature, H_0, and cosmological redshift in the HTC model.

Table 1 shows our predicted H_0 values in comparison to recent DESI-based H_0 values. It should be noted that the DESI estimated values for H_0 are different for different models. We see, for example, that the pure ΛCDM model gives H_0 values slightly above those derived from the Haug-Tatum $R_{H_t} = ct$ model. The $\omega_0\omega_a$ CDM model, on the other hand, allows for dynamic dark energy which, by definition, changes over cosmic time. One can readily see that the Haug-Tatum values for H_0 are, for most of the DESI-related values of H_0, well within the 95% confidence intervals. However, note that the Haug-Tatum model gives much more precise H_0 values than the other models, due to its exact mathematical relationships between H_0, CMB and cosmological redshift z. The models with $\sum m_\nu$ also allow for the neutrino mass parameter to vary, assuming a $\sum m_\nu > 0$; see [29].

Table 1. This table shows H_0 values from the Haug-Tatum model in comparison to the H_0 values from DESI observations.

From:	Hubble Parameter:	Study
CMB	$H_0 = 67.4 \pm 0.5$ km/s/Mpc	Planck Collobration [36]
CMB	$H_0 = 66.8943 \pm 0.0287$ km/s/Mpc	Tatum *et al* [7]
SNe Ia Pantheon+	$H_0 = 66.8943 \pm 0.0287$ km/s/Mpc	Haug and Tatum [9]
SNe Ia Union2	$H_0 = 66.8711 \pm 0.0019$ km/s/Mpc	Haug and Tatum [37]
ΛCDM		See TABLE V. [29]
DESI + BBN	$H_0 = 68.51 \pm 0.58$ km/s/Mpc	
DESI + CMB	$H_0 = 68.17 \pm 0.28$ km/s/Mpc	
ωCDM		See TABLE V. [29]
DESI + CMB	$H_0 = 69.51 \pm 0.92$ km/s/Mpc	
DESI + CMB + Pantheon+	$H_0 = 66.75 \pm 0.56$ km/s/Mpc	
DESI + CMB + Union3	$H_0 = 68.01 \pm 0.68$ km/s/Mpc	
DESI + CMB + DESY5	$H_0 = 67.34 \pm 0.54$ km/s/Mpc	
$\omega_0\omega_a$ CDM		
DESI BAO + CMB + Pantheon+	$H_0 = 67.51 \pm 0.59$ km/s/Mpc	See TABLE V. [29]
DESI BAO + CMB + Union3	$H_0 = 65.91 \pm 0.84$ km/s/Mpc	
DESI BAO + CMB + DESY5	$H_0 = 66.74 \pm 0.56$ km/s/Mpc	

Continued

ΛCDM + $\sum m_\nu$:		See TABLE VII. [29]
DESI BAO + CMB [Camspec]	$H_0 = 68.36 \pm 0.29$ km/s/Mpc	
DESI BAO + CMB [L-H]	$H_0 = 68.48 \pm 0.30$ km/s/Mpc	
DESI BAO + CMB [Plik]	$H_0 = 68.56 \pm 0.31$ km/s/Mpc	
ωCDM + $\sum m_\nu$:		
DESI BAO + CMB	$H_0 = 69.28 \pm 0.92$ km/s/Mpc	See TABLE VII. [29]
DESI BAO + CMB + Pantheon+	$H_0 = 67.94 \pm 0.58$ km/s/Mpc	
DESI BAO + CMB + Union3	$H_0 = 67.93 \pm \pm 0.69$ km/s/Mpc	
DESI BAO + CMB + DESY5	$H_0 = 67.34 \pm 0.53$ km/s/Mpc	
$\omega_0\omega_a$ CDM + $\sum m_\nu$		
DESI BAO + CMB	$H_0 = 69.28 \pm 0.92$ km/s/Mpc	See TABLE VII. [29]
DESI BAO + CMB + Pantheon+	$H_0 = 67.54 \pm 0.59$ km/s/Mpc	
DESI BAO + CMB + Union3	$H_0 = 65.96 \pm 0.84$ km/s/Mpc	
DESI BAO + CMB + DESY5	$H_0 = 66.75 \pm 0.56$ km/s/Mpc	

The DESI comparison in **Table 1** can be judged by the simple rule of overlap of confidence intervals. All papers referenced in this table explain how the estimates and their confidence intervals were calculated. Forthcoming papers of ours will delve further into statistical comparisons with various DESI data sets, including Baryonic Acoustic Oscillations data. The current paper does not perform a new fit to DESI data and instead compares HTC predictions with published parameter estimates from other analyses.

5. Conclusion

We have shown that we must have a time-dependent Lambda according to $\Lambda_t = \Lambda_0 (1+z)^4$ in our HTC variant of $R_{H_t} = ct$ black hole cosmology. This is not only consistent with the observation-based relation $T_t = T_0(1+z)$, but also consistent with a non-accelerating expansion of the universe following the $R_{H_t} = ct$ principle. We eagerly look forward to seeing further dynamic dark energy observational evidence along the lines shown in our **Figure 1**.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Tatum, E.T., Seshavatharam, U.V.S. and Lakshminarayana, S. (2015) The Basics of Flat Space Cosmology. *International Journal of Astronomy and Astrophysics*, **5**, 116-124. https://doi.org/10.4236/ijaa.2015.52015

[2] Haug, E.G. (2024) CMB, Hawking, Planck, and Hubble Scale Relations Consistent with Recent Quantization of General Relativity Theory. *International Journal of The-*

oretical Physics, **63**, Article No. 57. https://doi.org/10.1007/s10773-024-05570-6

[3] Haug, E.G. and Wojnow, S. (2024) How to Predict the Temperature of the CMB Directly Using the Hubble Parameter and the Planck Scale Using the Stefan-Boltzmann Law. *Journal of Applied Mathematics and Physics*, **12**, 3552-3566. https://doi.org/10.4236/jamp.2024.1210211

[4] Muller, S., Beelen, A., Black, J.H., Curran, S.J., Horellou, C., Aalto, S., *et al.* (2013) A Precise and Accurate Determination of the Cosmic Microwave Background Temperature at $z = 0.89$. *Astronomy & Astrophysics*, **551**, A109. https://doi.org/10.1051/0004-6361/201220613

[5] Haug, E.G. and Tatum, E.T. (2024) The Hawking Hubble Temperature as the Minimum Temperature, the Planck Temperature as the Maximum Temperature, and the CMB Temperature as Their Geometric Mean Temperature. *Journal of Applied Mathematics and Physics*, **12**, 3328-3348. https://doi.org/10.4236/jamp.2024.1210198

[6] Haug, E.G. (2025) The CMB Temperature Is Simply the Geometric Mean: $T_{cmb} = \sqrt{T_{min} T_{max}}$ of the Minimum and Maximum Temperature in the Hubble Sphere. *Journal of Applied Mathematics and Physics*, **13**, 1085-1096. https://www.scirp.org/journal/paperinformation?paperid=141824

[7] Tatum, E.T., Haug, E.G. and Wojnow, S. (2024) Predicting High Precision Hubble Constant Determinations Based on a New Theoretical Relationship between CMB Temperature and H_0. *Journal of Modern Physics*, **15**, 1708-1716. https://doi.org/10.4236/jmp.2024.1511075

[8] Haug, E.G. and Tatum, E.T. (2025) Friedmann Type Equations in Thermodynamic Form Lead to Much Tighter Constraints on the Critical Density of the Universe. *Discover Space*, **129**, Article No. 6. https://doi.org/10.1007/s11038-025-09566-y

[9] Haug, E.G. and Tatum, E.T. (2025) Solving the Hubble Tension Using the PantheonPlusSH0ES Supernova Database. *Journal of Applied Mathematics and Physics*, **13**, 593-622. https://doi.org/10.4236/jamp.2025.132033

[10] Haug, E.G. (2025) Closed Form Solution to the Hubble Tension Based on $R_h = ct$ Cosmology for generalized Cosmological Redshift Scaling of the Form: $z = \left(R_h / R_t\right)^x - 1$ Tested against the Full Distance Ladder of Observed SN Ia Redshift. *Journal of Applied Mathematics and Physics*, **13**, 3293-3307.

[11] Haug, E.G. and Tatum, E.T. (2025) A Newly-Derived Cosmological Redshift Formula Which Solves the Hubble Tension and Yet Maintains Consistency with $T_t = T_0(1+z)$, the $R_h = ct$ Principle and the Stefan-Boltzmann Law. *European Journal of Applied Physics*, **7**, 48-50. https://doi.org/10.24018/ejphysics.2025.7.1.368

[12] de Martino, I., Atrio-Barandela, F., da Silva, A., Ebeling, H., Kashlinsky, A., Kocevski, D., *et al.* (2012) Measuring the Redshift Dependence of the Cosmic Microwave Background Monopole Temperature with Planck Data. *The Astrophysical Journal*, **757**, Article No. 144. https://doi.org/10.1088/0004-637x/757/2/144

[13] Li, Y.Y. (2021) Constraining Cosmic Microwave Background Temperature Evolution with Sunyaev-Zel'dovich Galaxy Clusters from the Atacama Cosmology Telescope. *The Astrophysical Journal*, **922**, Article No. 136.

[14] Riechers, D.A., Weiss, A., Walter, F., Carilli, C.L., Cox, P., Decarli, R., *et al.* (2022) Microwave Background Temperature at a Redshift of 6.34 from H_2O Absorption. *Nature*, **602**, 58-62. https://doi.org/10.1038/s41586-021-04294-5

[15] Melia, F. and Shevchuk, A.S.H. (2011) The $R_h = ct$ Universe. *Monthly Notices of the Royal Astronomical Society*, **419**, 2579-2586.

https://doi.org/10.1111/j.1365-2966.2011.19906.x

[16] Melia, F. (2013) The $R_h = ct$ Universe without Inflation. *Astronomy & Astrophysics*, **553**, A76. https://doi.org/10.1051/0004-6361/201220447

[17] Melia, F. (2014) On Recent Claims Concerning the $R_h = ct$ Universe. *Monthly Notices of the Royal Astronomical Society*, **446**, 1191-1194. https://doi.org/10.1093/mnras/stu2181

[18] Melia, F. (2023) A Resolution of the Monopole Problem in the $R_h = ct$ Universe. *Physics of the Dark Universe*, **42**, Article ID: 101329. https://doi.org/10.1016/j.dark.2023.101329

[19] Melia, F. (2018) A Comparison of the $R_h = ct$ and ΛCDM Cosmologies Using the Cosmic Distance Duality Relation. *Monthly Notices of the Royal Astronomical Society*, **481**, 4855-4862. https://doi.org/10.1093/mnras/sty2596

[20] Chandak, N., Melia, F. and Wei, J. (2026) Model Selection with the Pantheon+ Type Ia Supernova Sample. *Astronomy & Astrophysics*, **706**, L20. https://doi.org/10.1051/0004-6361/202658990

[21] Haug, E.G. and Tatum, E.T. (2026) How a New Type of $R_h = ct$ Cosmological Model Outperforms the Λ-CDM Model in Numerous Categories and Resolves the Hubble Tension. *Journal of Applied Mathematics and Physics*, **14**, 1206-1217. https://doi.org/10.4236/jamp.2026.143057

[22] Einstein, A. (1917) Cosmological Considerations in the General Theory of Relativity. Sitzungsberichte der Preussischen Akademie der Wissenschaften, 142.

[23] Wojnow, S. (2026) Thermodynamic Cosmology $R_h = ct$: Evolution of $\Lambda_{\rm eff}$ and Resolution of DESI Tension and JWST. https://constantecosmologique.fr/wp-content/uploads/2026/03/001a.2-DESI-Eng.pdf

[24] Fixsen, D.J., Kogut, A., Levin, S., Limon, M., Lubin, P., Mirel, P., *et al.* (2004) The Temperature of the Cosmic Microwave Background at 10 GHz. *The Astrophysical Journal*, **612**, 86-95. https://doi.org/10.1086/421993

[25] Fixsen, D.J. (2009) The Temperature of the Cosmic Microwave Background. *The Astrophysical Journal*, **707**, 916-920. https://doi.org/10.1088/0004-637x/707/2/916

[26] Dhal, S., Singh, S., Konar, K. and Paul, R.K. (2023) Calculation of Cosmic Microwave Background Radiation Parameters Using COBE/FIRAS Dataset. *Experimental Astronomy*, **56**, 715-726. https://doi.org/10.1007/s10686-023-09904-w

[27] Dhal, S. and Paul, R.K. (2023) Investigation on CMB Monopole and Dipole Using Blackbody Radiation Inversion. *Scientific Reports*, **13**, Article No. 3316. https://doi.org/10.1038/s41598-023-30414-4

[28] Son, J., Lee, Y., Chung, C., Park, S. and Cho, H. (2025) Strong Progenitor Age Bias in Supernova Cosmology—II. Alignment with DESI BAO and Signs of a Non-Accelerating Universe. *Monthly Notices of the Royal Astronomical Society*, **544**, 975-987. https://doi.org/10.1093/mnras/staf1685

[29] Karim, A.M., *et al.* (2025) DESI DR2 Results II: Measurements of Baryon Acoustic Oscillations and Cosmological Constraints. https://arxiv.org/abs/2503.14738

[30] Haug, E.G. (2024) The Extremal Universe Exact Solution from Einstein's Field Equation Gives the Cosmological Constant Directly. *Journal of High Energy Physics, Gravitation and Cosmology*, **10**, 386-397. https://doi.org/10.4236/jhepgc.2024.101027

[31] Bekenstein, J.D. (1972) Black Holes and the Second Law. *Lettere Al Nuovo Cimento*

Series 2, **4**, 737-740. https://doi.org/10.1007/bf02757029

[32] Hawking, S.W. (1974) Black Hole Explosions? *Nature*, **248**, 30-31. https://doi.org/10.1038/248030a0

[33] Planck, M. (1899) Natuerliche Masseinheiten. Der Königlich Preussischen Akademie Der Wissenschaften.

[34] Planck, M. (1913) Vorlesungen über die Theorie der Wärmestrahlung. J.A. Barth, 163.

[35] Tatum, E.T. and Haug, E.G. (2025) How the Haug-Tatum Cosmology Model Entropic Energy Might Be Directly Linked to Dark Energy. *Journal of Modern Physics*, **16**, 382-389. https://doi.org/10.4236/jmp.2025.163021

[36] Aghanim, N., *et al*. (2021) Planck 2018 Results. VI. Cosmological Parameters. *Astronomy & Astrophysics*, **641**, A6. https://arxiv.org/abs/1807.06209

[37] Haug, E.G. and Tatum, E.T. (2025) Finding the Planck Length from the Union2 Supernova Database in a Way That Appears to Resolve the Hubble Tension. *Journal of Applied Mathematics and Physics*, **13**, 2063-2089. https://doi.org/10.4236/jamp.2025.136115