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Nature Astronomy
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Subject: Submission of Manuscript – Reevaluating Lunar Laser Ranging, Type Ia Supernovae, and Earth Thermal History Constraints on Epoch-Dependent G Models

Dear Editor,

I am pleased to submit my manuscript, *Reevaluating Lunar Laser Ranging, Type Ia Supernovae, and Earth Thermal History Constraints on Epoch-Dependent G Models*, for consideration in *Nature Astronomy*. This study challenges current constraints on the variability of Newton's gravitational constant, G, by demonstrating that an epoch-dependent G model not only remains consistent with observations but also resolves key cosmological and astrophysical anomalies without requiring dark matter or dark energy.

Widely accepted constraints on G-variability rely on assumptions embedded in planetary dynamics, stellar evolution, and supernova standardization. This work critically reevaluates three primary lines of reasoning:

1. **The Young Faint Sun Paradox** – I present a novel resolution where continuous hydrogen accretion by the Sun stabilizes Earth's thermal history, eliminating the need for fine-tuned greenhouse gas effects while allowing for a variable G.
2. **Type Ia Supernovae Standardization** – Using David Arnett's supernova detonation physics, I derive the explicit G-dependence of SN1a absolute luminosity. I show that the current interpretation of SN1a distances assumes a fixed G, leading to systematic biases in photometric distances.
3. **Lunar Laser Ranging (LLR) Constraints** – I demonstrate that NASA's analysis fails to incorporate the required epoch-dependent corrections for angular momentum conservation, overstating LLR constraints on G-variability.

A key result of this study is that when tested against observational data, the *Hypergeometrical Universe (HU) Model*—which postulates a lightspeed-expanding hyperspherical universe—predicts significantly larger values of G in earlier epochs. Specifically, at the time of the Cosmic Microwave Background (CMB) emission, G was up to **1261 times its current value**. At redshift z=13, the epoch of early galaxy formation), G was fourteen times larger than the current value of G_0. G follows the relation $G = (z+1)G_0$, where G_0 is today's gravitational constant.

This epoch-dependent G model explains:

- **The Great Attractor velocity field** in our cosmic neighborhood, resolving the observed large-scale drift without requiring exotic physics.
- **Early galaxy formation** without invoking dark matter. HU demonstrates that a stronger G at high redshift accelerates structure formation naturally.
- **SN1a data from both the Pantheon SN1a Survey and the Supernova Cosmology Project** without needing dark matter or dark energy.
- **Spiral galaxy rotation curves and galaxy formation times** as a function of G, aligning with observational constraints while avoiding dark matter assumptions.

These findings directly challenge the ΛCDM paradigm, suggesting that dark energy and dark matter may be artifacts of a flawed assumption of constant G. The HU framework unifies cosmic expansion, gravitational interactions, and particle physics under a single principle while maintaining consistency with all major observational datasets.

Given the significant implications for cosmology, fundamental physics, and astrophysical modeling, this work will greatly interest the readership of *Nature Astronomy*. It not only proposes a novel theoretical framework but also provides testable predictions that can be verified with future observations.

I confirm that this manuscript is original, has not been published elsewhere, and is not under consideration by any other journal. Supporting calculations, data, and model implementations are available in publicly accessible repositories, including GitHub and Zenodo, as cited in the manuscript.

I appreciate your time and consideration. Please do not hesitate to contact me should you require any further information. I look forward to your feedback.

Sincerely,

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SSRN Abstracts
HU-The Big Pop Cosmogenesis
https://papers.ssrn.com/abstract=5012159
The Hypergeometrical Universe
https://papers.ssrn.com/abstract=5012064

Docker Images
docker pull ny2292000/hu_galaxy_package

Repositories
https://github.com/ny2292000/CMB_HU
https://github.com/ny2292000/HU_GalaxyPackage
https://github.com/ny2292000/HU_Papers
https://github.com/ny2292000/DataSupernovaLBLgov

Preprints ZENODO
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https://zenodo.org/records/14047261
The Hypergeometrical Universe
https://zenodo.org/records/14047049

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https://www.preprints.org/manuscript/202411.0689/v1
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https://www.preprints.org/manuscript/202201.0106/v2