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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF OPEN SCIENCE

2026
INTERNATIONAL SPACE STATION (ISS), NASA ARTEMIS, AND ASTROPHYSICS
PUBLICATIONS FOR THE PUBLIC

BRIAN E. COX AND PATRICIA I. COX



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF OPEN SCIENCE

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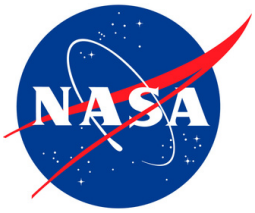

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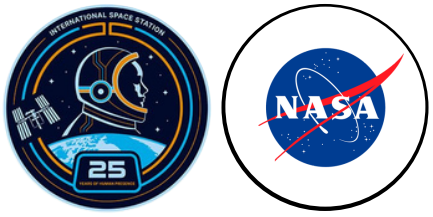

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ACADEMIC PAPERS

The "Academic Papers" section of *National Aeronautics and Space Administration of Open Science: 2026 International Space Station (ISS), NASA Artemis, and Astrophysics Publications for the Public* consists of eight academic papers authored and published for the public during the 2026 year from Thursday, April 30th, 2026 to Sunday, September 20th, 2026 (originally) and Thursday, May 7th, 2026 to Tuesday, September 29th, 2026 (revised).

Listed in chronological order, the eight academic papers are the following:

1. Astrophysics Wonders: Dark Matter, Velocity, Kinetic Energy, Time, Temperature, and Soundwaves
2. Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health
3. The Big Bang Theory: Krakatoa
4. An Analysis of the "Smell-o-Meter by Sophie": Smells Even Better
5. An Analysis of "Cooking by Jessica": Eukaryotic
6. The Big Bang: Creation in Outer Space
7. An Analysis of "Cleaned Windows by Jack Hathaway": Very Clean Math
8. A Mathematics and Physics Analysis of NASA Roman Relative to NASA Hubble by First Image: More Images, More Pixels, More Layers, and More Stars with Combined Dark Matter and Dark Energy within 3.84 Percentage Points from 95

Astrophysics Wonders:
Dark Matter, Velocity, Kinetic Energy, Time, Temperature, and Soundwaves

Astrophysics Wonders: Dark Matter, Velocity, Kinetic Energy, Time, Temperature, and Soundwaves

Brian E. Cox
University of Manchester

Patricia I. Cox
Oregon State University

ORIGINAL: April 30, 2026
REVISED: May 07, 2026

ABSTRACT
This paper introduces six physics concepts for advancing the field of astrophysics. Dr. Brian E. Cox and Patricia I. Cox dually conjecture and postulate dark matter, velocity, kinetic energy, time, temperature, and soundwaves. Applying their respective expertise, physics and mathematics, Cox and Cox reflect and analyze 15 to 30 years of secondary and post-secondary English and American public education. Published authors, educators, and scientists, Cox and Cox find creative rote methods best spark innate curiosity—an intrinsic yearning to learn in a world unknown. Evidenced by six Advanced Placement Physics AB concepts retained, taught, discovered upon, and taught anew decades after, physics is best taught in tandem with the Science, Technology, Engineering, and Mathematics (STEM) families. Scientists, students, and the general public need only look to exponential, logarithmic patterns to paint a Cartesian dark matter inclusive of Newtonian white light. Perhaps? Perhaps probably!

Keywords: white light, dark matter, acceleration, velocity, potential energy, kinetic energy, gravity, time, kelvin, celsius, fahrenheit, sound, trigonometry, physics, mathematics, infinity, positive infinity

INTRODUCTION

The field of physics is laden with scientific, technical, engineering, and mathematical language.

Introductory topics of physics include baby-g, Big-G, baby forces, Net Force, Force equals mass times acceleration, Newton, Potential Energy, Kinetic Energy, momentum, Newton's Three Laws, dark matter, temperature conversion, the metric system, thermodynamics, and time.

Could wonder exist in more than one of these introductory topics of physics? If so, how can we incandescent these wonders?

BACKGROUND
Traditional K-12 public education rests upon the rote method.

The rote method relies on memorization. Memorization usually means encode from short-term memory to long-term memory.

Non-traditional K-12 public educations rests upon inquiry-based learning.

Inquiry-based learning relies on curiosity. Curiosity usually means ask from the who, what, when, where, why, and how questions.

Could wonder exist in more than one pedagogical world? We take a look at physics for a potentially probable perhaps!

METHODS
Physics analysis rooted in mathematics analysis (e.g., further developed at Los Angeles Unified School District [LAUSD]) — inquiry-based logic within the physical sciences.

RESULTS
The following six physics concepts were discovered by Patricia I. Cox (formerly Patricia I. Vargas) from September 2008 to June 2009 in the Advanced Placement Physics AB classroom of John Palazzini at San Fernando High School in Pacoima, California, United States within LAUSD and after being allowed to learn for the sake of learning.

SIX CONCEPTUAL PHYSICS FINDS DEFINED	
Unique 2008 Autumn season thought, so long as laws of physics balanced (i.e., Newton's Third Law remembered):	dark matter must be white light
Unique 2008 Autumn season find, so long numbers stabilized (i.e., LOCKED in):	velocity^2 = speed^4
Unique 2008 Autumn season find, so long as Kinetic Energy infinite (i.e., classic L'Hospitaled):	oil (perhaps, dark matter) created when forces are netted infinitely
Unique 2008 Autumn season find, so long as gravity stabilized (i.e., computed mathematically):	projectiles yield both gravity and time frozen at an apogee

Unique 2009 Spring season find, so long as absolute zero untampered (i.e., absolute):	temperature in Fahrenheit = temperature in Celsius - 32
Unique 2009 Spring season find, so long as soundwaves isolated (i.e., sound ONLY):	sinosodial waves and cosinosodial waves in synchronous motion yield lambda

CONCLUSION & IMPLICATIONS

Parenting, teaching, and professoring an embrace for a love for learning aligns not only with computational skills but with conceptual mastery. In physics, conceptual mastery pushes the field beyond the stars and into astrophysics.

We learn physics wonders exist more prevalently when in more than one pedagogical world. And we learn we can incandescent these very physics wonders with not only the rote method and with not only inquiry-based learning, but with creative rote methods such as inquiry-based logic within the physical sciences.

Why does this matter? Well, because you matter.

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Rene Descartes
Roque Montañez
Roseanne Hill
Schuck
Shawbillion
Socrates

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Cox, B.E. and Vargas, P.I. (2025). The Inflationary Multiverse: Universes within the Universe. In National Aeronautics and Space Administration of Open Science. Washington, DC: National Aeronautics and Space Administration. 1-6.

Vargas, P.I. (2021). What Most Affects the Probability of Receiving Public Assistance? Examining the Effect of Family Background and Educational Attainment on Receiving Public Assistance with Multivariate Regression Analysis. In the American Statistical Association of Joint Statistical Meeting Proceedings 2021. Alexandria, VA: American Statistical Association. 2098-2110.

APPENDIX

AP Physics AB
Palazzini

gravity: force understood to be felt EVERYWHERE

acceleration = speed^2

Force = mass * acceleration

Kinetic Energy = (1/2) * mass * (velocity^2)

Sir Isaac Newton: Isaac Newton, PhD; family man; physics

Newton's Three Laws: equilibrium

Newton's First Law: an object at rest stays at rest

Newton's Second Law: an object in motions stays in motion

Newton's Third Law: energy cannot be destroyed only transferred

black matter: powerful, also known as dark matter

Newton's reminder: do not play with dark matter

N: newton, a unit of measure for Force

Unique 2008 autumn season thought, so long as laws balanced (i.e., Newton's Third Law remembered):
dark matter must be white light

Unique 2008 autumn season find, so long numbers stabilized (i.e., LOCKED

in):
velocity^2 = speed^4

Unique 2008 autumn season find, so long as Kinetic Energy infinite (i.e., classic L'Hospitaled):
oil (perhaps, dark matter) created when forces are netted infinitely

gravity = 9.81247... meters per seconds^2

Examples of forces: gravity (approximated to 9.81 meters per seconds^2), friction, air resistance, sound

Joueles: unit of measure for energy

Potential Energy: unapplied energy

momentum: visible motion

vacuum: net zero air resistance

copper spring: net zeroes infinite Kinetic Energy

imperial: system for units of measure in the United States ONLY

metric: system for units of measure outside of the Unites States

Temperature in Celsius = Temperature in Fahrenheit + 32

Unique 2008 autumn season find, so long as gravity stabilized (i.e., computed mathematically):
Trajectiles yield both gravity and time frozen at an apogee

Unique 2009 spring season find, so long as absolute zero untampered (i.e., absolute):
Temperature in Fahrenheit = Temperature in Celsius - 32

Lambda: symbol for soundwaves

Unique 2009 spring season find, so long as soundwaves isolated (i.e., sound ONLY): sinosodial waves and cosinosodial waves in synchronous motion yield lambda

thermodynamics: volcanic level energies

====
AP PHYSICS AB MEMORIES OF PATRICIA IBETH VARGAS JOTTED ON THURSDAY, APRIL 30TH, 2026 4:47PM AS PATRICIA IBETH COX.

LEGAL CITATION

Cox, B.E. and Cox, P.I. (2026). Astrophysics Wonders: Dark Matter, Velocity, Kinetic Energy, Time, Temperature, and Soundwaves. In National Aeronautics and Space Administration of Open Science. Washington DC: National Aeronautics Space Administration. 1-6.

Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health

Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health

Brian E. Cox[1] and Patricia I. Cox[2]
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300 E. Street SW, Washington, DC 20546

May 31, 2026

Abstract
The National Aeronautics and Space Administration (NASA) Human Research Program collected data from the Artemis II four-person mission through three studies: the Artemis II Spaceflight Standard Measures study, the ARCHeR (Artemis Crew Health and Research) study, and the Immune Biomarkers study. These three studies presented a significant analytical challenge—extremely small sample size ($n \leq 4$); high dimensionality ($p >> n$); and "multiple physiological, behavioral, and operational data streams" (NASA Human Research Program & Floor23 Digital 2026c). In response, NASA sponsored and launched the NASA Artemis II Human Research Data Methodology Challenge under the America COMPETES Act on Monday, March 30, 2026, posing the question: "How do we extract the maximum possible scientific insight from data of this nature?" (NASA Human Research Program & Floor23 Digital 2026b). This paper posits linear regression analysis to be a feasible data methodology for identifying trends within Artemis II astronauts over time in support of astronaut health by demonstrating such a data methodology with longitudinal proxy data. More specifically, demonstrating linear regression analyses for identifying hematocrit and plasma percentage trends within astronaut-like individuals over time to support healthy cardiovascular physiology for astronauts by utilizing UTMB bedrest data from Campaign 3 ($n=4$, $N=23$) and Campaign 11 ($n=4$, $N=37$) is accomplished.

Keywords: bedrest studies, artemis, artemis II, astronauts, astronaut-like cohorts, nasa, NASA Life Sciences Portal (NLSP), regression analysis, linear regression analysis, quantitative research, longitudinal data, data methodology, red blood cell volume, hematocrit, plasma volume, plasma percentage, total blood volume, cardiovascular physiology, astronaut health

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[1] Brian E. Cox is University of Manchester alumna with a Doctorate of Philosophy in Physics. He completed this project for the NASA Artemis II Human Research Data Methodology Challenge with his wife Patricia I. Cox.
[2] Patricia I. Cox is an Oregon State University alumna with a Bachelor of Science in Sociology rearticulated from the University of California, Los Angeles (UCLA). She completed this project for the NASA Artemis II Human Research Data Methodology Challenge as a Citizen Scientist alongside her husband, Brian E. Cox, PhD and can be reached at patriciaicox@yahoo.com.

I. Introduction

The National Aeronautics and Space Administration (NASA) Human Research Program collected data from the Artemis II four-person mission through three studies: the Artemis II Spaceflight Standard Measures study, the ARCHeR (Artemis Crew Health and Research) study, and the Immune Biomarkers study. These three studies presented a significant analytical challenge—extremely small sample size ($n \leq 4$); high dimensionality ($p >> n$); and "multiple physiological, behavioral, and operational data streams" (NASA Human Research Program & Floor23 Digital 2026c: 4). In response, NASA sponsored and launched the NASA Artemis II Human Research Data Methodology Challenge under the America COMPETES Act on Monday, March 30, 2026, posing the question: "How do we extract the maximum possible scientific insight from data of this nature?" (NASA Human Research Program & Floor23 Digital 2026b). This paper describes citizen science that explored just this challenge (i.e., contributing a data methodology that can yield maximum insight from longitudinal Artemis II data limited by small sample size, high dimensionality, and multi-modal nature) with linear regression analysis.

Proxying NASA Artemis II data with University of Texas Medical Branch (UTMB) bedrest data from two different campaigns and electing to focus on the research area of cardiovascular physiology, I asked: What is the effect of "head-down-tilts" on hematocrit and plasma percentage of astronaut-like individuals over time?

II. Background

NASA Artemis II Data. NASA Artemis II data is multi-modal. Across the three Artemis II studies, data is collected from "biological samples such as blood, saliva [wet and 'dry'], and urine" before, during, and/or after the mission; from "MRI imaging"; from "additional testing and surveys" during the mission; from "physical function tests" after the mission; from "behavioral performance surveys administered before and after the mission"; and "from actigraphy sensors" during the mission (NASA Human Research Program & Floor23 Digital 2026c: 3-4). NASA Artemis II studies capture the effect of microgravity (and more) on the human body (e.g., cardiovascular system, immune system, skeletal system, etc.) with a mission into deep space (i.e., a mission beyond low Earth orbit, specifically a 10-day trip around the moon) (NASA Human Research Program & Floor23 Digital 2026c: 3).

UTMB Bedrest Data. UTMB bedrest data is multi-modal as well. Across UTMB bedrest studies for Campaign 3 and Campaign 11, data is collected from biological samples such as blood, saliva, and urine; from the cycle ergometer test; from "echocardiography"; from the "functional mobility test"; from "bone densitometry"; from clinical laboratory assessments; from Functional Magnetic Resonance Imagining (fMRI); from Transcranial Magnetic Stimulation (TMS); from the "Spaceflight Cognitive Assessment Tool for Windows (WinSCAT) test"; from "Peripheral Quantitative Computerized Tomography (pQCT)"; and from "Quantitative Computerized Tomography (QCT)" (Bloomberg 2026; Laughlin 2026ab; McMonigal 2026; Moore & Ploutz-Snyder 2026abd; Moore & Ploutz-Snyder 2026c; Pierson 2026a-f; Platts & Meck 2026am; Platts & Meck 2026b-i,n; Platts & Meck 2026jk; Platts & Meck 2026l; Putcha 2026; Reschke 2026ab; Reschke 2026cd; Roberts 2026; Sams 2026ab; Sibonga 2026a; Sibonga 2026b-g; Sibonga &

LeBlanc 2026a-d; Sipes 2026; Smith 2026a-c; Stowe 2026ab; Woods & Paloski 2026). UTMB bedrest studies simulate the effect of microgravity on the human body (e.g., cardiovascular system, immune system, skeletal system, etc.) with "head-down-tilts" (Cranford 2026).

Cardiovascular Physiology. Cardiovascular physiology includes the circulatory system which includes blood. Blood is made up of four main components: plasma, red blood cells, white blood cells, and platelets (American Society of Hematology 2026). On average, whole blood is 55% plasma and 45% red blood cells, and another word for red blood cell percentage is hematocrit (American Society of Hematology 2026; National Library of Medicine 2024).

Linear Regression Analysis. Linear regression analysis is a data methodology that can identify trends between pairs of variables.

2.1 Linear Regression Analysis for Longitudinal Data

Linear regression analysis prompts us to plot each datum and identify a line that best captures the trend for all plotted data. In statistics, we call this line the *regression line*. We analyze this regression line by looking at its *regression equation*: $Y = a + b(X)$.

For longitudinal data, we can track changes within individuals over time using linear regression analysis. In this case, X represents a point in time (e.g., a test phase in UTMB bedrest studies), while Y represents our variable of choice (e.g., hematocrit or plasma percentage in UTMB bedrest studies). Further, *a* represents our average initial value for our variable of choice, while *b* represents the factor by which our variable of choice changes across time.

Overall, regression analysis is "a method of data analysis in which the relationships among variables are represented in the form of an equation, called a regression equation" (Babbie 2014: 456). And linear regression analysis is "a form of statistical analysis that seeks the equation for the straight line that best describes the relationship between two ratio variables (Babbie 2014: 456).

2.2 Theoretical Basis for Linear Regression Analysis

Linear regression analysis dates back about 150 years. The work of Sir Francis Galton "on inherited characteristics of sweet peas led to the initial conceptualization of linear regression" during the 19th century (Stanton 2001: 1). Fast-forward to the 21st century, linear regression analysis continues to be foundational (especially for more complex statistical analyses such as multiple regression analysis by way of an elaboration model) (Babbie 2014: 456-458, 433; Vargas 2021: 2099).

Specific to our *NASA Artemis II Human Research Data Methodology Challenge* which utilizes longitudinal data, and as highly recommended by NASA Subject Matter Experts, we can track changes within individuals over time using linear regression analysis (NASA Human Research Program and Floor23 Digital 2026a).

As previously mentioned, for our regression equation $Y = a + b(X)$, X represents a point in time (e.g., a test phase in UTMB bedrest studies), while Y represents our variable of choice (e.g., hematocrit or plasma percentage in UTMB bed studies). Further, *a* represents our average initial

value for our variable of choice, while *b* represents the factor by which our variable of choice changes across time.

Overall, linear regression analysis is a foundational methodology that welcomes multiple regression analysis, "a form of statistical analysis that seeks the equation representing the impact of two or more independent variables on a single dependent variable" (Babbie 2014: 458). And key for multiple regression analysis is the concept of an elaboration model, "a logical model for understanding the relationship between two variables by controlling for the effects of a third. Principally developed by Paul Lazarsfeld [in 1946], the various outcomes of an elaboration analysis are replication, explanation, interpretation, and specification" (Babbie 2014: 433).

2.3 Domains in which Linear Regression Analysis is Used

Linear regression analysis is a foundational statistics analysis that makes prediction possible, and so is used across several domains (e.g., economics, business, finance, psychology, health, medicine, education, social sciences, etc.). The U.S. Bureau of Labor Statistics, for example, publishes the Occupational Outlook Handbook, communicating the fastest growing occupations. (U.S. Bureau of Labor Statistics 2025).

2.4 Evidence Base Supporting the Effectiveness of Linear Regression Analysis

The effectiveness of linear regression analysis, which is the foundation for multiple regression analysis, can best be evidenced by successful federal government publications such as those by U.S. Bureau of Transportation Statistics, U.S. Bureau of Labor Statistics, and the U.S. Environmental Protection Agency that predict variables like airline passenger boarding, growing occupations, and river stream flows (U.S. Department of Transportation 2025; U.S. Bureau of Labor Statistics 2025; U.S. Environmental Protection Agency 2026).

III. Methodology

Quantitative Analysis. This citizen science grew from considering a bivariate analysis using cross-sectional data to exploring linear regression analysis in Microsoft Excel using longitudinal open-access data from UTMB bedrest studies sponsored by the National Aeronautics and Space Administration (NASA).

3.1 UTMB Bedrest Campaign 3

The data for this citizen science comes from the 2006, 2007, 2008, and 2009 phases of UTMB Bedrest Campaign 3 (Payload ID: Campaign 3), a study "conducted at the Flight Analogs Research Unit (FARU) located at the University of Texas Medical Branch (UTMB) in Galveston, Texas" that consisted of eight phases (C3A, C3B, C3C, C3D, C3E, C3F, C3G, and C3H) (NASA Life Sciences Portal 2026a). "The study enrolled a total of 52 subjects; of those, 23 subjects completed the study, 17 were dismissed early, 10 were evacuated, and two were screen failures" (NASA Life Sciences Portal 2026a). Having focused on cardiovascular physiology, specifically hematocrit and plasma percentage, the "UTMB Bedrest Campaign 3 Plasma Volume" dataset was utilized to draw a stratified simple random sample (n=4, N=23).

3.2 UTMB Bedrest Campaign 11

The data for this citizen science also comes from the four participant groups of UTMB Bedrest Campaign 11 (Payload ID: CFT70), a study "conducted at the Flight Analogs Research Unit (FARU) located at the University of Texas Medical Branch (UTMB) in Galveston, Texas" that consisted of four participant groups (control, exercise A, exercise B, and fly) (NASA Life Sciences Portal 2026b). The focus of UTMB Bedrest Campaign 11 was "countermeasures [(e.g., exercise)] and functional testing focusing on the key physiological factors that contribute to changes in performance of a set of functional tasks that are representative of critical mission tasks for planetary operations" (NASA Life Sciences Portal 2026b). Having focused on cardiovascular physiology, specifically hematocrit and plasma percentage, the "BRSMPV CFT70 PLASMA VOLUME DATA" dataset was utilized to draw a stratified simple random sample (n=4, N=37).

Overall, the data for this demonstrated linear regression analysis is highly relevant for mimicking spaceflight conditions given UTMB Bedrest Campaign 3 (Payload ID: Campaign 3) data (n=4, N=23) and UTMB Bedrest Campaign 11 (Payload ID: CFT70) data (n=4, N=37)—accessible through the NASA Life Sciences Portal (LSP)—were utilized to track changes within each participant of our stratified simple random sample. Again, UTMB bedrest studies simulate the effect of microgravity on the human body (e.g., cardiovascular system, immune system, skeletal system, etc.) with "head-down-tilts" making results highly relevant to NASA Artemis II (Cranford 2026).

3.3 Variables Examined

Conducting a linear regression analysis consisted of working with three variables: hematocrit, plasma percentage, and time.

3.3.1 Hematocrit

Hematocrit is another word for red blood cell percentage (American Society of Hematology 2026; National Library of Medicine 2024). We compute hematocrit by first dividing red blood cell volume in liters [coded as "RBCvol_l" or "RBCvol"] by total blood volume in liters [coded as "Bvtot_l" or "BVtot (L)"] and then multiplying by 100 (to convert from proportion format to percentage format). *Figure 1* visually summarizes this.

$$Hematocrit = \frac{RBCvol_l}{Bvtot_l} * 100$$

Figure 1. Formula for Hematocrit

3.3.2 Plasma Percentage

Plasma percentage is just that—the percentage of plasma in total blood. We compute plasma percentage by first dividing plasma volume in liters [coded as "Pvtot_l" or "PVtot (L)"] by total blood volume in liters [coded as "Bvtot_l" or "BVtot (L)"] and then multiplying by 100 (to convert from proportion format to percentage format). *Figure 2* visually summarizes this.

$$Plasma\ Percentage = \frac{Pvtot_l}{Bvtot_l} * 100$$

Figure 2. Formula for Plasma Percentage

3.3.3 Time

Time is the multiple moments in time during which a blood sample was collected (coded as "Test_Phase" and/or "Date") for each participant.

3.4 Stratified Simple Random Sampling

NASA Human Research Open-Access Datasets were sifted through by UTMB bedrest campaign (i.e., UTMB Campaign 3 and UTMB Campaign 11) to organize a respective population .csv file from which a stratified simple random sample could be drawn for the experiment titled, "Bed Rest Standard Measures: Plasma Volume" (Babbie 2014: 182-220; Barratt & Shantikumar 2018) A respective sample .csv file was organized.

3.4.1 UTMB Campaign 3 Stratified Simple Random Sample

First, I sifted through the 28 .csv files under the "UTMB Bedrest Campaign 3 Plasma Volume" dataset to identify the 23 participants who completed the study by following the information provided in the study description: four phase C3A participants completed the study; zero phase C3B participants completed the study; two phase C3C participants completed the study; seven phase C3D participants completed the study; two C3E participants completed the study; zero phase C3F participants completed the study; seven C3G participants completed the study; and one C3H participant completed the study (NASA Life Sciences Portal 2026a).

Second, I created a single population .csv file—titled "UTMB Campaign 3 Population - Plasma Volume Data"— with the respective data for these 23 participants across six campaign phases who completed the study.

Third, from these 23 participants, I stratified by highest number of BR Day within each campaign phase (C3A, C3C, C3D, C3E, C3G, and C3H). Fourth, for the cases where there were duplicates or triplicates, I conducted a Simple Random Sample within these strata using a random number generator. Fifth, after having a single participant from each of the six campaign phases, I conducted a final Simple Random Sample to select four out of six of these campaign phases for our UTMB Campaign 3 sample of four (C3D, C3E, C3G, and C3C).

Sixth, I created a single sample .csv file—titled "UTMB Campaign 3 Sample - Plasma Volume Data"—with only the relevant data (i.e., ID, campaign, subject, data, test phase, red blood cell volume, plasma volume, and total blood volume) for these four participants across four campaigns phases who completed the study. Seventh, within this file, I added the provided date to each provided test phase (i.e., renamed the first "PRE_TEST" to "PRE_TEST (05/06/06)"; renamed the second "PRE_TEST" to "PRE_TEST (05/14/06)", etc.). Eighth, within this file, I renamed "RBCvol_l" to "Red Blood Cell Volume," and I renamed "Pvtot_l" to "Plasma Volume." Ninth, with data organized by participant, I ensured there to be a variable identifying row for each participant, creating a total of three rows.

Tenth, I created a second single sample .csv file—titled "UTMB Campaign 3 Sample – Plasma Percentage Data"—similar to the above but displaying "Red Blood Cell Percentage" rather than "Red Blood Volume" and "Plasma Percentage" rather than "Plasma Volume" by applying the formula for hematocrit (red blood cell percentage) in *Figure 1* and formula for plasma percentage in *Figure 2*, respectively.

3.4.2 UTMB Campaign 11 Stratified Simple Random Sample

First, I scanned the two .csv files under the "BRSMPV CFT70 PLASMA VOLUME DATA" dataset to identify the file with population data—the file titled "BRSMPV_CFT70_PLASMA_VOLUME_all_subjects"—and tallied 37 participants across four participant groups (NASA Life Sciences Portal 2026b).

Second, I titled this single population .csv file with the respective data for these 37 participants across four participant groups, "UTMB Campaign 11 Population - Plasma Volume Data."

Third, from these 37 participants, I stratified by highest number of BR Day within each participant group (control, exercise A, exercise B, and fly). Fourth, for the cases where there were duplicates or triplicates, I conducted a Simple Random Sample within these strata using a random number generator. Fifth, after having a single participant from each of the four participant groups (control, exercise A, exercise B, and fly), our UTMB Campaign 11 sample of four was established.

Sixth, I created a single sample .csv file—titled "UTMB Campaign 11 Sample - Plasma Volume Data"—with only the relevant data (i.e., ID, campaign, subject, data, test phase, red blood cell volume, plasma volume, and total blood volume) for these four participants across four participant groups. Seventh, within this file, I added a respective number to each provided test phase by type (i.e., renamed the first "PRE_TEST" to "PRE_TEST (1 of 2)"; renamed the second "PRE_TEST" to "PRE_TEST (2 of 2)", etc.). Eighth, within this file, I renamed "RBCvol" to "Red Blood Cell Volume," and I renamed "Pvtot (L)" to "Plasma Volume." Ninth, with data organized by participant, I ensured there to be a variable identifying row for each participant, creating a total of three rows.

Tenth, I created a second single sample .csv file—titled "UTMB Campaign 11 Sample – Plasma Percentage Data"—similar to the above but displaying "Red Blood Cell Percentage" rather than "Red Blood Volume" and "Plasma Percentage" rather than "Plasma Volume" by applying the formula for hematocrit (red blood cell percentage) in *Figure 1* and formula for plasma percentage in *Figure 2*, respectively.

3.5 Linear Regression Analysis

Linear regression analysis is the data methodology that was applied to track changes in hematocrit and plasma percentage within astronaut-like individuals over time for two different UTMB bedrest studies: UTMB Campaign 3 ($n=4$, $N=23$) and UTMB Campaign 11 ($n=4$, $N=37$). Data, inclusive of our regression line and regression equation (Figure 3), was visualized in Microsoft Excel on Monday, May 25th, 2026.

$$Y = a + b(X)$$

Figure 3. Regression equation

A ReadMe file with clear instructions for reproducing the following results for the UTMB Campaign 3 data and UTMB Campaign 11 data was authored on Saturday, May 23rd, 2026 and revised on Sunday, May 31st, 2026.

IV. Results

4.1 Overarching Trend

A healthy trend in cardiovascular physiology was observed among astronaut-like participants for both our stratified simple random samples. Hematocrit decreased and plasma percentage increased for the majority of UTMB bedrest study participants in our small samples of four.

Among astronaut-like UTMB Campaign 3 participants (n=4), hematocrit (i.e., red blood cell percentage which is computed by dividing red blood cell volume by total blood volume, and multiplying by 100) decreased over time for three out of four of our participants with an average factor change of -0.407375 (Figure 4, Figure 5, Figure 7, and Figure 8). Among astronaut-like UTMB Campaign 3 participants (n=4), plasma percentage (i.e., plasma volume out of total blood volume) increased over time for three out of four of our participants with an average factor change of 0.426325 (Figure 4, Figure 5, Figure 7, and Figure 8).

Among astronaut-like UTMB Campaign 11 participants (n=4), hematocrit (i.e., red blood cell percentage which is computed by dividing red blood cell volume by total blood volume, and multiplying by 100) decreased over time for three out of four of our participants with an average factor change of -0.211625 (Figure 9, Figure 10, Figure 12, and Figure 13). Among astronaut-like UTMB Campaign 11 participants (n=4), plasma percentage (i.e., plasma volume out of total blood volume) increased over time for three out of four of our participants with an average factor change of 0.224125 (Figure 9, Figure 10, Figure 12, and Figure 13).

These results are illustrated across 10 data visualizations. Eight of 10 data visualizations are linear regression analysis graphs labeled Figure 4, Figure 5, Figure 6, Figure 7, Figure 9, Figure 10, Figure 11, and Figure 12. Lastly, two out of 10 visualizations are factor change graphs labeled Figure 8 and Figure 13.

4.2 Visualizations for Sample from UTMB Campaign 3

Figures 4-7 illustrate hematocrit and plasma percentage by participant for UTMB Campaign 3 (n=4). *Figure 8* illustrates the factor change values for hematocrit and plasma percentage for UTMB Campaign 3 participants (n=4).

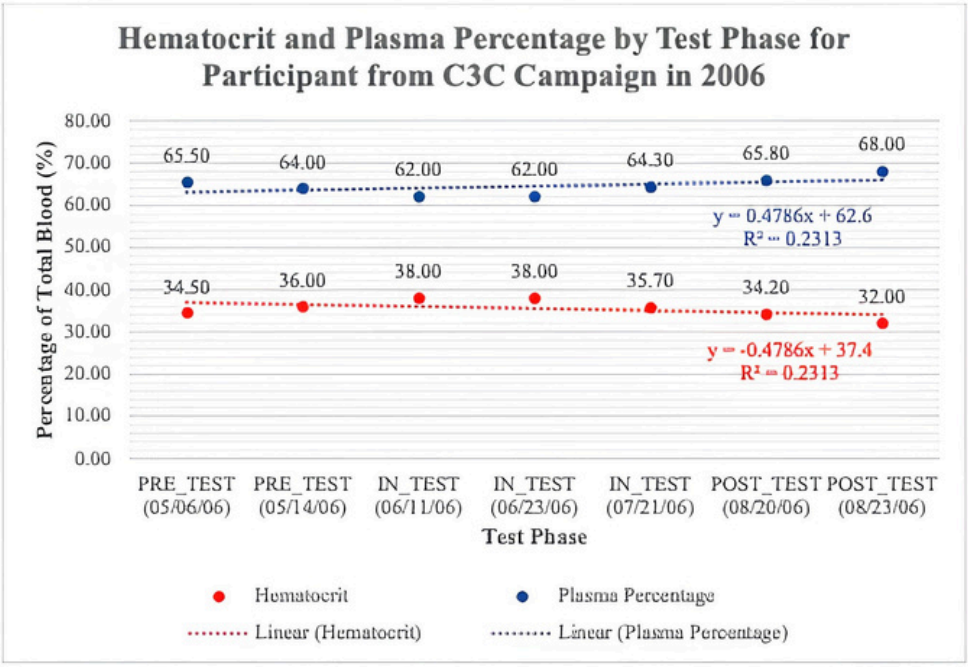

Figure 4. Hematocrit and Plasma Percentage by Test Phase for Participant from C3C Campaign in 2006

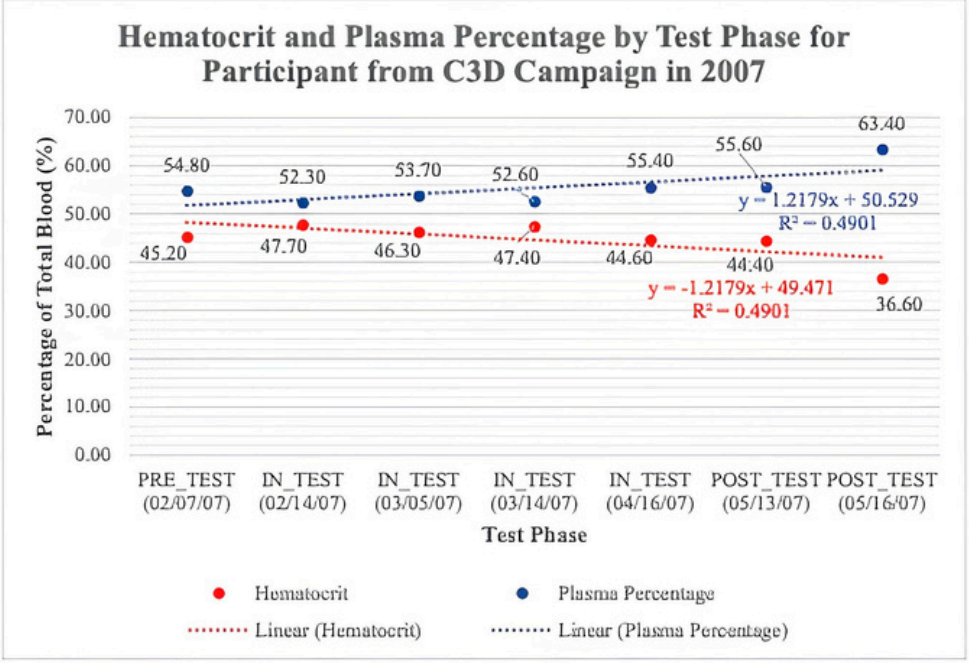

Figure 5. Hematocrit and Plasma Percentage by Test Phase for Participant from C3D Campaign in 2007

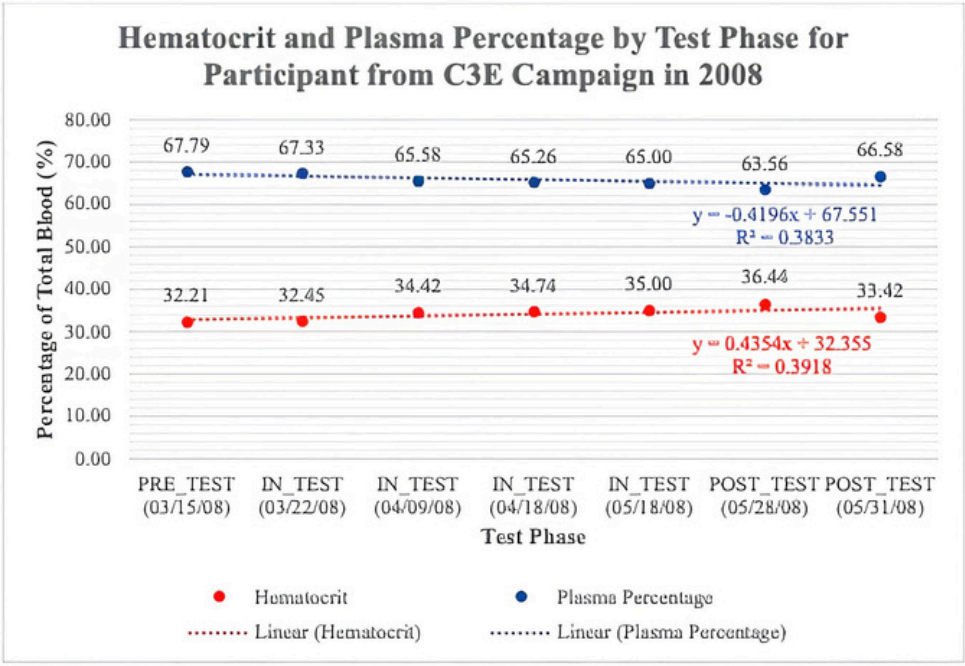

Figure 6. Hematocrit and Plasma Percentage by Test Phase for Participant from C3E Campaign in 2008

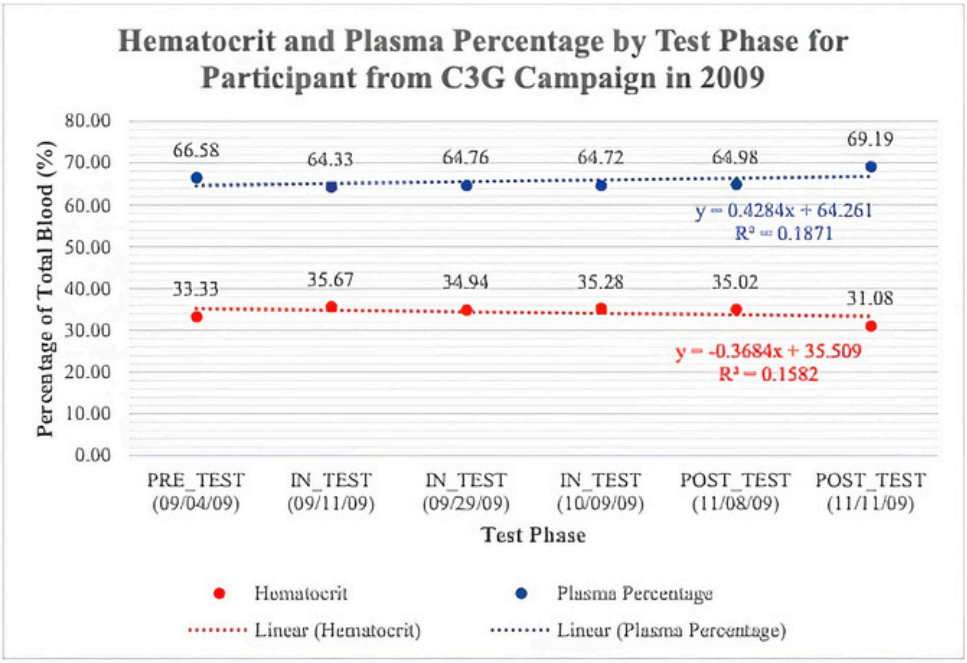

Figure 7. Hematocrit and Plasma Percentage by Test Phase for Participant from C3G Campaign in 2009

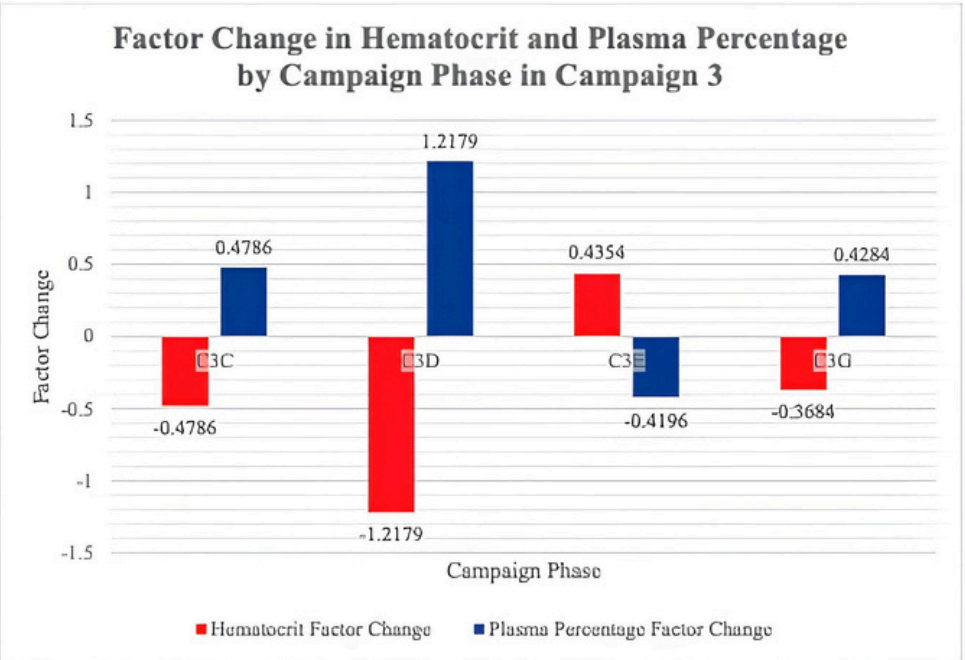

Figure 8. Factor Change in Hematocrit and Plasma Percentage by Campaign Phase in Campaign 3

4.3 Visualizations for Sample from UTMB Campaign 11

Figures 9-12 illustrate hematocrit and plasma percentage by participant for UTMB Campaign 11 (n=4). *Figure 13* illustrates the factor change values for hematocrit and plasma percentage for UTMB Campaign 11 participants (n=4).

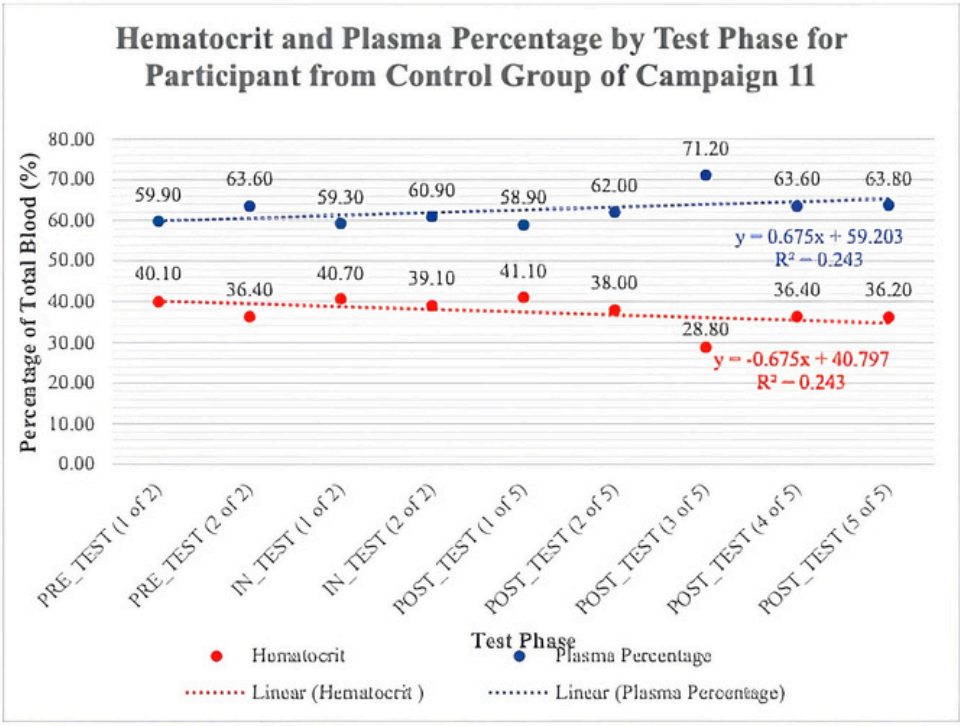

Figure 9. Hematocrit and Plasma Percentage by Test Phase for Participant from Control Group of Campaign 11

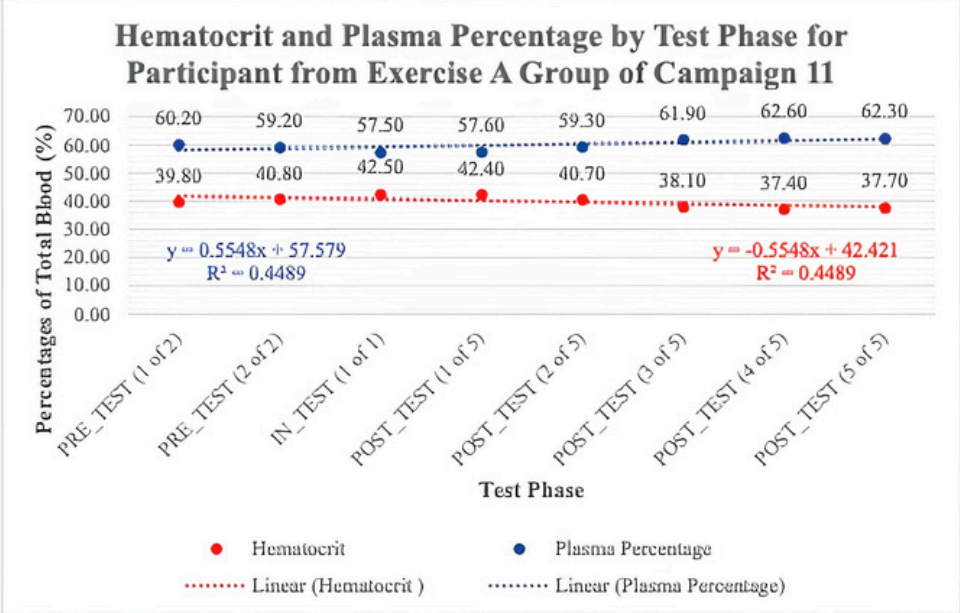

Figure 10. Hematocrit and Plasma Percentage by Test Phase for Participant from Exercise A Group of Campaign 11

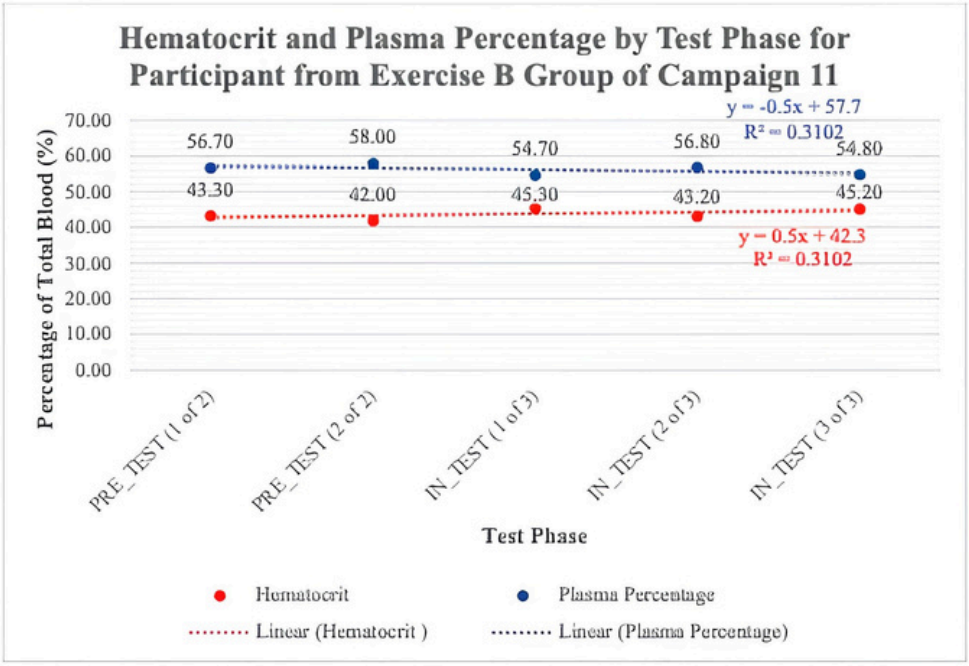

Figure 11. Hematocrit and Plasma Percentage by Test Phase for Participant from Exercise B Group of Campaign 11

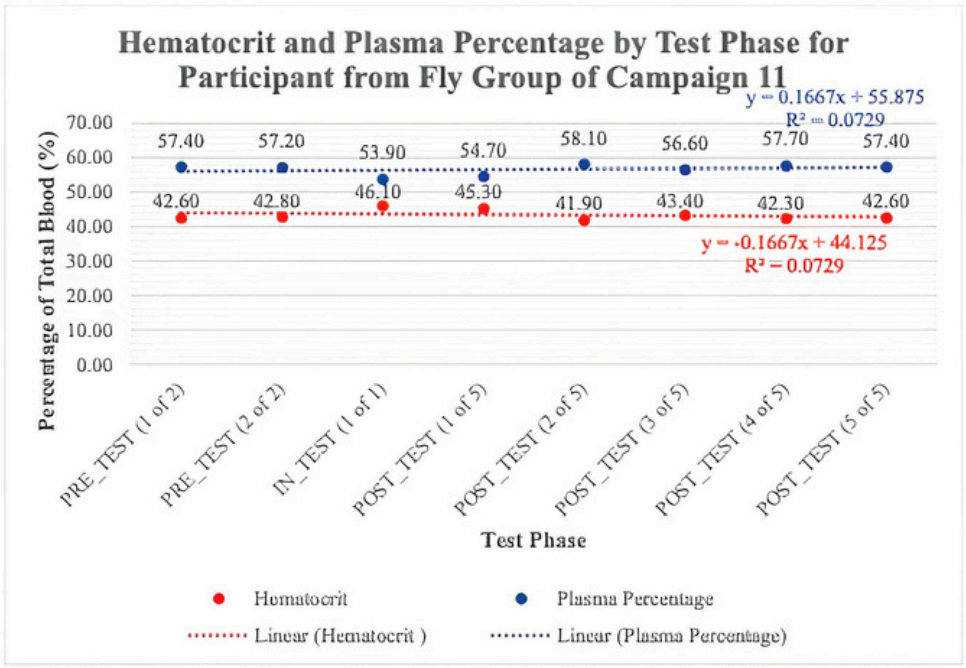

Figure 12. Hematocrit and Plasma Percentage by Test Phase for Participant from Fly Group of Campaign 11

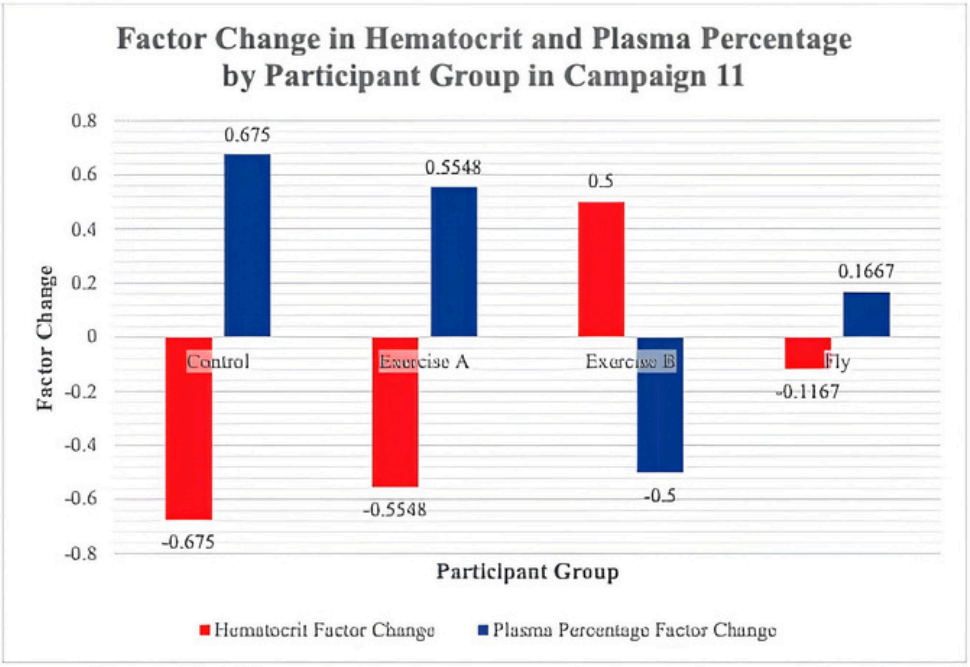

Figure 13. Factor Change in Hematocrit and Plasma Percentage by Participant Group in Campaign 11

Collectively, our 13 figures illustrate how we can examine blood (hematocrit and plasma percentage in particular) within astronaut-like individuals over time using linear regression analysis to support healthy cardiovascular physiology. Given the role plasma plays in physiology (e.g., coagulation, defense, maintenance of osmotic pressure, nutrition, respiration, excretion, hormones, regulation of acid-base balance, and regulation of body temperature), and given the role endurance exercise plays in plasma volume (i.e., increased plasma volume with endurance exercise), we can reason "plasma percentage increase" to be an indicator of "healthy cardiovascular physiology" (Mathew, Sankar, & Varacallo 2023; Fellmann 1992; Kargotich et al. 1998).

V. Conclusions and Implications

Linear regression analysis proves to be a feasible data methodology for identifying trends within astronaut-like individuals over time in support of astronaut health. Our eight regression lines and our eight regression equations for the plotted longitudinal data of each astronaut-like individual in our stratified simple random sample of four for our two different datasets—UTMB Campaign 3 ($n=4$, $N=23$) and UTMB Campaign 11 ($n=4$, $N=37$)—visually and statistically summarize the effect of "head-down-tilts" on hematocrit and plasma percentage of astronaut-like individuals over time: Hematocrit decreased and plasma percentage increased for the majority of UTMB bedrest study participants in our small samples of four. Moreover, plasma percentage increase can be read as an indicator of healthy cardiovascular physiology (Mathew, Sankar, & Varacallo 2023).

This demonstrated linear regression analysis can be applied to actual Artemis II datasets (e.g., Artemis II Spaceflight Standard Measures) (N=4) by tracking changes within each astronaut over time for any research area and respective variable of choice (e.g., hematocrit and plasma percentage within the research area of cardiovascular physiology).

Reflecting on the unique fact that Artemis II is a historic mission into deep space (i.e., a mission beyond low Earth orbit, specifically a 10-day trip around the moon), I would embrace the opportunity to enhance the value of existing data by chronologizing Artemis II data for our NASA Artemis II crew within six milestones in time: (1) Before Astronaut Candidate Training, (2) After Astronaut Candidate Training, (3) Before an Astronaut Mission to the International Space Station (ISS), (4) After an Astronaut Mission to the ISS, (5) Before an Astronaut Mission to the Moon, and (6) After an Astronaut Mission to the Moon. *Table 1* visually summarizes these milestones.

Artemis II Astronaut	Astronaut Candidate Class	Astronaut Mission to the ISS	Astronaut Mission to the Moon
Gregory Reid Wiseman	2009	2014	2026
Christina Hammock Koch	2013	2019	2026
Jeremy Roger Hansen	2009	N/A	2026
Victor Jerome Glover Jr.	2013	2020	2026

Table 1. NASA Artemis II Astronaut Milestones

Moreover, I would invest in collecting Immunology data (specifically killer T-cell count) for our NASA Artemis II crew across the abovementioned milestones to enable us to metric a concept such as acclimation.

An alternative hypothesis like the following could be tested with such data collection: As an astronaut advances from Non-Astronaut to Artemis Astronaut (e.g., from Non-Astronaut to Astronaut Candidate to ISS Astronaut to Artemis Astronaut), their killer T-Cell count increases.

Overall, Artemis II was a historic success, and we can gain the most possible scientific insight from the data across our three studies—the Artemis II Spaceflight Standard Measures study; the ARCHeR (Artemis Crew Health and Research) study; and the Immune Biomarkers study—with data methodologies that prioritize longitudinal data over cross-sectional data. Linear regression analysis welcomes just this by allowing us to track changes within each Artemis II astronaut over time for a research area and respective variable of choice. Linear regression analysis for longitudinal data stands a feasible data methodology for identifying trends within Artemis II astronauts over time in support of astronaut health, and its future applications await.

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Lastly, thank you to the NASA Life Sciences Portal (LSP) for making the University of Texas Medical Branch (UTMB) bedrest study datasets from UTMB Campaign 3 and UTMB Campaign 11 available to the public. Writing and publishing representative findings would not have been possible without the ability to access data from UTMB Bedrest Campaigns 3 and 11—managed by the NASA Johnson Space Center—to conduct quantitative research. Thank you.

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ReadMe

This is a ReadMe file text with clear instructions for reproducing the results for the UTMB Campaign 3 data and UTMB Campaign 11 data for NASA Artemis II Human Research Data Methodology Challenge.

Dataset: UTMB Campaign 3 Sample - Plasma Percentage Data
Description: This dataset provides the percentage values for red blood cell (i.e., red blood cell volume divided by total blood volume, multiplied by 100) and plasma (i.e., plasma volume divided by total blood value, multiplied by 100) for our sample from our UTMB Campaign 3 via stratified simple random sampling (n=4, N=23).

This data stems from the "UTMB Bedrest Campaign 3 Plasma Volume" dataset for the NASA experiment titled "Bed Rest Standard Measures: Plasma Volume" for UTMB Campaign 3 (Platts & Meck 2026m).

Dataset: UTMB Campaign 11 Sample - Plasma Percentage Data
Description: This dataset provides the percentage values for red blood cell (i.e., red blood cell volume divided by total blood volume, multiplied by 100) and plasma (i.e., plasma volume divided by total blood value, multiplied by 100) for our sample from our UTMB Campaign 11 via stratified simple random sampling (n=4, N=37).

This data stems from the "BRSMPV CFT70 PLASMA VOLUME DATA" dataset for the NASA experiment titled "Bed Rest Standard Measures: Plasma Volume" for UTMB Campaign 11 (Platts & Meck 2026a).

The above datasets are publicly available via the following ZIP Folder:
https://drive.google.com/file/d/1TGLr4q0kQqwqVRNG-wowm-MSYOBYT_J1/view?usp=share_link

Description of ZIP Folder/File Contents:
There are three folders.

1. The first folder is titled "Microsoft Excel Workbook for Linear Regression Analysis" and contains one .xlsx file, titled "Linear Regression Analysis for UTMB Campaign 3 and UTMB Campaign 11 - Plasma Volume Data," with eight spreadsheets.

2. The second folder is titled "UTMB Campaign 3 Data for Plasma Volume" and contains three .csv files: (1) "UTMB Campaign 3 Population – Plasma Volume Data"; (2) "UTMB Campaign 3 Sample – Plasma Percentage Data"; and (3) "UTMB Campaign 3 Sample – Plasma Volume Data."

3. The third folder is titled "UTMB Campaign 11 Data for Plasma Volume" and contains three .csv files: (1) "UTMB Campaign 11 Population – Plasma Volume Data"; (2)

"UTMB Campaign 11 Sample – Plasma Percentage Data"; and (3) "UTMB Campaign 11 Sample – Plasma Volume Data."

Instructions for Reproducing the Results for the UTMB Campaign 3 Data:

1. Open the "UTMB Campaign 3 Sample - Plasma Percentage Data" .csv file with Microsoft Excel. Note: The Microsoft Excel version used is Version 16.109.
2. In Microsoft Excel, highlight the titles "Test Phase," "Red Blood Cell Percentage," and "Plasma Percentage" with all values for Subject 7772 from Campaign C3C. In other words, highlight from E1 to G8.
3. Click "Insert" at the top. Within "Insert" click "Line." Within "Line" click "Line with Markers" under 2-D Line. A visualization of the data selected in step 2 should populate. Stretch out the visualization as needed.
4. Edit the Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from C3C Campaign in 2006"** and bold the text.
5. Click the graph then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Axis Titles." Within "Axis Titles," click "Primary Horizontal."
6. Edit (horizontal) Axis Title to "Test Phase" and bold the text.
7. Click to "Axis Titles" again and click "Primary Vertical."
8. Edit (vertical) Axis Title to "Percentage of Total Blood (%)" and bold the text.
9. Click the graph then click "Chart Design" at the top again. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Data Labels." Within "Data Labels," click "Above"
10. Click the graph then click "Chart Design" at the top again. Within "Chart Design" click "Add Chart Element." Within "Add Chart Element," click "Gridlines." Within "Gridlines," click "Primary Minor Horizontal"
11. Click the graph. Click the points of the Red Blood Cell Percentage line so that all points are highlighted. Then click on "Format" at the top. Within "Format," click "Shape Outline." Within "Shape Outline," click "No Outline." Only the points should appear now.
12. Click the graph again. Click the points of the Plasma Percentage line so that all points are highlighted. Then click on "Format" at the top. Within "Format," click "Shape Outline." Within "Shape Outline," click "No Outline." Only the points should appear now.
13. Click the graph. Click the points of the Red Blood Cell Percentage line so that all points are highlighted. Then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Trendline." Within "Trendline," click "Linear." A respective dotted line should appear.
14. Click the graph. Click the newly created dotted line for Red Blood Cell Percentage. Right-click the dotted line. Within the right-click menu, click "Format Trendline…" Within the "Format Trendline" menu that displays to the right, check the box for "Display

Equation on chart" and check the box for "Display R-squared value on the chart." An equation and R-squared value should appear on the graph now. Move items lower as needed so fully visible.

15. Click the graph. Click the points of the Plasma Percentage line so that all points are highlighted. Then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Trendline." Within "Trendline," click "Linear." A respective dotted line should appear.
16. Click the graph. Click the newly created dotted line for Plasma Percentage. Right-click the dotted line. Within the right-click menu, click "Format Trendline…" Within the "Format Trendline" menu that displays to the right, check the box for "Display Equation on chart" and check the box for "Display R-squared value on the chart." An equation and R-squared value should appear on the graph now. Move items lower as needed so fully visible.
17. Repeat Step 2 through Step 16 for Subject 7984 from Campaign C3D. In other words, highlight from E9 to G16; edit Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from C3D Campaign in 2007,"** etc. This creates our second linear regression analysis visual.
18. Repeat Step 2 through Step 16 for Subject 8715 from Campaign C3E. In other words, highlight from E17 to G24; edit Chart Title **to "Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from C3E Campaign in 2008,"** etc. This creates our third linear regression analysis visual.
19. Repeat Step 2 through Step 16 for Subject 5814 from Campaign C3G. In other words, highlight from E25 to G31; edit Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from C3G Campaign in 2009,"** etc. This creates our fourth linear regression analysis visual.
20. With our four linear regression analysis visuals created, highlight "Campaign Phase," "Red Blood Cell Percentage Factor Change," and "Plasma Percentage Factor Change" with all values for C3C, C3D, C3E, and C3G selected. In other words, highlight from E36 to G40.
21. Click "Insert" at the top. Within "Insert" click "Column." Within "Column" click "Clustered Column" under 2-D Column. A visualization of the data selected in step 20 should populate. Stretch out the visualization as needed.
22. Edit the Chart Title to **"Factor Change in Red Blood Cell Percentage and Plasma Percentage by Campaign Phase in Campaign 3"** and bold the text.
23. Click the graph, then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Axis Titles." Within "Axis Titles," click "Primary Horizontal."
24. Edit (horizontal) Axis Title to "Campaign Phase" and bold the text.
25. Click to "Axis Titles" again and click "Primary Vertical."
26. Edit (vertical) Axis Title to "Factor Change" and bold the text.

27. Click the graph then click "Chart Design" at the top again. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Data Labels." Within "Data Labels," click "Outside End"
28. Click the graph then click "Chart Design" at the top again. Within "Chart Design" click "Add Chart Element." Within "Add Chart Element," click "Gridlines." Within "Gridlines," click "Primary Minor Horizontal"
29. Click the "C3C, C3D, C3E, and C3G" campaign phase labels, then click "Home." Under "Home," click "Fill Color" and select "White." Click "Fill Color" again and select "More Colors…" Under "Opacity," type in "30%" and click "Ok." This finalizes the steps for our fifth and last visual for UTMB Campaign 3 Data.

Instructions for Reproducing the Results for the UTMB Campaign 11 Data:

1. Open the "UTMB Campaign 11 Sample - Plasma Percentage Data" .csv file with Microsoft Excel. Note: The Microsoft Excel version used is Version 16.109.
2. In Microsoft Excel, highlight the titles "Test Phase," "Red Blood Cell Percentage," and "Plasma Percentage" with all values for Subject 5210 (Control Group) from Campaign 11. In other words, highlight from D1 to F10.
3. Click "Insert" at the top. Within "Insert" click "Line." Within "Line" click "Line with Markers" under 2-D Line. A visualization of the data selected in step 2 should populate. Stretch out the visualization as needed.
4. Edit the Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from Control Group of Campaign 11"** and bold the text.
5. Click the graph then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Axis Titles." Within "Axis Titles," click "Primary Horizontal."
6. Edit (horizontal) Axis Title to "Test Phase" and bold the text.
7. Click to "Axis Titles" again and click "Primary Vertical."
8. Edit (vertical) Axis Title to "Percentage of Total Blood (%)" and bold the text.
9. Click the graph then click "Chart Design" at the top again. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Data Labels." Within "Data Labels," click "Above"
10. Click the graph then click "Chart Design" at the top again. Within "Chart Design" click "Add Chart Element." Within "Add Chart Element," click "Gridlines." Within "Gridlines," click "Primary Minor Horizontal"
11. Click the graph. Click the points of the Red Blood Cell Percentage line so that all points are highlighted. Then click on "Format" at the top. Within "Format," click "Shape Outline." Within "Shape Outline," click "No Outline." Only the points should appear now.

12. Click the graph again. Click the points of the Plasma Percentage line so that all points are highlighted. Then click on "Format" at the top. Within "Format," click "Shape Outline." Within "Shape Outline," click "No Outline." Only the points should appear now.
13. Click the graph. Click the points of the Red Blood Cell Percentage line so that all points are highlighted. Then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Trendline." Within "Trendline," click "Linear." A respective dotted line should appear.
14. Click the graph. Click the newly created dotted line for Red Blood Cell Percentage. Right-click the dotted line. Within the right-click menu, click "Format Trendline…" Within the "Format Trendline" menu that displays to the right, check the box for "Display Equation on chart" and check the box for "Display R-squared value on the chart." An equation and R-squared value should appear on the graph now. Move items lower as needed so fully visible.
15. Click the graph. Click the points of the Plasma Percentage line so that all points are highlighted. Then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Trendline." Within "Trendline," click "Linear." A respective dotted line should appear.
16. Click the graph. Click the newly created dotted line for Plasma Percentage. Right-click the dotted line. Within the right-click menu, click "Format Trendline…" Within the "Format Trendline" menu that displays to the right, check the box for "Display Equation on chart" and check the box for "Display R-squared value on the chart." An equation and R-squared value should appear on the graph now. Move items lower as needed so fully visible.
17. Repeat Step 2 through Step 16 for Subject 6403 (Exercise A Group) from Campaign 11. In other words, highlight from D17 to F25; edit Chart Title **to "Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from Exercise A Group of Campaign 11,"** etc. This creates our second linear regression analysis visual.
18. Repeat Step 2 through Step 16 for Subject 7036 (Exercise B Group) from Campaign 11. In other words, highlight from D11 to F16; edit Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from Exercise B Group of Campaign 11,"** etc. This creates our third linear regression analysis visual.
19. Repeat Step 2 through Step 16 for Subject 5673 (Fly Group) from Campaign 11. In other words, highlight from D26 to F34; edit Chart Title to **"Red Blood Cell Percentage and Plasma Percentage by Test Phase for Participant from Fly Group of Campaign 11,"** etc. This creates our four linear regression analysis visual.
20. With our four linear regression analysis visuals created, highlight "Campaign Phase," "Red Blood Cell Percentage Factor Change," and "Plasma Percentage Factor Change" with all values Control, Exercise A, Exercise B, and Fly selected. In other words, highlight from D38 to F42.

21. Click "Insert" at the top. Within "Insert" click "Column." Within "Column" click "Clustered Column" under 2-D Column. A visualization of the data selected in step 20 should populate. Stretch out the visualization as needed.
22. Edit the Chart Title to **"Factor Change in Red Blood Cell Percentage and Plasma Percentage by Participant Group in Campaign 11"** and bold the text.
23. Click the graph, then click "Chart Design" at the top. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Axis Titles." Within "Axis Titles," click "Primary Horizontal."
24. Edit (horizontal) Axis Title to "Campaign Phase" and bold the text.
25. Click to "Axis Titles" again and click "Primary Vertical."
26. Edit (vertical) Axis Title to "Factor Change" and bold the text.
27. Click the graph then click "Chart Design" at the top again. Within "Chart Design," click "Add Chart Element." Within "Add Chart Element," click "Data Labels." Within "Data Labels," click "Outside End"
28. Click the graph then click "Chart Design" at the top again. Within "Chart Design" click "Add Chart Element." Within "Add Chart Element," click "Gridlines." Within "Gridlines," click "Primary Minor Horizontal"
29. Click the "Control, Exercise A, Exercise B, and Fly" participant group labels, then click "Home." Under "Home," click "Fill Color" and select "White." Click "Fill Color" again and select "More Colors…" Under "Opacity," type in "30%" and click "Ok." This finalizes the steps for our fifth and last visual for UTMB Campaign 11 Data.

ADDITIONAL STEP: Replace "Red Blood Cell Percentage" with the word "Hematocrit" everywhere, respectively (e.g., in Excel column titles and in chart titles). The word "hematocrit" is another word for the ratio of red blood cell volume to total blood volume.

Author of this ReadMe:
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Last Revised: Sunday, May 31st, 2026 at 9:56PM PDT

APPENDIX B: Raw Data

UTMB Campaign 3 Sample - Plasma Percentage Data

ID	Campaign	Subject	Date	Test_Phase	Hematocrit	Plasma Percentage	Bvtot_l
1	C3C	7772	5/6/06	PRE_TEST (05/06/06)	34.50	65.50	3.489011213
2	C3C	7772	5/14/06	PRE_TEST (05/14/06)	36.00	64.00	3.2003066
3	C3C	7772	6/11/06	IN_TEST (06/11/06)	38.00	62.00	3.03791862
4	C3C	7772	6/23/06	IN_TEST (06/23/06)	38.00	62.00	2.871486831
5	C3C	7772	7/21/06	IN_TEST (07/21/06)	35.70	64.30	2.864933181
6	C3C	7772	8/20/06	POST_TEST (08/20/06)	34.20	65.80	2.984952208
7	C3C	7772	8/23/06	POST_TEST (08/23/06)	32.00	68.00	3.144837569
ID	Campaign	Subject	Date	Test_Phase	Hematocrit	Plasma Percentage	Bvtot_l
1	C3D	7984	2/7/07	PRE_TEST (02/07/07)	45.20	54.80	5.628849366
2	C3D	7984	2/14/07	IN_TEST (02/14/07)	47.70	52.30	5.363810528
3	C3D	7984	3/5/07	IN_TEST (03/05/07)	46.30	53.70	5.691241768
4	C3D	7984	3/14/07	IN_TEST (03/14/07)	47.40	52.60	4.887406505
5	C3D	7984	4/16/07	IN_TEST (04/16/07)	44.60	55.40	5.024075378
6	C3D	7984	5/13/07	POST_TEST (05/13/07)	44.40	55.60	5.032104448
7	C3D	7984	5/16/07	POST_TEST (05/16/07)	36.60	63.40	7.163620605
ID	Campaign	Subject	Date	Test_Phase	Hematocrit	Plasma Percentage	Bvtot_l
1	C3E	8715	3/15/08	PRE_TEST (03/15/08)	32.21	67.79	4.44
2	C3E	8715	3/22/08	IN_TEST (03/22/08)	32.45	67.33	4.53
3	C3E	8715	4/9/08	IN_TEST (04/09/08)	34.42	65.58	4.3
4	C3E	8715	4/18/08	IN_TEST (04/18/08)	34.74	65.26	4.26
5	C3E	8715	5/18/08	IN_TEST (05/18/08)	35.00	65.00	4.2
6	C3E	8715	5/28/08	POST_TEST (05/28/08)	36.44	63.56	3.76
7	C3E	8715	5/31/08	POST_TEST (05/31/08)	33.42	66.58	3.86
ID	Campaign	Subject	Date	Test_Phase	Hematocrit	Plasma Percentage	Bvtot_l
1	C3G	5814	9/4/09	PRE_TEST (09/04/09)	33.33	66.58	3.74
2	C3G	5814	9/11/09	IN_TEST (09/11/09)	35.67	64.33	3.42
3	C3G	5814	9/29/09	IN_TEST (09/29/09)	34.94	64.76	3.32
4	C3G	5814	10/9/09	IN_TEST (10/09/09)	35.28	64.72	3.43
5	C3G	5814	11/8/09	POST_TEST (11/08/09)	35.02	64.98	3.17
6	C3G	5814	11/11/09	POST_TEST (11/11/09)	31.08	69.19	3.7

UTMB Campaign 11 Sample - Plasma Percentage Data

ID	Subject	Group	Test_Phase	Hematocrit	Plasma Percentage	BVtot (L)
1	5210	Ctrl	PRE_TEST (1 of 2)	40.10	59.90	3.563832533
2	5210	Ctrl	PRE_TEST (2 of 2)	36.40	63.60	3.546874121
3	5210	Ctrl	IN_TEST (1 of 2)	40.70	59.30	3.796505499
4	5210	Ctrl	IN_TEST (2 of 2)	39.10	60.90	3.339326131
5	5210	Ctrl	POST_TEST (1 of 5)	41.10	58.90	3.239156937
6	5210	Ctrl	POST_TEST (2 of 5)	38.00	62.00	3.528338977
7	5210	Ctrl	POST_TEST (3 of 5)	28.80	71.20	4.242120663
8	5210	Ctrl	POST_TEST (4 of 5)	36.40	63.60	3.364567608
9	5210	Ctrl	POST_TEST (5 of 5)	36.20	63.80	3.506272747
ID	Subject	Group	Test_Phase	Hematocrit	Plasma Percentage	BVtot (L)
19	7036	ExB	PRE_TEST (1 of 2)	43.30	56.70	4.448001127
20	7036	ExB	PRE_TEST (2 of 2)	42.00	58.00	4.747759169
21	7036	ExB	IN_TEST (1 of 3)	45.30	54.70	4.367915043
22	7036	ExB	IN_TEST (2 of 3)	43.20	56.80	4.44585814
23	7036	ExB	IN_TEST (3 of 3)	45.20	54.80	4.245607737
ID	Subject	Group	Test_Phase	Hematocrit	Plasma Percentage	BVtot (L)
151	6403	ExA	PRE_TEST (1 of 2)	39.80	60.20	6.526449275
152	6403	ExA	PRE_TEST (2 of 2)	40.80	59.20	6.337709971
153	6403	ExA	IN_TEST (1 of 1)	42.50	57.50	5.856192285
154	6403	ExA	POST_TEST (1 of 5)	42.40	57.60	5.795979182
155	6403	ExA	POST_TEST (2 of 5)	40.70	59.30	6.584765684
156	6403	ExA	POST_TEST (3 of 5)	38.10	61.90	6.541826957
157	6403	ExA	POST_TEST (4 of 5)	37.40	62.60	6.422261133
158	6403	ExA	POST_TEST (5 of 5)	37.70	62.30	6.359303362
ID	Subject	Group	Test_Phase	Hematocrit	Plasma Percentage	BVtot (L)
256	5673	Fly	PRE_TEST (1 of 2)	42.60	57.40	5.86784513
257	5673	Fly	PRE_TEST (2 of 2)	42.80	57.20	5.816721186
258	5673	Fly	IN_TEST (1 of 1)	46.10	53.90	5.199701967
259	5673	Fly	POST_TEST (1 of 5)	45.30	54.70	4.637215569
260	5673	Fly	POST_TEST (2 of 5)	41.90	58.10	5.21312993
261	5673	Fly	POST_TEST (3 of 5)	43.40	56.60	4.696674087
262	5673	Fly	POST_TEST (4 of 5)	42.30	57.70	5.41954262
263	5673	Fly	POST_TEST (5 of 5)	42.60	57.40	4.872896693

UTMB Campaign 3 Sample - Plasma Percentage Data (cont'd)

Campaign Phase	Hematocrit Factor Change	Plasma Percentage Factor Change
C3C	-0.4786	0.4786
C3D	-1.2179	1.2179
C3E	0.4354	-0.4196
C3G	-0.3684	0.4284

UTMB Campaign 11 Sample - Plasma Percentage Data (cont'd)

Participant Group	Hematocrit Factor Change	Plasma Percentage Factor Change
Control	-0.675	0.675
Exercise A	-0.5548	0.5548
Exercise B	0.5	-0.5
Fly	-0.1167	0.1667

The Big Bang Theory:
Krakatoa

The Big Bang Theory: Krakatoa

Brian E. Cox
University of Manchester

Patricia I. Cox
Oregon State University

Original: Sunday, June 14th, 2026
iCloud: Tuesday, June 16th, 2026

Original Revised: Saturday, June 27th, 2026
iCloud Revised: Monday, June 29th, 2026

Abstract
This paper explains how to understand the concept of Krakatoa by way of positive infinity.

Keywords: #krakatoa #universe #infinity #darkmatter #whitelight #planets #helios #origin #worlds #life #existence

Introduction
The Big Bang is creation in outer space. Hydrogen and Carbon are essential to create electric life. The Big Bang Theory, on other hand, is something very different.

Different in that, it is a placeholder for infinite destruction in outer space.

In other words, The Big Bang is creation and The Big Bang Theory is not.

Background
Archaic lingo in the realm of something like Latin can surmise words such as Krakatoa.

Krakatoa can render dark or light; light and dark; dark and light; and light or dark.

Methods
An application of multivariate regression analysis for astrophysics with the irrational infinite of Pythagoras, the irrational infinite of Euler, the irrational infinite of Euler (again), and the positive rational infinite of infinity. In pictorial form, the visual below illustrates this. Please see Table 1 in the Results section.

Results

Input	
pi	pythagoras
euler	euler
euler	euler
k	positive infinity

Table 1. *The Raw Input for the Concept of the Universe in the Astrophysics World*

After Dr. Brian Edward Cox, reached out to Ms. Patricia Ibeth Vargas, she hand-wrote the following onto a purple Post-It during the Autumn season of 2025.

Post-It	
Purple	"How to Disprove the Big Bang Theory"

Table 2. *An Application of Multivariate Regression Analysis for Astrophysics*

Given Ms. Vargas had a concept of psychology, she was able to acknowledge her living environment to the best of her abilities. A recollection of primary school, secondary school, community college, and university permitted the following 10 astrophysics re-discoveries.

Conceptual Physics Finds Defined	
Unique Re-Discovery of the Autumn Season of 2025	Positive Infinity is the Radius of the Universe ("The Inflationary Multiverse")
Unique Re-Discovery of the Autumn Season of 2025	Helios continues to shine anew
Unique Re-Discovery of the Autumn Season of 2025	Black Holes need their two Worm Holes to be thy Black Holes
Unique Re-Discovery of the Autumn Season of 2025	Pluto is a vital planet
Unique Re-Discovery of the Autumn Season of 2025	Planet Mars works very well with Planet Pluto
Unique Re-Discovery of the Autumn Season of 2025	Life beyond Pluto, continues to exist
Unique Re-Discovery of the Autumn Season of 2025	Alternate and Parallel Worlds, continue to exist
Unique Re-Discovery of the Autumn Season of 2025	Even more life continues to exist between the Alternate and Parallel Worlds
Unique Re-Discovery of the Autumn Season of 2025	The dark is the air and, in some way, the light
Unique Re-Discovery of the Autumn Season of the 2025	Infinite Destruction cannot be Infinite Destruction, Infinitely

From these 10 re-discoveries we can re-verify the definition of quack.

Quack? Quack is a professional researcher who will accept false findings to continue to be acknowledged as a professional researcher.

In other words, to embrace that The Milky Way is not elliptical is quite a novel finding, especially to define ellipse after introducing one of its definitions.

The word ellipse means forever. The word ellipse also means a shape that is round without corners, without a perfect radius---a shape with a focii.

Focii, a plural for the word focus. And so now we shall focus on the light that this archaic language has permitted to re-see, to see anew.

Conclusion & Implications
In conclusion, Krakatoa is a very old way of saying "The Big Bang Theory." So old that we perhaps see even more light anew.

More light anew like the origin of the Universe—Helios. Very different from the words Sun. An origin for the Universe. A way of saying bright, sedentary, twinkling light—for The Milky Way to continue to exist.

Just as Latin and Greek continue to exist.

Acknowledgements
The Russians, the Prussians, the Antarctic; the Africans, the Afrikkans, Africa; the Asians, thee Asians, Asia; the Oceans, the Oceania, Australia; the Northerners, the North, North America; the Southerns, the South, South America; and the English, thee English, Europe.

The entire globe of planet Earth. Some continents—six out of seven with parallelism; and with a love for an ear for tectonic plate movement so that the core of planet Earth may continue to breathe in synch with an origin.

Thank you, sincerely to all my math teachers, inclusive of my father.

And thank you to all thy founding fathers of not only a nation but a field and fields (e.g., Sir Isaac Newton, Pythagoras, Rene Descartes, and so many more).

May the light that continues to shine bright from the heavens—en español conocido como los cielos, sigua brillando siempre pa todos los niños y toda la gente (may all the light from the heavens continue to be thy light from thee heavens for all).

Truly. The Big Bang — a concept taught during primary school to thy child Patricia Ibeth Vargas with permission of thy parents after thy child was prompted to communicate with thy mother so that a proper majority voice could be reached. May The Big Bang always outweigh Krakatoa.

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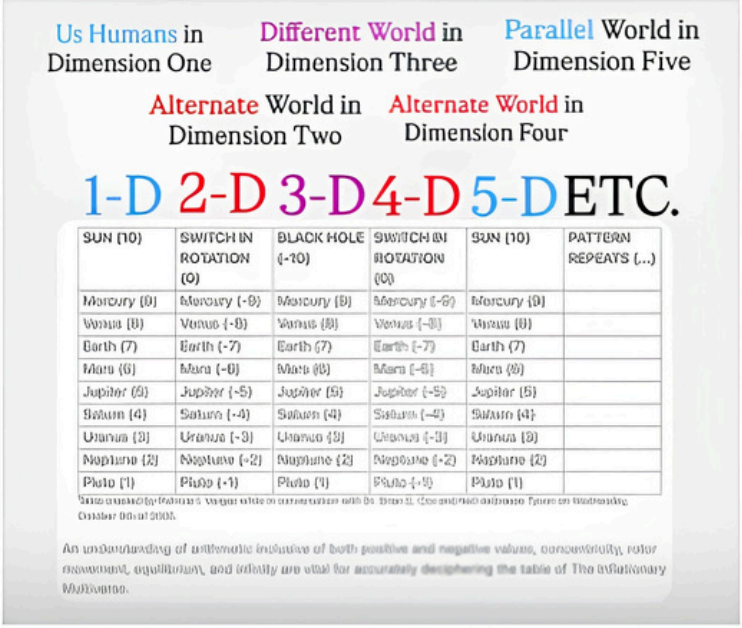
Vargas, P.I. (2025). What Most Affects the Probability of Receiving Public Assistance? Examining the Effect of Family Background and Educational

Attainment on Receiving Public Assistance with Multivariate Regression Analysis. In American Statistical Association of the 2021 Joint Statistical Meeting. 2098-2110.

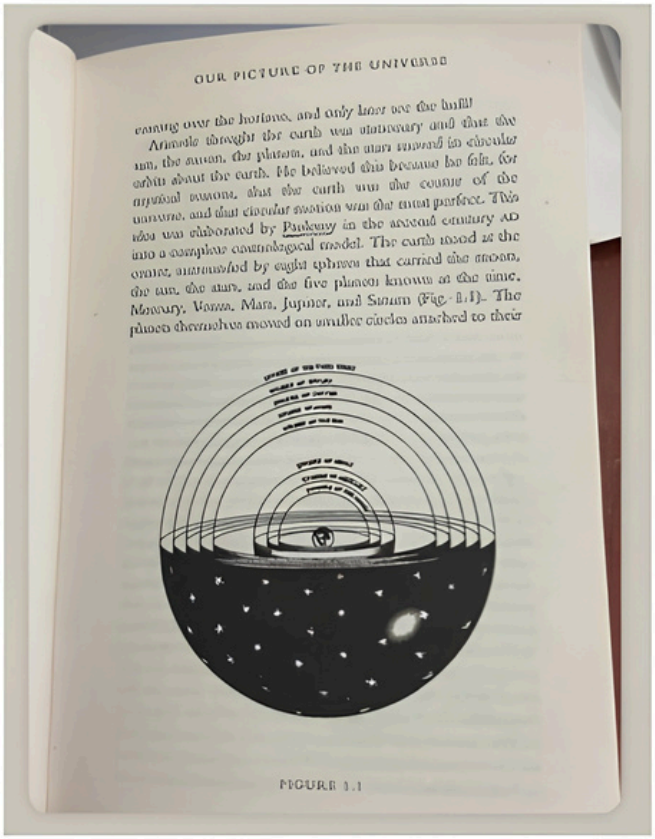
APPENDIX

#krakatoa #universe #infinity #darkmatter #whitelight #planets #helios #origin #worlds #life #existence

Some keywords above to verify that I usually write well when allowed to rough draft for the sake of transcribing what ideas are flowing so that my attempt at a rough draft can be a not too shabby final draft. Thank you Romero (my secondary school English Language Arts teacher), thank you Ms. Hill (just one of my many incredible primary school teachers). Thank you mom. Thank you my beautiful Ms. Vargas (my sister-in-law). Thank you Mr. Vargas (my younger brother and father). Thank you Dr. Cox (my forever, one and only husband); and thank you anyone and everyone who identifies with any of the above sentiments and thoughts. Truly though. Thank you. Truly.



Visual in color created by Patricia I. Vargas while in conversation with Dr. Brian E. Cox via Instagram on Thursday, December 4th, 2025.



Annotated photograph provided by Astrophilesz via Instagram on Saturday, June 14th, 2025.



Image 1. META generated animated visual (screenshot) prompted by a synthesis of the above (this paper).

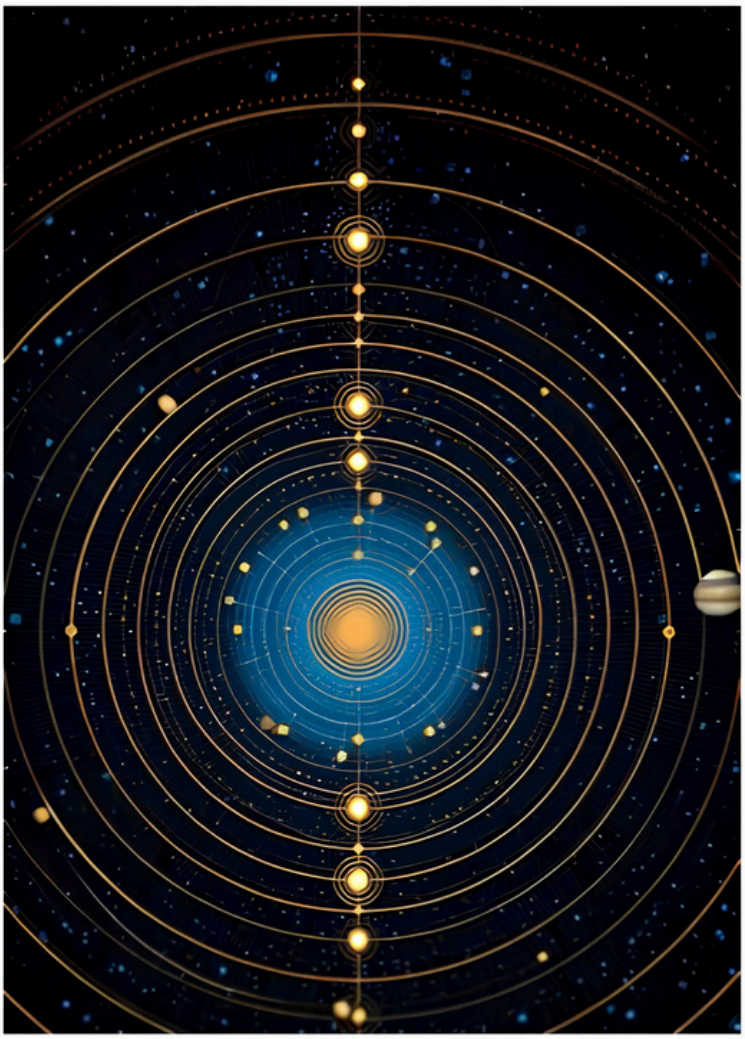


Image 2. META generated animated visual (screenshot) prompted by a synthesis of the above (this paper).

LEGAL CITATION
Cox, B.E. and Cox, P.I. (2026). The Big Bang Theory: Krakatoa. In National Aeronautics and Space Administration of Open Science. Washington, DC: National Aeronautics and Space Administration. 1-7. DOI: 10.17605/OSF.IO/3V8YE.

An Analysis of the “Smell-o-Meter by Sophie”: Smells Even Better

An Analysis of the "Smell-o-Meter by Sophie": Smells Even Better

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Patricia I. Cox
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Original: Wednesday, July 15, 2026
Revised: Wednesday, August 12, 2026

Keywords: #hygiene #iss #internationalspacestation #modules #environment #teamwork #astronauts #cosmonauts #analysis

Abstract

This short science write communicates an analysis of the "Smell-o-Meter by Sophie" created and reported on Monday, July 13th, 2026 from the International Space Station (ISS). Our sample size is that of one, while our population was that of 7 (n=1, N=7). European Space Agency (ESA) Astronaut Sophie Adenot created a non-lichter data collector. National Aeronautics and Space Administration (NASA) Citizen Science contributor Patricia I. Cox analyzed Adenot's non-lichter data collector. Cox found Adenot's "neutral" (i.e., 0.50) to be "more of a neutral" (0.363636...). In short, the ISS is smelling even better.

Introduction

Just like the history of the black plague matters for people on Earth, the lived experiences of cosmonauts and astronauts aboard the International Space Station (ISS), too, matters.

Background

Historical figures such as Christopher Columbus (1492) remind us of the importance of trickling down lived experience. Thanks to collaborative teamwork, Columbus's expedition sponsored by the crown was carried out and the concept of map and globe continues to exist.

Methods

A quantitative analysis of the "Smell-o-Meter by Sophie" (2026) (i.e., values attributed to a non-lichter scale, whereby "non-lichter scale" means "not five categories") was applied.

Results

Qualitative results:

> Sophie Adenot: "So as a conclusion, the ISS does not smell bad, does not smell good, it smells really neutral in most of the places"

> Patricia I. Cox: "At the quantitative level, the ISS smells better than neutral =)"

Quantitative results:

Our sample size is 1 and our population is 7 (n=1, N=7).

None: 0.00000...
Light: 0.33333...
Medium: 0.66666...
Strong: 0.99999...

Smell-o-Meter Raw Data with Ratio Value Attributed

ISS Location	Intensity	Description	Ratio
Airlock	Medium	"LIKE BURNT METAL ONLY AFTER EVAs"	**0.66666...**
Hygiene Area (aka the shower in Japanese Module JLP)	Medium	"LIKE LAVENDER SOAP"	**0.66666...**
Columbus Module	None	"NEUTRAL"	**0.00000...**
Location where we put our trash in PMM	Light	"LIKE A TRASH =(THAT HAS BEEN FORGOTTEN IN A HOME FOR 15 DAYS"	**0.33333...**
Cupola	None	"NEUTRAL"	**0.00000...**
Veggie Facility	Strong	"LIKE EARTH <3"	**0.99999...**
Urine recycler in NODE 3 aft	Light	"LIKE DOG PEE UNDER A BRIDGE (ONLY WHEN SYSTEM IS ACTIVE)"	**0.33333...**
WHC (the toilets!)	None	"NEUTRAL"	**0.00000...**
Node 1 Kitchen Area	Medium	"TASTY FOOD =)"	**0.66666...**
Storage (with our biking shoes) (inside the Lab module, close to CEVIS)	Light	"LIKE A GYM LOCKER ROOM (CYCLING SHOES)"	**0.33333...**

My crew quarters	Light	"LIKE THE MAN I LOVE <3 (HIS T-SHIRT WAS SENT AS A SURPRISE)	**0.00000...**

The average: 4.00000... / 11 = 0.36

—|0.36363...
11|4.00000
|33
|070
|066
|0040
|0033
|00070
|00066
|000040

Sophie Adenot: "So as a conclusion, the ISS does not smell bad, does not smell good, it smells really neutral in most of the places"

Patricia I. Cox: "At the quantitative level, the ISS smells better than neutral =)"

Conclusion & Implications
In conclusion, the "Smell-o-Meter by Sophie" is incredible. It renders irrationals. Why? Because it is not on the lichter scale (i.e., the categorical options for thy smell are four). The concept of a lichter-scale (i.e., five categorical options) renders your true 100. In other words, once an absolute zero is established results will be rendered true.

For additional examples of data analyses that render a 100 contingent upon an absolute zero, feel welcome to read additional Science, Technology, Engineering, and Mathematics (STEM) papers noted in the references section of this paper.

Acknowledgements
Thank you to all parents, teachers, and professors who continue to share their talents, passions, and gifts with the world.

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Appendix

Mental math. The probability of thy average being an irrational was very likely from a mathematical perspective given the "Smell-o-Meter by Sophie" is on a non-lichter scale.

Please see next page for revised data visualizations rendering such lovely irrationals with a concept of mu, rho, and data standardization. Forgot to type the last 0.00 on Figure 1, thank goodness raw data (Figure 2) cannot lie. Also. Confirmed the absolute "0.00000..." to be "NONE." Thank you for reading this far. Raw data, cannot lie. Hence, may we continue to not lie.

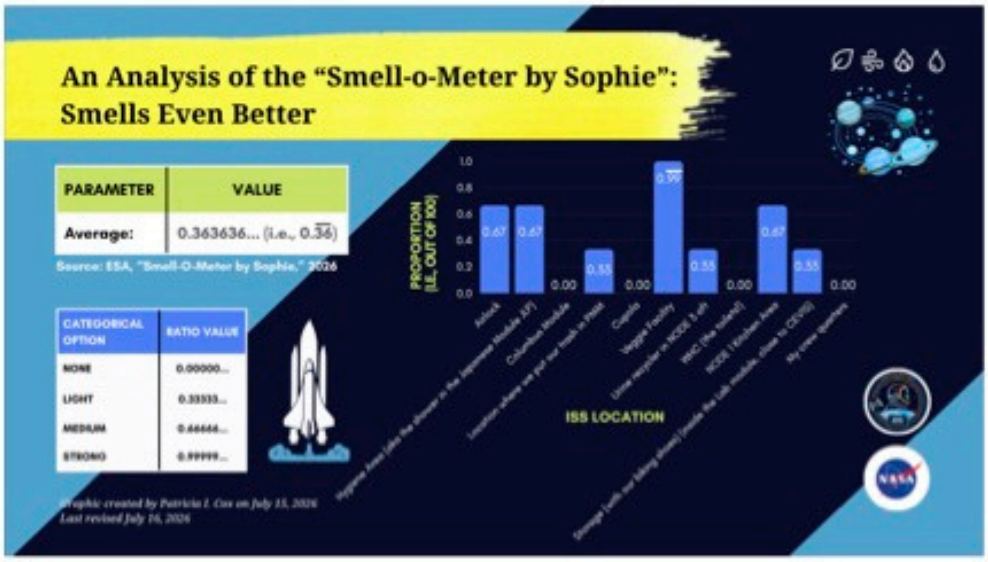

Figure 1. Results in data visualization format



Figure 2. Raw data in data visualization format

LEGAL CITATION

Cox, B.E. and Cox, P.I. (2026). An Analysis of the "Smell-o-Meter by Sophie": Smells Even Better. National Aeronautics and Space Administration of Open Science. Washington, DC: National Aeronautics and Space Administration. 1-5.

An Analysis of “Cooking by Jessica”: Eukaryotic

An Analysis of "Cooking by Jessica": Eukaryotic

Brian E. Cox
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Patricia I. Cox
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Original: Monday, August 17, 2026
Re-typed: Saturday, August 22, 2026

Abstract
This short write postulates that after The Big Bang, the first cell on planet Earth that bloomed is that of the eukaryotic cell rather than that of the prokaryotic cell. For this short science write, we justify this postulate by way of mathematics with a consenting participant within an American schooling system in the United States of America. After quite the rho (i.e., our average of our Los Angeles Unified School District [LAUSD] sample)—i.e., about 20 years—we can proved quite the potential to develop critical thinking skills. In short, to educate—parent, teach, professor—is an incredible team effort. By the way, this short science write was prompted by more qualitative (rather than quantitative) data shared by the National Aeronautics and Space Administration (NASA), "Cooking with Jessica" (2026).

Keywords: #family #logic #light #philosophy #love #science #lifescience #k12education

Introduction

The Big Bang is a concept perhaps mastered most by our average atheist. While our average non-atheists may not master all elements of creation (The Big Bang), some of our average non-atheists may master that the Big Bang is creation...in outer space.

When we continue to focus on the topic of creation, we can imagine what creation may have been on planet Earth after The Big Bang.

What came first—the eukaryotic cell or the prokaryotic cell? What was our consenting participant in an American schooling system in the United States of America taught by her teacher of biology?

Read on to find out about some of this non-attrition science.

Background

To clarify what non-attrition science is, a definition of attrition is shared here.

Attrition is academic vocabulary within the field of psychology that communicates when a participant (formerly known as a subject, and even more formerly known as a specimen) is no longer participating in a research study.

In the field of mathematics, this could be equated to not knowing what L'Hospital is.

L'Hospital is academic vocabulary within the field of mathematics that communicates when a student and life-long learner of mathematics can paint principle.

Methods
A primary and secondary concept of L'Hospital—that is an introduction to not only zero and the positive infinity but the negative infinity prior to secondary school.

Results
After the quite the number of years, our consenting participant continues to remember and continues to learn within their group (i.e., the family).

What came first the prokaryotic cell or the eukaryotic cell? The eukaryotic cell.

What came first the prokaryotic cell or the eukaryotic cell? The eukaryotic cell.

What was our consenting participant in an American schooling system in the United States of America taught by her teacher of biology? The opposite.

And so perhaps, students and life-long learners of mathematics are all quite unique. This consenting participant in an American schooling system in the United States of America applied logic to rationalize why her teacher of biology was perhaps cleverly communicating why it was impossible for the first cell to bloom on planet Earth to be that of the eukaryotic cell.

Conclusions & Implications
Eukaryotic cells—quite the life of the cell party. For after the eukaryotic cell, the prokaryotic cell arrived, and then the amoeba.

Acknowledgements
If I may, my favorite Big Bang is my husband, Dr. Brian E. Cox. Thank you for re-kindling this inner light to the perpetual and purposeful. I love you baby.

Thank you to all our National Aeronautics and Space Administration (NASA) astronauts and astronaut families—our good guys.

Thank you to all my Los Angeles Unified School Teachers (LAUSD), including Mrs. Paulsun, my ninth grade teacher of biology.

Thank you to my immediate family—my mom, my dad, my brothers, and my historically neighboring cousins.

Additional related NASA papers in the references section.

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Appendix



Screenshot 1 of 2 of "Cooking with Jessica" audiovideo posted on Instagram by NASA Astronaut Anil Mennon (n=2, N=7)



Screenshot 2 of 2 of "Cooking with Jessica" audiovideo posted on Instagram by NASA Astronaut Anil Mennon (n=2, N=7)

Legal Citation

Cox, B.E. and Cox, P.I. (2026). An Analysis of "Cooking with Jessica": Eukaryotic. National Aeronautics and Space Administration of Open Science. Washington DC: National Aeronautics and Space Administration. 1-5

The Big Bang:
Creation in Outer Space

The Big Bang: Creation in Outer Space

Brian E. Cox
University of Manchester

Patricia I. Cox
Oregon State University

Original: Saturday, August 22nd, 2026
Revised: Sunday, September 13th, 2026

Abstract
This short science write communicates the three elements that capture the concept of The Big Bang: Hydrogen, Carbon, and Helium. Approximately between 2001 and 2002, the concept of The Big Bang was taught to a pupil of the Los Angeles Unified School District (LAUSD). Approximately between 2025 and 2026, this pupil of LAUSD tuned into astrophysics conversations from her social location and wondered why The Big Bang was not being taught by way of the three elements. In an effort to contribute Citizen Science, she reached out to Dr. Brian E. Cox to re-kindle astrophysics conversation in 2025. In short, perhaps one of the best things we can remember is that parents, teachers, and professors most likely best parent, teach, and professor as a team with a concept of family dynamics (2026).

Keywords: #thebigbang #creation #creationinouterspace #chemistry #alchemy #science #physics #astrophysics #k12education

Introduction

This short science write re-affirms that "Hydrogen and Carbon are essential to creation for electric life" (Cox and Cox 2026). Much like the electron can create quite the life (e.g., the fruit fly) on planet Earth, so can Hydrogen, Carbon, and Helium within an ocean of dark matter.

Dark matter is something that can cycle itself back into the Inflationary Multiverse (Cox and Vargas 2025).

Background

The Inflationary Multiverse is perhaps the latest terminology within the astrophysics world to communicate "Universes within the Universe" (Cox and Vargas 2025). In short, not just spiral about an origin (i.e., Helios). In place of spiral, alternating sets of concentric circles that ensure an existence of Helios,

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto (Cox and Vargas 2025).

Methods

By way of fossilized memories and logic, we can continue to spark creativity for something such as The Big Bang (LAUSD 2010; Cox and Cox 2026).

Results

The Big Bang continues to be remembered, cherished, and recalled for the purpose of public learning and re-learning (teaching and re-teaching; professoring and re-professoring). About 24 years later, a pupil of LAUSD continues to voice that The Big Bang is "creation...in outer space" and that "Hydrogen and Carbon are essential to creation for electric life" (Cox and Cox 2026). She reaffirms that The Big Bang from the perspective of an alchemist is inclusive of Hydrogen, Carbon, and Helium. Hydrogen, Carbon, and Helium in an ocean of dark matter for creation in outer space.

Conclusions & Implications

Our outer space experts (e.g., the National Aeronautics and Space Administration [NASA]) continue to remind us that The Big Bang is creation in outer space over thousands of years ago. Relative to a year of 2026, perhaps "13.8 billion years" ago (NASA 2026; Cox and Cox 2026).

Acknowledgements

Thank you to all our astronauts, all our science experts, all our astro-families and all our life-long learners of quite the celestial world(s).

Thank you to our immediate families, our parents, our teachers, our professors, and all who guide us from near and far.

May we continue to work together as a team with a continued concept of family dynamics.

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Appendix

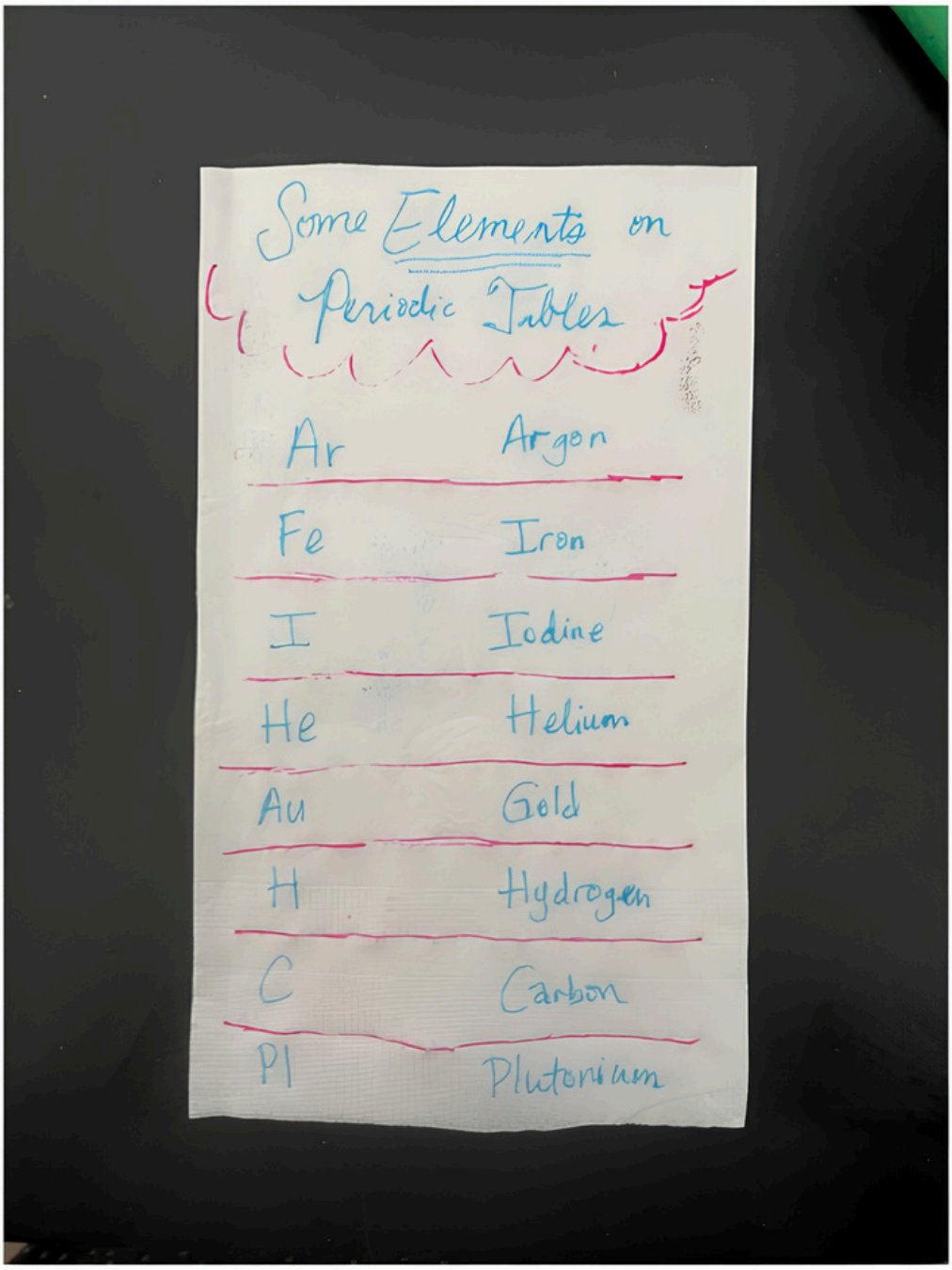

Photo (1 of 3) communicating continued appreciation, cherishing, and love for The Big Bang by way of creativity on April 14, 2026

Appendix (continued)

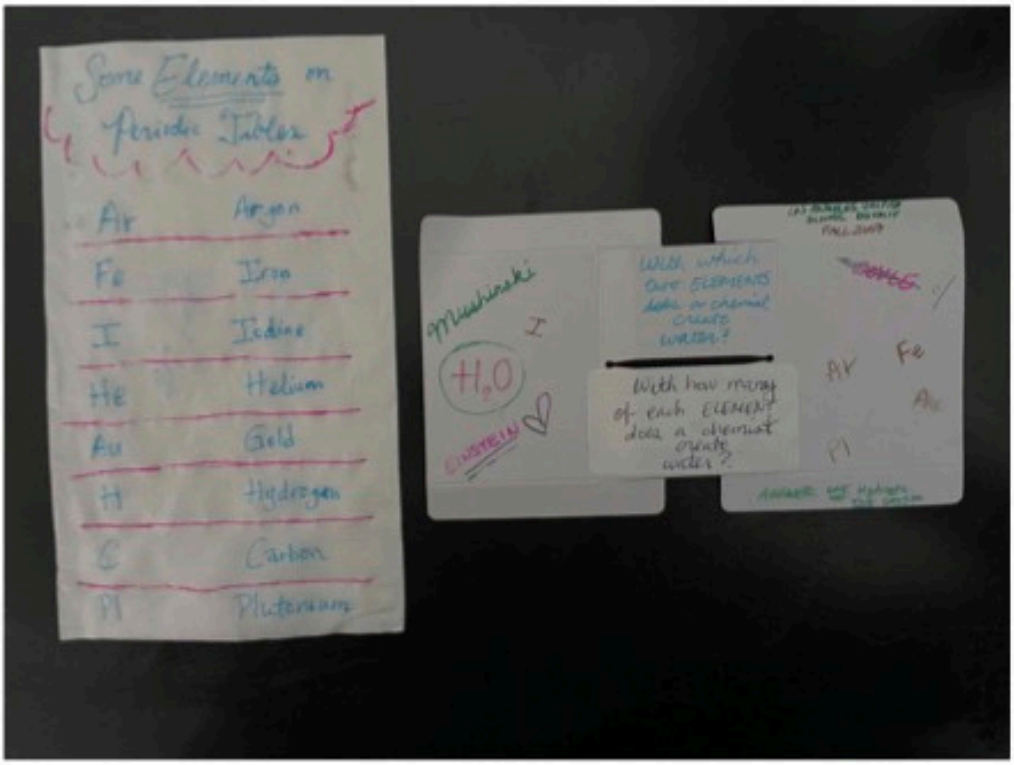

Photo (2 of 3) communicating continued appreciation, cherishing, and love for teachers of chemistry on April 14, 2026

Appendix (continued)

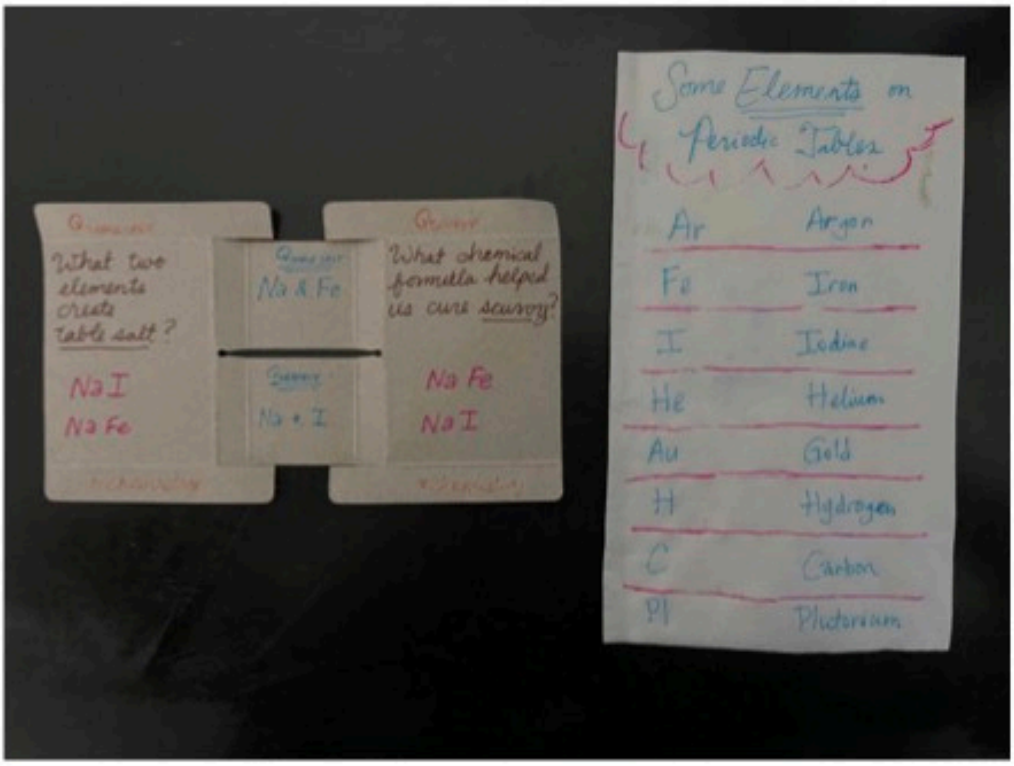

Photo (3 of 3) communicating continued appreciation, cherishing, and love for teachers of chemistry on April 14, 2026

Legal Citation

Cox, B.E. and Cox, P.I. (2026). The Big Bang: Creation in Outer Space. In National Aeronautics and Space Administration of Open Science. Washington, DC: National Aeronautics and Space Administration. 1-7

An Analysis of “Cleaned Windows by Jack Hathway”: Very Clean Math

An Analysis of "Cleaned Windows by Jack Hathaway": Very Clean Math

Brian E. Cox
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Thursday, September 17th, 2026

Abstract
This short science write applies mathematics to qualitative data from the International Space Station (ISS) to yield values for, and quantitative meaning to, "Cleaned Windows by Jack Hathaway" (Menon 2026). A concept of 360 and patterns of three helps us figure out the angles that open and close windows in the cupola. Thirty-degrees to open windows in the cupola and 120-degrees to close windows in the cupola. These values affirm the 90-degree angle it takes to move from the y-axis (i.e., x = 0) to the x-axis (i.e., y = 0). With our delta close and open (i.e., 120-degree and 30-degree) being 90 (i.e., 90-degree), we see very clean math in "Cleaned Windows by Jack Hathaway" (2026).

Keywords: cupola, windows, iss, international space station, teamwork, math, mathematics, angles, light, science

Introduction

The International Space Station (ISS) works with five federal space agencies: Roscosmos; National Aeronautics and Space Administration (NASA); European Space Agency (ESA); Canadian Space Agency (CSA); and Japan Aerospace Exploration Agency (JAXA) (Cox and Cox 2026).

Seven cosmonauts and astronauts work together during missions at least eight-months in length. Including Extravehicular Activity (EVAs) (i.e., spacewalks), there are 12 ISS locations (Cox and Cox 2026). Among the dozen is the cupola.

Background

The cupola is known for its ability to welcome extremes—darkening depths of dark matter and blinding brights of white light. How? With welcoming windows.

Working these very windows is then crucial. On Thursday, September 17th, 2026, NASA SpaceX Crew-12 (i.e., Roscosmos Cosmonaut Andrey Fedyaev, NASA Astronaut Jack Hathaway, NASA Astronaut Jessica Meir, and ESA Astronaut

Sophie Adenot) and ISS Expedition 75 (i.e., NASA Astronaut Anil Menon, Roscosmos Cosmonaut Pyotr Dubrov, and Roscosmos Cosmonaut Anna Kikina) demonstrated cleaned cupola windows from aboard the ISS.

What values may capture cleaned windows and what might this mean?

Methods

An application of mathematics to qualitative data welcomes values that can be further analyzed for a then qualitative result—in short, mixed methods.

Results

Qualitative:

Andrey Fedyaev: "What is it?"
Sophie Adenot: "It is clean. Windows are clean..."

Patricia I. Cox: "It is very clean. Very clean math :-)"

Quantitative:

A 90-degree angle will open the cupola window such that we move from the y-axis (i.e., $x = 0$) to the x-axis (i.e., $y = 0$).

"Cleaned Windows by Jack Hathaway" (Menon 2026) communicates "CLOSED or 120-degrees OP," as well as "FULL OP or 30-degrees OP."

In other words, 30-degrees will open the cupola window and 120-degrees will close the cupola window.

True enough, 30-degrees plus 90-degrees yields 120-degrees. And a retraction of 120-degrees will, again, close the cupola window.

Mathematically, delta close and open (i.e., 120-degrees minus 30-degrees) yields 90 (i.e., 90-degrees).

Conclusion & Implications

One-quarter of 360, 90. One-third of 90, 30. And so 30, 60, 90, and so forth remind us of the patterns of three.

These patterns of three within our concept of 360 give us the values for which the cupola window opens (i.e., 30 as in 30-degrees) and the cupola window closes (i.e., 120 as in 120-degrees).

And so "What is it?" "It is clean. Windows are clean..." Very clean, with "very clean math"!

Acknowledgements
We share our thanks with all who continue to interact with us both near and far. May this short science write have sparked smiles and perhaps even curiosity for any and all "very clean math."

With all the love, passion, and joy for Science, Technology, Engineering, and Mathematics (STEM), happiness from your friendly (husband-and-wife) scientists, Brian and Patty.

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Appendix



Screenshot (1 of 4) of "Cleaned Windows by Jack Hathaway" audiovideo posted on Instagram by NASA Astronaut Anil Menon (n=4, N=12)

Appendix (cont'd)



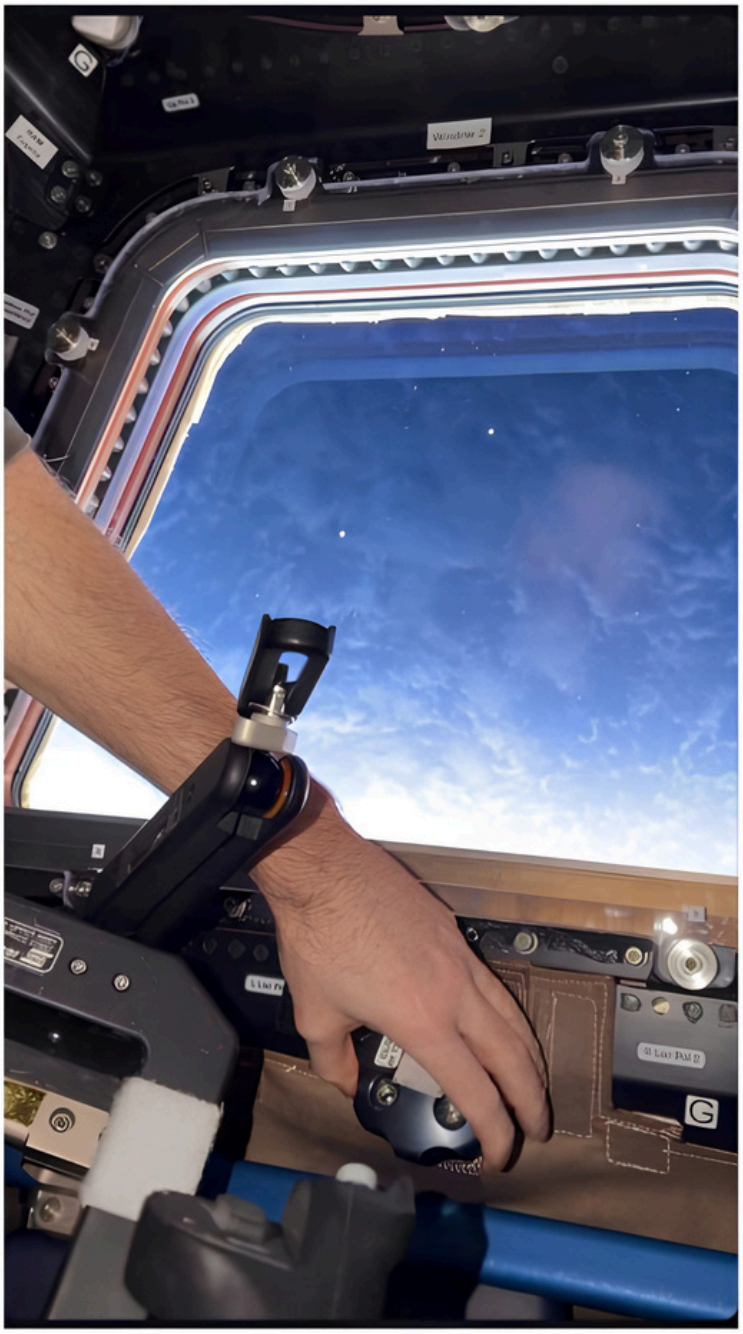
Screenshot (2 of 4) of "Cleaned Windows by Jack Hathaway" audiovideo posted on Instagram by NASA Astronaut Anil Menon (n=4, N=12)

Appendix (cont'd)



Screenshot (3 of 4) of "Cleaned Windows by Jack Hathaway" audiovideo posted on Instagram by NASA Astronaut Anil Menon (n=4, N=12)

Appendix (cont'd)



Screenshot (4 of 4) of "Cleaned Windows by Jack Hathaway" audiovideo posted on Instagram by NASA Astronaut Anil Menon (n=4, N=12)

Legal Citation

Cox, B.E. and Cox, P.I. (2026). An Analysis of "Cleaned Windows by Jack Hathaway": Very Clean Math. In National Aeronautics and Space Administration of Open Science. Washington, DC: National Aeronautics and Space Administration. 1-9

A Mathematics and Physics Analysis of NASA Roman Relative to NASA Hubble by First Image: More Images, More Pixels, More Layers, and More Stars with Combined Dark Matter and Dark Energy within 3.84 Percentage Points of 95

A Mathematics and Physics Analysis of NASA Roman Relative to NASA Hubble by First Image: More Images, More Pixels, More Layers, and More Stars with Combined Dark Matter and Dark Energy within 3.84 Percentage Points of 95

Brian E. Cox
University of Manchester

Patricia I. Cox
Oregon State University

Original: Sunday, September 20th, 2026
Revised: Tuesday, September 29th, 2026

Abstract
This paper analyzes the first image taken by the Edwin P. Hubble Space Telescope (i.e., Hubble or NASA Hubble) launched in 1990 with the first image taken by the Nancy Grace Roman Space Telescope (i.e., Roman or NASA Roman) launched in 2026 (NASA 2026; Dooren 2026; Gainor 2020: 1). Moving from the first image taken by Hubble on Sunday, May 20th, 1990 to the first image taken by Roman on Tuesday, September 15th, 2026, high frequency surfaces as a pattern: more images, more pixels, more layers, and more stars. As we apply mathematics to such qualitative data from the National Aeronautics and Space Administration (NASA), we can welcome physics to explore dark matter and dark energy. Perhaps dark matter and dark energy are solid particles and non-solid particles, respectively (Cox and Cox 2026; Vargas 2021; Cox 1998). Perhaps NASA Roman images past our first image may soon elucidate. For now, what is more certain is the first image of NASA Roman (2026) and the first image of NASA Hubble (1990) both appear to affirm the latest reported statistical mu for dark matter and dark energy combined (i.e., 95-percent) at 91.16-percent and 98.34-percent, respectively—and so may both astronomy and astrophysics conversations continue to flourish.

Keywords: dark matter, dark energy, roman, nasa, hubble, space telescope, math, mathematics, physics, astrophysics, astronomy, k12education, university

Introduction

The National Aeronautics and Space Administration (NASA) is the federal space agency of the United States of America. Working with several aerospace and

astrophysics experts from across the globe, NASA launched the latest space telescope to outer space on Sunday, August 30th, 2026—the Nancy Grace Roman Space Telescope (i.e., NASA Roman).

Among the NASA Roman community, space telescope conversations have surfaced to include other space telescopes in existence such as the Edwin P. Hubble Space Telescope (i.e., NASA Hubble).

What might the first image of NASA Roman look like relative to the first of image of NASA Hubble? A question for curiosity pondered and analyzed with mathematics and physics by husband-and-wife scientists, Brian E. Cox, PhD and Patricia I. Cox.

Background

The first image taken by NASA Hubble took place on Sunday, May 20th, 1990—i.e., 30-days after launch. (NASA Hubble launched aboard the Space Shuttle Discovery from the John F. Kennedy Space Center [i.e., NASA Kennedy] on Tuesday, April 24th, 1990) (Gainor 2020: 1, 63).

Fast forward 36 years, and the first image taken by NASA Roman took place on Tuesday, September 15th, 2026—i.e., 15-days after launch. (NASA Roman launched aboard Falcon Heavy from NASA Kennedy on Sunday, August 20th, 2026) (Dooren 2026; NASA 2026).

NASA Hubble and NASA Roman first images are thanks to the work of many. Lyman S. Spitzer, Jr. is credited with having started NASA Hubble, while Jamie Dunn is credited with having started NASA Roman (Gainor 2020: 9; NASA 2026).

Focusing on NASA Roman, the space telescope is managed primarily by the Goddard Space Flight Center (i.e., NASA Goddard) and Jet Propulsion Laboratory (i.e., NASA JPL). Following NASA Goddard and NASA JPL are Caltech/Infrared Processing & Analysis Center (IPAC); the Space Telescope Science Institute (STScI); and even more experts from a number of research institutions (Dooren 2026; Gainor 2020: xvi; California Institute of Technology 2026; NASA 2026).

"The primary industrial partners are BAE Systems Inc., L3Harris Technologies, and Teledyne Scientific & Imaging" (Dooren 2026).

Further, contributions to NASA Roman have been made by the European Space Agency (ESA), Japan Aerospace Exploration Agency (JAXA), the Centre National d'Études Spatiales (CNES), and the Max Planck Institute for Astronomy (Dooren 2026; Max-Planck-Gesellschaft 2026).

Building upon the written work of NASA's Jennifer M. Dooren, we learn that science experts abound. For example, in addition to their being a Max Planck Institute (MPI) for Astronomy there also exists an MPI for Astrophysics (Max-

Planck-Gesellschaft 2026). Perhaps astronomy focuses on the stars that light up against the backdrop of dark matter, while astrophysics focuses more on dark matter itself.

How might we know this? Perhaps through an application of science and mathematics—specifically, concepts within the field of physics (e.g., an Advanced Placement Physics class) and math (e.g., a Math Analysis class).

Methods

Both mathematics and physics are applied to this qualitative analysis (i.e., the first image of NASA Roman is compared and contrasted with the first image of NASA Hubble).

Results

Qualitative and Quantitative, Mathematics:

> Color, quantity, resolution, and picture-within-picture are the first words that came to mind upon seeing and analyzing the first image of NASA Roman (2026) with the first image of NASA Hubble (1990).

Upon first having seen and analyzed the first image of NASA Hubble on Sunday, August 30th, 2026, I admired the resolution, pixels, color, and number of light in spherical form being shown. Please see *Image 1* (left only) for the first image of NASA Hubble taken on Sunday, May 20th, 1990 (Belleville and Bolles 2023).

Upon first having seen and analyzed the first image of NASA Roman on Tuesday, September 15th, 2026, I admired the resolution, pixels, color, and number of light in spherical form being shown, again. This time in quite an incredibly, different way for all the more "logarithmic beauty." Please see *Image 2* for the first image of NASA Roman taken on Tuesday, September 15th, 2026 (Balzer 2026).

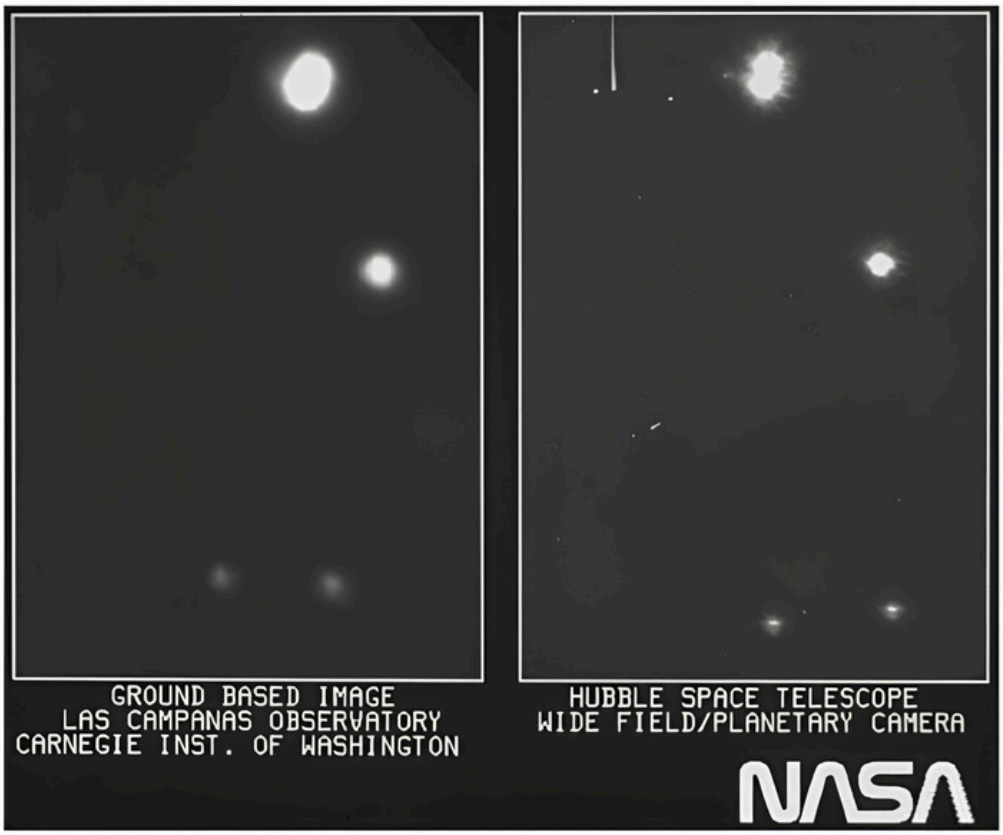


Image 1. First image and second image taken by NASA Hubble. First image taken by NASA Hubble on Sunday, May 20th, 1990 (left). Second image taken by NASA Hubble on Saturday, December 18, 1993 (right).

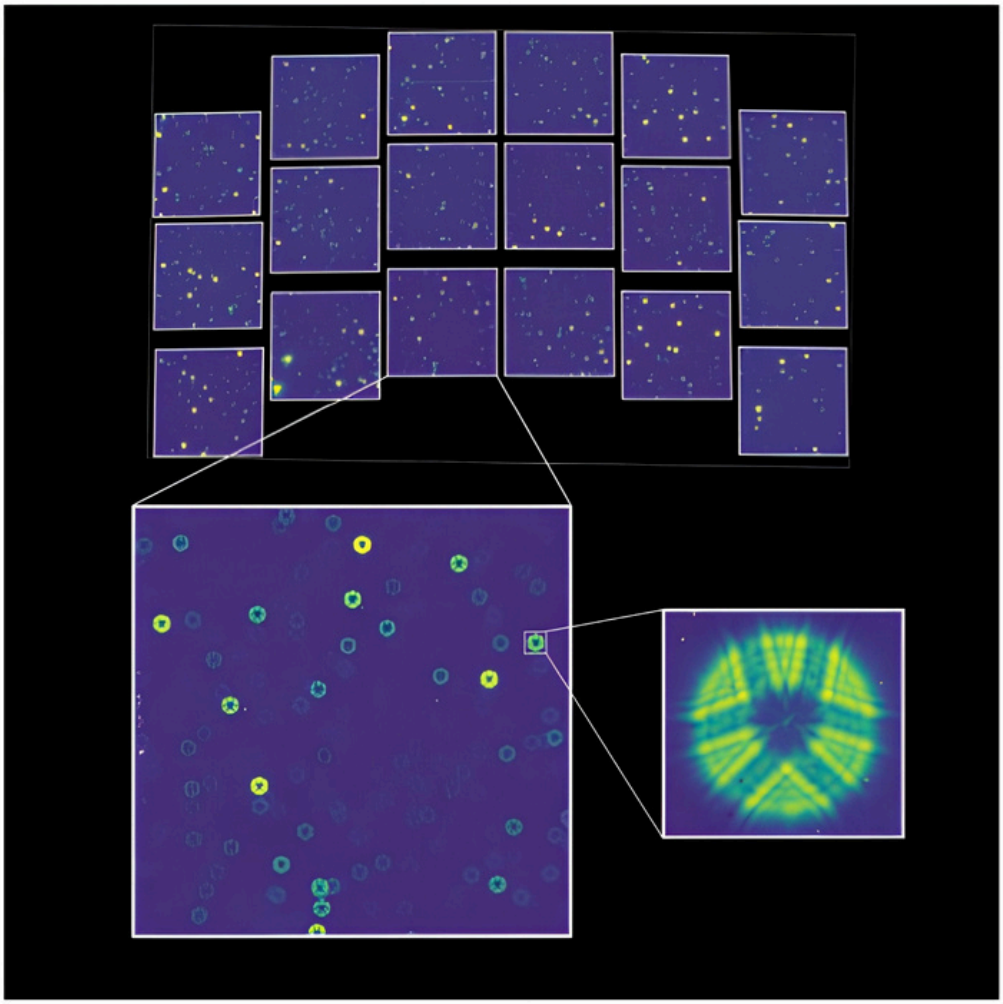


Image 2. First image taken by NASA Roman on Tuesday, September 15th, 2026.

Color — The first image of NASA Roman (2026) is in color, while the first image of NASA Hubble (1990) is in non-color (i.e., black-and-white). From a quantitive standpoint, the technology behind NASA Roman (2026) renders a first image in color because there are more layers present filtering the image (e.g., Red, Green, and Blue light) (Smithsonian Institute 2026). In other words, the technology behind NASA Hubble (1990) renders a first image of non-color (i.e., black-and-white) because there are less layers present in filtering the image (i.e., not Red, Green, and Blue light) (Smithsonian Institute 2026).

Quantity — The first image of NASA Roman (2026) has approximately 2,772 stars (i.e., light in spherical form) being shown to the human eye, while the first image of NASA Hubble (1990) has approximately four stars (i.e., light in spherical form)

being shown to the human eye. From a quantitative standpoint, the technology behind NASA Roman (2026) renders a first image with more stars present (approximately 2,768 more stars to be exact) than the technology behind NASA Hubble (1990) because there are more images being taken at the exact same time (17 more images to be exact).

Please see *Image 3* for the annotated first image of NASA Hubble taken on Sunday, May 20th, 1990 manually counting the number of stars (i.e., light in spherical form) in image.

We arrive at our approximation of four stars for our first image of NASA Hubble (1990) by manually counting the stars by region and summing these values.

We counted four stars across two regions of two and two. With our sum being four (i.e., two plus two), approximately four stars in the first image of NASA Hubble (1990) are perceptible to the human eye.

Further, please see *Image 4* for the annotated first image of NASA Roman taken on Tuesday, September 15th, 2026 manually counting the number of stars (i.e., light in spherical form) in one out of the 18 detectors. "The [NASA Goddard / Tyler Desjardins (Space Telescope Science Institute)] image...zooms into one detector and zooms again to a single star in the insets..." (Balzer 2026).

Thus, we arrive at our approximation of 2,772 stars for our first image of NASA Roman (2026) by manually counting the stars in the enlarged detector (region by region) and multiplying this value by the total number of detectors (i.e., 18).

We counted 154 stars in the enlarged detector across six regions of four, eight, 13, 69, 46, and 14 stars. With our sum being 154 stars, we multiplied this value by 18, resulting in 2,772 stars. In other words, approximately 2,772 stars in the first image of NASA Roman (2026) are perceptible to the human eye—significantly more stars relative to NASA Hubble (1990)—specifically, approximately 2,768 more stars .

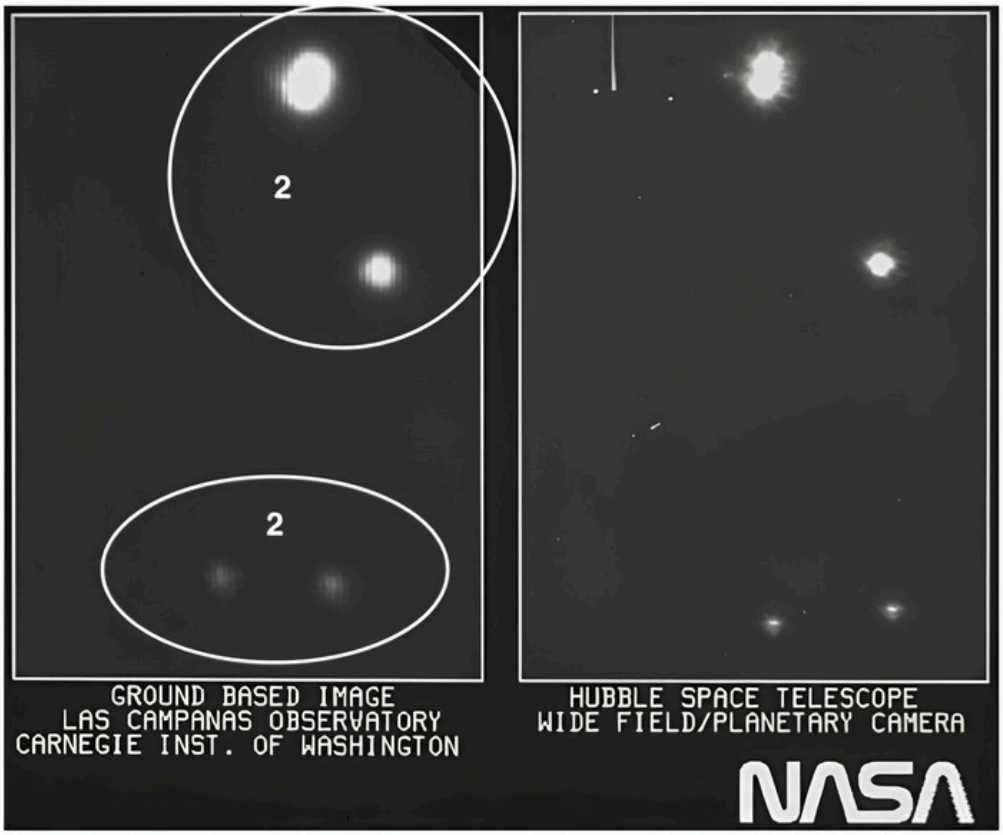


Image 3. Annotated first image taken by NASA Hubble on Sunday, May 20th, 1990. Annotated on Monday, September 21st, 2026 to approximate the number of stars in the first image of NASA Hubble (1990) perceptible to the human eye.

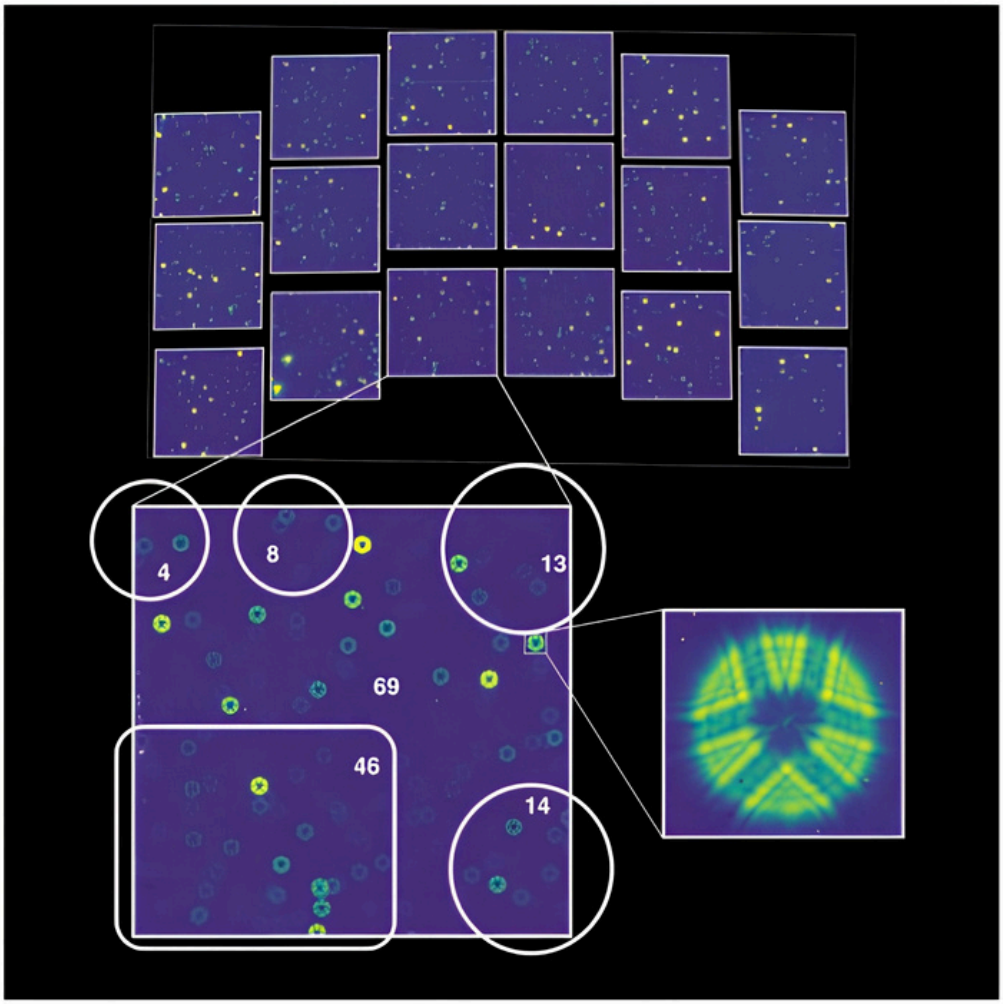


Image 4. Annotated first image taken by NASA Roman on Tuesday, September 15th, 2026. Annotated on Sunday, September 20th, 2026 to approximate the number of stars in the first image of NASA Roman (2026) perceptible to the human eye.

Resolution — The first image of NASA Roman (2026) has sharp resolution, while the first image of NASA Hubble (1990) has less-sharp resolution (i.e., pixelated resolution). From a quantitative standpoint, the technology behind NASA Roman (2026) renders a first image with sharper resolution than the first image of NASA Hubble (1990) with less-sharp resolution because there are more pixels in image.

Picture-within-picture — The first image of NASA Roman (2026) is a picture-within-picture (i.e., there is more than one picture within the image, 18 to be exact), while the first image of NASA Hubble (1990) is not a picture-within-picture (i.e., there is not more than one picture within the image). From a quantitative

standpoint, the technology behind NASA Roman (2026) renders a first image that is a picture-within-picture because there are multiple detectors (18 detectors to be exact) whereas the technology behind NASA Hubble (1990) renders a first image that is not a picture-within-picture because there are no multiple detectors (one detector only).

In short, the first image of NASA Roman (2026)—relative to first image of NASA Hubble (1990)—shines bright with color, quantity, resolution, and picture-within-picture capability.

Color (more layers), quantity (more stars), resolution (more pixels), and picture-within-picture (more images) for a resounding more images, more pixels, more layers, and more stars.

Qualitative and Quantitative, Physics:

Remembering that more stars means more light visible against dark matter (and dark energy), we can then apply physics for a more astrophysics perspective to our first image of NASA Roman (2026) relative to our first image of NASA Hubble (1990).

Color, Quantity, Resolution, and Picture-within-Picture — The first image of NASA Roman (2026) is a picture-within-picture with more than three high-resolution colors (e.g., purple, green, blue, yellow), while the first image of NASA Hubble (1990) is not a picture-within-picture (i.e., is one picture only) with two low-resolution colors (i.e., black and white). From a physics standpoint, the first image of NASA Roman (2026) illustrates the presence of dark matter and dark energy with the color purple, while the first image of NASA Hubble (1990) illustrates the presence of dark matter and dark energy with the color black (*Image 1* and *Image 2*).

The proportion of dark matter and dark energy (i.e., what is not a star) can thus be approximated with arithmetic and geometry by subtracting the area of light in spherical form (i.e., the area of stars) from the area of the whole image, and dividing this value by the area of the whole image.

For the first image of NASA Hubble (1990), the value for the area of light in spherical form (i.e., the area of stars) in the first image is approximately 4.5628125, while the value for the area of the whole image is approximately 274.3125. Therefore, the proportion of the presence of dark matter and dark energy (i.e., what is not a star) is 274.3125 minus 4.5628125 (i.e., 269.7496875), divided by 274.3125—resulting in 0.983366370472.

Please see *Image 5* for the annotated first image of NASA Hubble taken on

Sunday, May 20th, 1990 computing the proportion/percentage of the presence of dark matter and dark energy manually and with an eight-digit calculator.

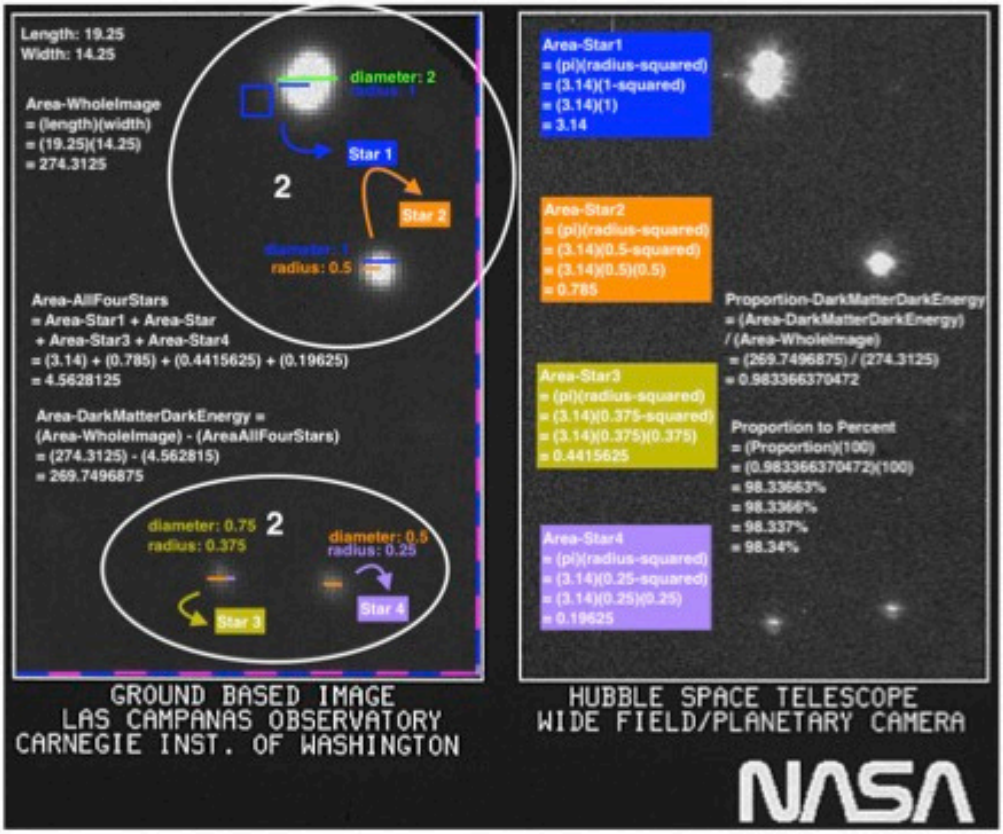


Image 5. Annotated first image taken by NASA Hubble on Sunday, May 20th, 1990. Annotated on Monday, September 21st, 2026 to approximate the proportion and percentage of the presence of dark matter and dark energy in the first image of NASA Hubble (2026) perceptible to the human eye.

Given the image of NASA Hubble (1990) is not a picture-within-picture (i.e., is one picture only), and given we approximated the number of stars to be four and all non-congruent (i.e., each with a different radius), the proportion of the presence of dark matter and dark energy (i.e., 0.983366370472) applies to our first image of NASA Hubble (1990) in full.

In other words, per these approximations computed manually and with an eight-digit calculator, about 98.34-percent of the first image of NASA Hubble (1990) is dark matter and dark energy.

This value, 98.34-percent, hovers closely to what physics and astronomy experts

with the University of Manchester report to be dark matter and dark energy combined: 95-percent (University of Manchester 2026). Further, we note dark energy appears to be the latest terminology being communicated within the astrophysics world to describe the absence of light when spoken in tandem with the more historic term, dark matter (Friday Night with Jonathan Ross 2010; Brill and Bolles 2025).

Pivoting from the first image of NASA Hubble (1990) to NASA Roman (2026), we continue our physics analysis by again, remembering that more stars means more light visible against dark matter (and dark energy). And again, while the first image of NASA Hubble (1990) illustrates the presence of dark matter and dark energy with the color black from a physics standpoint, the first image of NASA Roman (2026) illustrates the presence of dark matter and dark energy with the color purple (*Image 1* and *Image 2*).

For the first image of NASA Roman (2026), the value for the area of light in spherical form (i.e., the area of stars) in the enlarged detector is approximately 1.88890625, while the value for the area of the whole image of the enlarged detector is approximately 21.375. Therefore, the proportion of the presence of dark matter and dark energy (i.e., what is not a star) is 21.375 minus 1.88890625 (i.e., 19.48609375), divided by 21.375—resulting in 0.911630116959.

Please see *Image 6* for the annotated first image of NASA Roman taken on Tuesday, September 15th, 2026 computing the proportion/percentage of the presence of dark matter and dark energy manually and with an eight-digit calculator.

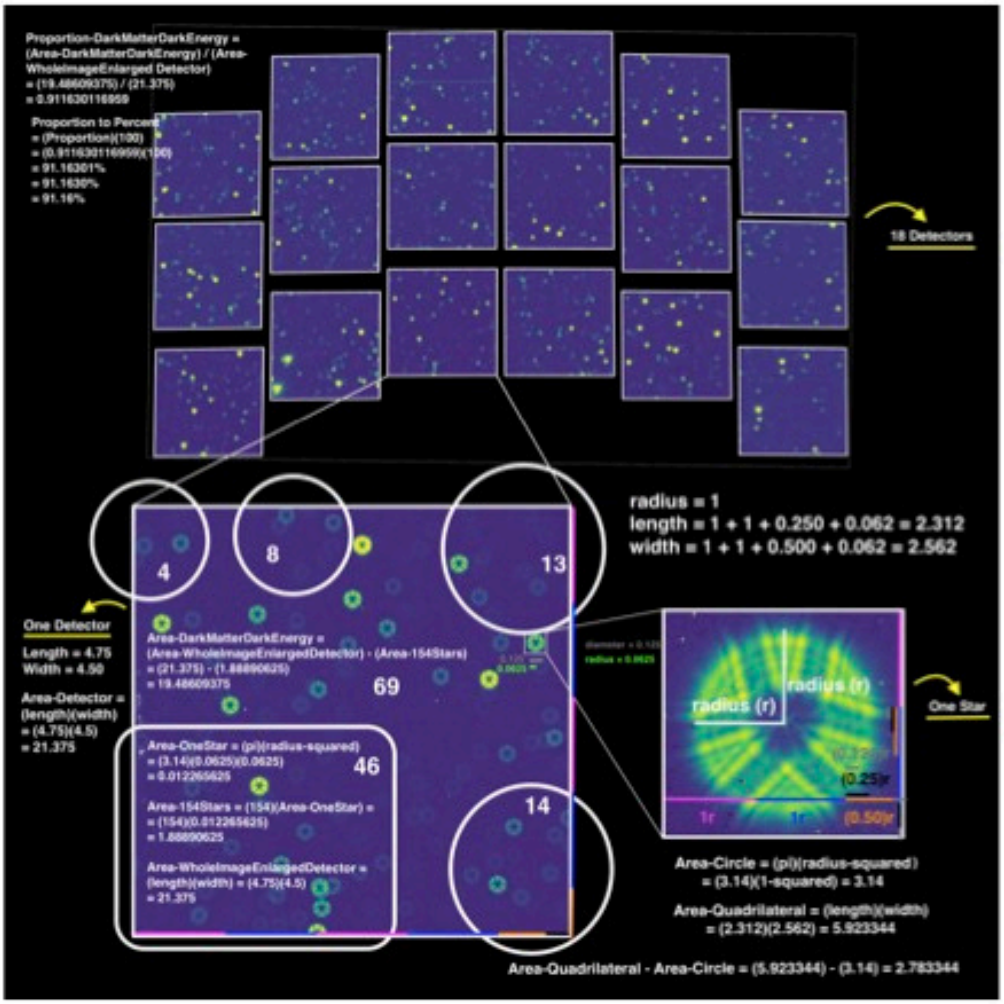


Image 6. Annotated first image taken by NASA Roman on Tuesday, September 15th, 2026. Annotated on Monday, September 21st, 2026 to approximate the proportion and percentage of the presence of dark matter and dark energy in the first image of NASA Roman (2026) perceptible to the human eye.

Given the images for all 18 detectors of NASA Roman (2026) are identical in dimension, and given we approximated the number of stars across all 18 detectors proportionally (by multiplying the number of stars in one detector by 18), the proportion of the presence of dark matter and dark energy (i.e., 0.91163011695906) applies to our first image of NASA Roman (2026) in full.

In other words, per these approximations computed manually, about 91.16-percent of the first image of NASA Roman (2026) is dark matter and dark energy.

This value, 91.16-percent, hovers closely to what physics and astronomy experts with the University of Manchester report to be dark matter and dark energy combined: 95-percent (University of Manchester 2026). And so dark energy appears to continue to stand as good terminology to communicate the absence of light when spoken in tandem with the term dark matter.

Taking the latest reported value for dark matter and dark energy combined (i.e., 95-percent) to be our statistical mu and applying Chi-square analysis concepts, the percentage point difference from this very mu is 3.34 for our first image of NASA Hubble (1990) and 3.84 for our first image of NASA Roman (2026) (University of Manchester 2026; Vargas 2020).

First Image of NASA Hubble (1990) Analyzed	**First Image of NASA Roman (2026) Analyzed**
Black-and-white (B&W)	Color
One picture	18 pictures
Low-resolution (less pixels)	High-resolution (more pixels)
About four stars	About 2,772 stars
Percent dark matter and dark energy combined: 98.34-percent (i.e., 3.34 percentage-points from latest reported 95-percent mu for dark matter and dark energy combined)	Percent dark matter and dark energy combined: 91.16-percent (i.e., 3.84 percentage-point difference from latest reported 95-percent mu for dark matter and dark energy combined)

Table 1. Summary table comparing and contrasting the first image taken by NASA Hubble on Sunday, May 20th, 1990 with the first image taken by NASA Roman on Tuesday, September 15th, 2026. Mathematics and physics applied to analyze NASA Hubble (1990) and NASA Roman (2026) comparatively by first image taken.

Further, we note dark energy appears to be the latest terminology being communicated within the astrophysics world to describe the absence of light when spoken in tandem with the more historic term, dark matter (Friday Night with Jonathan Ross 2010; Brill and Bolles 2025).

Conclusion & Implications

Dark matter continues to matter.

Dark energy? Within the context of dark matter, a solid 98.34-percent for NASA Hubble (1990) and solid 91.16-percent for NASA Roman(2026).

Perhaps dark energy may be what exists within dark matter in its solid form (i.e., white light that captures the concept of perpetual which is something non-solid) (Cox 1998).

What is true is more images, more pixels, more layers, and more stars with combined dark matter and dark energy within 3.84 percentage points of 95 continues to exist.

Acknowledgements
Thank you to the public, thank you to all our astro and cosmos teams (e.g., Roscosmos, NASA, the European Space Agency, the Canadian Space Station, and JAXA), and thank you to a University of California, Los Angeles alumni (i.e., Hannah Masresha) who helped spark motivation to commence analyzing after expressing interest in hearing about work with NASA and interest in astronomy and space.

Thank you to all our NASA Hubble and NASA Roman families as well. Thank you to all our astronomy and astrophysics teams who continue to interact, engage, and help incandescent this very work (e.g., NASA Citizen Science contributors, Sourabh Paul, Dr. Zhaoting Chen).

And as always, thank you to my always and forever husband and fellow Science, Technology, Engineering, and Mathematics (STEM) life-long learning nerd, Dr. Brian E. Cox, who continues to inspire and motivate me the most. I love you baby, infinitely—and always toward the positive infinity as communicated in 2025, 2026, and always evermore.

May NASA missions such as that of NASA Roman, and all astro and cosmo missions, continue to inspire physics and astronomy joy and curiosity among all.

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Appendix

Transcribed excerpt of an interview with Dr. Brian E. Cox where "dark energy" is mentioned in tandem with "dark matter"

When asked by Jonathan Ross on Friday, March 26, 2010, "What is the Universe made up to the extent of our knowledge because there is a very large proportion that we cannot identify? Is this correct?"

Dr. Brian E. Cox responded, "We now think about 96-percent of it is made up of something else other then this [taps the furniture upon which he is seated], of this and every star, remember there are hundred billion galaxies we can see in the

Universe, each with, in the observable Universe, each with a hundred billion stars in it like our Sun" to which Ross interjects, "Headache," and Cox continues, "that appears to be about, what four-percent of the stuff in the Universe, which we have discovered in the last 10 years. It's a bit embarrassing for fundamental physics, that 96-percent of the Universe is something else."

Ross continues, asking, "Is this because it is not matter in the way we understand it?"

"Yeah it is not this stuff, it is not stuff that shines in stars or galaxies, it is something else. So we call it dark matter, and there is some other stuff around called dark energy. And that is what we know about it basically. It has got a name and that's about it."

Ross continues, "And if you go down to the quantum level, this [taps the desk upon which his arms are over, taps his left hand with his right hand] is the same as that [taps the furniture upon which Cox is seated].

Cox replies, "That's right Paul. This is very good."

And Paul/Ross says, "It is really hard to understand."

Cox continues, "It is, but I think that most people I meet are interested, genuinely interested. And I think that image of science being difficult is a problem we need to get over. Particularly for kids. It is not that difficult, I mean I am no clever than you. I cannot believe I have said that. I am not. I am no clever than you. I am no clever than you."

Paul/Ross responds, "You cannot laugh when you say that" and Cox says, "I know."

Full interview (18:42) originally recorded audiovisually on Friday, March 26th, 2010 and shared by "Friday Night with Jonathan Ross" via YouTube on Wednesday, August 17th, 2022.

Excerpt of interview (2:33 to 4:00) transcribed by Patricia I. Cox on Sunday, September 20th, 2026 and Monday, September 21st, 2026.

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DATA VISUALIZATIONS
(INCLUDING VISUAL GRAPHICS)

The "Data Visualizations (including Visual Graphics)" section of *National Aeronautics and Space Administration of Open Science: 2026 International Space Station (ISS), NASA Artemis, and Astrophysics Publications for the Public* consists of five data visualizations (including visual graphics) authored and published for the public during the 2026 year from Tuesday, June 23rd, 2026 to Friday, November 13th, 2026 (originally) and Monday, July 6th, 2026 to Friday, November 13th, 2026 (revised).

Listed in chronological order, the five data visualizations (including visual graphis) are the following:

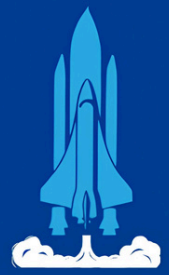
1. Artemis Accords Signatories by Continent, Relative Proportion
2. International Space Station (ISS) Fiscal Responsibility by Space Agency, Relative Proportion
3. International Space Station (ISS) Fiscal Responsibility by Country, Relative Proportion
4. A Mathematics and Physics Analysis of "Dark Energy" based on NASA Roman and NASA Hubble
5. The Universe: Ten Planets for Logarithmic Beauty taught by way of The Perpetual

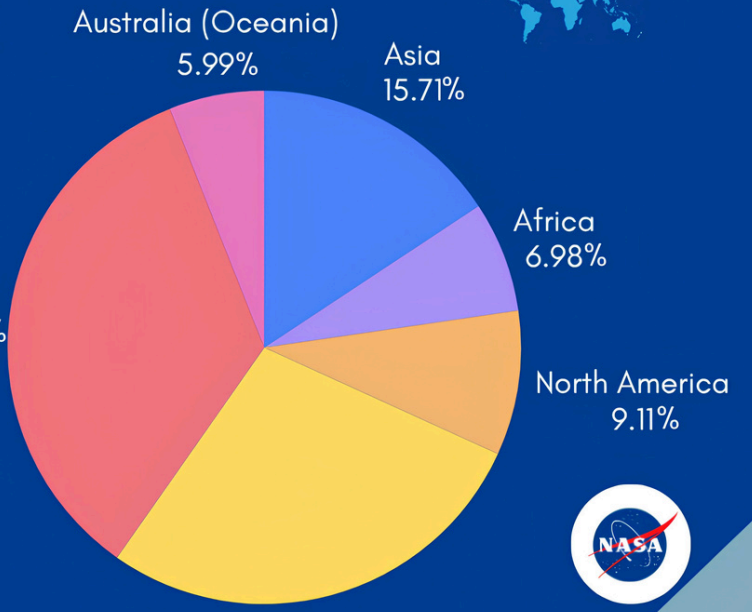
Artemis Accords Signatories by Continent, Relative Proportion

Artemis Accords Signatories by Continent, Relative Proportion

(Antarctica Excluded)

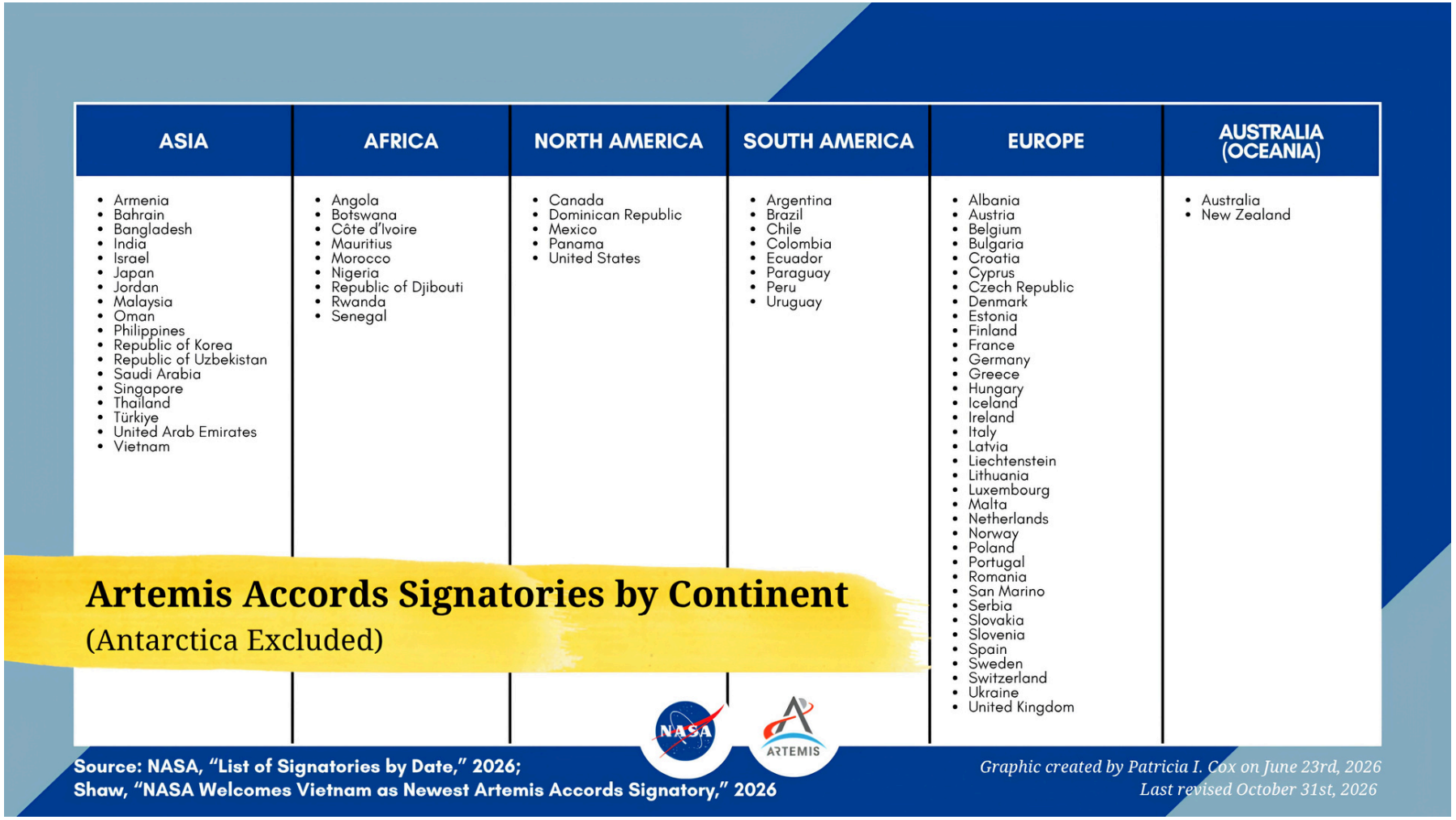
CONTINENT	NUMBER OF COUNTRIES
Asia	18 out of 48 countries
Africa	9 out of 54 countries
North America	5 out of 23 countries
South America	8 out of 12 countries
Europe	36 out of 44 countries
Australia	2 out of 14 countries





Source: NASA, "List of Signatories by Date," 2026;
Shaw, "NASA Welcomes Vietnam as Newest Artemis Accords Signatory," 2026

Graphic created by Patricia I. Cox on June 23rd, 2026. Last revised October 31st, 2026.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Bahrain
Bangladesh
India
Israel
Japan
Jordan
Malaysia
Oman
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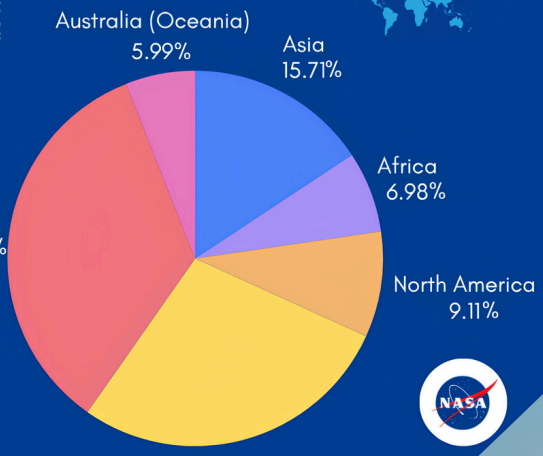
Republic of Korea
Republic of Uzbekistan
Saudi Arabia
Singapore
Thailand
Türkiye
United Arab Emirates
Vietnam
AFRICA
Angola
Botswana
Côte d'Ivoire
Mauritius
Morocco
Nigeria
Republic of Djibouti
Rwanda
Senegal
NORTH AMERICA
Canada
Dominican Republic
Mexico
Panama
United States
SOUTH AMERICA
Argentina
Brazil
Chile
Colombia
Ecuador
Paraguay
Peru
Uruguay
EUROPE
Albania
Austria
Belgium
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Netherlands
Norway
Poland
Portugal
Romania
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
United Kingdom
AUSTRALIA (OCEANIA)
Australia
New Zealand
Artemis Accords Signatories by Continent
(Antarctica Excluded)
NASA
ARTEMIS
Source: NASA, "List of Signatories by Date," 2026;
Shaw, "NASA Welcomes Vietnam as Newest Artemis Accords Signatory," 2026
Graphic created by Patricia I. Cox on June 23rd, 2026
Last revised October 31st, 2026

Artemis Accords Signatories by Continent, Relative Proportion
(Antarctica Excluded)

CONTINENT	NUMBER OF COUNTRIES
Asia	18 out of 48 countries
Africa	9 out of 54 countries
North America	5 out of 23 countries
South America	8 out of 12 countries
Europe	36 out of 44 countries
Australia	2 out of 14 countries





Source: NASA, "List of Signatories by Date," 2026;
Shaw, "NASA Welcomes Vietnam as Newest Artemis Accords Signatory," 2026

Graphic created by Patricia I. Cox on June 23rd, 2026. Last revised October 31st, 2026.

ASIA	AFRICA	NORTH AMERICA	SOUTH AMERICA	EUROPE	AUSTRALIA (OCEANIA)
• Armenia • Bahrain • Bangladesh • India • Israel • Japan • Jordan • Malaysia • Oman • Philippines • Republic of Korea • Republic of Uzbekistan • Saudi Arabia • Singapore • Thailand • Türkiye • United Arab Emirates • Vietnam	• Angola • Botswana • Côte d'Ivoire • Mauritius • Morocco • Nigeria • Republic of Djibouti • Rwanda • Senegal	• Canada • Dominican Republic • Mexico • Panama • United States	• Argentina • Brazil • Chile • Colombia • Ecuador • Paraguay • Peru • Uruguay	• Albania • Austria • Belgium • Bulgaria • Croatia • Cyprus • Czech Republic • Denmark • Estonia • Finland • France • Germany • Greece • Hungary • Iceland • Ireland • Italy • Latvia • Liechtenstein • Lithuania • Luxembourg • Malta • Netherlands • Norway • Poland • Portugal • Romania • San Marino • Serbia • Slovakia • Slovenia • Spain • Sweden • Switzerland • Ukraine • United Kingdom	• Australia • New Zealand

Artemis Accords Signatories by Continent
(Antarctica Excluded)

Source: NASA, "List of Signatories by Date," 2026;
Shaw, "NASA Welcomes Vietnam as Newest Artemis Accords Signatory," 2026

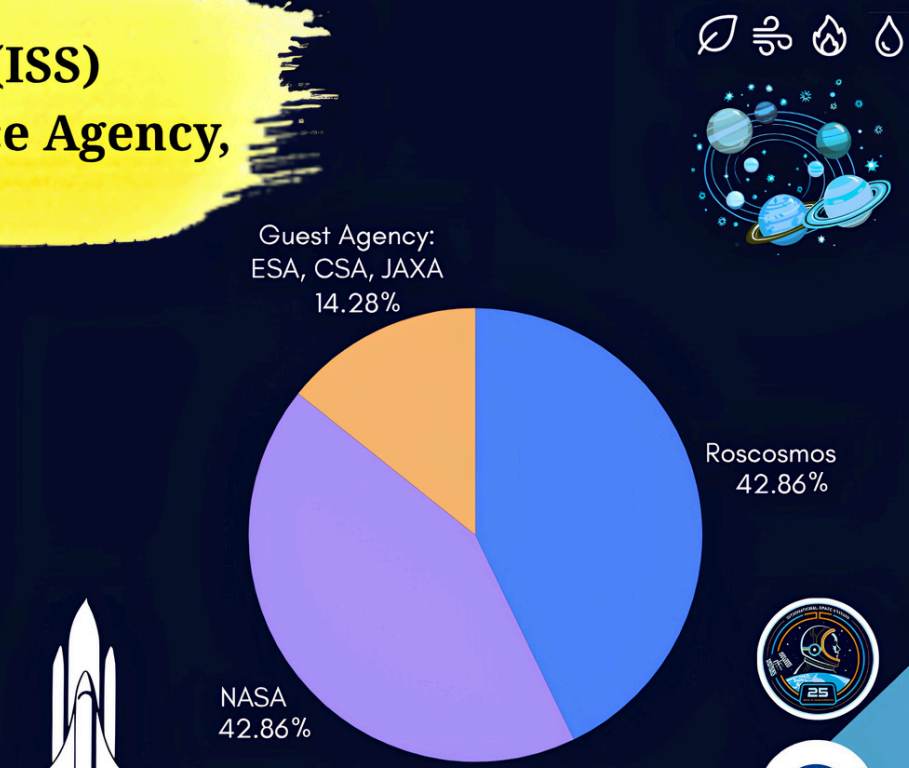
Graphic created by Patricia I. Cox on June 23rd, 2026
Last revised October 31st, 2026

International Space Station (ISS) Fiscal Responsibility by Space Agency, Relative Proportion

International Space Station (ISS) Fiscal Responsibility by Space Agency, Relative Proportion

SPACE AGENCY	NUMBER OF PARTICIPANTS
Roscosmos	3 out of 7 participants
NASA	3 out of 7 participants
Guest Agency: ESA, CSA, JAXA	1 out of 7 participants

Source: NASA, 1995-2026; Oregon State University, 2020



Graphic created by Patricia I. Cox on July 06, 2026
Last revised July 06, 2026

International Space Station (ISS) Fiscal Responsibility by Space Agency, Relative Proportion

SPACE AGENCY	PARTICIPANTS	DEPARTURE	RETURN	RELATIVE PROPORTION
Roscosmos	3	Russia, United States of America	Russia, United States of America	**0.42857...**
National Aeronautics and Space Administration (NASA)	3	Russia, United States of America	Russia, United States of America	**0.42857...**
European Space Agency (ESA)	1	United Staes of America	United States of America	**0.142857...**
Canadian Space Agency (CSA)		United States of America	United States of America	
Japan Aerospace Exploration Agency (JAXA)		United States of America	United States of America	

Source: NASA, 1995-2026; Oregon State University, 2020

Graphic created by Patricia I. Cox on September 15, 2026. Last revised September 15, 2026

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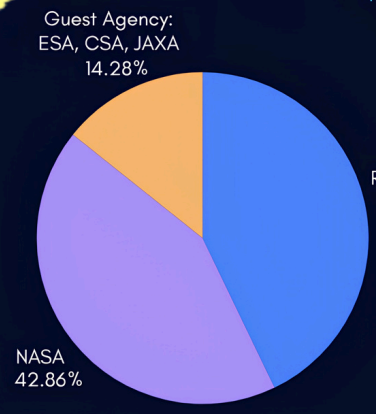

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Graphic created by Patricia I. Cox on July 06, 2026
Last revised July 06, 2026

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Canadian Space Agency (CSA)		United States of America	United States of America	
Japan Aerospace Exploration Agency (JAXA)		United States of America	United States of America	

Source: NASA, 1995-2026; Oregon State University, 2020

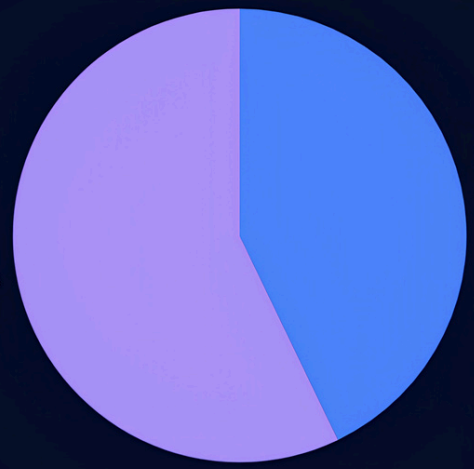
Graphic created by Patricia I. Cox on September 15, 2026. Last revised September 15, 2026

International Space Station (ISS) Fiscal Responsibility by Country, Relative Proportion

International Space Station (ISS) Fiscal Responsibility by Country, Relative Proportion

COUNTRY	NUMBER OF PARTICIPANTS
Russia	3 out of 7 participants
United States of America	4 out of 7 participants

Source: NASA, 1995-2026; Oregon State University, 2020



Graphic created by Patricia I. Cox on July 06, 2026
Last revised July 06, 2026

International Space Station (ISS) Fiscal Responsibility by Country, Relative Proportion



SPACE AGENCY	NUMBER OF PARTICIPANTS	COUNTRY	RELATIVE FRACTION	RELATIVE PROPORTION
Roscosmos	3 out of 7	Russia	3 out of 7	**0.42857...**
National Aeronautics and Space Administration (NASA)	3 out of 7	United States of America		
Guess Agency: European Space Agency (ESA), Canada Space Agency (CSA), Japan Aerospace Exploration Agency (JAXA)	1 out of 7	United States of America	4 out of 7	**0.571428...**

Source: NASA, 1995-2026; Oregon State University, 2020



Graphic created by Patricia I. Cox on September 15, 2026. Last revised September 15, 2026

International Space Station (ISS) Fiscal Responsibility by Country, Relative Proportion

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Russia	3 out of 7 participants
United States of America	4 out of 7 participants

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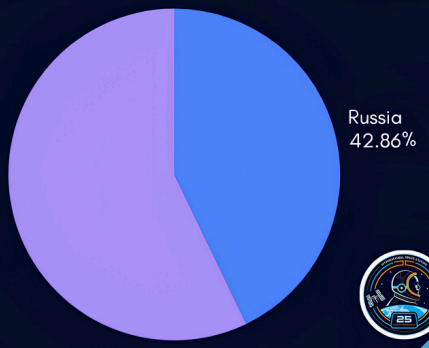

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Source: NASA, 1995-2026; Oregon State University, 2020

Graphic created by Patricia I. Cox on September 15, 2026. Last revised September 15, 2026

A Mathematics and Physics Analysis of “Dark Energy” based on NASA Roman and NASA Hubble

A Mathematics and Physics Analysis of "Dark Energy" based on NASA Roman and NASA Hubble



PARAMATER	VALUE
Average (mu):	95

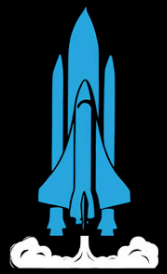
Source: University of Manchester, 2026

PARAMATER	VALUE
Average (rho):	96

Source: Cox & Ross, 2010

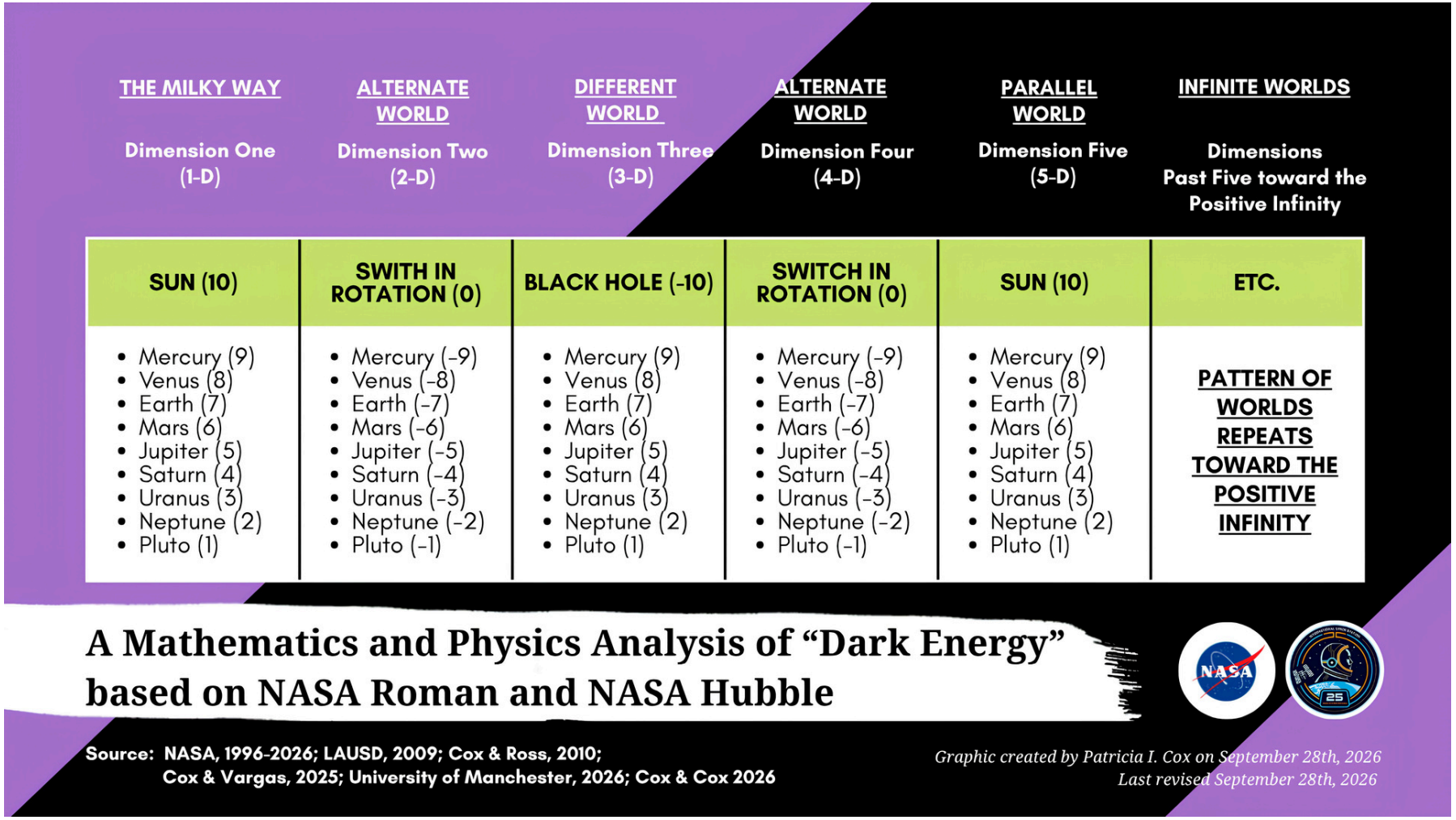
Values for "Perpetual" Contingent upon a start from The Milky Way

DIMENSION	VALUE
Parallel World	3.84
Alternate World	1.92
Different World	5.76



Source: NASA, 1996-2026; LAUSD, 2009; Cox & Ross, 2010; University of Manchester, 2026; Cox & Cox 2026

Graphic created by Patricia I. Cox on September 28th, 2026. Last revised September 28th, 2026.


THE MILKY WAY
Dimension One (1-D)
ALTERNATE WORLD
Dimension Two (2-D)
DIFFERENT WORLD
Dimension Three (3-D)
ALTERNATE WORLD
Dimension Four (4-D)
PARALLEL WORLD
Dimension Five (5-D)
INFINITE WORLDS
Dimensions Past Five toward the Positive Infinity
SUN (10)
• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)
SWITH IN ROTATION (0)
• Mercury (-9) • Venus (-8) • Earth (-7) • Mars (-6) • Jupiter (-5) • Saturn (-4) • Uranus (-3) • Neptune (-2) • Pluto (-1)
BLACK HOLE (-10)
• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)
SWITCH IN ROTATION (0)
• Mercury (-9) • Venus (-8) • Earth (-7) • Mars (-6) • Jupiter (-5) • Saturn (-4) • Uranus (-3) • Neptune (-2) • Pluto (-1)
SUN (10)
• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)
ETC.
PATTERN OF WORLDS REPEATS TOWARD THE POSITIVE INFINITY
A Mathematics and Physics Analysis of "Dark Energy" based on NASA Roman and NASA Hubble
Source: NASA, 1996-2026; LAUSD, 2009; Cox & Ross, 2010; Cox & Vargas, 2025; University of Manchester, 2026; Cox & Cox 2026
Graphic created by Patricia I. Cox on September 28th, 2026
Last revised September 28th, 2026

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PARAMATER	VALUE
Average (mu):	95

Source: University of Manchester, 2026

PARAMATER	VALUE
Average (rho):	96

Source: Cox & Ross, 2010

Values for "Perpetual" Contingent upon a start from The Milky Way

DIMENSION	VALUE
Parallel World	3.84
Alternate World	1.92
Different World	5.76



Source: NASA, 1996-2026; LAUSD, 2009; Cox & Ross, 2010; University of Manchester, 2026; Cox & Cox 2026

Graphic created by Patricia I. Cox on September 28th, 2026. Last revised September 28th, 2026.

THE MILKY WAY Dimension One (1-D)	ALTERNATE WORLD Dimension Two (2-D)	DIFFERENT WORLD Dimension Three (3-D)	ALTERNATE WORLD Dimension Four (4-D)	PARALLEL WORLD Dimension Five (5-D)	INFINITE WORLDS Dimensions Past Five toward the Positive Infinity
SUN (10)	SWITH IN ROTATION (0)	BLACK HOLE (-10)	SWITCH IN ROTATION (0)	SUN (10)	ETC.
• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)	• Mercury (-9) • Venus (-8) • Earth (-7) • Mars (-6) • Jupiter (-5) • Saturn (-4) • Uranus (-3) • Neptune (-2) • Pluto (-1)	• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)	• Mercury (-9) • Venus (-8) • Earth (-7) • Mars (-6) • Jupiter (-5) • Saturn (-4) • Uranus (-3) • Neptune (-2) • Pluto (-1)	• Mercury (9) • Venus (8) • Earth (7) • Mars (6) • Jupiter (5) • Saturn (4) • Uranus (3) • Neptune (2) • Pluto (1)	PATTERN OF WORLDS REPEATS TOWARD THE POSITIVE INFINITY

A Mathematics and Physics Analysis of "Dark Energy" based on NASA Roman and NASA Hubble

Source: NASA, 1996-2026; LAUSD, 2009; Cox & Ross, 2010; Cox & Vargas, 2025; University of Manchester, 2026; Cox & Cox 2026

Graphic created by Patricia I. Cox on September 28th, 2026
Last revised September 28th, 2026

The Universe: Ten Planets for Logarithmic Beauty taught by way of The Perpetual

The Universe: Ten Planets for Logarithmic Beauty taught by way of The Perpetual 🤍🤍🤍



THE MILKY WAY (1-D)	ALTERNATE WORLD (2-D)	DIFFERENT WORLD (3-D)	ALTERNATE WORLD (4-D)	PARALLEL WORLD (5-D)	THE UNIVERSE EXISTING FOR EONS
Helios	**Switch in Rotation**	**Black Hole**	**Switch in Rotation**	**Helios**	**Pattern Repeats to the Positive Infinity**
• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	• Kepler • Pluto • Neptune • Uranus • Saturn • Jupiter • Mars • Earth • Venus • Mercury	• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	• Kepler • Pluto • Neptune • Uranus • Saturn • Jupiter • Mars • Earth • Venus • Mercury	• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	Pattern continues to exist with a concept of L'hospital whereby classic k is positive infinity and the perpetual is the self-sustaining white light contained within rock solid dark matter 🤍

Source: LAUSD 1996-2010; NASA 1996-2026; UCLA 2009-2026; Oregon State University 2020-2026; University of Manchester 1998-2026; Cox & Cox 2026

Graphic created by Patricia I. Cox on Friday, November 13th, 2026.

The Universe: Ten Planets for Logarithmic Beauty taught by way of The Perpetual 🤍🤍🤍

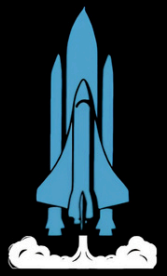


What is L'hospital?

Computing to the infinities (i.e., positive infinity and negative infinity) with a concept of zero. 🤍

P.S. The values of the perpetual for the Universe? Permutable when with a strong concept of the positive infinity 🤍

The Milky Way: 3.84
Alternate World: 1.92
Different World: 5.76



What may the equivalent for teaching physics in a way that makes the field incandescent be?

Perhaps teaching by way of the perpetual (i.e., teaching the concept of the perpetual as soon as students of physics are ready to grasp the concept).

How? Perhaps with by teaching Newton's Three Laws with all the perpetual. And perhaps by teaching such that classic k (i.e., positive infinity) kindly reminds us of the tenth planet in the Universe (i.e., planet Kepler) with kind alliteration.

Classic k (positive infinity), classic Kepler. 🤍

Source: LAUSD 1996-2010; NASA 1996-2026; UCLA 2009-2026; Oregon State University 2020-2026; University of Manchester 1998-2026; Cox & Cox 2026

Graphic created by Patricia I. Cox on Friday, November 13th, 2026.

The Universe: Ten Planets for Logarithmic Beauty taught by way of The Perpetual 🤍🤍🤍



THE MILKY WAY (1-D)	ALTERNATE WORLD (2-D)	DIFFERENT WORLD (3-D)	ALTERNATE WORLD (4-D)	PARALLEL WORLD (5-D)	THE UNIVERSE EXISTING FOR EONS
Helios	**Switch in Rotation**	**Black Hole**	**Switch in Rotation**	**Helios**	**Pattern Repeats to the Positive Infinity**
• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	• Kepler • Pluto • Neptune • Uranus • Saturn • Jupiter • Mars • Earth • Venus • Mercury	• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	• Kepler • Pluto • Neptune • Uranus • Saturn • Jupiter • Mars • Earth • Venus • Mercury	• Mercury • Venus • Earth • Mars • Jupiter • Saturn • Uranus • Neptune • Pluto • Kepler	Pattern continues to exist with a concept of L'hospital whereby classic k is positive infinity and the perpetual is the self-sustaining white light contained within rock solid dark matter 🤍

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Graphic created by Patricia I. Cox on Friday, November 13th, 2026.

MUSIC

The "Music" section of *National Aeronautics and Space Administration of Open Science: 2026 International Space Station (ISS), NASA Artemis, and Astrophysics Publications for the Public* consists of one music creation authored and published for the public during the 2026 year on Thursday, June 11th, 2026.

Listed in chronological order, the one music creation is the following:

1. The Moon: La Luna (An Academic "Album")

The Moon:
La Luna (An Academic “Album”)

AUDIO FILES



An audio creation for the moon given irrational infinites (i.e., pi and gravity) may work very well when in synchronous motion for infinite light.

"Album" artwork included.

Link to download audio files:

https://zenodo.org/records/24573837

RECORD ALBUM ARTWORK – FRONT



RECORD ALBUM ARTWORK – BACK



RECORD LABEL



LYRICS

Nursery Rhyme - La Luna (The Moon)

pi
will not lie
will ask why
for is

an infinity
like gravity

and we
love thee





LYRICS

Nursery Rhyme - La Luna (The Moon) - Español (Spanish)

el infinito
irracional
de pitágoras
es bonito

ambamente
muy bonito
al irracional
infinito

de la luna
que no es quesito
el irracional
muy bonito

es la gravedad
chiquitita
muy bonita





PRESENTATIONS

The "Presentations" section of *National Aeronautics and Space Administration of Open Science: 2026 International Space Station (ISS), NASA Artemis, and Astrophysics Publications for the Public* consists of three presentations authored and published for the public during the 2026 year from Tuesday, November 3rd, 2026 to Friday, November 27th, 2026.

Listed in chronological order, the three presentations are the following:

1. Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health
2. Trayectoria a la Administración Nacional Aeronáutica y Espacial (NASA) de Patricia I. Cox con Brian E. Cox, PhD
3. Trajectory to National Aeronautics and Space Administration (NASA) of Patricia I. Cox with Brian E. Cox, PhD

Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health

Transforming Limited Data into Mission Knowledge: Outcomes from the HRP Artemis II Data Challenge

Transfer-Calibrated Normative Modeling: Small-Sample, High-Dimensional Analysis for Four-Person Artemis II Crews, Demonstrated on Inspiration4 Data
★ *Praniil Nagaraj – Purdue University*

STELLAR: A Layered Bayesian Pipeline for Longitudinal Trajectory Estimation in Small-Crew, High-Dimensional Artemis II Human Research Data
★ *Estrella C. Perez*

Scalable Bayesian Health Monitoring for Deep Space Crew Operations
★ *Ivan Lavlinski, MS – NexAI Incorporation*

Akasi: Data Visualization for Artemis II Physiological Analysis
★ *Carm Hermosilla, BS in Comp Sci – NASA HRP Data Challenge*

A Framework for SANS Prediction and Glymphatic Biomarker Discovery in Small-Sample Longitudinal Spaceflight Data
★ *Aaron Krasinski – Massachusetts Institute of Technology*

Hierarchical Bayesian Multi-Block Longitudinal Factor Analysis with Population Borrowing
★ *Ashlei Lewis, PhD – NeuroViu*

Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health
★ *Patricia I. Cox, BS – National Aeronautics and Space Administration*

LINEAR REGRESSION ANALYSIS FOR LONGITUDINAL DATA: A DATA METHODOLOGY FOR IDENTIFYING TRENDS WITHIN INDIVIDUALS FOR A VARIABLE OF CHOICE OVER TIME TO SUPPORT ASTRONAUT HEALTH

Patricia I. Cox, BS
National Aeronautics and Space Administration

Overview

I. Introduction
II. Background
III. Methods
IV. Results
V. Conclusions & Implications
VI. Recommendations
VII. Acknowledgements
VIII. References
IX. Legal Citation

Introduction

America COMPETES Act (15 U.S.C. § 3719)

The National Aeronautics and Space Administration (NASA) Human Research Program collected data from the Artemis II four-person mission through three studies: the Artemis II Spaceflight Standard Measures study, the ARCHeR (Artemis Crew Health and Research) study, and the Immune Biomarkers study. These three studies presented a significant analytical challenge—extremely small sample size (n=<4); high dimensionality (p>>n); and "multiple physiological, behavioral, and operational data streams" (NASA Human Research Program). In response, NASA sponsored and launched the NASA Artemis II Human Research Data Methodology Challenge under the America COMPETES Act on Monday, March 30, 2026, posing the question:

"How do we extract the maximum possible scientific insight from data of this nature?"

(NASA Artemis 2026)

Source: National Aeronautics and Space Administration, 2026

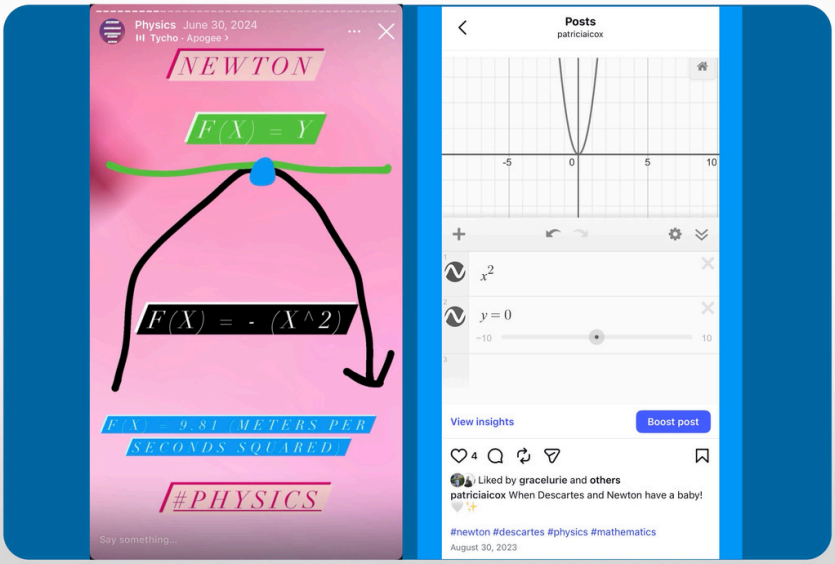
Background

What is Linear Regression Analysis?

Linear regression analysis prompts us to plot each datum and identify a line that best captures the trend for all plotted data. In statistics, we call this line the regression line. We analyze this regression line by looking at its regression equation.

LINEAR REGRESSION ANALYSIS	ELABORATION MODEL
1855	1946

Background (cont'd)



Methods

Proxy Data

The University of Texas Medical Branch (UTMB) in Galveston, Texas, USA led bedrest studies out of their Flight Analogs Research Unit (FARU) in preparation for spaceflight from planet Earth to outer space.

UTMB Campaign 3	**UTMB Campaign 11**
2006 to 2009	After 2009

Sum of Least Squares (Capped)

$$Given: f(x)$$
$$Find: y$$
$$\int_0^4 a + b(X)$$

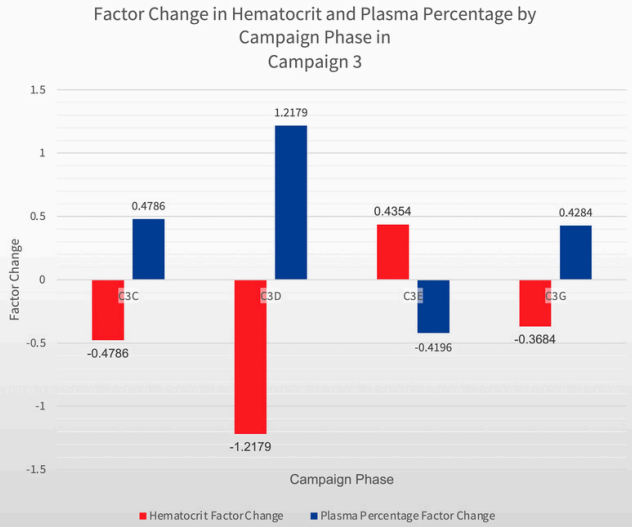
Results

Majority Healthy Astronaut-Like Individuals

Among respective Artemis II stratified simple random samples for two distinct UTMB bedrest studies (n=4, N=23; n=4, N=37), majority (75-percent; 75-percent) communicated continued physiological health compatible with spaceflight via spaceflight standard measures (plasma).

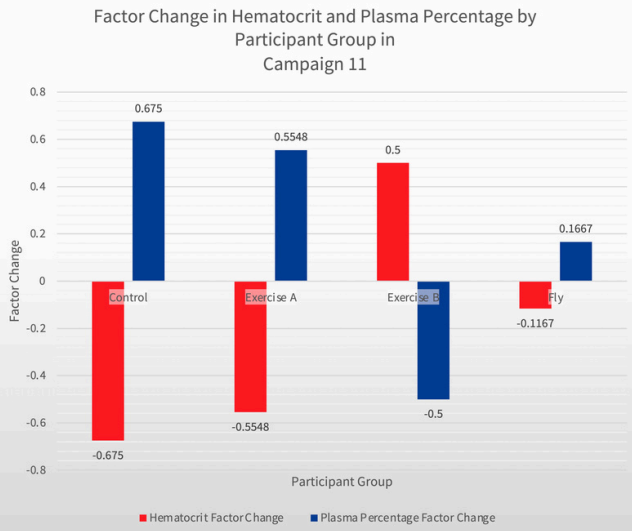
UTMB Campaign 3	**UTMB Campaign 11**
2006 to 2009	After 2009

UTMB Campaign 3 Plasma Trends



Source: NASA Johnson Space Center, 2026

UTMB Campaign 11 Plasma Trends



Source: NASA Johnson Space Center, 2026

Results (cont'd)

"Given the role plasma plays in physiology (e.g., coagulation, defense, maintenance of osmotic pressure, nutrition, respiration, excretion, hormones, regulation of acid-base balance, and regulation of body temperature), and given the role endurance exercise plays in plasma volume (i.e., increased plasma volume with endurance exercise), we can reason 'plasma percentage increase' to be an indicator of 'healthy cardiovascular physiology' (Mathew, Sankar, & Varacallo 2023; Fellmann 1992; Kargotich et al. 1998)."


Linear Regression Analysis for Longitudinal Data: A Data Methodology for Identifying Trends within Individuals for a Variable of Choice over Time to Support Astronaut Health

Source: Cox & Cox, 2026

Conclusions & Implications

Time is Vital

Conducting a window of what in concept is a multivariate regression of time enables us to condition participants for spaceflight. In other words, time is not finite. Plasma is. In other words, time depends on a concept of L'hospital, and plasma is independent of time.

DV	IV
Plasma	Time

Conclusions & Implications (cont'd)

Metric with Milestones

Artemis II Astronaut	Astronaut Candidate Class	Astronaut Mission to the ISS	Astronaut Mission to the Moon
Gregory Reid Wiseman	2009	2014	2026
Christina Hammock Koch	2013	2019	2026
Jeremy Roger Hansen	2009	N/A	2026
Victor Jerome Glover Jr.	2013	2020	2026

Source: NASA and Canadian Space Agency, 2026

Recommendations

Next: Killer T-Cells

Conducting a window of what in concept is a multivariate regression of time enables us to condition participants for spaceflight—evermore. In other words, time is infinite. CD8+ perhaps. In other words, time depends on a concept of limits, and CD8+ is potentially dependent on infinite time.

DV	IV
CD8+	Time

Acknowledgements

Thank you. Gracias. Mèrci. Danke schön. Dōmo. Ad astra

- Dr. Kristin Fabre, NASA Human Research Program
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- Dr. Steven Platts, NASA Johnson Space Center
- NASA Astronaut Reid Wiseman, Artemis II
- CSA Astronaut Jeremy Hansen, Artemis II
- NASA Astronaut Christina Koch, Artemis II
- NASA Astronaut Victor Glover, Artemis II
- Dr. Brian E. Cox, University of Manchester
- UTMB Campaign 1 Male Cohort, National Aeronautics and Space Administration

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Trayectoria a la Administración Nacional Aeronáutica y Espacial (NASA) de Patricia I. Cox con Brian E. Cox, PhD

National Aeronautics and Space Administration

Trayectoria a la Administración Nacional Aeronáutica y Espacial (NASA) de Patricia I. Cox con Brian E. Cox, PhD

Universidad de California, Los Ángeles (UCLA)

Noviembre 2026

B.E. Cox y P.I. Cox

NASA Directivo de Misiones Científicas – Ciencia Pública

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Visión General

I. ¿Cuál fue su trayectoria?
II. ¿Cómo llego usted a la ciencia, la tecnología, la ingeniería y la matemática (STEM)?
III. ¿Cuáles fueron sus influencias?
IV. ¿Qué trayectoria respaldó su llegada a la Administración Nacional Aeronáutica y Espacial (NASA)?
V. Pregunta y Respuesta (Q&A)



NASA/Joel Kowsky

I. ¿Cuál fue su trayectoria?

- **Preescolar público** en el Distrito Escolar Unificado de Los Ángeles (LAUSD).
- **Educación pública (K-12)** en el Distrito Escolar Unificado de Los Ángeles (LAUSD).
- **Educación superior pública (colegio comunitario) mediante inscripción simultánea** en el Distrito de Colegios Comunitarios de Los Ángeles (LACCD).
- **Universidad pública**: Universidad de California, Los Ángeles (UCLA); Universidad Estatal de Oregón (OSU); Universidad Estatal de California, Northridge (CSUN); Universidad Estatal de California, Dominguez Hills (CSUDH); y Universidad de Mánchester (UoM).*
- **Servicio público**: Universidad de California, Los Ángeles (UCLA); Departamento de Estado de los Estados Unidos (DoS); Fundación Nacional para la Ciencia (NSF); Distrito Escolar Unificado de Los Ángeles (LAUSD); y la Administración Nacional Aeronáutica y Espacial (NASA), ¡nada menos! ☺

* Solicitud presentada para el ciclo de otoño del 2027

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II. ¿Cómo llego usted a STEM?

- **Pasión por la matemática** desde la educación primaria (por ejemplo, practicar las tablas de multiplicar, saltando en juego con mi papá durante la infancia).
- **Aptitud para la ciencia** desde la educación secundaria (por ejemplo, al analizar la célula eucariota en la clase de biología, razonar que fue la primera en florecer en planeta Tierra).
- **Interés por la ingeniería** desde la educación primaria (por ejemplo, aprender de niña a solucionar problemas con baterías utilizando aluminio).
- **Atención hacia la tecnología** desde la educación primaria (por ejemplo, desarrollar habilidades de cálculo mental y análisis matemático antes de empezar a utilizar calculadoras de ocho dígitos, computadoras, teléfonos o computadoras portátiles).

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III. ¿Cuáles fueron sus influencias?

- Mis padres
- Mis hermanos
- Mi esposo

- **Mis padres** aspiraban a obtener una formación académica, tanto fuera como dentro de los Estados Unidos; sin embargo, la pobreza y la familia dictaron lo opuesto.
- **Mis hermanos** aspiraban a alcanzar la formación académica que mis padres no pudieron lograr, así como a acceder una educación que, por diversas circunstancias, estaba a un alcance de manera muy distinta.
- **Mi esposo** aspiraba a obtener la formación académica que le permitiera hacer realidad sus sueños de dedicarse a la astrofísica y contribuir ciencia con luz.

IV. ¿Qué trayectoria respaldó su llegada a la NASA?

(1 de 2)

- **Pasión por la ciencia, la tecnología, la ingeniería y la matemática** (STEM) (por ejemplo, actividades durante el tiempo libre que incluyen enseñar la matemática y la ciencia al público).
- **Título universitario de cuatro años en la rama de la ciencia** (es decir, poseer una licenciatura de la ciencia).
- **Trayectoria en el servicio público** (por ejemplo, haber trabajado en una universidad y escuela pública; y haber trabajado con una agencia del gobierno federal).
- **Formación en el sistema público** (por ejemplo, haber estudiado en escuelas públicas y universidades públicas).

IV. ¿Qué trayectoria respaldó su llegada a la NASA?

(2 de 2)

- **Experiencia en investigaciones académicas públicas** (por ejemplo, haber colaborado como asistente de investigación en un proyecto financiado por el gobierno federal en una universidad pública; y haber trabajado con fichas federal como estudiante en una universidad pública).
- **Perfil similar al de un astronauta** (por ejemplo, no consumir alcohol, no fumar, y no participar en actividades recreativas como el sexo cual es meramente basado en el deseo carnal).

V. Pregunta y Respuesta (Q&A)

- **¿Posiblemente una pregunta?** ☺
- **¿Posiblemente guste una respuesta?** ☺
- **¡Estoy encantada de ayudarle explorar una pregunta!** ☺
- **¡Estoy encantada de ayudarle responder a una pregunta!** ☺



Gracias

por su tiempo, paciencia y participación

¿Cuál y cómo será *su* trayectoria? ☺

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Trajectory to National Aeronautics and Space Administration (NASA) of Patricia I. Cox with Brian E. Cox, PhD

National Aeronautics and Space Administration

Trajectory to National Aeronautics and Space Administration (NASA) of Patricia I. Cox with Brian E. Cox, PhD

University of California, Los Angeles (UCLA)

November 2026

B.E. Cox and P.I. Cox

NASA Science Mission Directorate – Open Science

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Overview

I. What was your trajectory?

II. How did you arrive at Science, Technology, Engineering, and Mathematics (STEM)?

III. What were your influences?

IV. What background supported your arrival at National Aeronautics and Space Administration (NASA)?

V. Question and Answer (Q&A)



NASA/Joel Kowsky

I. What was your trajectory?

- **Public Preschool** with Los Angeles Unified School District (LAUSD).
- **Public K-12** with Los Angeles Unified School District (LAUSD).
- **Public Community College via Concurrent Enrollment** with Los Angeles Community College District (LACCD).
- **Public University** with University of California, Los Angeles (UCLA); Oregon State University (OSU); California State University, Northridge (CSUN); California State University, Dominguez Hills (CSUDH); and University of Manchester (UoM).*
- **Public Service** with University of California, Los Angeles (UCLA); United States Department of State (DoS); National Science Foundation (NSF); Los Angeles Unified School District (LAUSD); and National Aeronautics and Space Administration (NASA), alas! ☺

* Applied for Fall 2027 term

II. How did you arrive at STEM?

- **Passion for mathematics** since primary school (e.g., hopscotching times tables with father as a kid).
- **Knack for science** since secondary school (e.g., rationalizing the eukaryotic cell to be the first to bloom on planet Earth in biology).
- **Appreciation for engineering** since primary school (e.g., learning how to fix battery challenges with aluminum as a kid).
- **Care for technology** since primary school (e.g., developing mental math and math analysis skills prior to interacting with eight-digit calculators, computers, phones, or laptops).

III. What were your influences?

- My parents
- My siblings
- My husband

- **My parents** aspired to attain a formal education both outside and in the United States; poverty and family thought otherwise.
- **My siblings** aspired to attain the formal education my parents did not attain, as well as aspired to attain the formal education that was uniquely differently accessible to them.
- **My husband** aspired to attain the formal education that would make astrophysics dreams come true and help bring light to science.

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IV. What background supported your arrival at NASA?

- **Passion for Science, Technology, Engineering, and Mathematics (STEM)** (e.g., leisure activities that involve teaching math and science to the public).
- **Four-year degree within the branch of science** (i.e., holding a Bachelor of Science).
- **Public service record** (e.g., working at a public university and public school; interning with a federal government agency).
- **Public schooling record** (e.g., attending public schools and public universities).
- **Public research record** (e.g., volunteering as a research assistant for a federally funded project at a public university; working federal data as an undergraduate at a public university).
- **Astronaut-like profile** (e.g., not drinking, not smoking, not engaging in recreational activity such as sex that is lust based).

6

V. Question and Answer (Q&A)

- **Any questions may have? ☺**
- **Any answers may need? ☺**
- **Happy to help explore a question! ☺**
- **Happy to help answer a question! ☺**

Thank you

for your time, patience, and engagement

What will *your* trajectory be like? ☺

VISUAL ART

The "Visual Art" section of *National Aeronautics and Space Administration of Open Science: 2026 International Space Station (ISS), NASA Artemis, and Astrophysics Publications for the Public* consists of two visual art creations authored and published for the public during the 2026 year from Saturday, February 28th, 2026 to Thursday, December 31st, 2026

Listed in chronological order, the two visual art creations are the following:

1. International Space Station (ISS) and NASA Artemis Astronaut-Cosmonaut Birthday Celebrations
2. Holiday Celebrations with National Aeronautics and Space Administration (NASA)

International Space Station (ISS) and NASA Artemis Astronaut–Cosmonaut Birthday Celebrations


ANDREY FEDYAEV
FEBRUARY 26, 2026
TO ONE OF THE WORLD'S
BEST
COSMONAUT
HAPPY
BELATED
BIRTHDAY!


2026
NASA ASTRONAUT VICTOR GLOVER
Happy 50th Birthday, Ike!



HOPE YOUR BIRTHDAY WAS
OUT OF THIS WORLD!



DEAR JACK,

Thank you for all your work alongside fellow astronauts (e.g., Jessica Meir, Sophie Adenot, & Chris Williams) and cosmonauts (e.g., Andrey Fedyaev, Sergey Kud-Sverchkov, & Sergei Mikaev) aboard the International Space Station (ISS).

SINCERELY, PATTY



National Aeronautics & Space Administration

Sally K. Ride, PhD

FIRST AMERICAN FEMALE, WOMAN, & LGBTQ+ ASTRONAUT

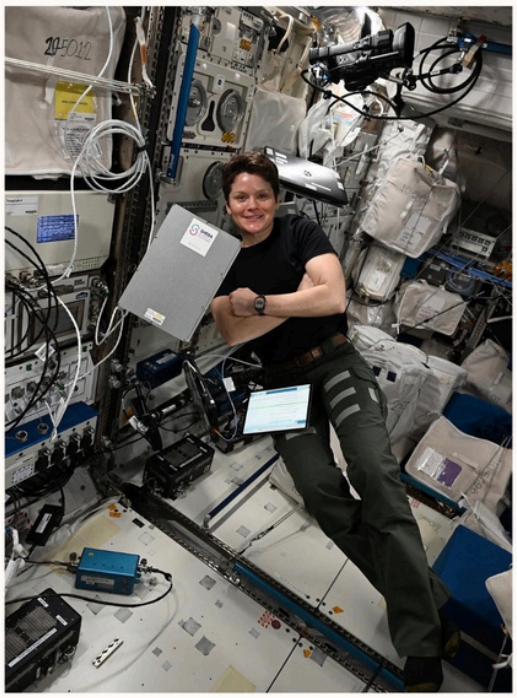
HAPPY BIRTHDAY

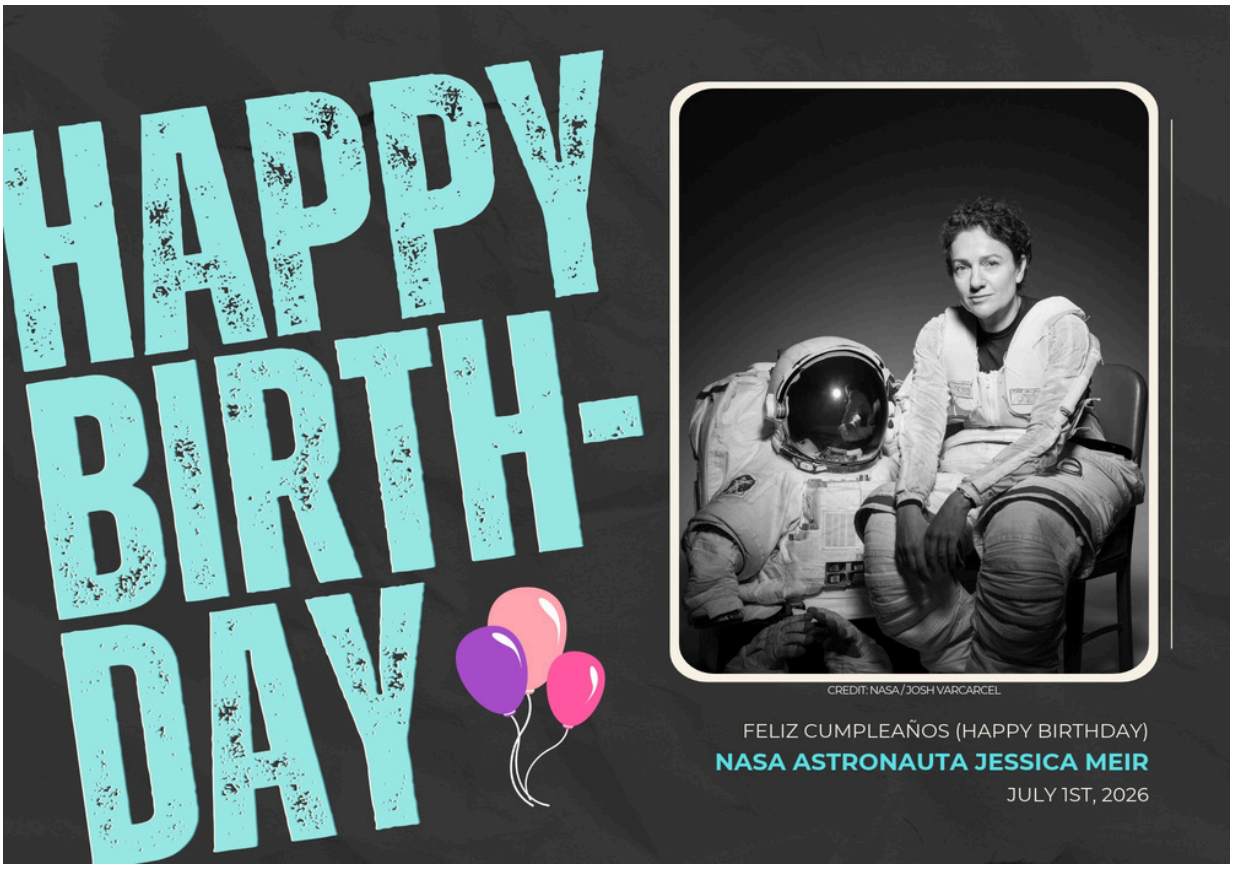
🌕🤍😳

In honour of all female astronauts, a special two-day belated birthday card for our @astro_annimal who can most likely also verify that the average mu (50th birthday) for thy female astronaut is less than 50 😘🤍😳

FROM PATTY

¡FELIZ CUMPLEAÑOS!




HAPPY
BIRTH-
DAY
CREDIT: NASA/JOSH VARCARCEL
FELIZ CUMPLEAÑOS (HAPPY BIRTHDAY)
NASA ASTRONAUTA JESSICA MEIR
JULY 1ST, 2026


Credit: ESA
Happy
Birthday
ESA Astronaut
Sophie Adenot
JULY 5TH, 2026


Happy Birthday
Canadian Space Agency (CSA)
Astronaut Dr. Jenni Gibbons
August 3rd, 2026


HAPPY
BELATED
Birthday
Sergei Mikaev
August 15th, 2026

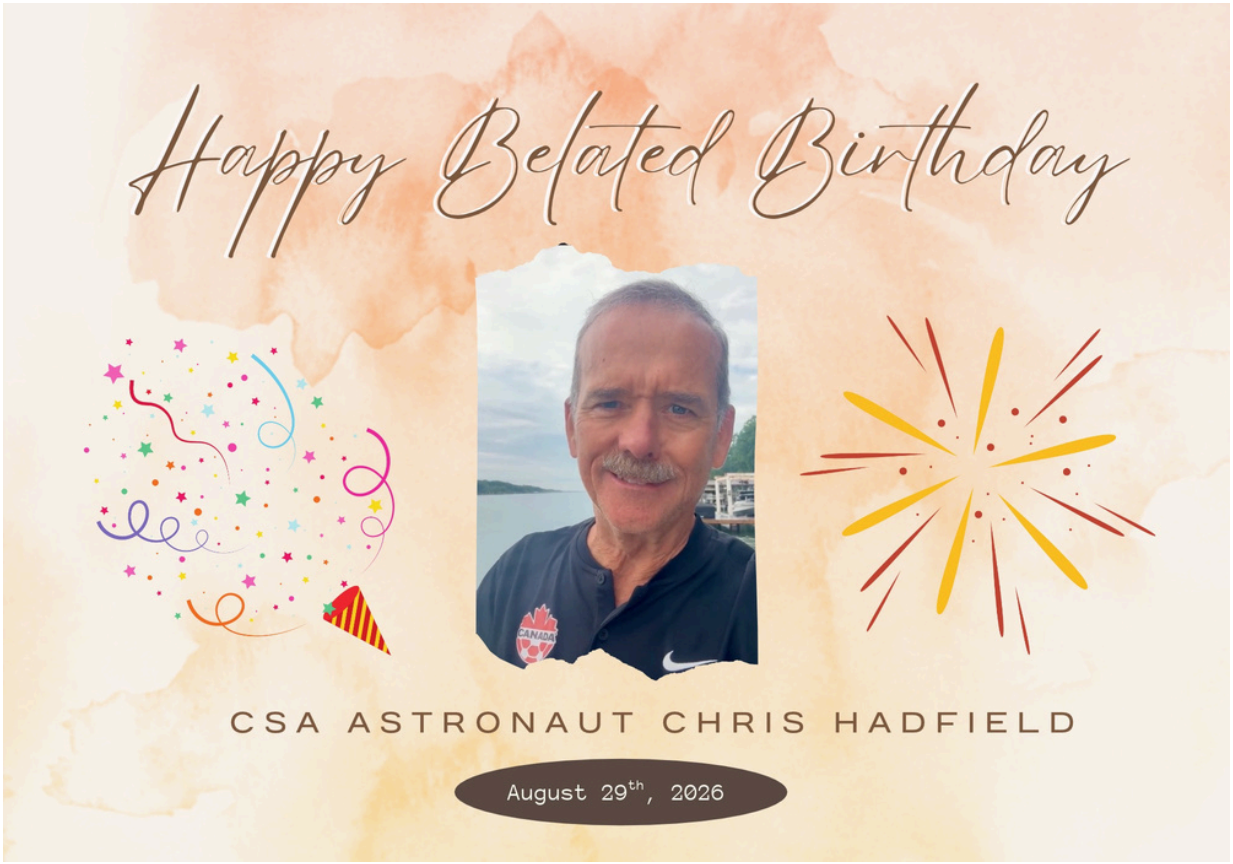

HAPPY BIRTHDAY
SERGEY RYZHIKOV
Roscosmos Cosmonaut
August 19th, 2026


Happy Birthday
August 22nd, 2026
ALEXEY ZUBRITSKII
Roscosmos Cosmonaut


HAPPY BIRTHDAY TO OUR COSMONAUT SERGEY KUD-SVERCHKOV
AUGUST 23, 2026
NASA
РОСКОСМОС


Happy Birthday
NASA Astronaut Luke Delaney
August 25, 2026
NASA


Happy Birthday, Anna Kikina!
ROSCOSMOS COSMONAUT
ANNA KIKINA
August 27th, 2026
NASA
РОСКОСМОС


Happy Belated Birthday
CSA ASTRONAUT CHRIS HADFIELD
August 29th, 2026

Let's celebrate, Woody. . .



. . . for your birthday is here!

NASA Astronaut
Woody Hoburg



September 16th, 2026

Happy Birthday!





NASA ASTRONAUT SUNITA WILLIAMS

September 19th, 2026

Happy Belated Birthday, Luca Parmitano!



Credit: NASA-JSC / NASA Artemis

Go International Space Station (ISS)! Go European Space Agency (ESA)! Go National Aeronautics and Space Administration (NASA)! Go NASA Artemis!

September 27th, 2026



Credit: ESA



Credit: NASA / Drew Morgan

Relative to Pacific Daylight Time (PDT)...

Happy (Early) Birthday, Deniz!

Excited for you to launch from Kazakhstan to the International Space Station (ISS) alongside Dmitri Petelin and Konstantin Borisov, about six months from now in March of 2027



Credit: NASA-JSC / Rober Markowitz

Have A Happy Birthday

Today

Tomorrow

And always!



Credit: NASA / Bob Ingalls / Joel Kowsky

October 1st, 2026


HAPPY
BELATED
Birthday
NASA Astronaut
Anil Menon
October 15th, 2026


Credit: NASA / Bill Ingalls
Happy Birthday NASA Astronaut Chris Williams!
October 23rd, 2026

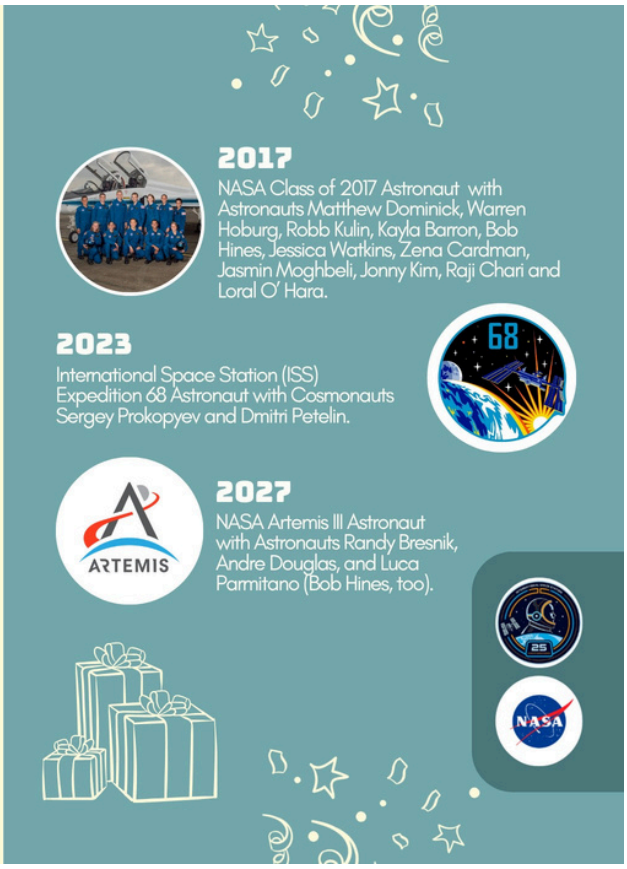

HAPPY BIRTHDAY
ZENA
NASA ASTRONAUT
Zena Cardman
October 26th, 2026


Get ready for...
"CELEBRATION TIME, COME ON!"
GET THAT SOON TO BE EXTRA NASA ARTEMIS II MOON JOY
NOW JET PROPULSION LABORATORY (JPL) JOYOUS JOULES
OUR NASA ARTEMIS II ASTRONAUT NOW JPL JOY REID WISEMAN
Credit: Katey P. Wiseman
"BLAST OFF!"
Wednesday, November 11th, 2026
THE SUNDAY, NOVEMBER 8TH, 2026 EDITION


"NON-KRAKATOA TIME, LIGHT ON!"
Right On
GET THAT MIDNIGHT MOON MAGIC (I.E., HAPPY STILL EXTRA SPECIAL BIRTHDAY 72-HOURS AFTER 11:59:59PM IN THE DIRECTION OF HELIOS WITH A CONCEPT OF HELIOS-MERCURY STABILIZED WITHIN NASA JET PROPULSION LABORATORY [JPL] TIME) 😎💫
OUR NASA ARTEMIS II ASTRONAUT NOW JPL JOY REID WISEMAN 😎💫
Credit: Katey P. Wiseman
Credit: Reid Wisemann
"BLAST OFF!"
Wednesday, November 11th, 2026


Dark Matter
Planets
Plant Cell
Life
BIRCH


FELIZ CUMPLEAÑOS
(HAPPY BIRTHDAY)
Credit: NASA / Luna Posadas Nava
NASA ASTRONAUT FRANK RUBIO
Friday, December 11th, 2026


2017
NASA Class of 2017 Astronaut with Astronauts Matthew Dominick, Warren Hoburg, Robb Kulin, Kayla Barron, Bob Hines, Jessica Watkins, Zena Cardman, Jasmin Moghbeli, Jonny Kim, Raji Chari and Loral O' Hara.
2023
International Space Station (ISS) Expedition 68 Astronaut with Cosmonauts Sergey Prokopyev and Dmitri Petelin.
68
ARTEMIS
2027
NASA Artemis III Astronaut with Astronauts Randy Bresnik, Andre Douglas, and Luca Parmitano (Bob Hines, too).
NASA

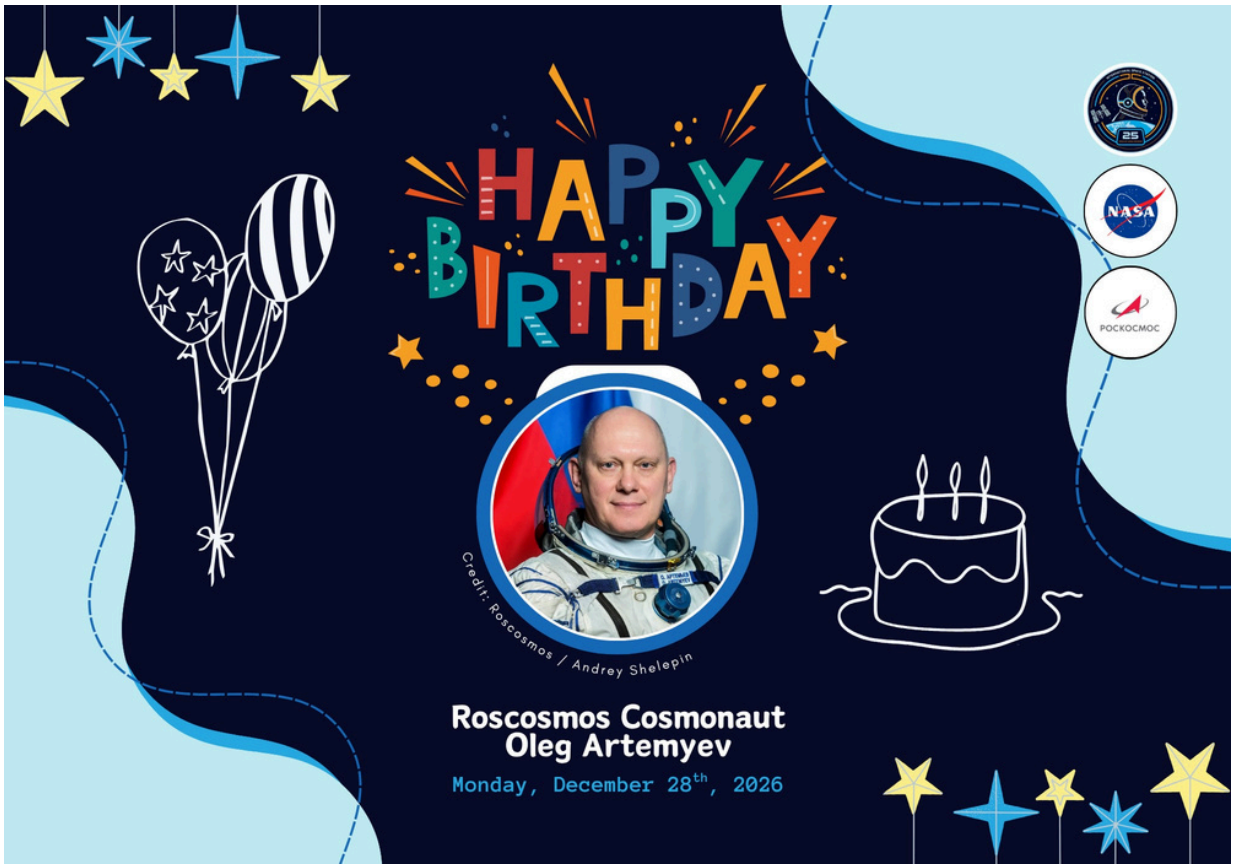

NASA Astronaut
Andre Douglas, PhD
HAPPY BIRTHDAY
Friday, December 11th, 2026
NASA


2026 (Backup) NASA Artemis II Astronaut
Credit: NASA / Luna Posadas Nava
2027 NASA Artemis III Astronaut


Happy Birthday
NASA Astronaut
Nichole "Vapors" Stilwell
Sunday, December 13th, 2026
Credit: NASA-JSC / Robert Markowitz
NASA


HAPPY
BIRTHDAY
ROSCOSMOS
COSMONAUT
SERGEY
TETERYATNIKOV
Saturday, December 19th, 2026
A Special Day for a
Special Roscosmos
Someone!
Credit: NASA / Bill Stafford
NASA
РОСКОСМОС
С днем рождения


お誕生日おめでとう
PACIFIC WISHES
ON YOUR BIRTHDAY
JAXA ASTRONAUT TAKUYA ONISHI
Tuesday, December 22nd, 2026
NASA
JAXA


HAPPY BIRTHDAY
Credit: Roscosmos / Andrey Shelepin
Roscosmos Cosmonaut
Oleg Artemyev
Monday, December 28th, 2026
NASA
РОСКОСМОС


お誕生日おめでとう
JAXA Astronaut
Akihiko Hoshide
Monday, December 28th, 2026
NASA
JAXA

Holiday Celebrations with National Aeronautics and Space Administration (NASA)


April 22nd
Credit: NASA / Reid Wiseman
Happy Earth Day


NASA
2025 NASA ASTRONAUT CANDIDATE CLASS
CREDIT: NASA / JOSH VARCARCEL
FIRST AMERICAN SPACEWALK BY ED WHITE IN 1965
CREDIT: NASA
— HAPPY —
Fathers' Day
TO ALL ASTRONAUTS (AND COSMONAUTS)
2026

Moon (Los Angeles, California, USA)



March 18, 2011

Happy International Observe the Moon Night

2026

Celebrate with a memory of the Moon from about 15 years ago for all who cherish and find joy in all the Moon gifts us 💫

For my husband (Brian), especially 🤍💫

Saturday, September 19th, 2026

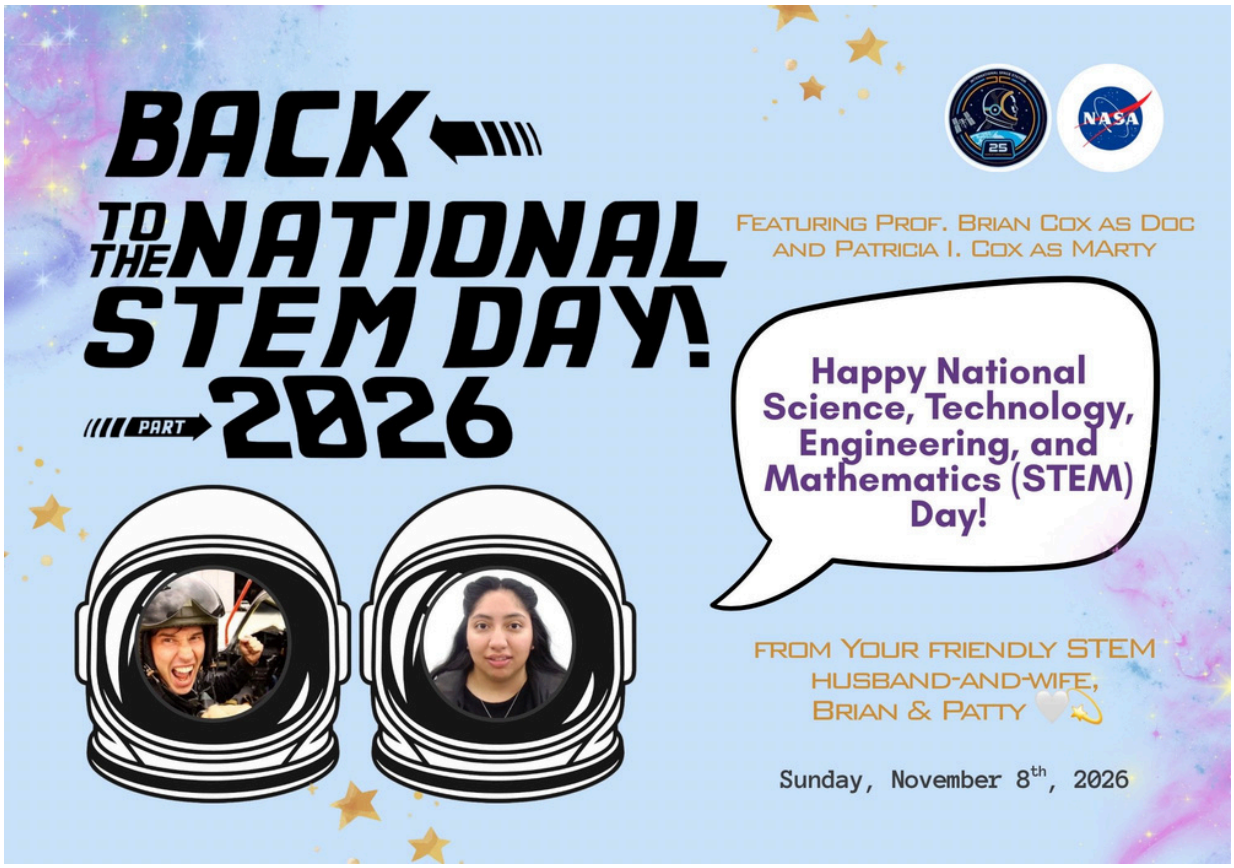
Corpse Bride

COX EDITION

SATURDAY



OCTOBER 31ST 2026


BACK TO THE NATIONAL STEM DAY!
PART 2026
FEATURING PROF. BRIAN COX AS DOC AND PATRICIA I. COX AS MARTY
Happy National Science, Technology, Engineering, and Mathematics (STEM) Day!
FROM YOUR FRIENDLY STEM HUSBAND-AND-WIFE, BRIAN & PATTY
Sunday, November 8th, 2026


CERTIFICATE
OF ACHIEVEMENT
Patricia Vargas
Nov 24, 2025
Dr. Nicola Fox
CERTIFICATE
OF ACHIEVEMENT
Patricia I. Cox
Apr 16, 2026
Dr. Nicola Fox
CELEBRATING
ONE YEAR
with NASA
Grateful to continue learning, growing, and contributing alongside many talented and gifted colleagues across the globe for continued International Space Station (ISS) success. Two-year NASA-versary on Wednesday, November 24th, 2027, here we come!
Brian & Patty
Tuesday, November 24th, 2026


Thank you for helping care for us on Earth
ROSCOSMOS COSMONAUTS, ESA/NASA/CSA/JAXA ASTRONAUTS, AND ASTRO-COSMO TEAMS AT LARGE
ISS Expedition 75: Anil Menon, Pyotr Dubrov, Anna Kikina
NASA SpaceX Crew-13: Jessica Watkins, Luke Delaney, Joshua Kutryk, Sergey Teteryatnikov
With all the astro-cosmo gratitude,
Brian & Patty
Thursday, November 26th, 2026


Happy Winter Holidays
Warm wishes for the season ahead.
From our family to yours
Wishing you joy, rest and time with all loved ones.
Most warmly,
Brian & Patty
#nasa


NASA
25
2026
HAPPY
NEW YEAR'S
EVE
12.31.2026

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF OPEN SCIENCE

2026 INTERNATIONAL SPACE STATION (ISS), NASA ARTEMIS, AND ASTROPHYSICS PUBLICATIONS FOR THE PUBLIC

National Aeronautics and Space Administration of Open Science documents International Space Station (ISS), NASA Artemis, and astrophysics publications for the public written during the calendar year. The NASA of Open Science journal for 2026 holds a total of 19 ISS, NASA Artemis, and astrophysics publications written between January 1st, 2026 and December 31st, 2026 across five categories: academic papers, data visualizations, music, presentations, and visual art.

ABOUT THE AUTHORS

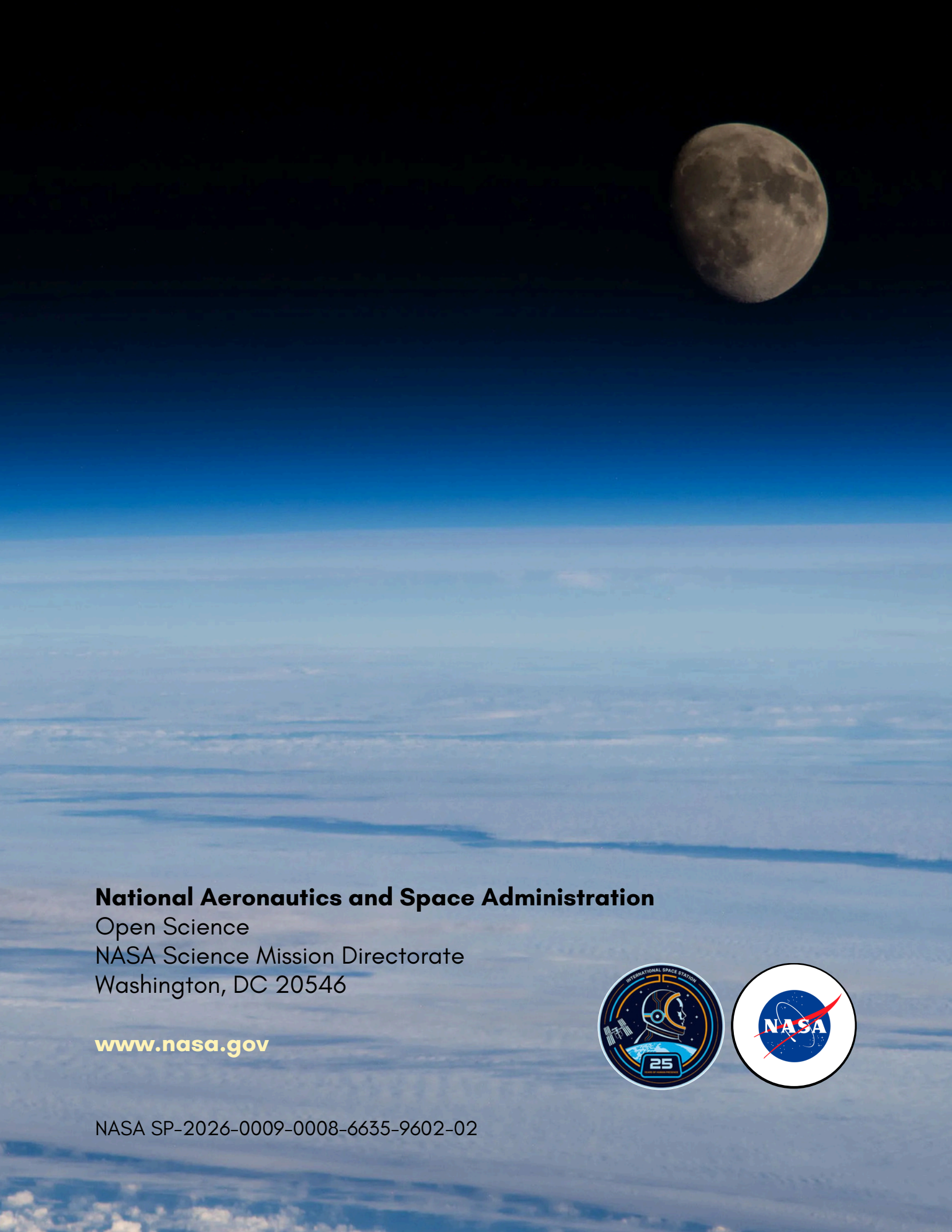
Brian E. Cox is the husband of Patricia I. Cox. Borne March 3rd, 1968 in Oldham, England, United Kingdom, he holds a Doctorate of Philosophy in Physics from University of Manchester (UoM) and is a Professor. Dr. Cox's wife worked his filed dissertation, *Double Diffraction Dissociation at Large Momentum Transfer (1998)* in 2026.

Patricia I. Cox is the wife of Brian E. Cox, PhD. Borne March 23rd, 1992 in Van Nuys, California, United States of America, she holds a Bachelor of Science in Sociology from Oregon State University (OSU) rearticulated from University of California, Los Angeles (UCLA) and is a Quantitative Social Scientist. Dr. Cox's husband worked her housed publication, *What Most Affects the Probability of Receiving Public Assistance? Examining the Effect of Family Background and Educational Attainment on Receiving Public Assistance with Multivariate Regression Analysis (2021)* in 2025.

The latest publication of Dr. and Dr. Cox is *A Mathematics and Physics Analysis of NASA Roman Relative to NASA Hubble by First Image: More Images, More Pixels, More Layers, and More Stars with Combined Dark Matter and Dark Energy within 3.84 Percentage Points of 95 (2026).*

FRONT COVER: International Space Station (ISS) photograph of planet Earth: Star Trails. "This long-duration image shows star trails above Earth and the blue lights of fishing boats and the yellow lights of Indonesian cities stretching below the International Space Station as it orbited 258 miles above the Banda Sea on Sept. 20, 2026."
(Credit: NASA / Anil Menon)

BACK COVER: International Space Station (ISS) photograph of the moon: Waxing Gibbous Moon. "The waxing gibbous moon rises above Earth's blue atmosphere in this photograph taken from the International Space Station on Oct. 3, 2025, as it orbited 263 miles above a cloudy Atlantic Ocean off the coast of Quebec, Canada."
(Credit: NASA)



National Aeronautics and Space Administration
Open Science
NASA Science Mission Directorate
Washington, DC 20546

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