

# Welcome

## Science Update: Bridging a Passion for Human Discovery in Space and on Earth — The Lucy Mission and Lucy in Space Contest

Presented by:

Donald Johanson, Harold Levison, and Julie  
Russ

January 14, 2021  
7:00 PM ET

Promoting excellence and innovation in science teaching and learning for all

# Meet today's presenters...



**Donald Johanson**  
Founding Director  
Institute of Human Origins

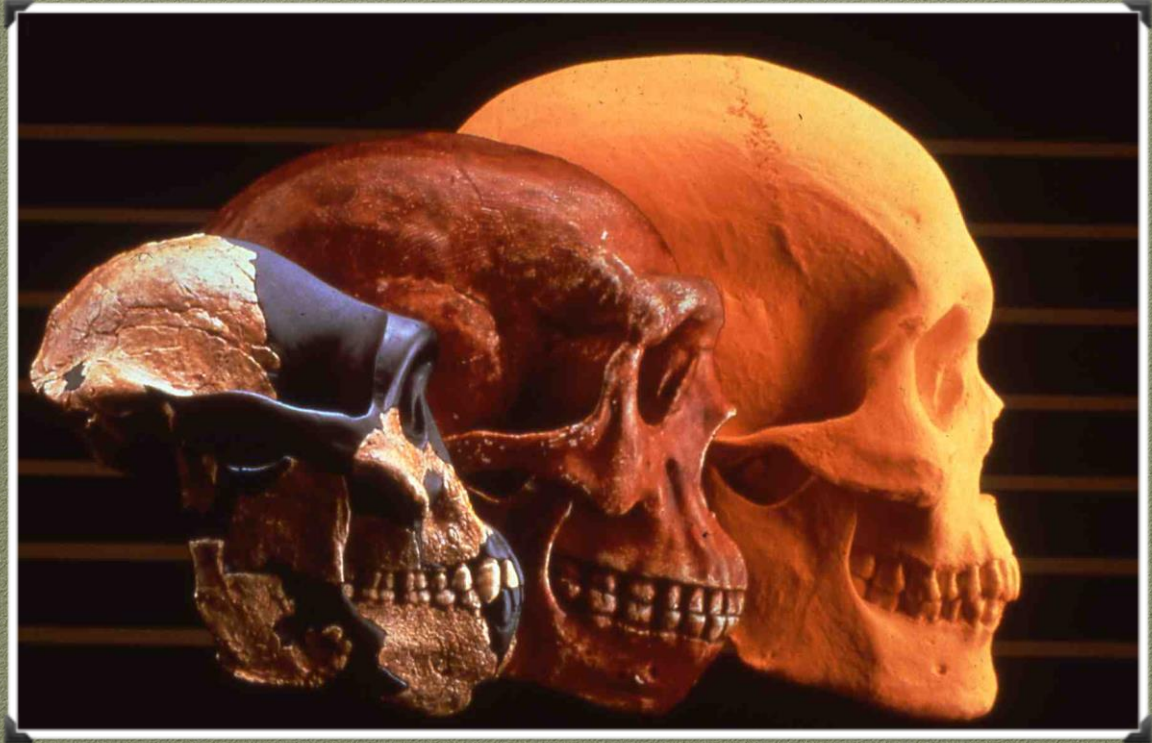


**Harold Levison**  
Principal Investigator  
NASA's Lucy Mission



**Julie Russ**  
Assistant Director  
Institute of Human Origins

# ANCESTORS



*James Brown,*  
EVIDENCE *Newport,*  
AS TO *1863.*

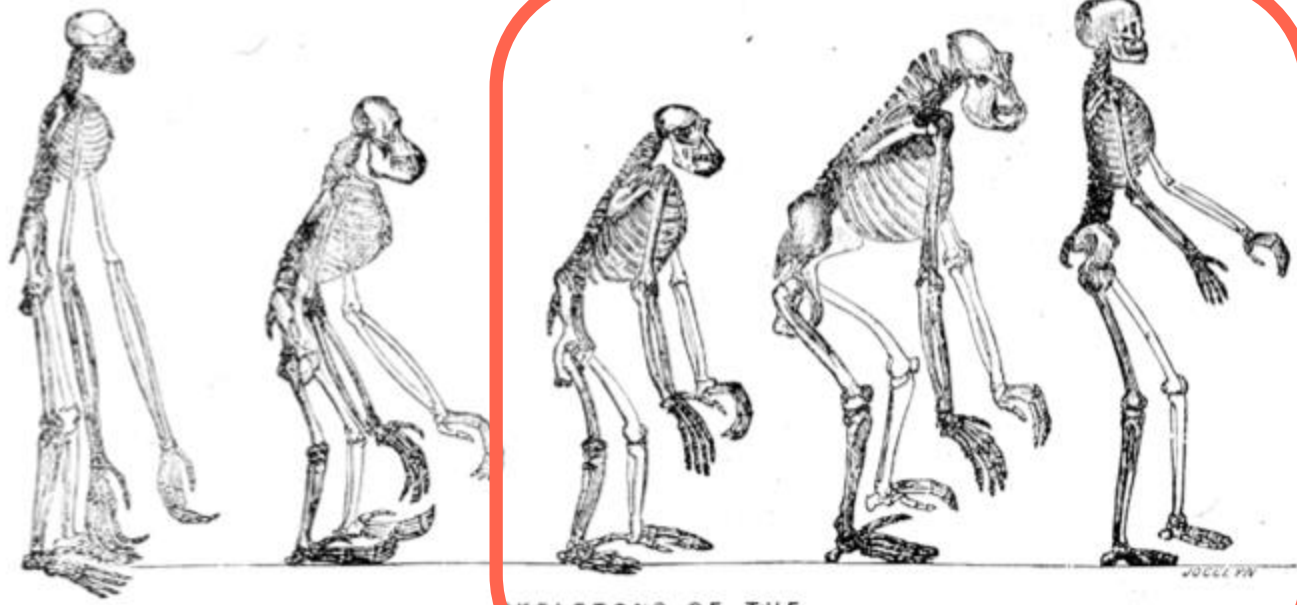
MAN'S PLACE IN NATURE.

BY  
THOMAS HENRY HUXLEY,  
FELLOW OF THE ROYAL SOCIETY.



WILLIAMS AND NORGATE,  
14, HENRIETTA STREET, COVENT GARDEN, LONDON;  
AND  
20, SOUTH FREDERICK STREET, EDINBURGH.  
1863.





GIBBON.

ORANG.

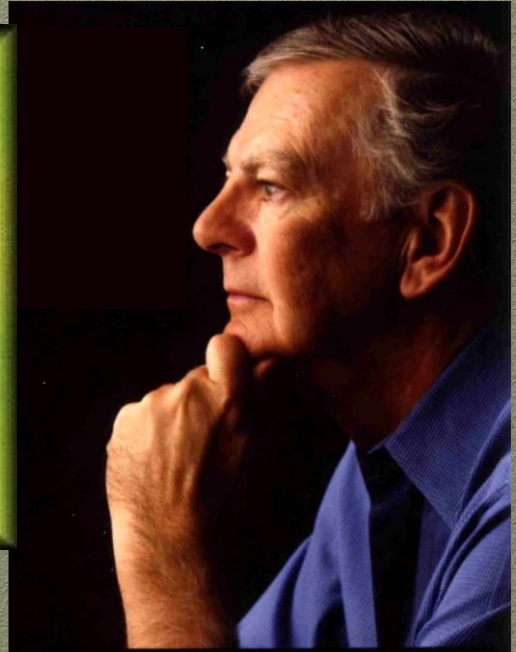
KELETONS OF THE

CHIMPANZEE.

GORILLA.

MAN.

*Photographically reduced from Diagrams of the natural size (except that of the Gibbon, which was twice as large as nature), drawn by Mr. Waterhouse Hawkins from specimens in the Museum of the Royal College of Surgeons.*

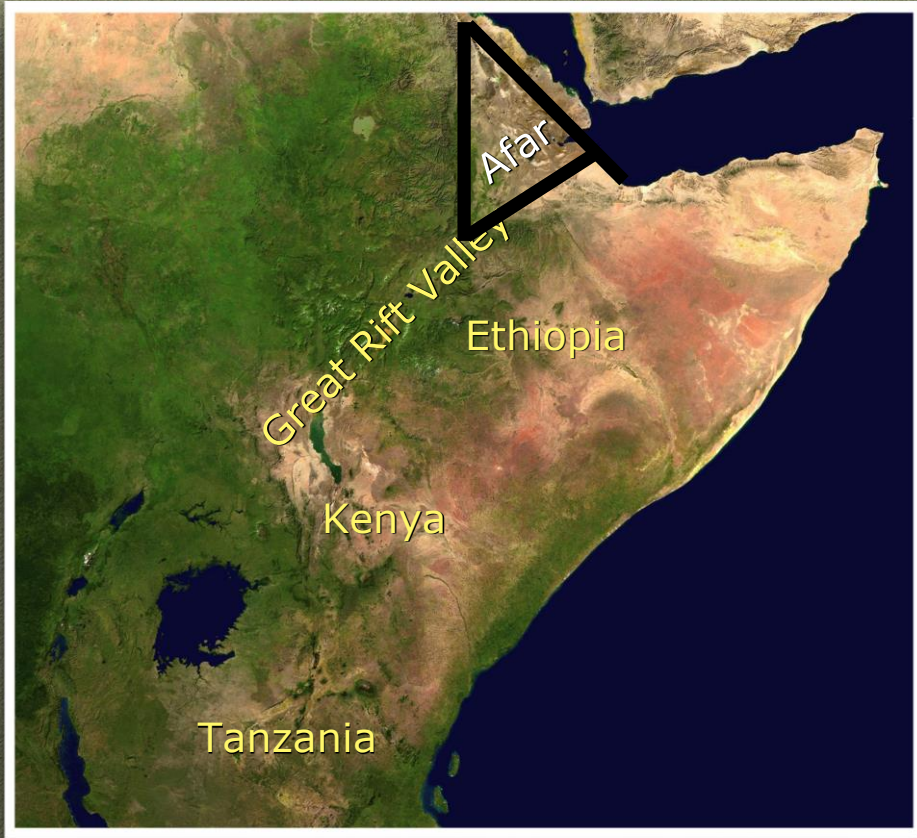




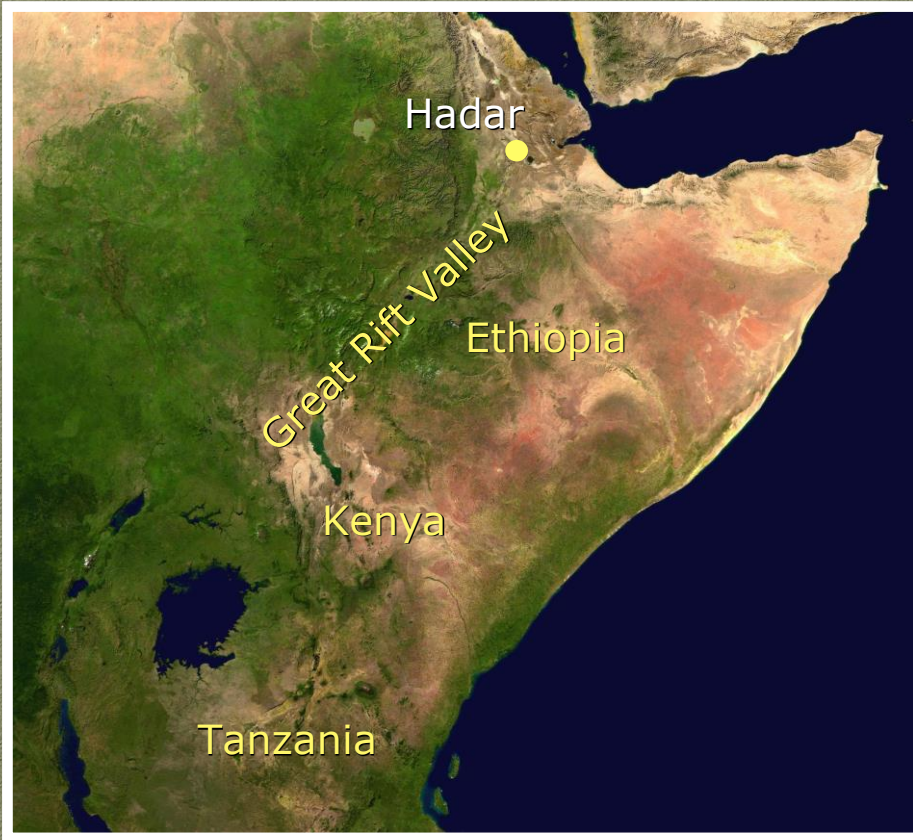


AFRICA'S  
CRadle OF  
RIFT VALLEY





# Horn of Africa



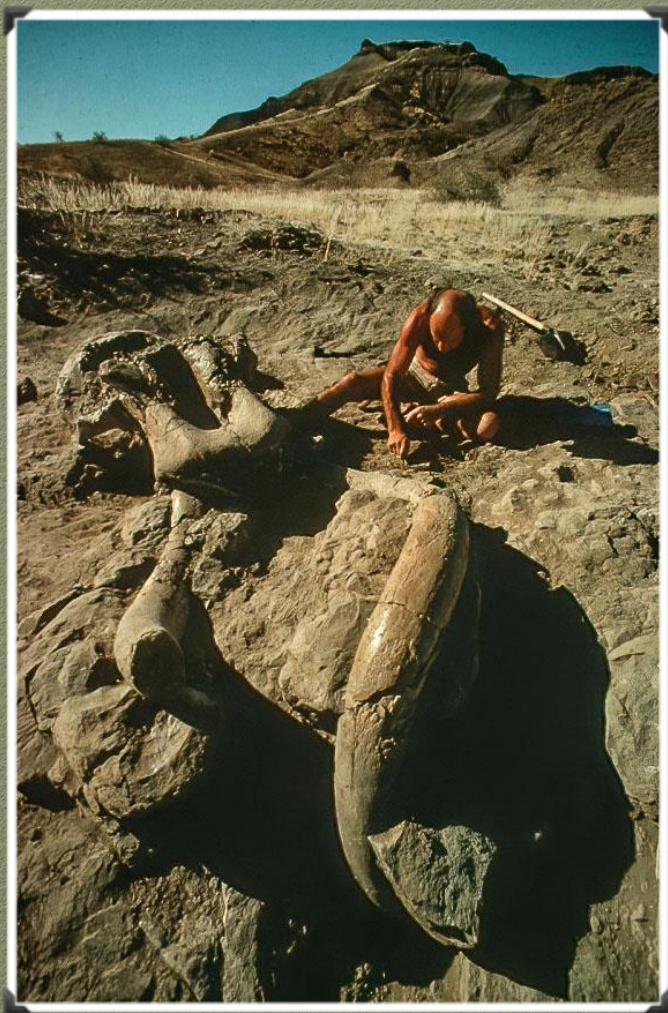
# Hadar, Ethiopia

# Hadar, Ethiopia









# Locality 288

November 24, 1974









Lucy

*Australopithecus  
afarensis*



3.2 mya



**HUMAN**

**LUCY**

**CHIMP**



# Laetoli, Tanzania



3.7 mya





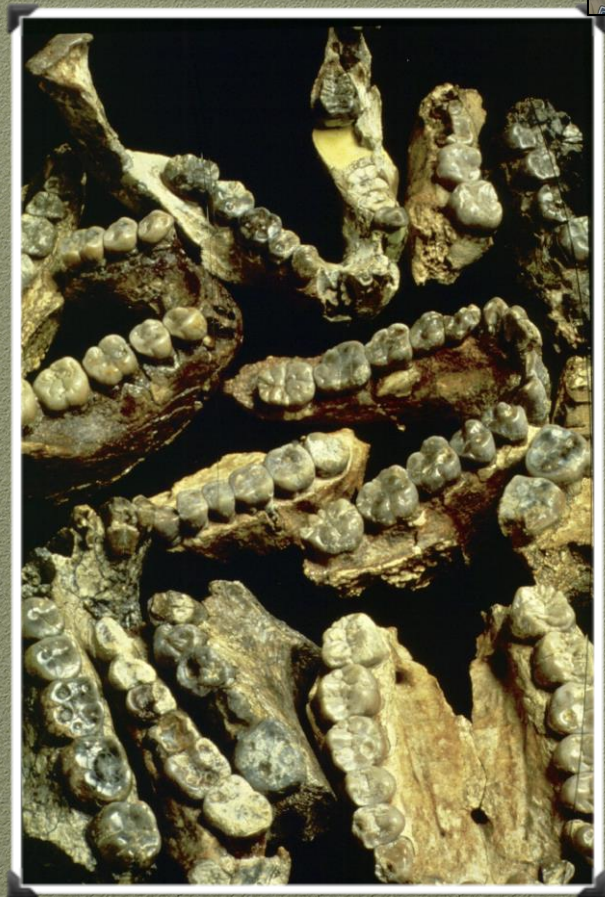
ኢትዮጵያ  
ፎንታን  
Dinkinesh  
2 Birr Ethiopia  
WOND WOSEN NEGA

3.2 MILLION YEARS OLD

TA "DARIIFAL" A 3.2 MILYOUNIH LIGGIDIH QUMRI LEH TAN LUCY,  
"AXCHY,"CEELŌ MAILY" (AUSTRALOPITHECUS AAFARANSISIL) TAMIXXIGE,  
GOHLAH, LAFĀ" ELL GEYTIMTEH TEN. GEYTEM, DOKTOR, JOHANSONU  
EDDE, GEEM, XIMOLIK, 15, 1966 HATŌ, LIGGIDA.

በዚህ ቦታ 3.2 ሚሊዮን ዓመት ዕድሜ ያላት «ኢንግሊድ» (አውስትራሎፒዥክስ ኦፊላንጎስ) አሳሪ አካል ስኬር 15 ቀን 1966 ዓ.ም. በዶ/ር ደ.ጋ. ጆሀንሰን ገኘች።

AT THIS LOCALITY THE 3.2 MILLION YEAR-OLD SKELETON OF "LUCY"  
(AUSTRALOPITHECUS APARENSIS) WAS DISCOVERED BY D. JOHANSON ON  
24 NOVEMBER, 1974.





# *Australopithecus afarensis*



*Female*



*Male*

# Hadar 3.2 mya

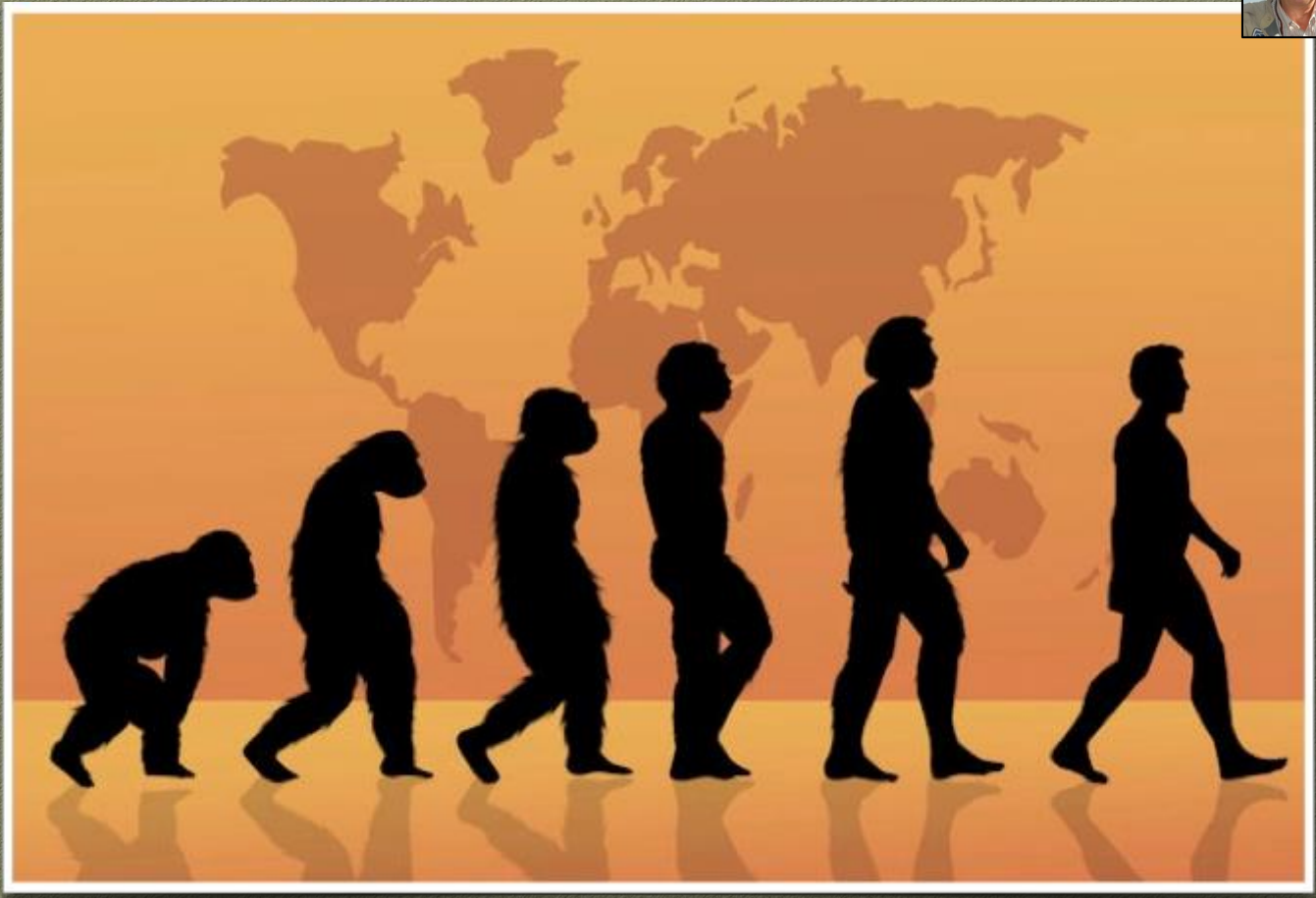


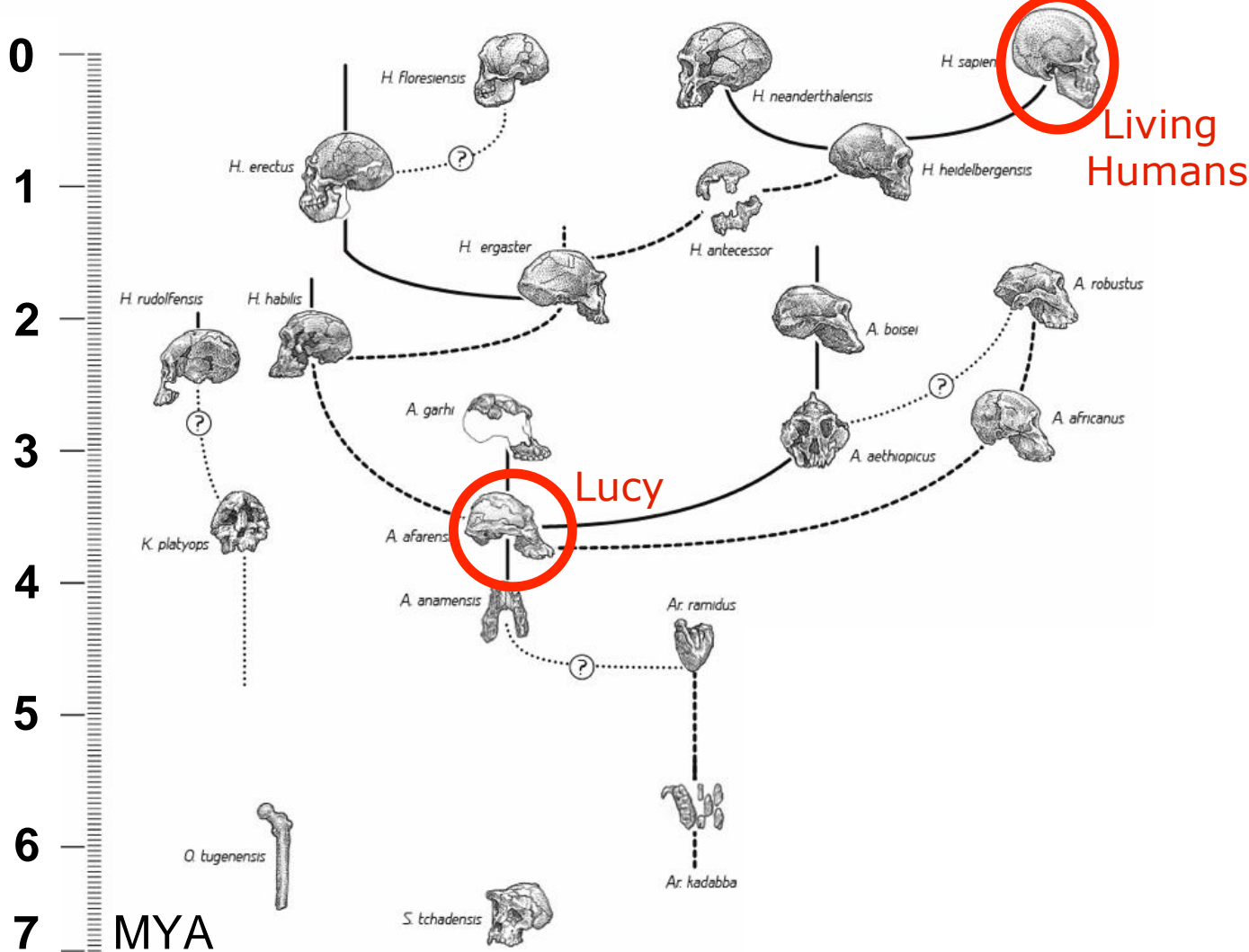
Courtesy Mauricio Anton





Courtesy Maurício Anton







# LUCY



Surveying  
the Diversity  
of Trojans



## Hal Levison

*Southwest Research Institute*

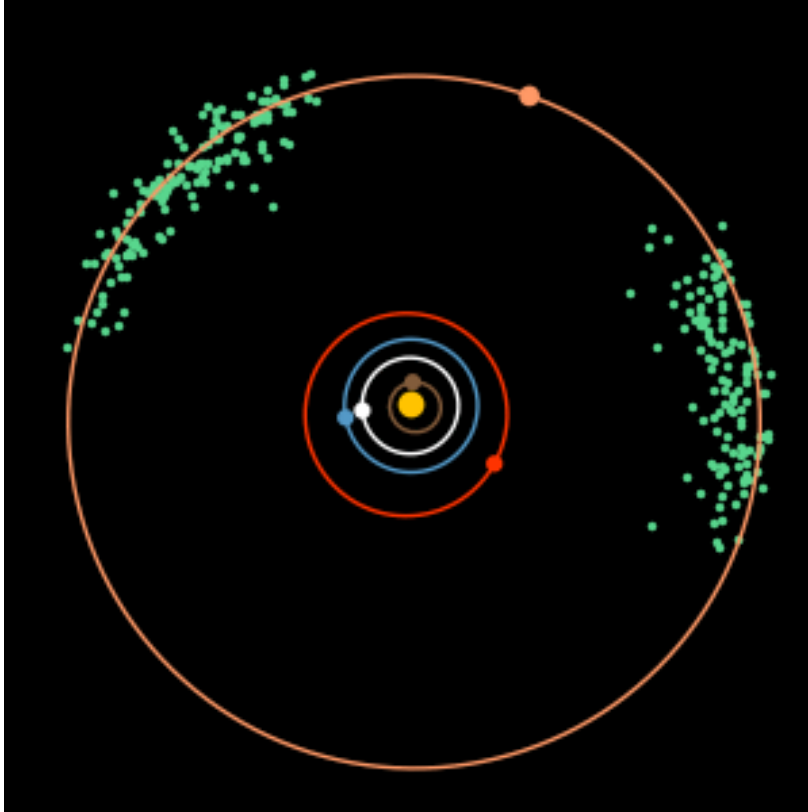
## *Lucy PI*







➤ Lucy is a Trojan tour



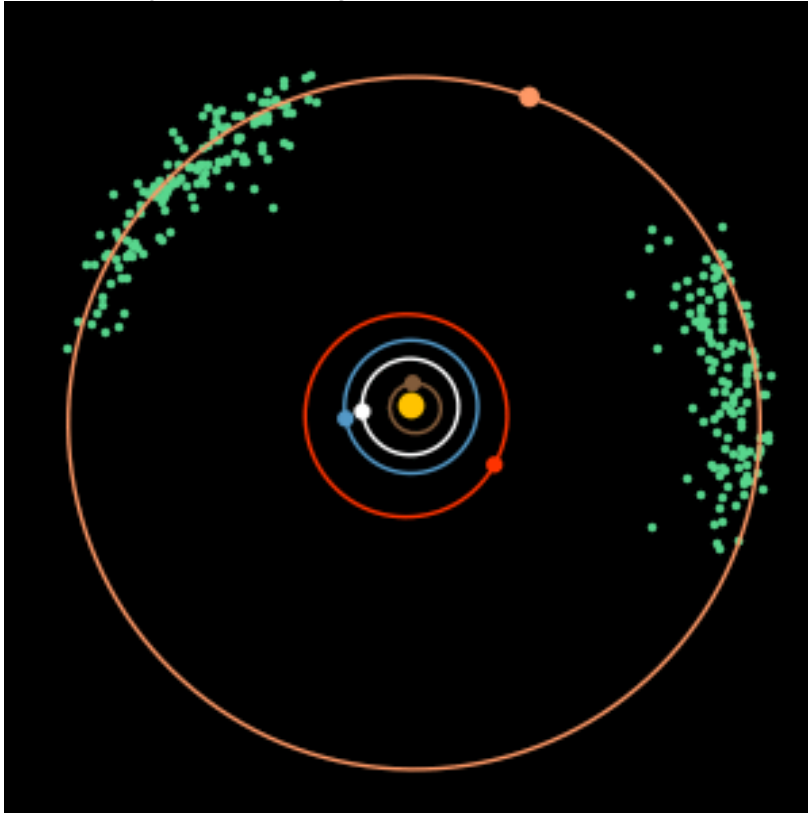
- Oct. 2021 launch
- MBA rehearsal in 2025
- 5 Trojan encounters from 2027-2033
  - Total of 7 objects





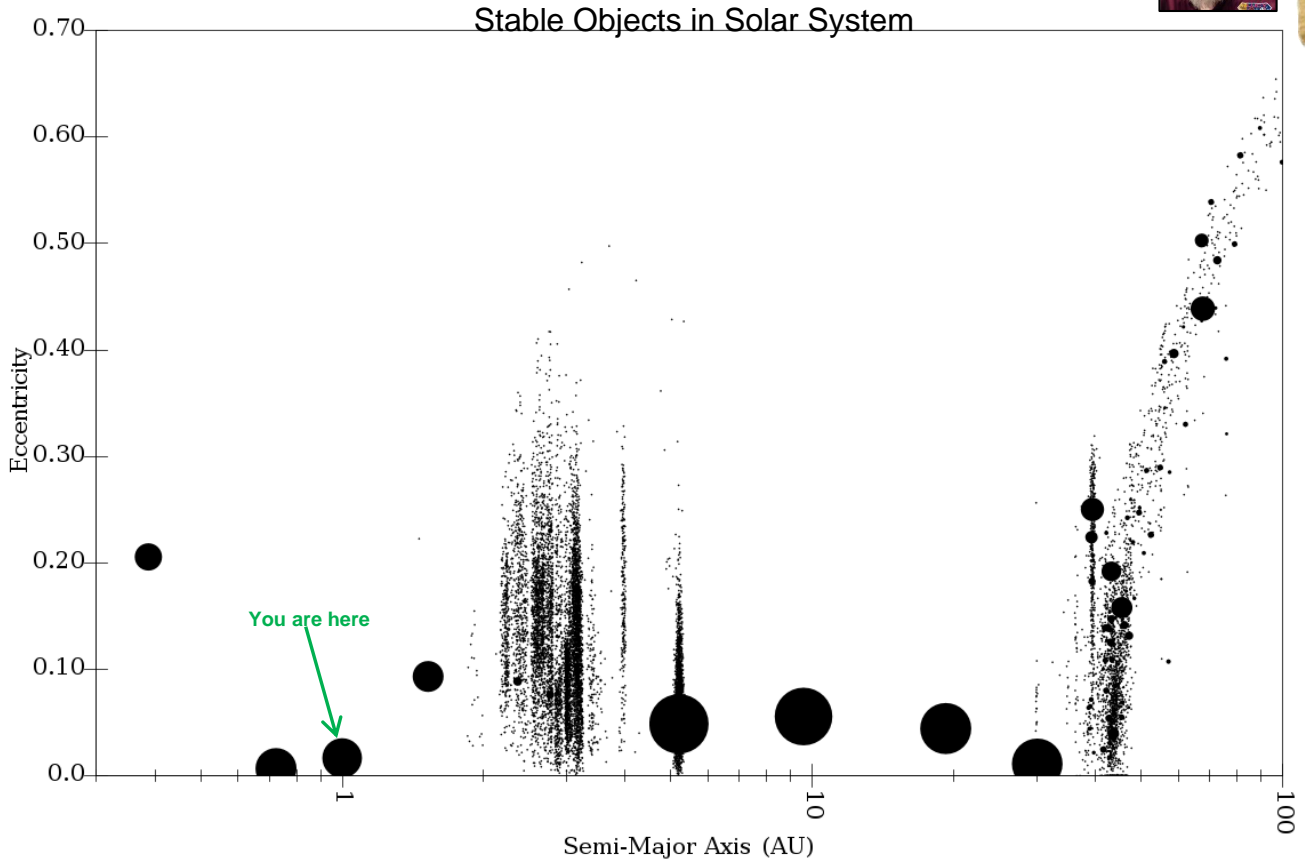
➤ Lucy is a Trojan tour

274 days, 11 hr, 5 min from now



- Oct. 2021 launch
- MBA rehearsal in 2025
- 5 Trojan encounters from 2027-2033
  - Total of 7 objects



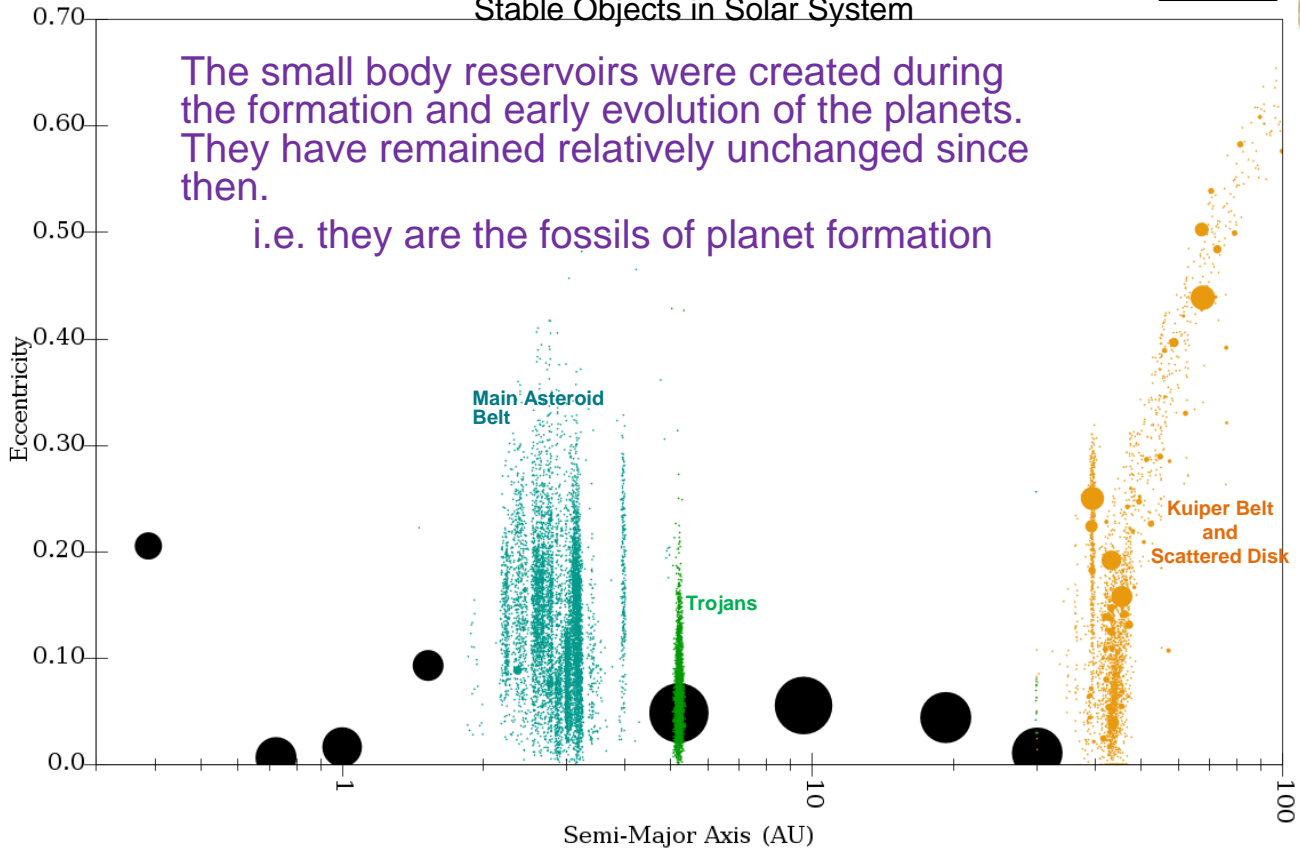


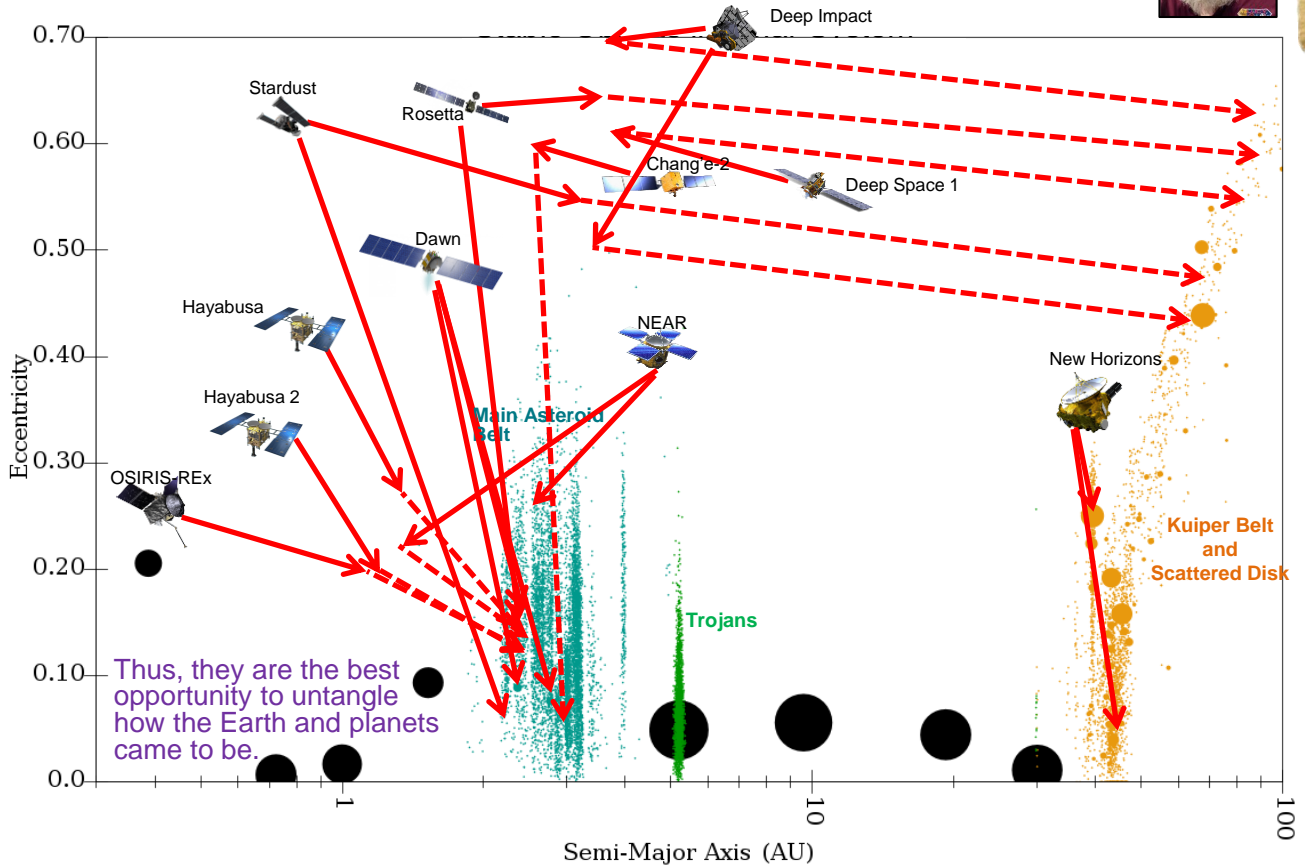


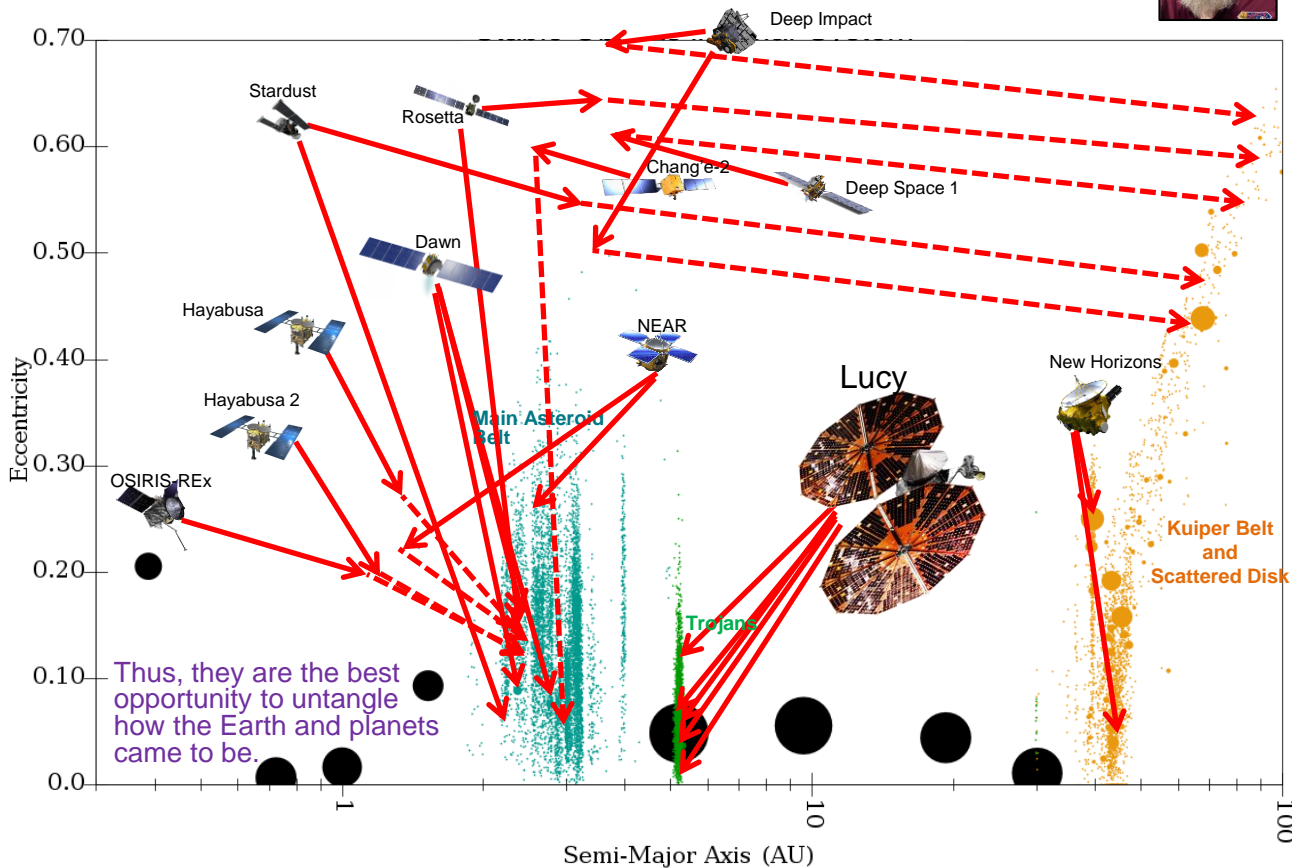
## Stable Objects in Solar System

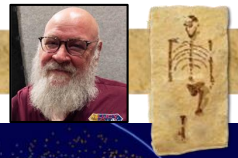
The small body reservoirs were created during the formation and early evolution of the planets. They have remained relatively unchanged since then.

i.e. they are the fossils of planet formation

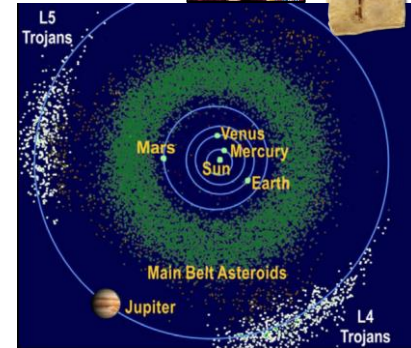




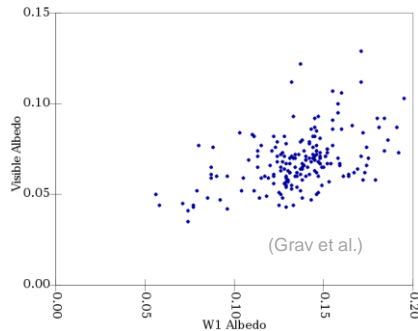




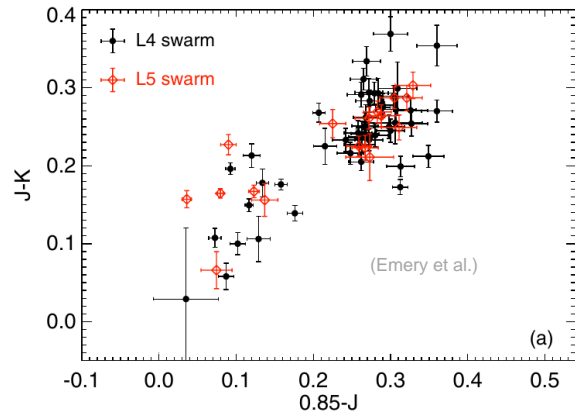
- To boldly go where no one has gone before
  - We have never seen one close up
- Trojans are remnants of giant planet formation
  - They should be low density and volatile rich below a desiccated surface layer with complex surface chemistry.
- **But**, they are not a homogeneous population
  - Contain C-, D-, and P-type spectral types

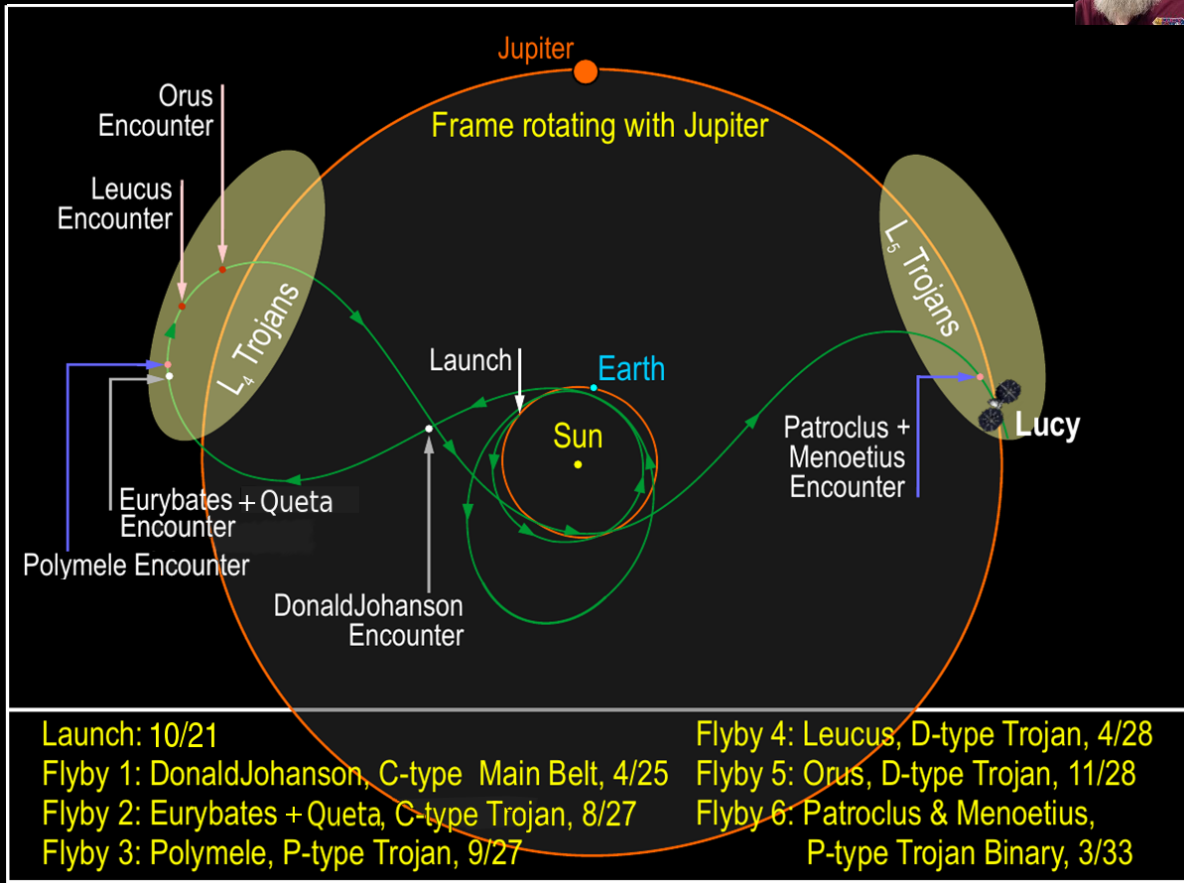


- Have visible albedos from ~4 - ~15%

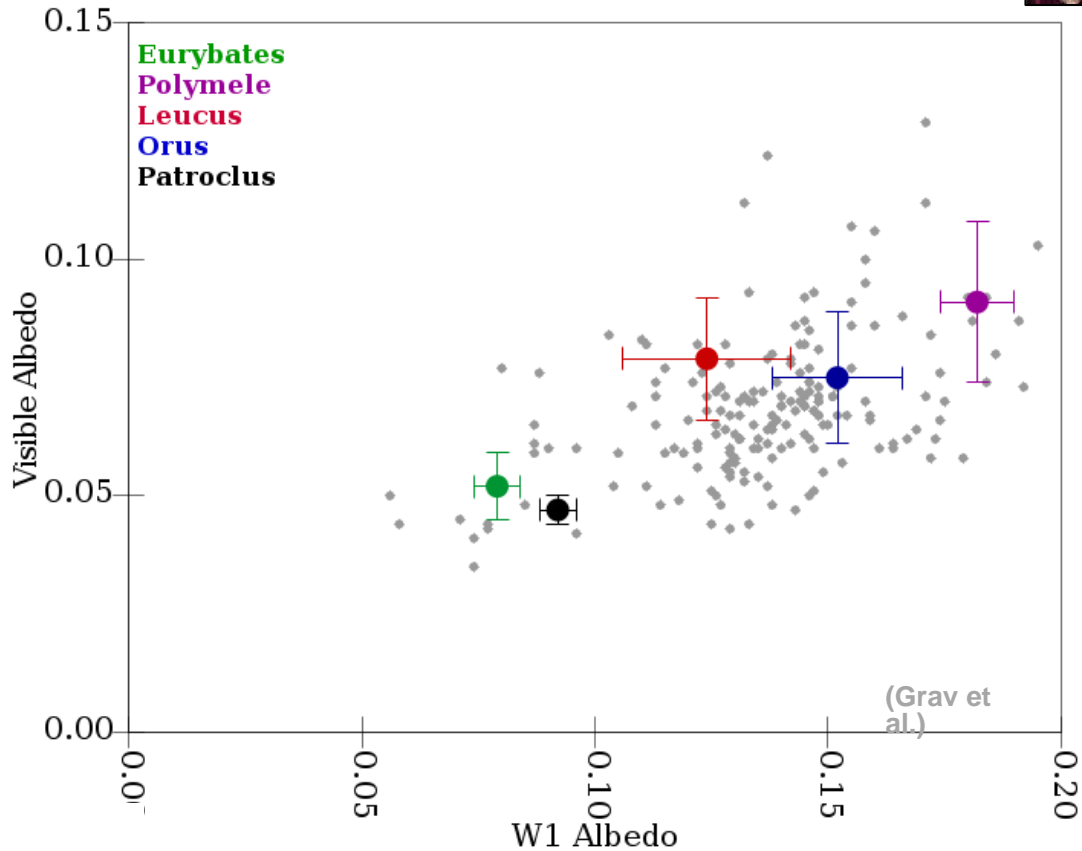


- Wide range of colors.





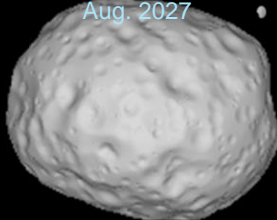






Eurybates +  
Queta

C-type  
Aug. 2027



L<sub>4</sub>  
:

Polymel

eP-type  
Sept. 2027



Leucus

D-type  
Apr. 2028



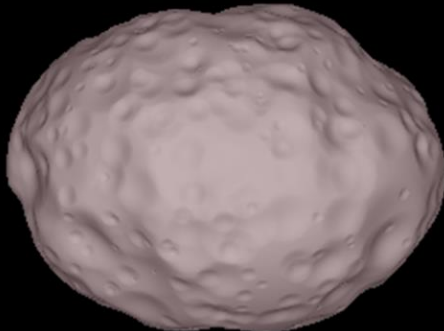
Orus

D-type  
Nov. 2028



Patroclus

Binary & P-type



L<sub>5</sub>  
:

Menoetius

Binary & P-type



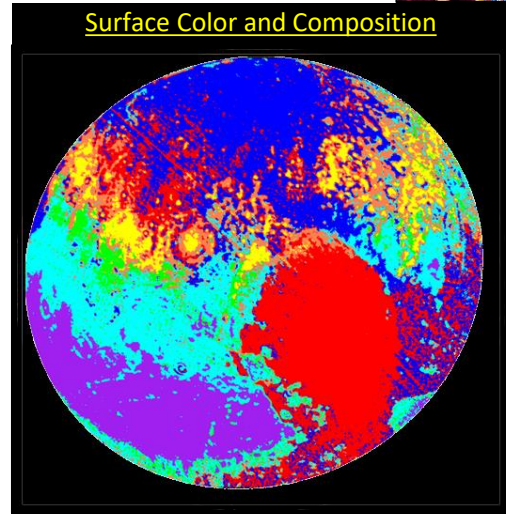
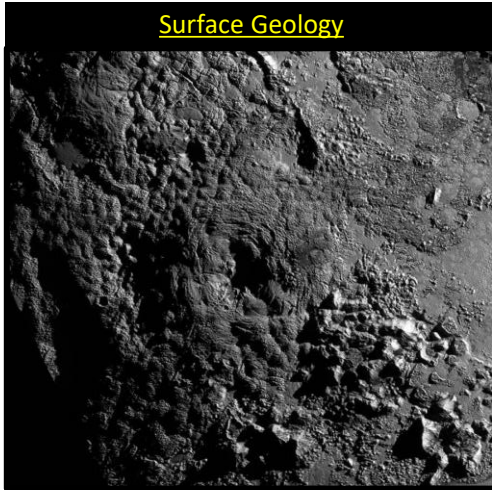
Mar. 2033

Artist conception based on Earth-based observations

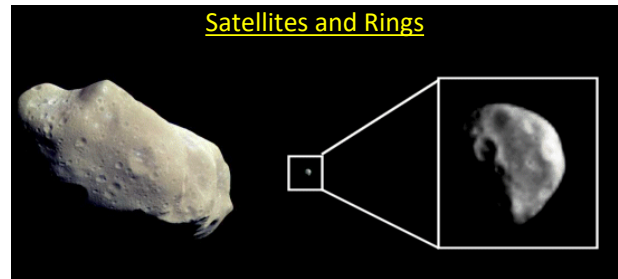
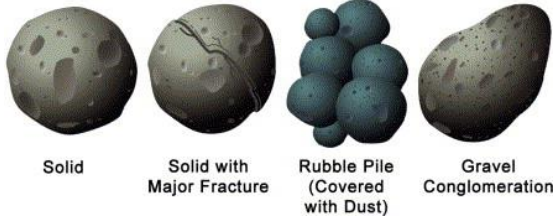
All known spectral types — Both the L<sub>4</sub> and L<sub>5</sub> swarms



➤ Lucy's remote sensing:



### Interiors



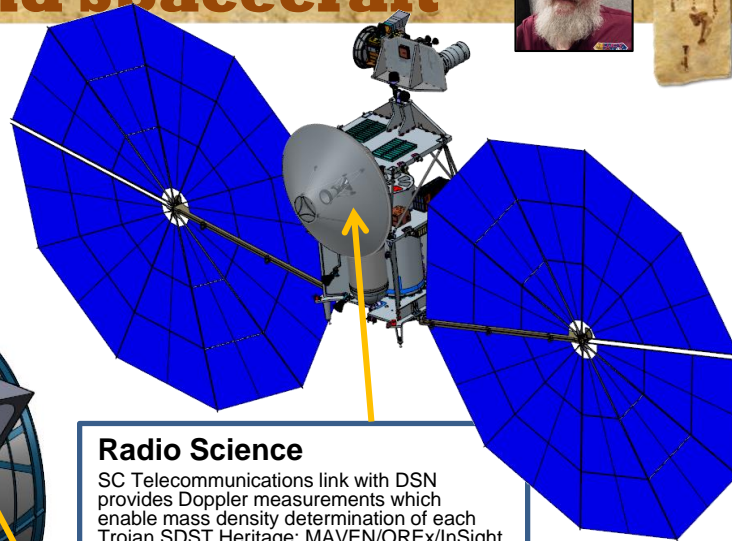
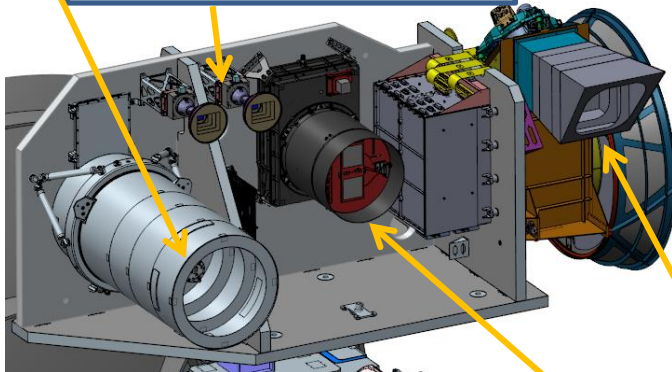


## L'ORRI

LONg Range Reconnaissance Imager (LORRI)  
High spatial resolution visible imager  
Heritage: NH

## TTCam

Terminal Tracking Camera (TTCam)  
Visible imager used for target centroiding  
Supplier: Malin Space Systems



## Radio Science

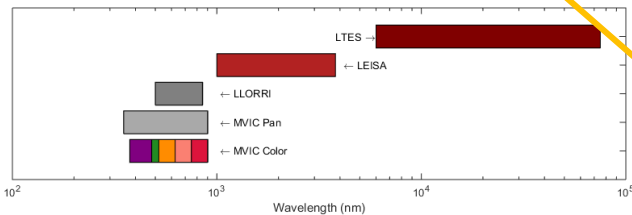
SC Telecommunications link with DSN provides Doppler measurements which enable mass density determination of each Trojan SDST  
Heritage: MAVEN/OREx/InSight

## L'Ralph

Multi-spectral Visible Imaging Camera (MVIC)  
Linear Etalon Imaging Spectral Array (LEISA)  
Color visible imager (MVIC) and infrared imaging spectrometer (LEISA)  
Heritage: NH, O'REX

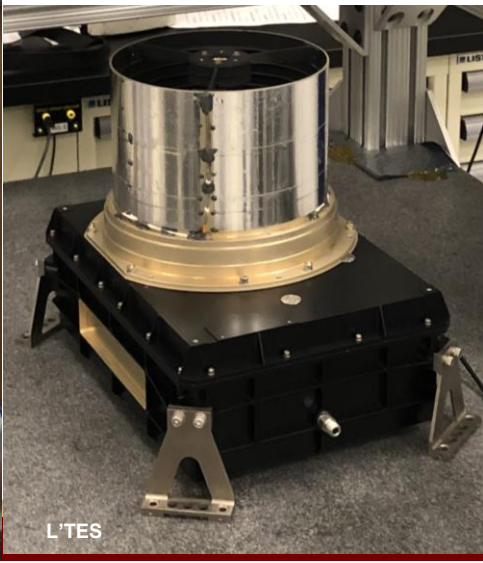
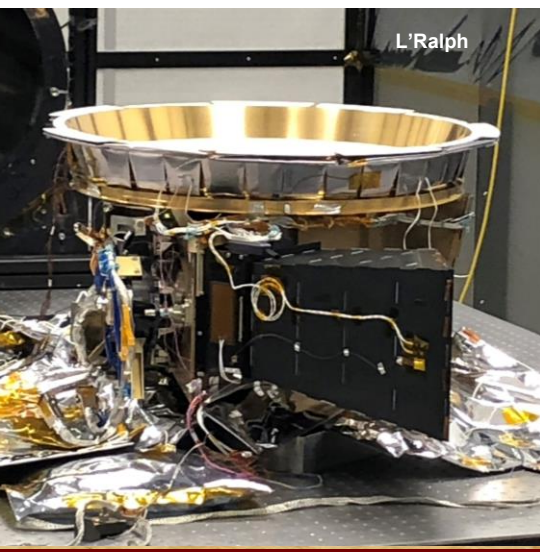
## L'TES

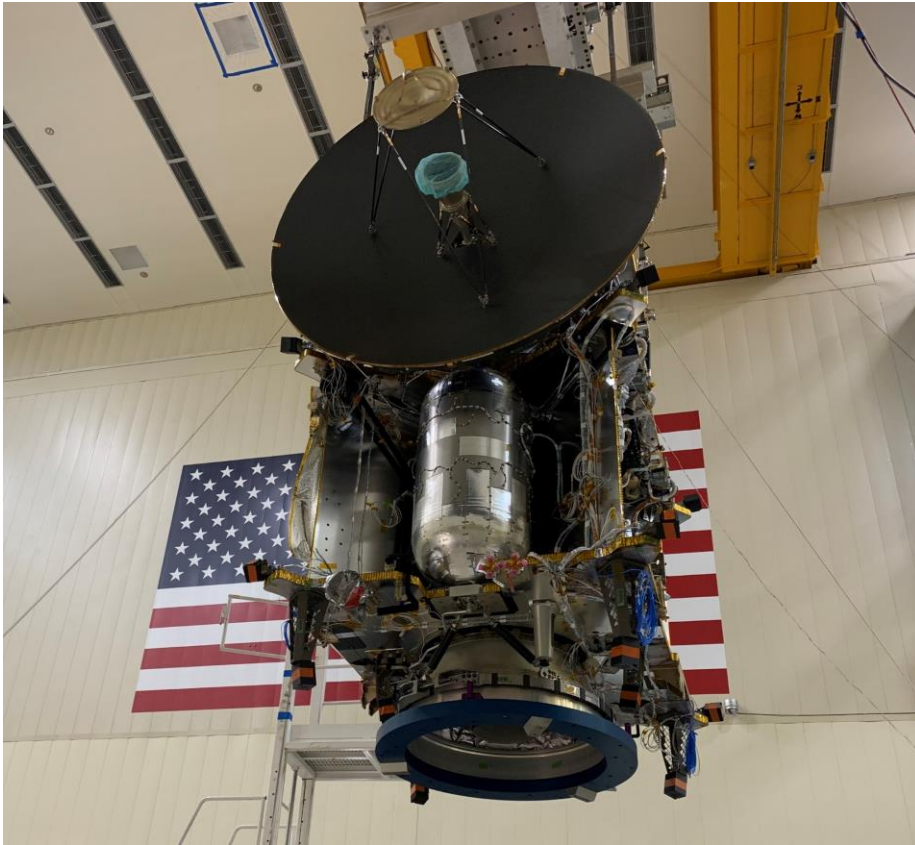
Thermal Emission Spectrometer (TES)  
Point FTIR spectrometer  
Heritage: O'REX, MGS





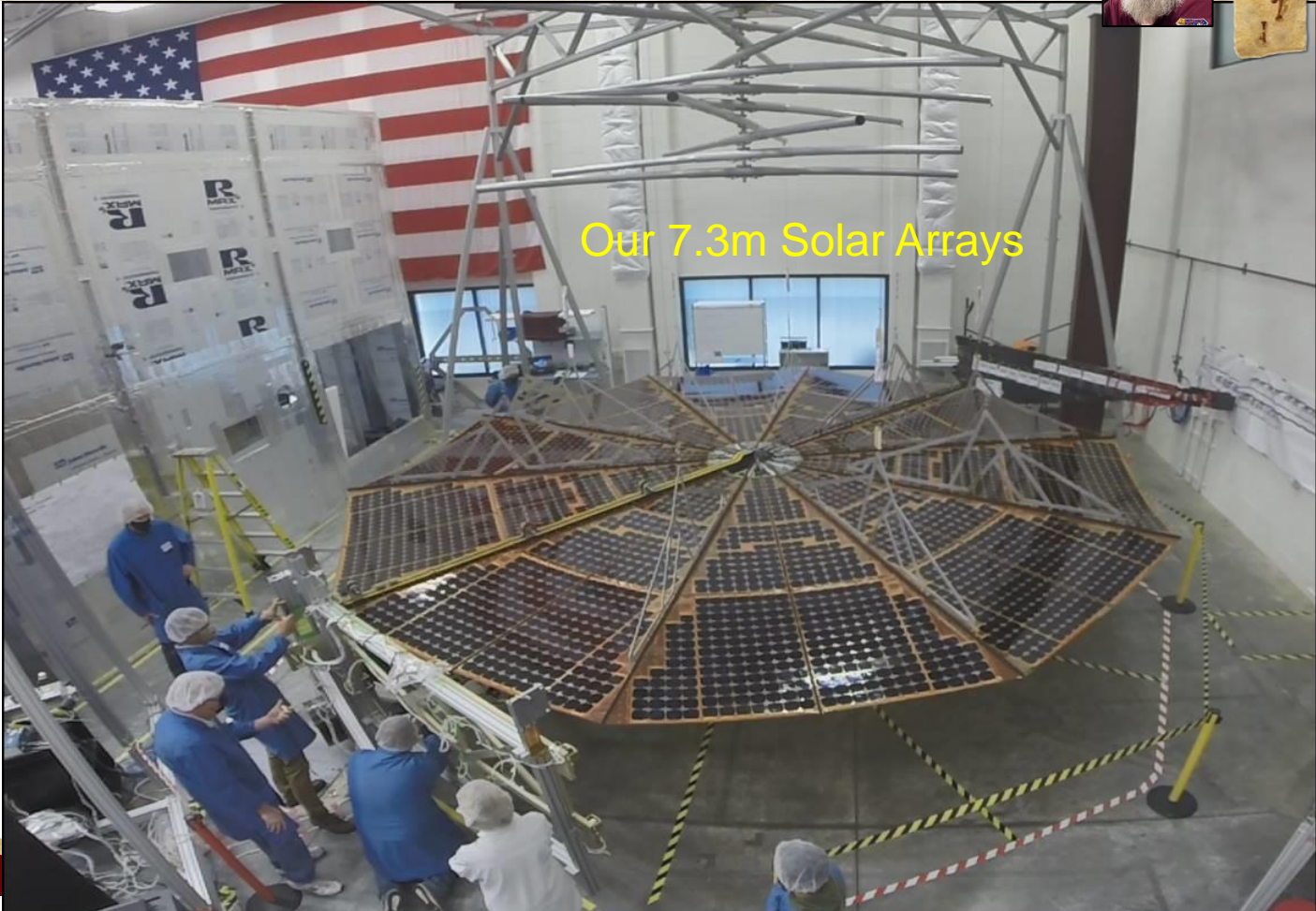
We are started *Assembly, Test, and Launch Operations:*





Lucy

Where are we now?



Our 7.3m Solar Arrays



"I Love Lucy" logo – Courtesy of CBS Broadcasting Inc.  
Used under License





# Connecting the **human past** to the **global future**



**The preeminent research institute  
for human origins science**

**ASU** Institute of  
Human Origins  
Arizona State University

A research unit of The College of Liberal Arts and Sciences



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# LUCY in SPACE



Lucy in Space Contest is supported by

National Aeronautics  
and Space  
Administration



Southwest Research Institute

**ASU** Arizona State  
University

Institute of Human Origins

School of Earth and Space Exploration

NASA L'Space Academy

A graphic for the 'Lucy in Space' contest. It features a dark blue space background with white stars. On the left, a large, cratered brown planet is shown. In the center, a white silhouette of a human skeleton is visible. To the right, there are two large orange umbrellas with a grid pattern, and a grey satellite dish. Several smaller brown planets with craters are scattered throughout the scene.

# LUCY<sup>in</sup> SPACE

## Lucy in Space Contest

- A creative and engaging way to connect students' understanding of the human drive for exploration and discovery of our origins on Earth and the origins of our solar system
- Connects to NGSS Biological Evolution: Unity and Diversity, Earth's Place in the Universe, and Space Systems
- Eligible for Middle and High School students in the United States and on military bases worldwide



Enter and details at  
<https://LucyinSpace.asu.edu>

Questions?

Contact Julie Russ [jruss@asu.edu](mailto:jruss@asu.edu)

**ASU** Institute of  
Human Origins  
Arizona State University

A research center of The College of Liberal Arts and Sciences



[iho.asu.edu](http://iho.asu.edu)

# Q&A Segment



**Donald Johanson**  
Founding Director  
Institute of Human Origins



**Harold Levison**  
Principal Investigator  
NASA's Lucy Mission



**Julie Russ**  
Assistant Director  
Institute of Human Origins

# Thanks to Today's Presenters...



**Donald Johanson**  
Founding Director  
Institute of Human Origins



**Harold Levison**  
Principal Investigator  
NASA's Lucy Mission



**Julie Russ**  
Assistant Director  
Institute of Human Origins

# Thank you for participating!



# Collection of Resources



This collection includes the slides (as PDF), handouts and other resources.



**Link to the collection:**

[https://my.nsta.org/collection/ZEipXJXfrLo\\_E?](https://my.nsta.org/collection/ZEipXJXfrLo_E?)





# NSTA Web Seminars (free)



**Teacher Tip Tuesday:** Supporting Ambitious  
Science Teaching

**January 26, 7:00 PM ET**



**Science Update:** Cosmic Explosions

**February 11, 7:00 PM ET**

<https://my.nsta.org/webseminars>



# NSTA Web Seminar Series



## NSTA Web Seminar Series: Topic Study: Assessing Three-Dimensional Learning: Using the Critical Aspects of Sensemaking to Design Assessments Meaningful to Both Teacher and Students

### Web Seminar Series

Tue Feb 09, 2021 | 7:00 PM - 8:30 PM Eastern

Tue Feb 16, 2021 | 7:00 PM - 8:30 PM Eastern

Tue Feb 23, 2021 | 7:00 PM - 8:30 PM Eastern

Tue Mar 02, 2021 | 7:00 PM - 8:30 PM Eastern



### Presenters



Jessica Holman



Kate Soriano



Kristen Moorhead

### Sponsors



<https://my.nsta.org/event/nsta-web-seminar-series-topic-study-assessing-three-dimensional-learning-usin>



# NSTA Member Web Seminars



**NSTA Author Series:** The NSTA Atlas of the Three Dimensions

**January 28, 7:00 PM ET**



**Transforming Science Learning:** Theory to Practice: Practical Guidance to Engage MLs in 3D Science

**February 24, 7:00 PM ET**

<https://my.nsta.org/webseminars>



# Thanks to the NSTA Virtual Learning Team



## **National Science Teaching Association**

Tricia Shelton, Director Professional Learning

Flavio Mendez, Assistant Executive Director

Kate Soriano, Standards Implementation Specialist

Wendy Binder, Program Director

Laura Jackson, Project Manager

Michelle Phillips, eLearning Engagement Specialist

Eddie Hausknecht, Web Developer

Don Boonstra, Technical Coordinator

***This concludes today's program.***

