

# Team 502: ASU/Psyche - ACCelerate Festival



# Team Members



Sara Bradley  
Mechatronics  
Engineer



Connor Bishop  
Electrical  
Engineer



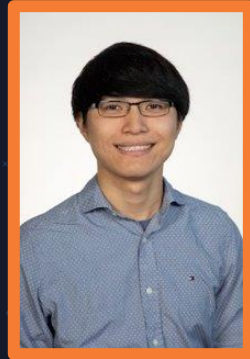
Spencer Martin  
Electrical  
Engineer



Mariam Medina  
Systems  
Engineer



Garrett  
Southerland  
Materials  
Engineer



Kenneth Zhou  
Mechanical  
Engineer

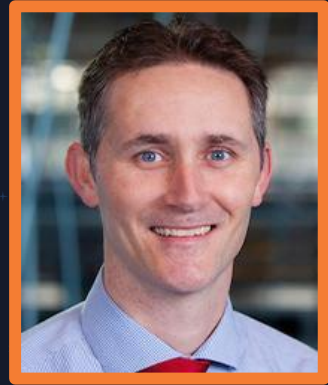
Kenneth Zhou



# Sponsor and Advisor



Sponsor  
Cassie Bowman, Ph.D.  
Associate Research Professor,  
ASU



Academic Advisor  
Shayne McConomy, Ph.D.  
ME Teaching Faculty, FSU

Kenneth Zhou





# Objective

The objective of this project is to create interest in the Psyche Mission with an interactive exhibit.

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# Project Overview

It is believed that Psyche is the remains of a planetesimal with an iron-nickel core that experienced many violent collisions.

The problem is ensuring a lasting interest in the Psyche Mission and Science, Technology, Engineering, Art, and Math (STEAM).

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# Critical Targets



Smaller than 125 square ft

One STEAM Related Concept



Maximum of \$1000

50% of Information should relate Psyche & Earth



Kenneth Zhou



# Validation of Targets



Measure with a measuring tape

Ask questions about takeaways from users



Track orders and budget use with a spreadsheet

Review displayed content and track information

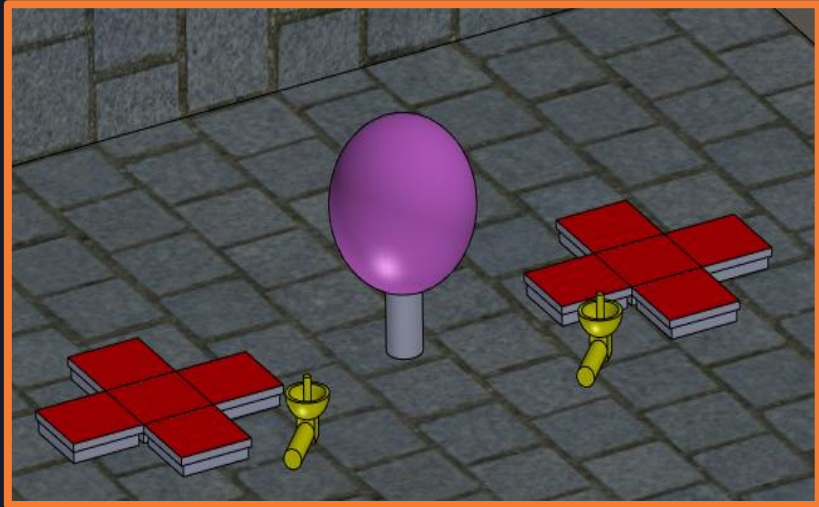
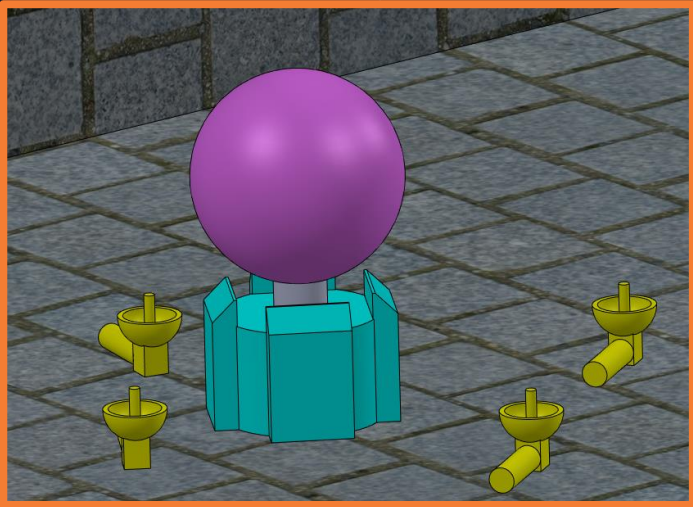


Kenneth Zhou



# Original Final Concept

IR pointer game + spacecraft controls



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# Asteroid Design

Fully 3D printed



Fully paper mâché



Mix of paper mâché and 3-D printed pieces

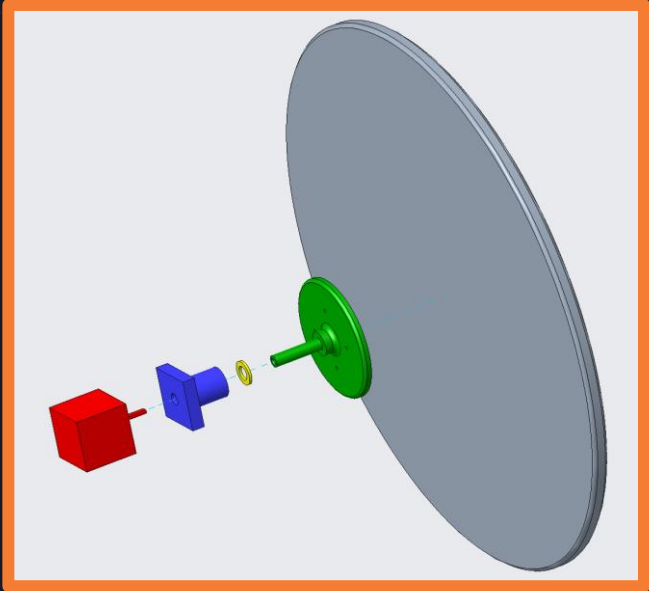
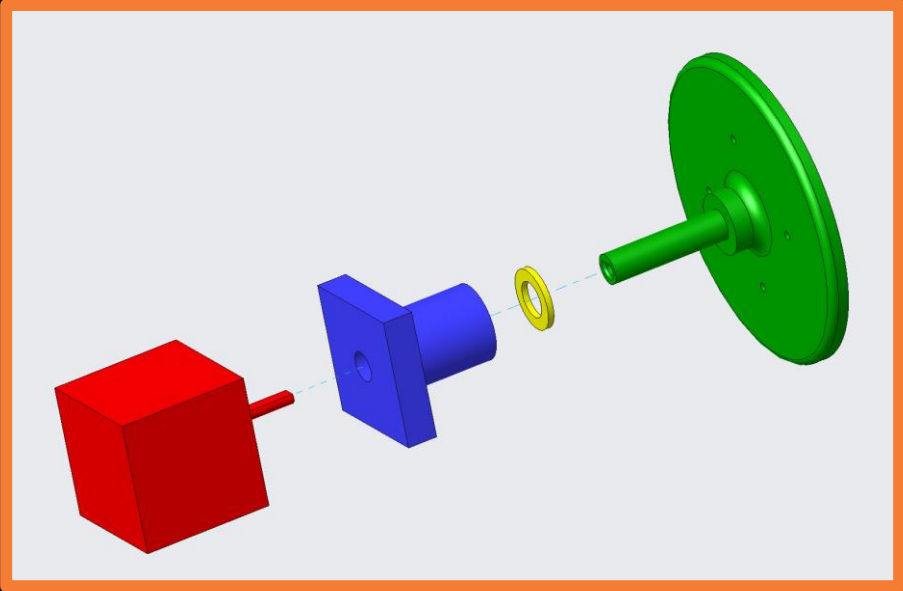


Kenneth Zhou



# Future Asteroid Work

## Rotating Asteroid Model



Kenneth Zhou



# Future Asteroid Work

Integrate IR emitters

Adding texture and  
sculpting other  
asteroid features

Painting (add more)

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Engineering

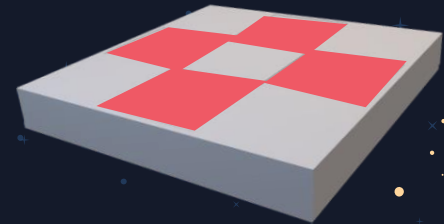
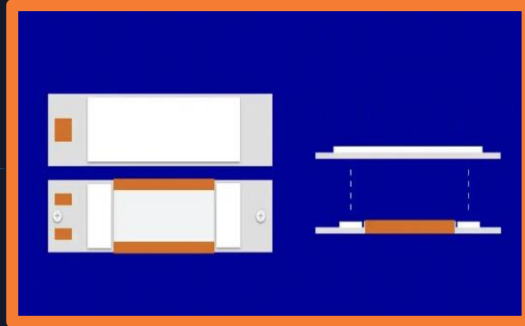


# DDR Design

Capacitive Sensor

Contact Sensor

Wood Structure +  
Polycarbonate  
Panels



Kenneth Zhou



# DDR Design Future Work

Testing

Addition of a second  
DDR pad

Connection to the  
asteroid model

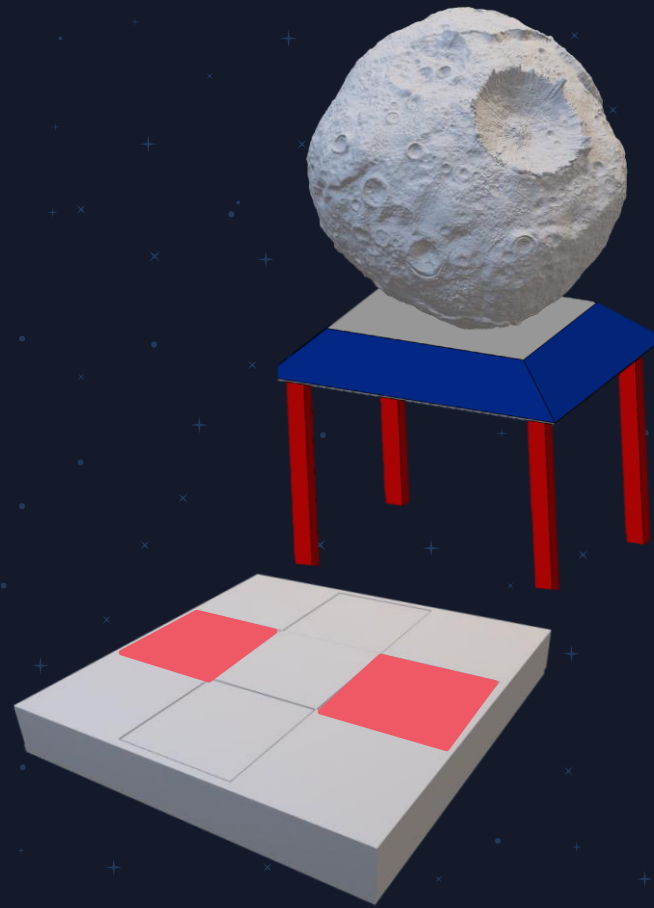
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Engineering



Connection to the  
asteroid model



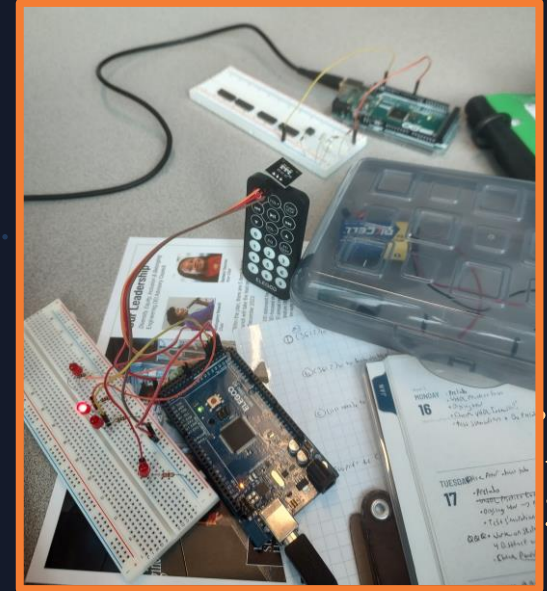
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# IR Design

Psyche asteroid IR  
sending code

Hardware  
prototyping for the  
communication  
network

IR scanner receiving  
code



Sara Bradley



# IR Design Future Work

Integrate into  
Psyche asteroid  
design

Integrate into IR  
scanner design

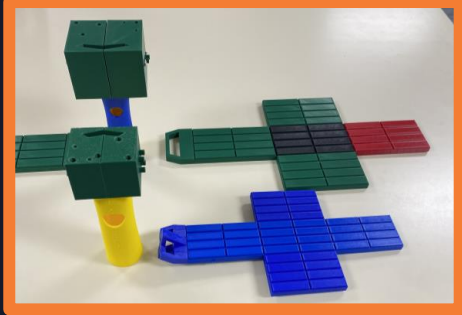
Implementation of  
the information  
displays

Sara Bradley





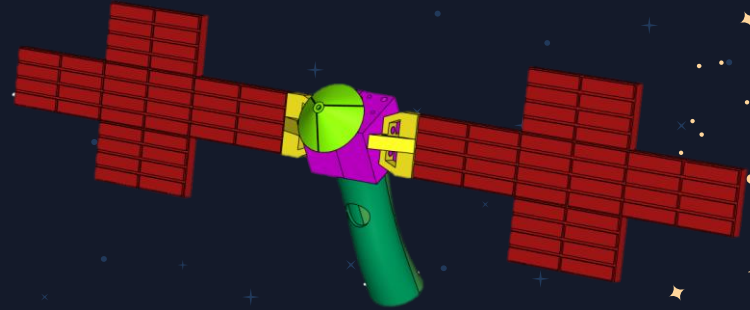
# Blaster Design



Fully 3D printed exterior

1:16 scale with the actual spacecraft

Button used to actuate a receiver works individually



Sara Bradley



# Blaster Design Future Work

Test durability and gather feedback on ergonomics of design

Modify design and reprint parts as feedback is given

Integrate button and receiver into blaster

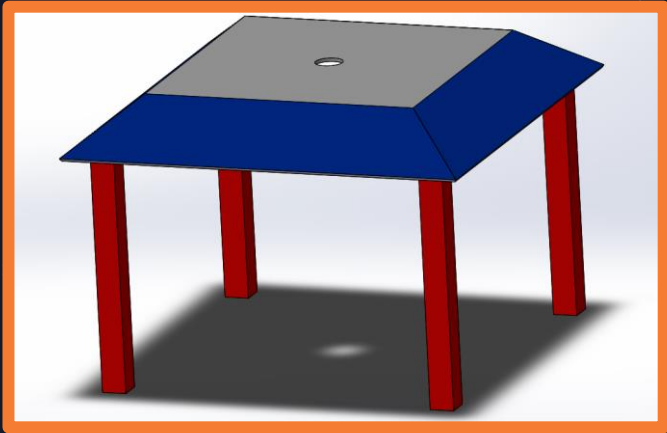
Sara Bradley



# Structure Design

Made of wood 4x4's  
and sheathing panels

Design not final-  
needs to be easier to  
build



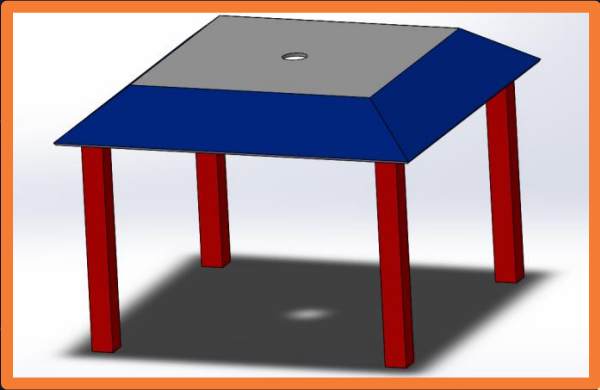


# Accessibility Considerations

Height of text panels

Ease of use for people in wheelchairs

Angle of text panels





# Structure Design Future Work

Simplify fabrication

Design and integrate  
electrical  
components

Split panels into  
smaller ones

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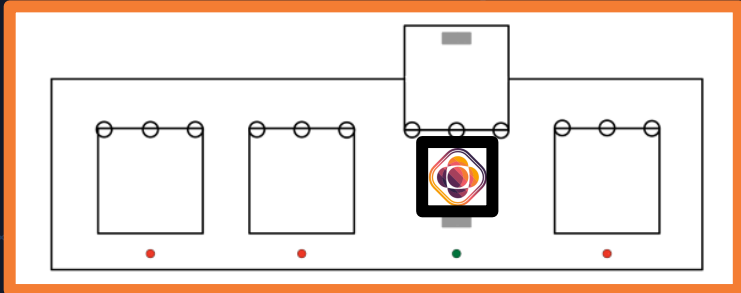


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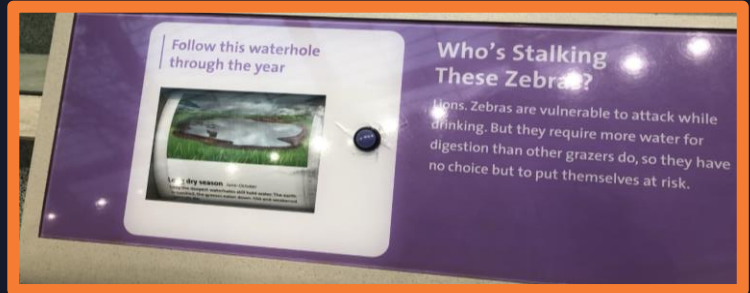


# Information Displays

Locked panels



Rotating information cylinder



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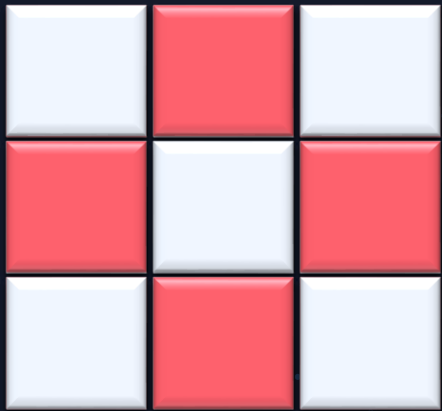


# Interactive Aspects

Repeat the pattern  
or Simon Says game

Interact with IR  
sensors to unlock  
information panels

Rotate the asteroid  
using dance pads



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# Interactive Aspects Future Work

Integrate the games  
with elements on the  
exhibit

Integrate  
electromagnets into  
display panels

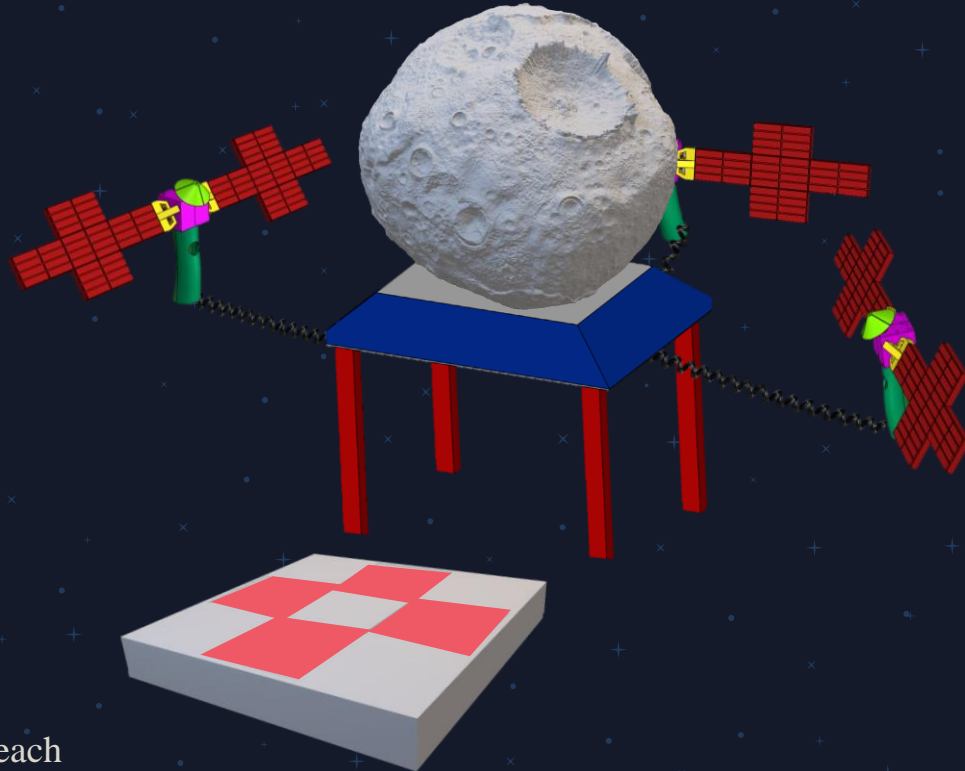
Integrate the rotating  
asteroid with dance  
pad

Garett Southerland





# Full Design



\*Designs not to scale with each other

Garett Southerland



# References

“A mission to a Metal World,” *Psyche Mission*, 21-Jul-2022. [Online]. Available: <https://psyche.asu.edu/>. [Accessed: 06-Oct-2022].

“Access smithsonian,” *Access Smithsonian / Access Smithsonian*. [Online]. Available: <https://access.si.edu/>. [Accessed: 06-Oct-2022].

E. Asphaug, J. F. Bell, C. J. Bierson, B. G. Bills, W. F. Bottke, S. W. Courville, S. D. Dobb, I. Jun, D. J. Lawrence, S. Marchi, T. J. McCoy, J. M. G. Merayo, R. Oran, J. G. O’Rourke, R. S. Park, P. N. Peplowski, T. H. Prettyman, C. A. Raymond, B. P. Weiss, M. A. Wicczorek, and M. T. Zuber, “Distinguishing the origin of asteroid (16) psyche - space science reviews,” *SpringerLink*, 12-Apr-2022. [Online]. Available: <https://link.springer.com/article/10.1007/s11214-022-00880-9>. [Accessed: 06-Oct-2022].



# Summary

After going through the initial design phase and early prototyping, we are in the process of refining and fabricating our designs to make a fully functioning exhibit by *2/25/23*.

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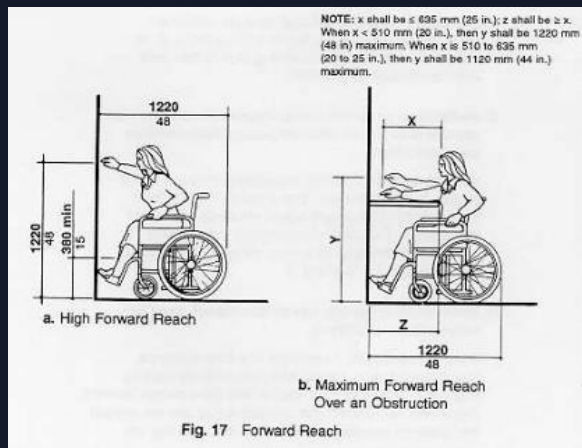
# Additional Slides



# PUT EXTRA STUFF IN THE SLIDES AFTER THIS



# Accessibility Considerations





# PSYCHE STORY

How did Psyche get there?

There are three theories, but one leading formation of Psyche:

Psyche believe to be part of a differentiated body, meaning it is what remains of a once larger planet, and experienced iron volcanism.

Current mission?

Psyche is the only metallic core-like body we have discovered and can teach us a lot. The mission is to study using a spacecraft also named *Psyche*.

Future of the mission?

The most recent major update on the Psyche mission was in Feb 2020 when NASA awarded SpaceX the \$117 million contract launch *Psyche*. *Psyche* is scheduled to launch no earlier than 2024.

Our role

Our objective is to raise awareness and interest in Psyche and to get the public excited about the future of the mission.

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# PSYCHE STORY

## What is Psyche?

A large asteroid the size of Massachusetts!

## The leading hypothesis of the formation:

The remains of a Planetesimal with an iron-nickel core that experienced many violent collisions.



Figure 1

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# PSYCHE STORY

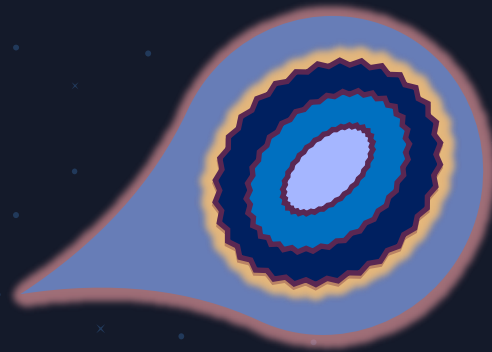
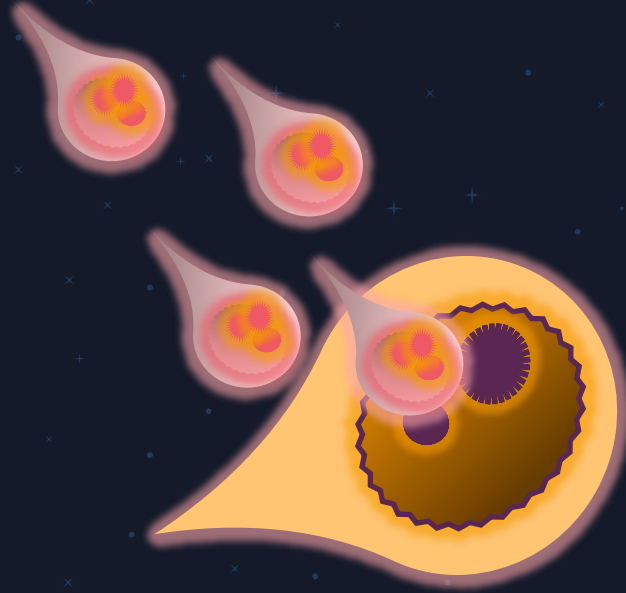


Figure 3: inside of  
the rocky layer as  
it cools

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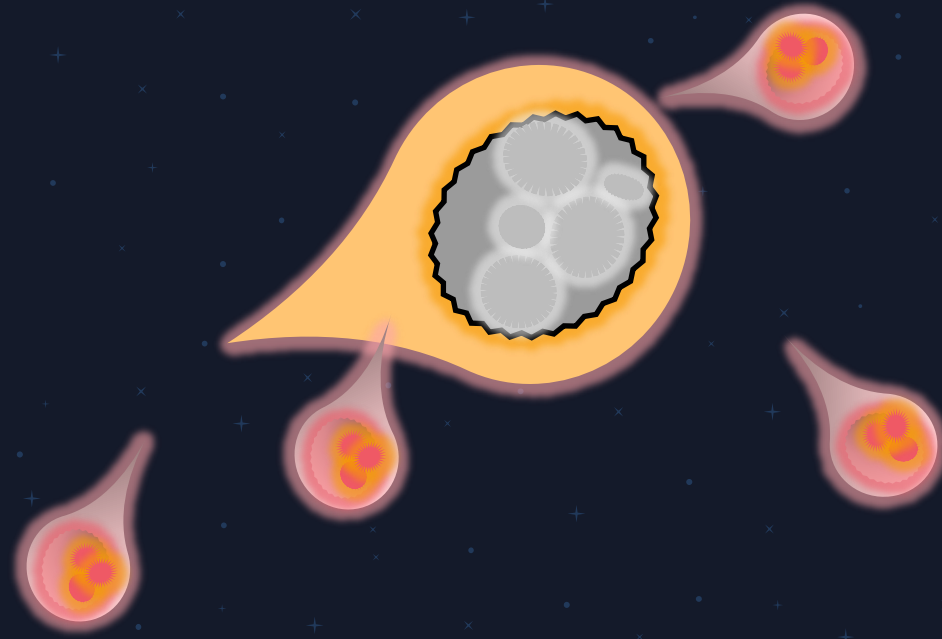
# PSYCHE STORY



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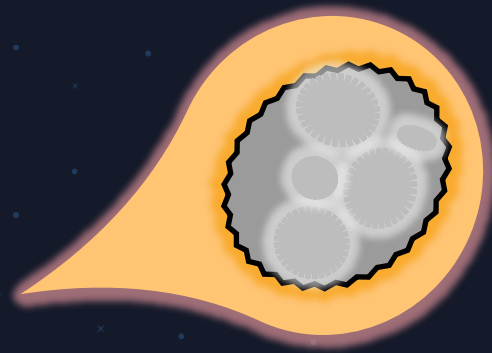
# PSYCHE STORY



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# PSYCHE STORY

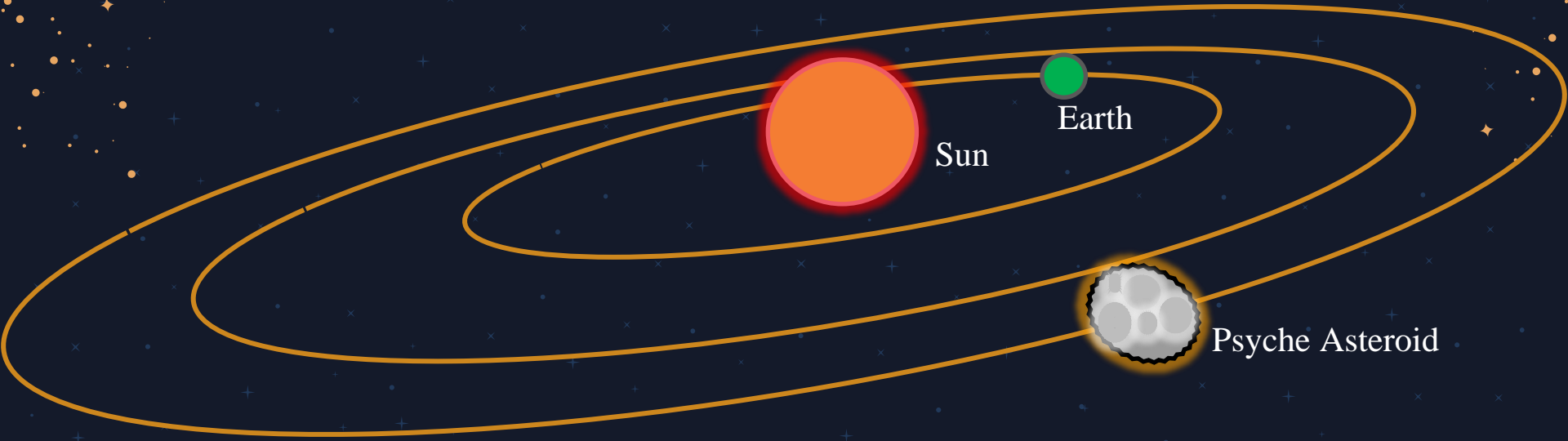


## A Metal World?

By observing Psyche from a distance, it is currently believed that Psyche is made of mostly metal because it gives off many reflections.

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# WHERE IS PSYCHE



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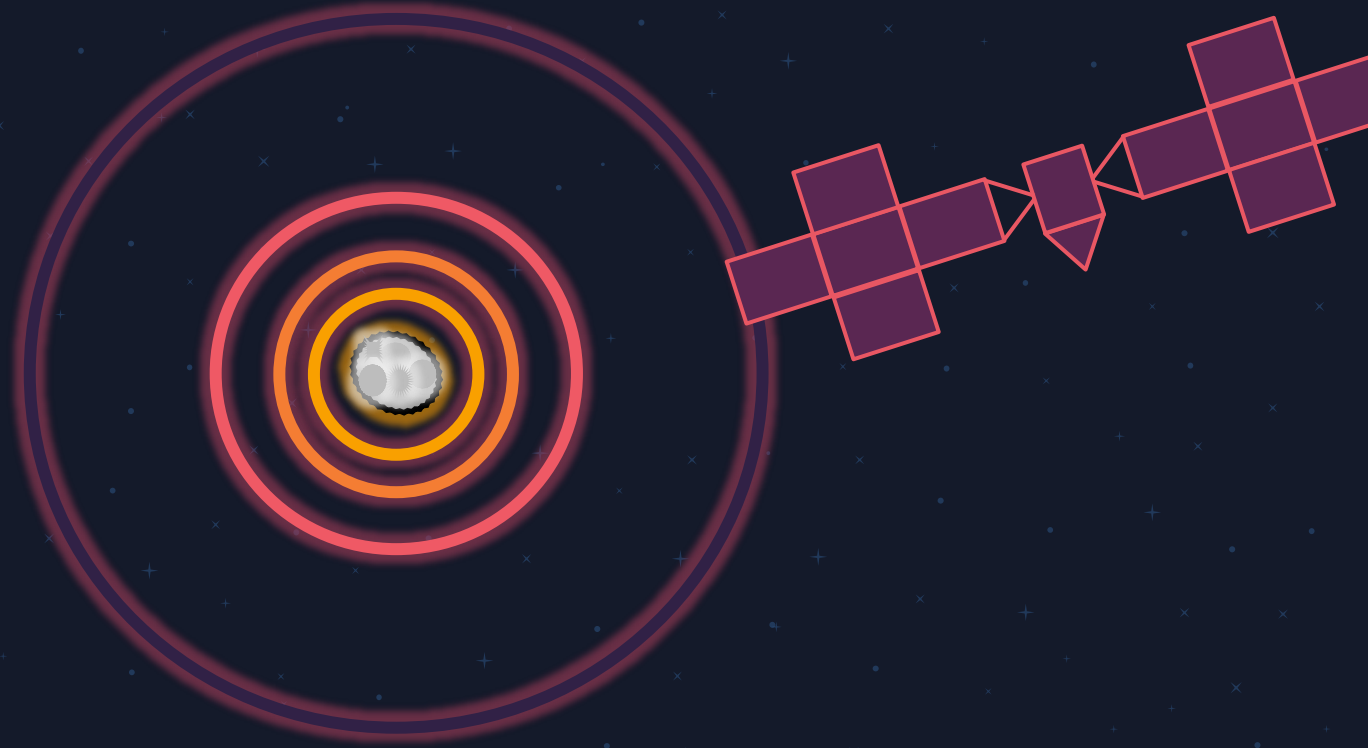
# ABOUT THE MISSION

## Present

Launch a spacecraft  
to travel to Psyche  
to further study

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# REACHING PSYCHE



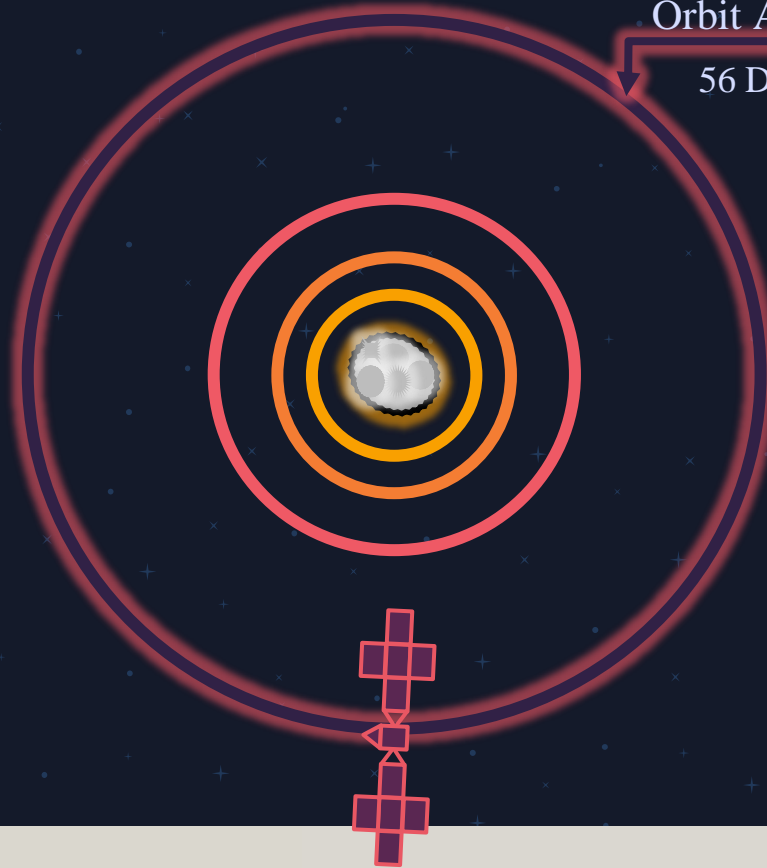
Presenter Name



# REACHING PSYCHE

Orbit A: Characterization

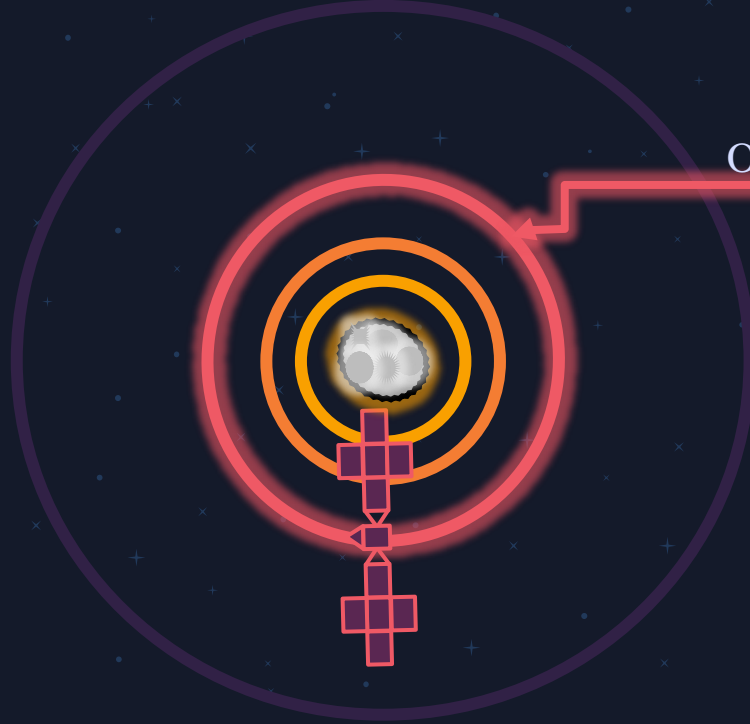
56 Days (41 Orbits)



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# REACHING PSYCHE

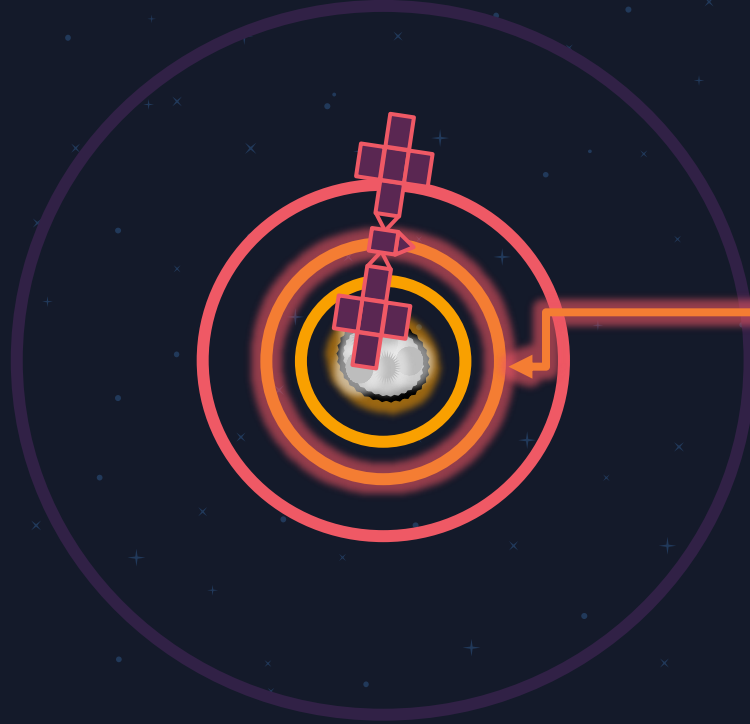


Orbit B: Topography  
80 Days (169 Orbits)

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# REACHING PSYCHE



Orbit C: Gravity Science  
100 Days (362 Orbits)

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# REACHING PSYCHE



Orbit D: Elemental Mapping  
100 Days (684 Orbits)

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# PRELIMINARY RESEARCH

Accessible Exhibition Design

Museum Visitor Experience

Previous ACCelerate Submissions

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# ACCESSIBLE EXHIBITION DESIGN

Mount small items no higher than 40 in (1015 mm) above the floor

Include closed captioning for audio aspects and alternative text for visual aspects of the design

Construct the top of a case no higher than 36 in (915 mm) above the ground

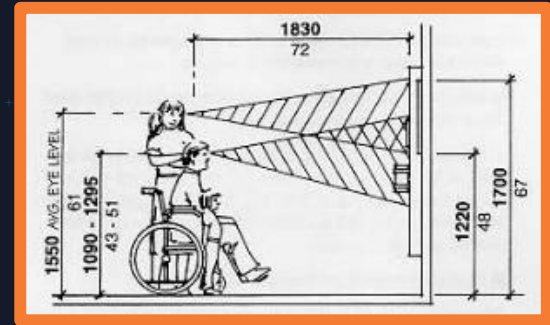


Figure 6 : Wall mounting



Figure 7: Table display

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# MUSEUM VISITOR EXPERIENCE



On average, families spend 1.6 minutes on an individual exhibit and non-families spend 1.1 minutes.

Mean Time per Exhibit			
	Family	Nonfamily	Average
Weekday	1.9 <sup>a</sup>	0.9 <sup>a</sup>	1.4
Weekend	1.3	1.2	1.3
Average	1.6	1.1	1.4

*Note.* All times are in minutes. Values are averaged over both exhibitions.  
<sup>a</sup>These values are statistically different from one another.

Figure 8: Time spent at each interactive exhibit

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# CURRENT RESEARCH

Survey on Target Audience

Social Media Interaction



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# ASSUMPTIONS

Power Source Access

Eighth Grade Level Concepts

Low-Cost Fabrication



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Engineering

#



# KEY GOALS



Interactive  
and  
Informative

Durable

Affordable

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# MARKETS



Museums

Planetarium

Academia

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# CUSTOMER NEEDS



The product has the ability to have a user interact with it.

The product has the ability to simulate the user's senses.

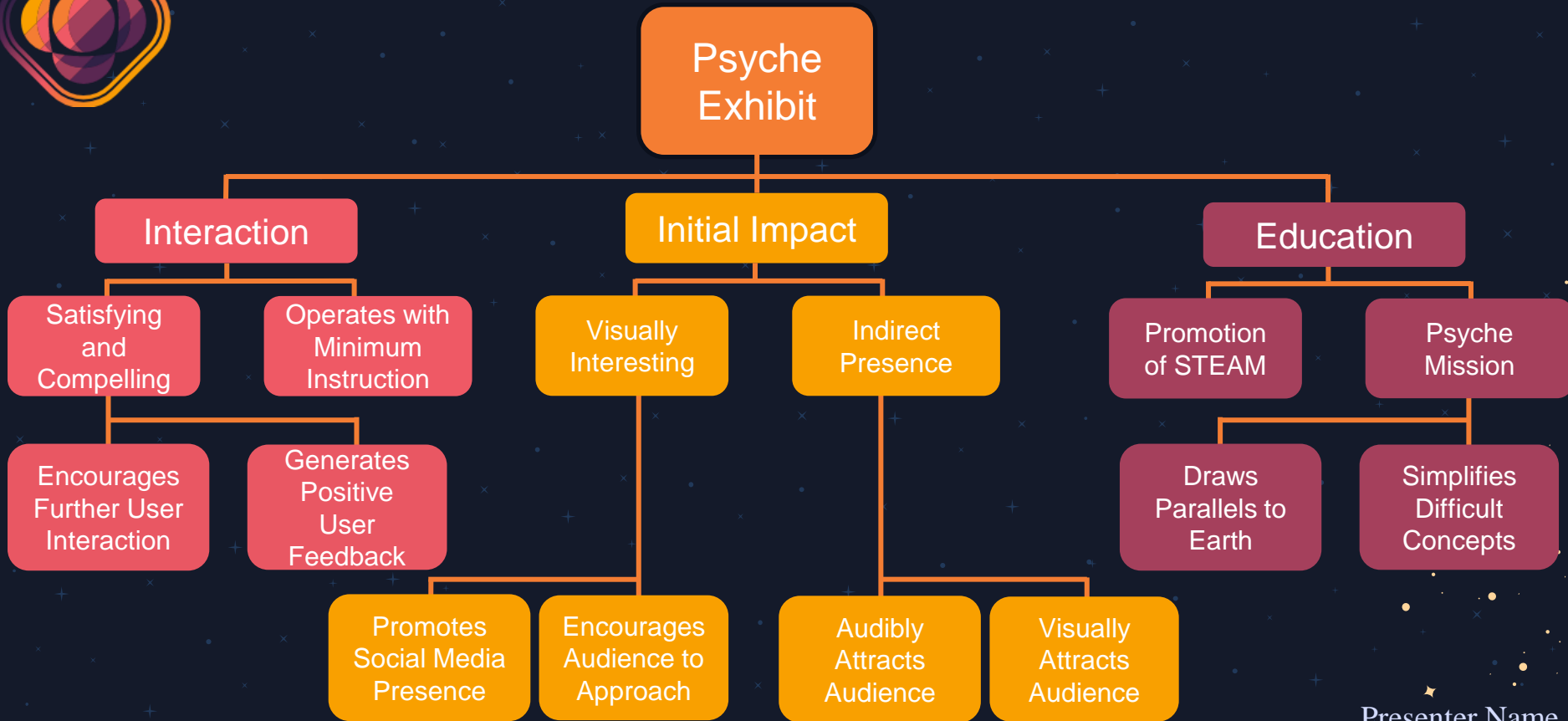
The product has the ability to run without a wall outlet if one is not available.

The product should use little to no custom parts outside of parts that are 3D printable

The product has the ability to hide components that are not meant for the user to touch.

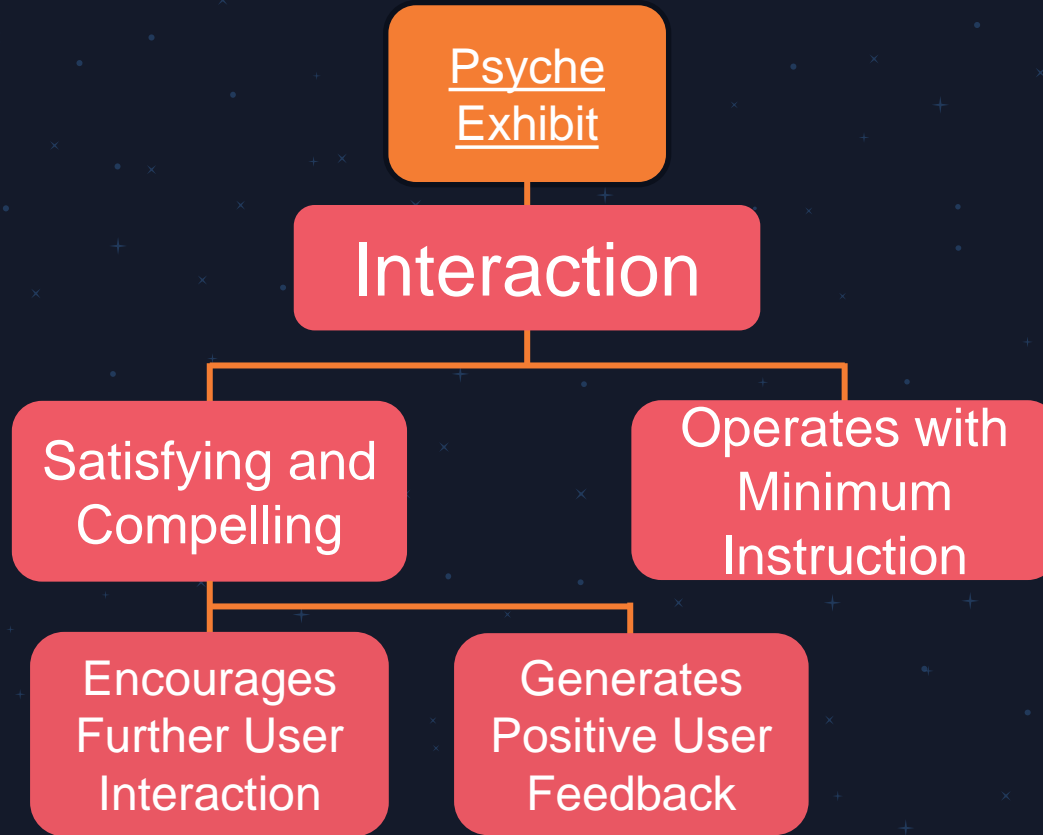
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# FUNCTIONAL DECOMPOSITION



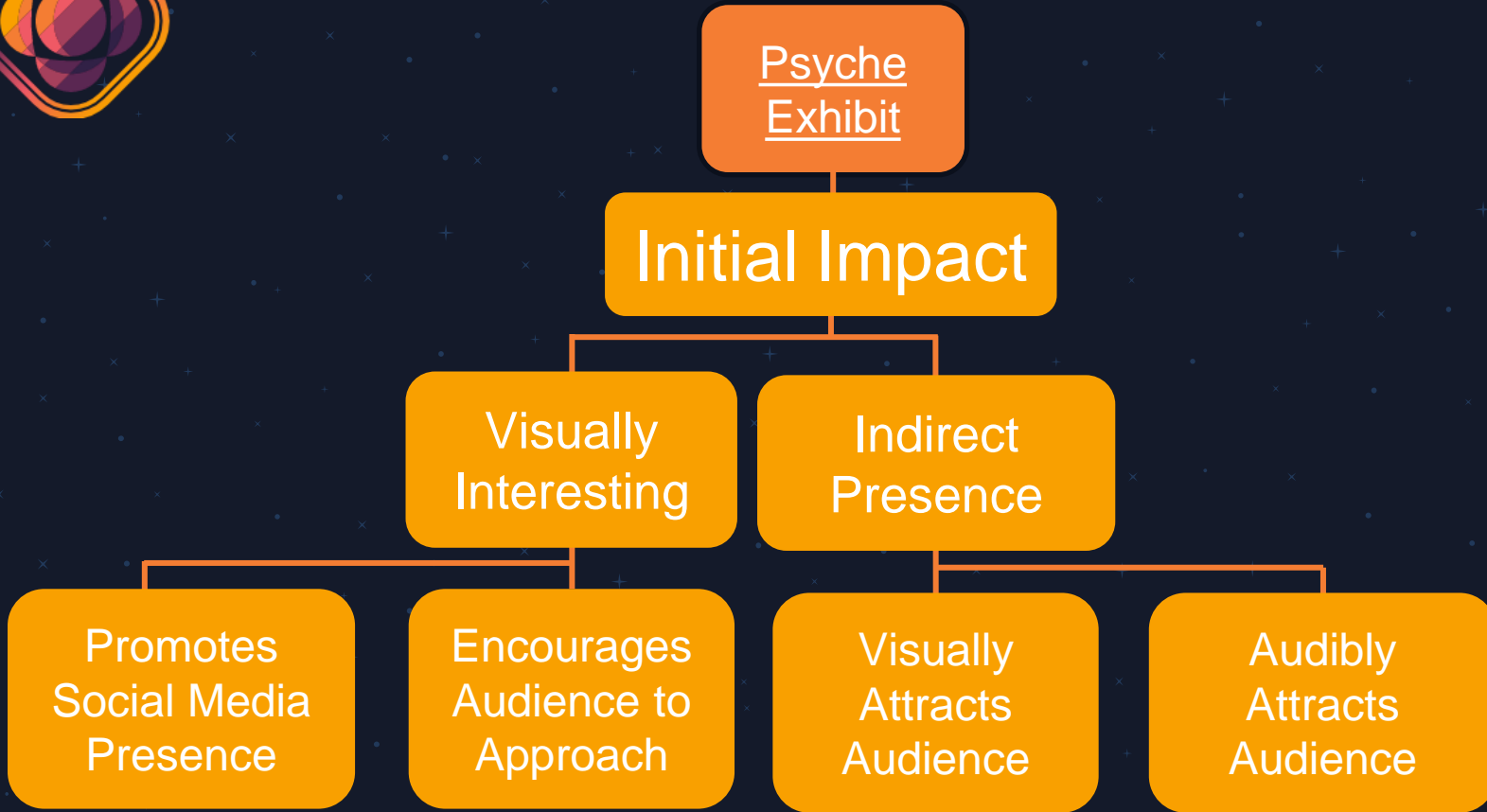
Presenter Name

# FUNCTIONAL DECOMPOSITION



Presenter Name

# FUNCTIONAL DECOMPOSITION



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# FUNCTIONAL DECOMPOSITION

Psyche  
Exhibit

Education

Psyche  
Mission

Promotion of  
STEAM

Draws  
Parallels to  
Earth

Simplifies  
Difficult  
Concepts

Presenter Name

# Extra Blaster Images

