

# Suggestions for Your Talk

Allan Adams' TED2014  
talk on South Pole  
search for CMB  
polarization




**John Matthews**

Professor of Physics, U. of New Mexico

# 1<sup>st</sup> what is your goal?

Be aware, and choose the goal of your talk.

Is it:

- to entertain?
- to impress?
- to communicate?  else we're done

[Don't worry: a good communicator will automatically impress and entertain the audience!]

## **2<sup>nd</sup> keep the talk structure simple**

What is the topic and why it it interesting?

What was your (part of the) project?

ONE selected part that you found most interesting or rewarding or challenging ... ie both details AND more personal.

What did you learn?

## 3<sup>rd</sup> to n<sup>th</sup> keep focus on communicating

### A few good habits:

- One topic/issue per slide and put a short title on each slide to highlight the main point of the slide.
- Distill your message, thus:
  - > the minimum number of words and/or math
  - > the most relevant figures
- Keep figures large, and put text on (not beside) the figures
- Use only black or white text
- Circle the important, thus avoid using a laser pointer
- Include slide numbers (helps when there are questions) 4

**Example:** What is the topic and why it it interesting?

# Opening the Infrared Treasure Chest with JWST

John Mather talk,  
UNM Colloquium,  
Jan 26, 2024

[https://unmm-my.sharepoint.com/personal/physics\\_unm\\_edu/\\_layouts/15/stream.aspx?id=%2Fpersonal%2Fphysics%5Funm%5Fedu%2FDocuments%2FPandA%20Colloquia%2FColloquium%5F2024%2D01%2D26%5FMather%2Emp4&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTaGFyZURpYWxvZy1MaW5rliwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifX0&ga=1&referrer=StreamWebApp%2EWeb&referrerScenario=AddressBarCopied%2EView](https://unmm-my.sharepoint.com/personal/physics_unm_edu/_layouts/15/stream.aspx?id=%2Fpersonal%2Fphysics%5Funm%5Fedu%2FDocuments%2FPandA%20Colloquia%2FColloquium%5F2024%2D01%2D26%5FMather%2Emp4&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTaGFyZURpYWxvZy1MaW5rliwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifX0&ga=1&referrer=StreamWebApp%2EWeb&referrerScenario=AddressBarCopied%2EView)

**John Mather**

**JWST Senior Project Scientist, 1995-2023**

**NASA's Goddard Space Flight Center**

Note:

- a) white text
- b) **on the image** (so where you focus is on what is important)



on behalf of 8 billion current humans, ~10,000 future observers, > 20,000 engineers and technicians, ~ 100 scientists worldwide, 3 space agencies

## Example: What is the topic and why it it interesting?

Where did we come from?

What does “we” mean?

What is our cosmic history?

**Circle the  
important**

Are we alone? Where are the neighbors?

Is life a miracle or a thermodynamic imperative?

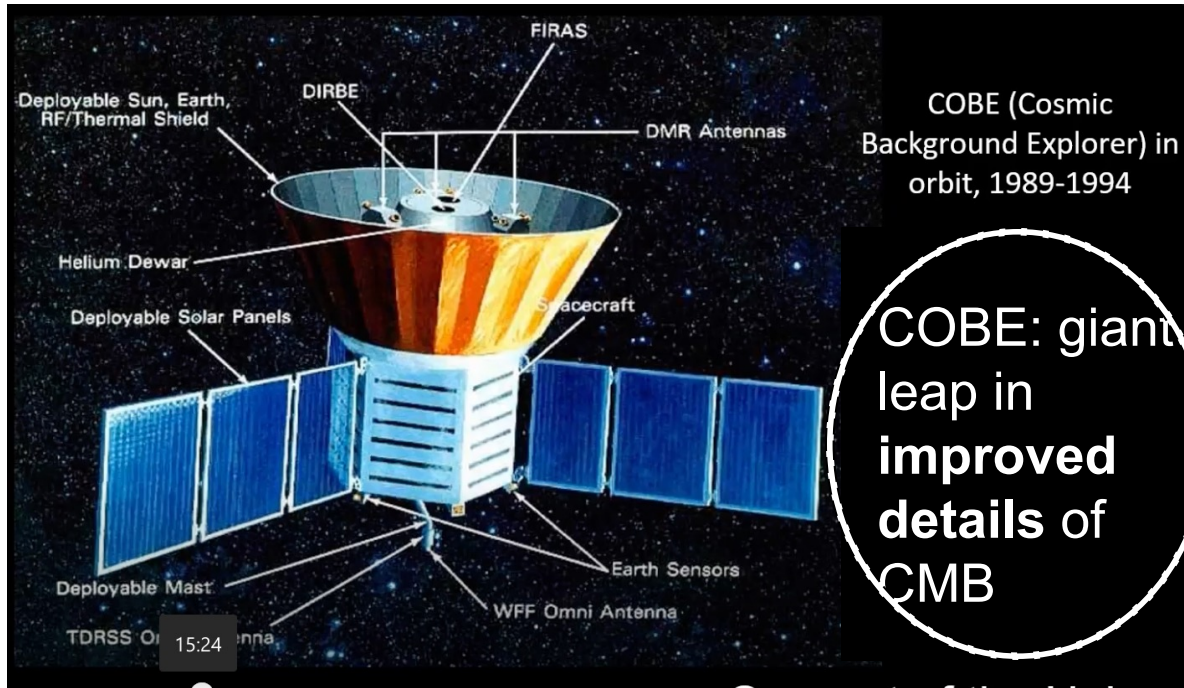
How far can we go?

People can go to Mars

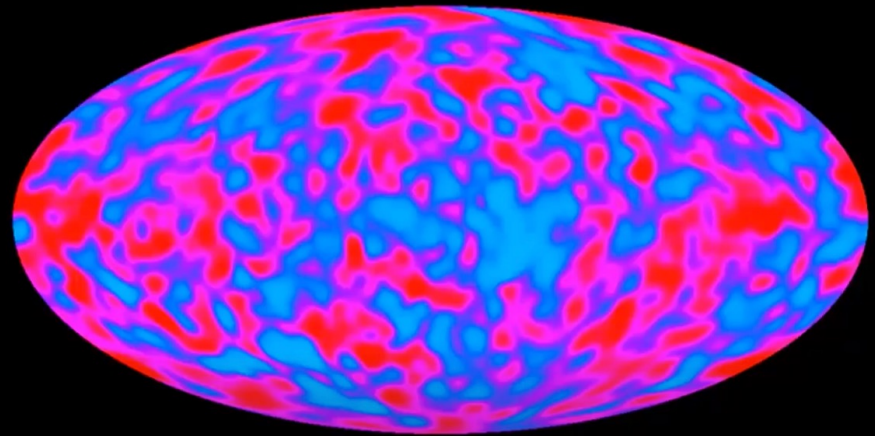
Pictures and imagination can go as far as you like



# Example: What is the topic and why it it interesting?

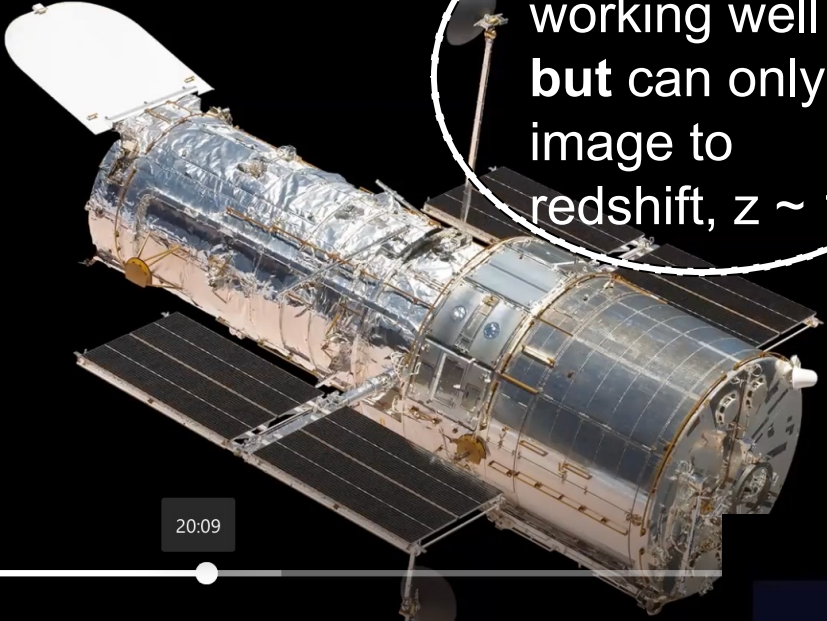


Our part of the Universe (age 400,000 yrs) from COBE



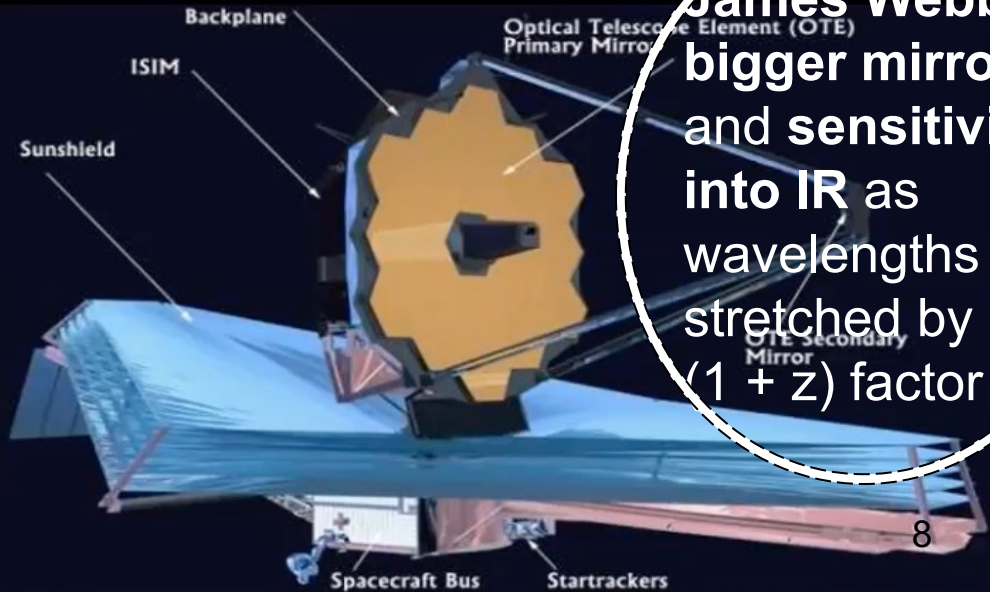
The sky as seen with millimeter wave eyes

## Example: What is the topic and why it it interesting?



Hubble is working well **but** can only image to redshift,  $z \sim 11$

20:09



James Webb: bigger mirror and sensitivity into IR as wavelengths are stretched by  $(1 + z)$  factor

Backplane  
ISIM  
Sunshield  
Optical Telescope Element (OTE)  
Primary Mirror  
Secondary Mirror  
Spacecraft Bus  
Startrackers

8



**Example:** What was your (part of the) project?

## JWST's 10 New Technologies 1996 - 2002

- Near infrared detectors (NIR): HgCdTe, 2 flavors
- Sidecar ASIC to run the NIR detectors
- Mid infrared detectors (MIR)
- MIRI cryocooler (pulse tube): unlimited lifetime
- Microshutters (250,000)
- Heat switch (not needed with cryocooler)
- Sunshield membrane
- Wavefront sensing & control (WFS&C): intentionally out of focus images + computer on ground
- Primary mirror (12 contracts to learn how)
- Cryogenic stable structures (invented high speed speckle interferometry)

OK if **only**  
to give  
sense of  
scope

24:08

John Mather was the lead **scientist/project manager** to make the almost impossible all happen

## A Project Scientist perspective on risk

- Murphy was an optimist: some things fail *after* test
- Informal risk assessment is not good enough: 12 friends fell off ladders, 1 fell from a roof and died
- Without risk management and resources, failure is not an option, it's guaranteed (cf. Faster Better Cheaper) OK if **only** to give speaker topics to reminisce on
- My opinion has no effect on the hardware
- Never trust the boss, especially if you are the boss
- If you don't have time to do it right, when will you have time to do it over?
- No increases in science requirements without flexible descopes

28:56

## Example: Selected part that you found most interesting

# JWST risk management plan

## Managing Risk for the James Webb Space Telescope Deployment Mechanisms: Enabling First Light

Prince Kalia, John Evans and Mike Menzel – NASA

Halil A. Kilic: Northrop Grumman

OK if **only** to give speaker  
topics to reminisce on

- 344 single point failures
- Very formal verification process including common cause impact analysis following Challenger lessons
- Decision ground rules for ~ 700 risk items
- At least two independent checks of everything important, from hardware to simulations to software
- Process monitoring for non-repeatable items (e.g. non-explosive actuators, rebuilt after use)
- 3 cryo tests of instrument module, 1 full optical test at JSC, 4 deployment tests
- Years of rehearsals for procedures using digital twin

**Example:** What did you learn? (recap the goals)

## JWST Science Themes



**End of the dark ages:  
First light and  
reionization**



**The assembly of  
galaxies**



**Birth of stars and proto-  
planetary systems**



**Planetary systems  
and the origin of life**

# Example: What did you learn? (early universe)

Too many, too big, too bright, too hot, too mature, too soon?

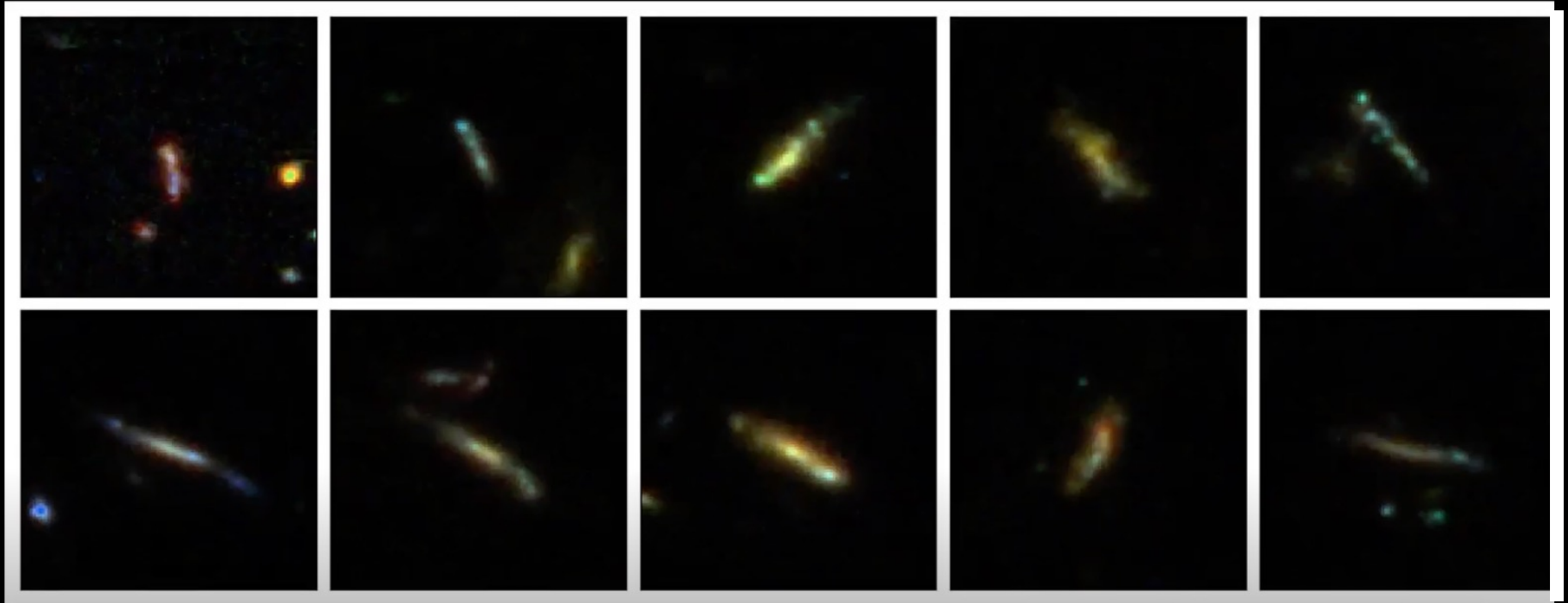
Physics Department





**Example:** What did you learn? (early universe)

**Too long and stringy too?**



Pandya et al, 2024. ApJ. Cosmic Evolution Early Release Science, or CEERS, survey.

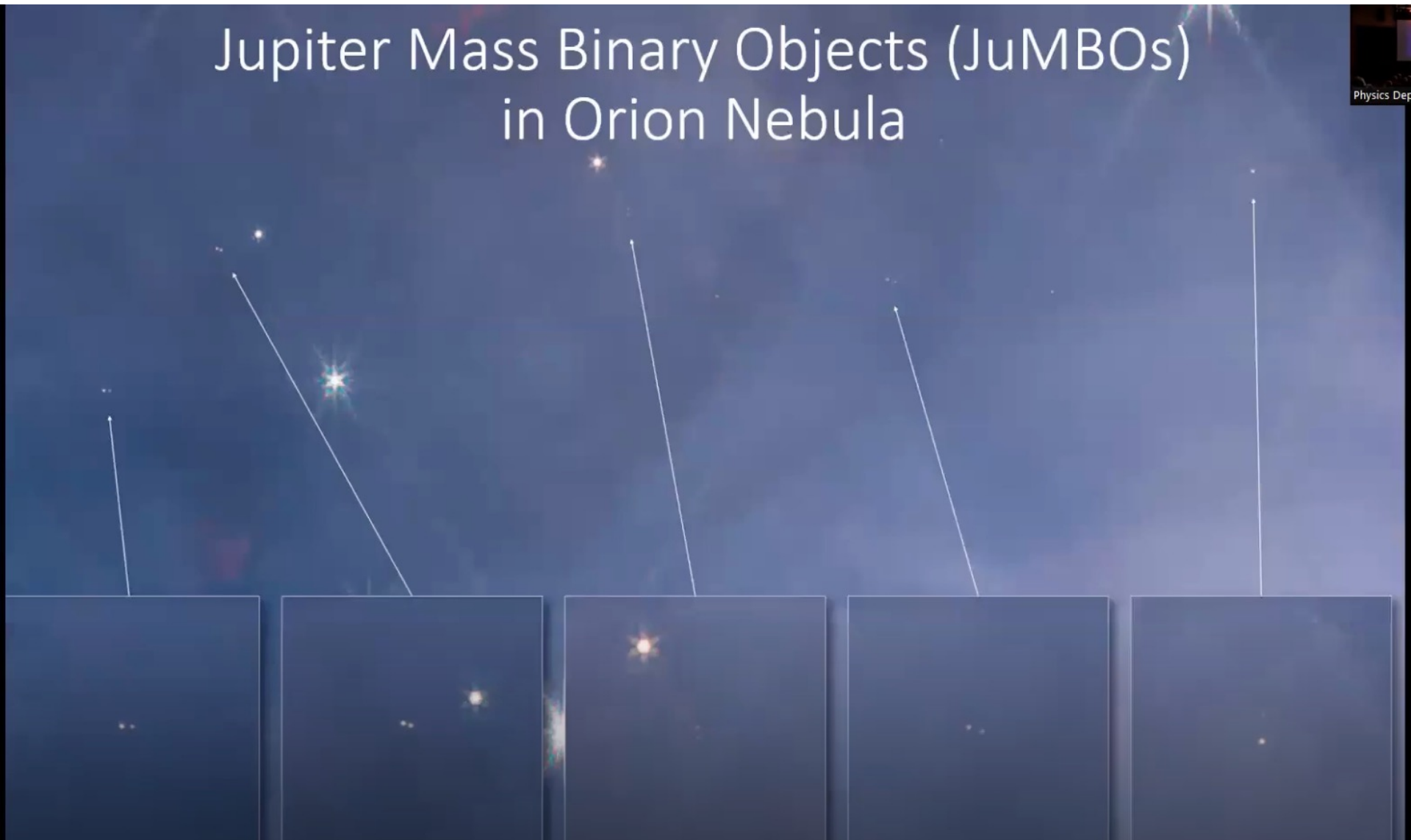
## Example: What did you learn? (assembly of galaxies)



Stephan's Quintet – 1 nearby ( $\sim 12$  Mpc) galaxy (AGB stars resolved),  
4 interacting galaxies ( $\sim 90$  Mpc), including 1 AGN (top)

**Example:** What did you learn? (birth of stars)

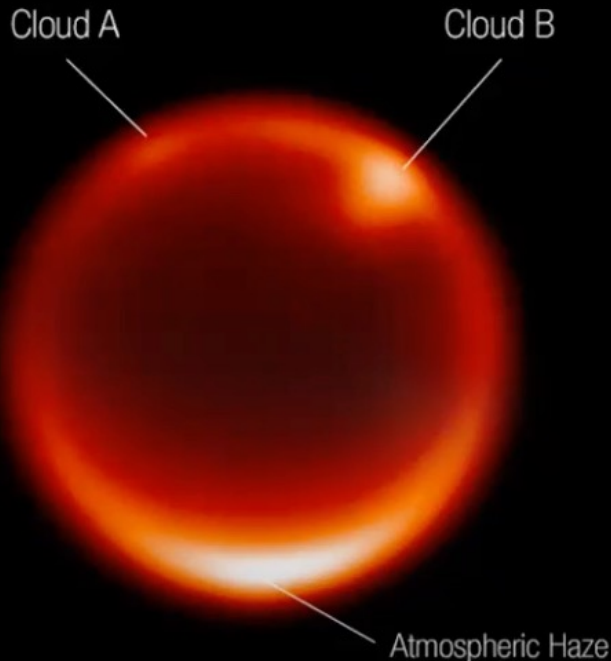
## Jupiter Mass Binary Objects (JuMBOs) in Orion Nebula



# Example: What did you learn? (planetary systems)

## Titan

November 4, 2022



lower atmosphere and clouds



atmosphere and surface

SCIENCE: NASA, ESA, CSA, Webb Titan GTO Team. IMAGE PROCESSING: Alyssa Pagan (STScI)

## Hope you learned some to-dos, and some not-to-dos

Did you go to Mather's talk?

What would you say was his goal?

Was it:

- to entertain?
- to impress?
- to communicate?

Before the talk, what did you think his goal would be?

[Thanks for contributions from UNM Professor Wolfgang Rudolph]