

# Astronomy C10: Week 1 (2 / 3 ....?)

(Peter) Xiangyuan Ma | Sections : 104/105/101

# Welcome!

**GSI:** Peter Ma

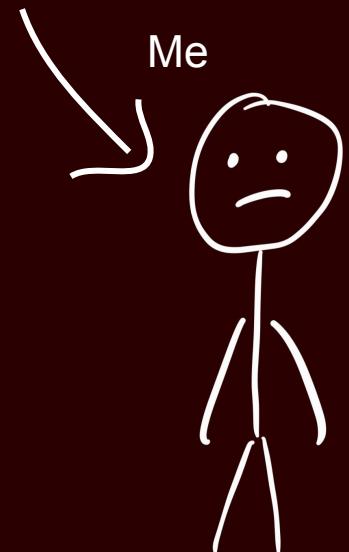
**E-mail:** [peter\\_ma@berkeley.edu](mailto:peter_ma@berkeley.edu)

(pls use “C10:” in header)

**Office:** Campbell 407D

**Office hours:** Monday 4-5pm, Thursday 9-10am (Campbell  
3rd Floor Common Space [room 355])

**TALC:** Wednesdays 5-7pm (Campbell 131), Thursdays  
5-7pm (Campbell 131)



# This weeks plan!

**Course overview** (~10 mins)

**Introductions** (Ice breaker) [~5-10 mins?]

**Math Review** [~5-10 mins?]

**What is light?** (Recap) [~10mins]

**Demo!** [~10mins]

**Questions?** [Remaining time]

# Course Overview

# Course Overview

**Survey course** → we'll discuss a wide variety of topics in astronomy but we won't go into too much depth and you won't need any crazy math

Expected background knowledge:

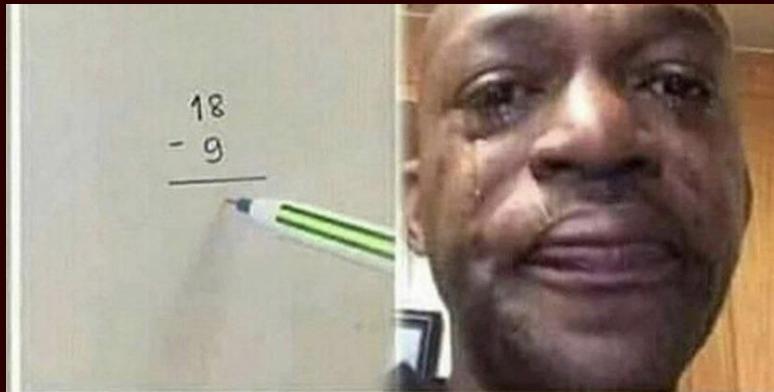
**Very elementary chemistry:** what is an element, atom, etc.

**Algebra:** square root, powers, scientific notation, ratios

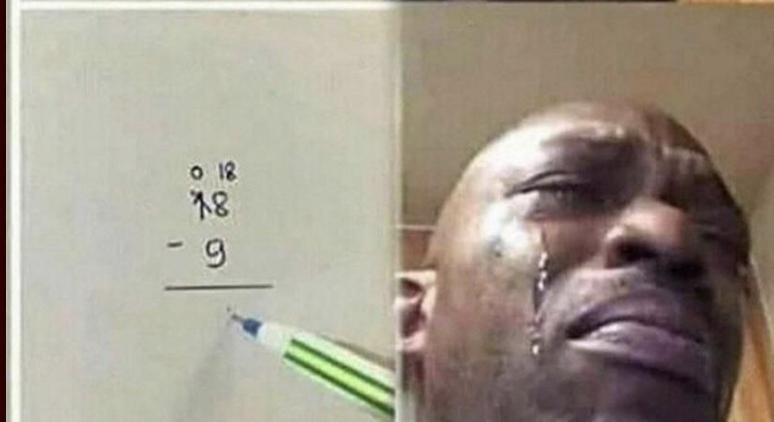
**Calculus is not required**

# Math is hard! Don't be afraid to ask for help!

Come to office  
hours!



Come to TALC!



Come say hi!



## **Textbook:**

The Cosmos: Astronomy in the New Millennium, 5th edition  
(2019), by Jay Pasachoff and Alex Filippenko

Available free online:

<https://www-cambridge-org.libproxy.berkeley.edu/highereducation/books/the-cosmos/A54F6C9E244A2E24E7939E90EF4B3FD9#contents>

## **Course Reader:**

Available in print (from Copy Central on Telegraph Ave.) or digital  
(<https://copycentral.redshelf.com/>)

Required!

# Homework

Homework assignments can be found in Course Reader

Generally due **Fridays at 6pm**

Must be **handwritten** with work shown

**Submit via Gradescope and remember to match pages to questions!!!!**

Write your name, SID, discussion section #, and GSI name at top of first page

**Late homework not accepted** and regrade requests heavily discouraged; instead, you get 3 homework drops for the semester

# Laboratory Exercises

Laboratory exercises can be found in Course Reader

Each lab is worth either 3 or 6 points and is due either October 24 or November 24

**You must complete 15 points worth of labs for the semester**

No extra credit for completing more than 15 points worth of labs

**Start early!** Many labs require observing celestial phenomena over an extended period of time

# Introductions!

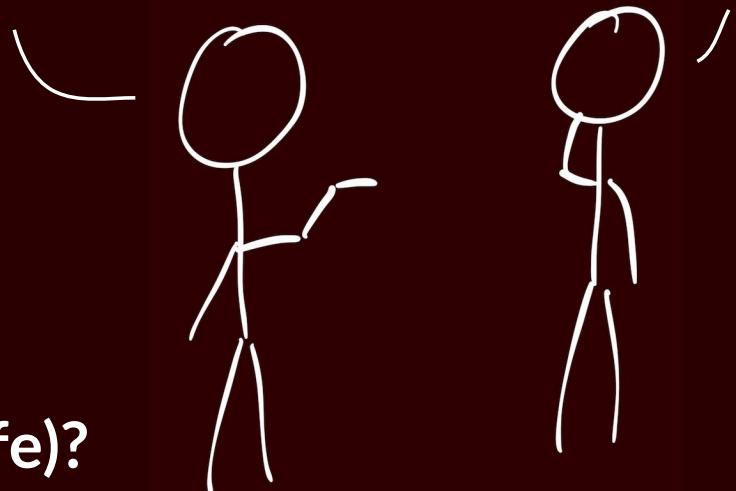
# Groups of (3 people?)

- Name
- Pronouns (optional)
- Program/major
- Interests in astro
- biggest fear (in this class or ... in life)?  
(Optional lol)

My name is **Peter** (he/him), I study **astrophysics**.

and ... I FEAR THE  
IMPENDING DOOM OF  
THE UNIVERSE AND THE  
MEANINGLESSNESS OF IT  
ALL

Sir this is a  
Wendy's.



# **Is Astrology a Science? [Optional Icebreaker]**

**Strengths:** Progressive, original, independent, humanitarian

**Weaknesses:** Runs from emotional expression, temperamental, uncompromising, aloof

**Likes:** Fun with friends, risky business, fighting for causes, intellectual conversations.

**Dislikes:** Limitations, broken promises, being lonely, dull or boring situations.

**What star sign am I?**

**Discuss with same group :P**

Aries, Taurus, Gemini, Cancer, Leo,  
Virgo, Libra, Scorpio, Sagittarius,  
Capricorn, Aquarius, and Pisces

# Math Review [10 mins]

# Question 1

Jupiter orbits the Sun at a distance of roughly **5 astronomical units (AU)**. If **1 AU** is equivalent to  **$1.5 \cdot 10^{11}$  meters**, then the distance between Jupiter and the Sun is around meters.

## Question 2

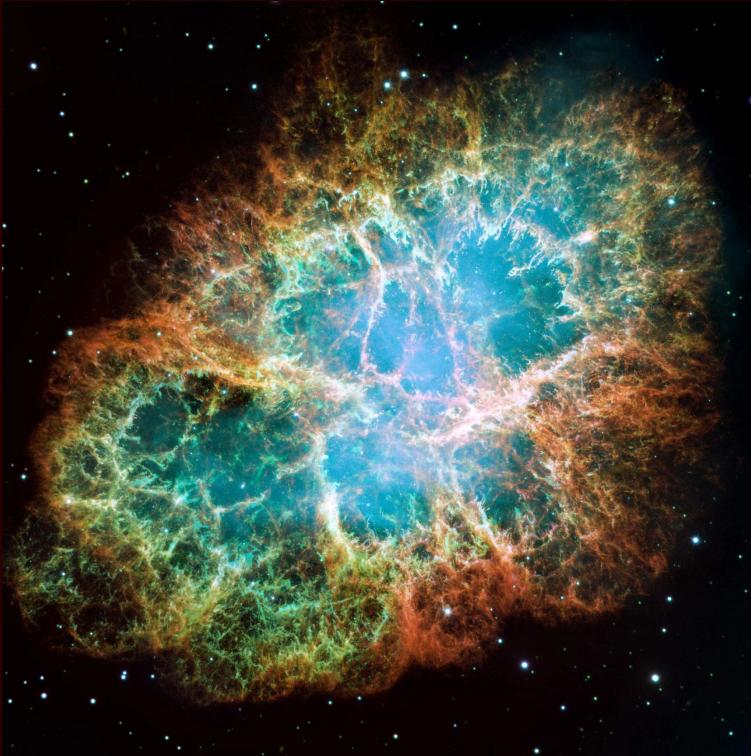
Brightness scales with  $1/d^2$ , where  $d$  is the distance between the observer and the light source. If the Earth were moved to **half** its current distance from the Sun, then the Sun would appear \_\_\_\_\_ times brighter.

## Question 3

The Universe is around **14 billion years old** and the Solar System is around **5 billion years old**. If the age of the Universe is scaled down to **7 hours**, then the Solar System formed after roughly \_\_\_\_\_ hours.

# Intro to light [10 mins]





In Astronomy, we can only *observe* what the universe is doing.

We can't actually *go* there to study it. (yet)

This means **light** is the primary way (with exceptions..) of studying the universe.



This is VERY different to other science, where you can “poke” and manipulate the things we study.

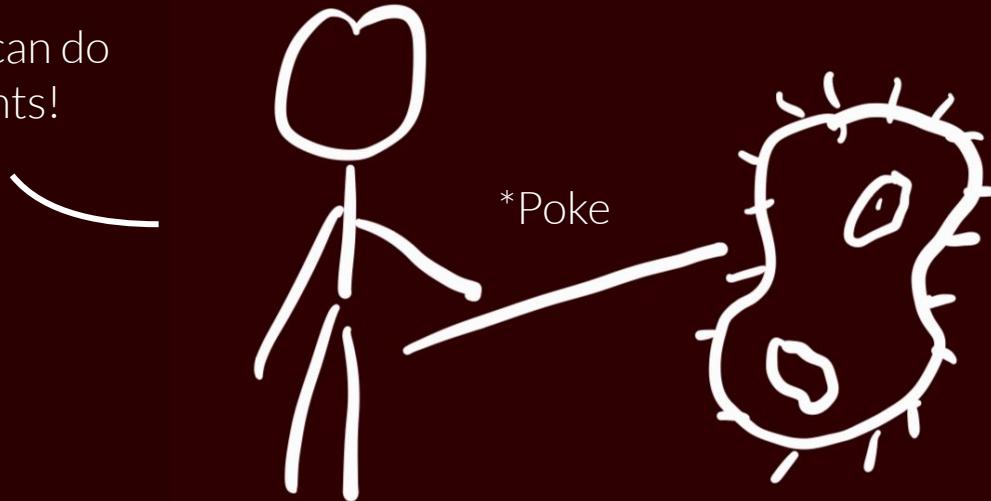
*Ex. Biology*

Wow we can do experiments!

**You**

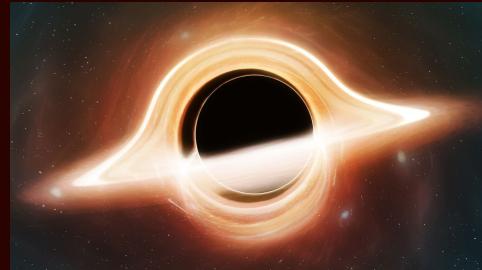
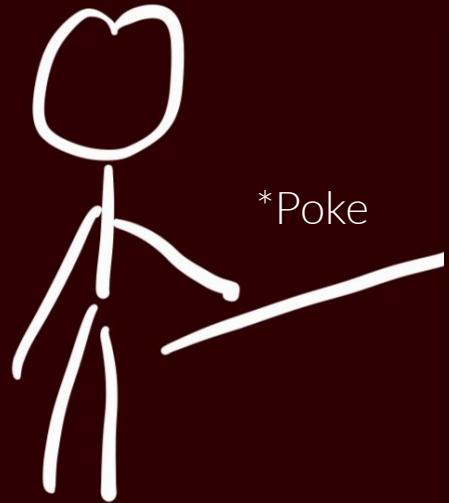
**Cells**

\*Poke



You

Black hole





You will die.



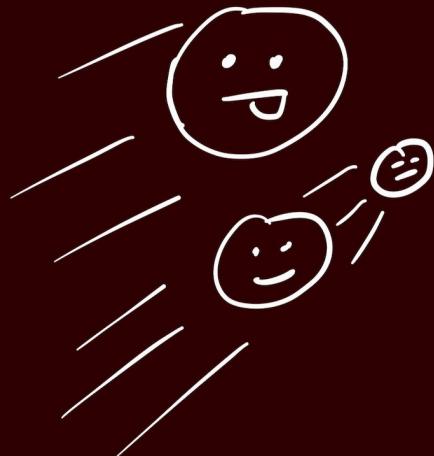


Man this would be a  
lot easier if we were  
just *there*....

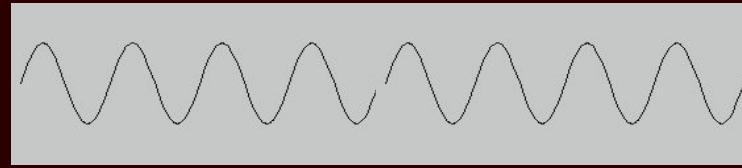


# But what even is light?

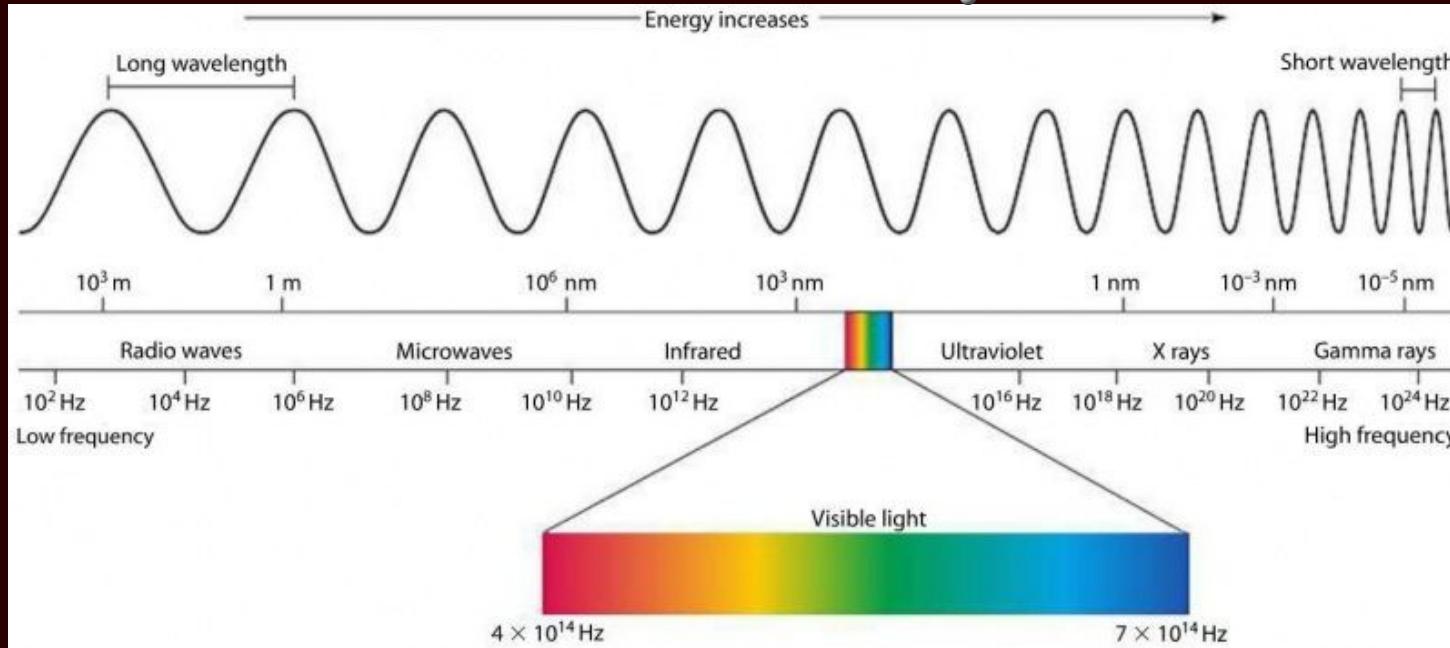
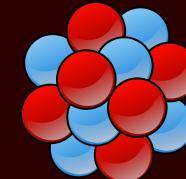
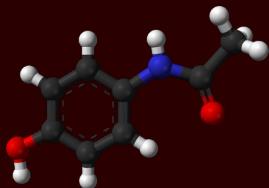
Particles of light: *Photons*



Light as a waves



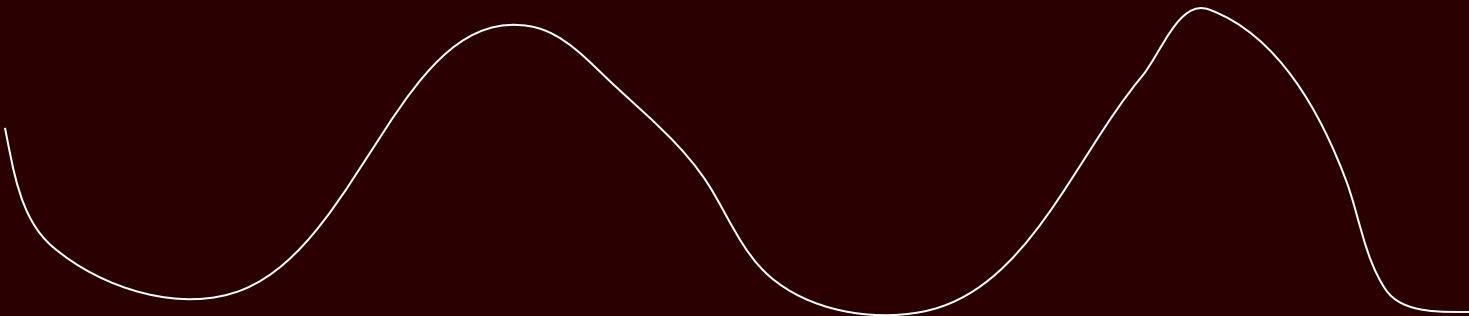
# Light as a wave?



Astronomers make use of every part of the spectrum to tell a story of our universe.

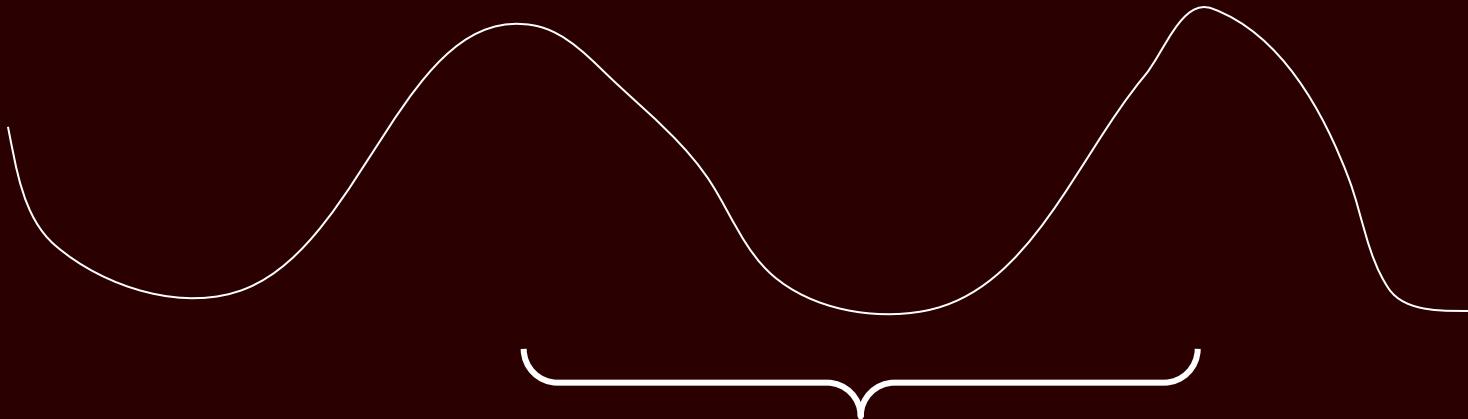


# Light as a wave?



# Light as a wave?

Waves have a **speed**, a **wavelength** and **frequency**.



How many times the wave  
goes up and down per second  
= **Frequency**

Distance between peaks =  
**Wavelength**

# Light as a wave?

$$c = f\lambda$$

$c$  = speed of light  $3 \times 10^8$  m/s

$\lambda$  = wavelength

$f$  = frequency

# Light as a wave?

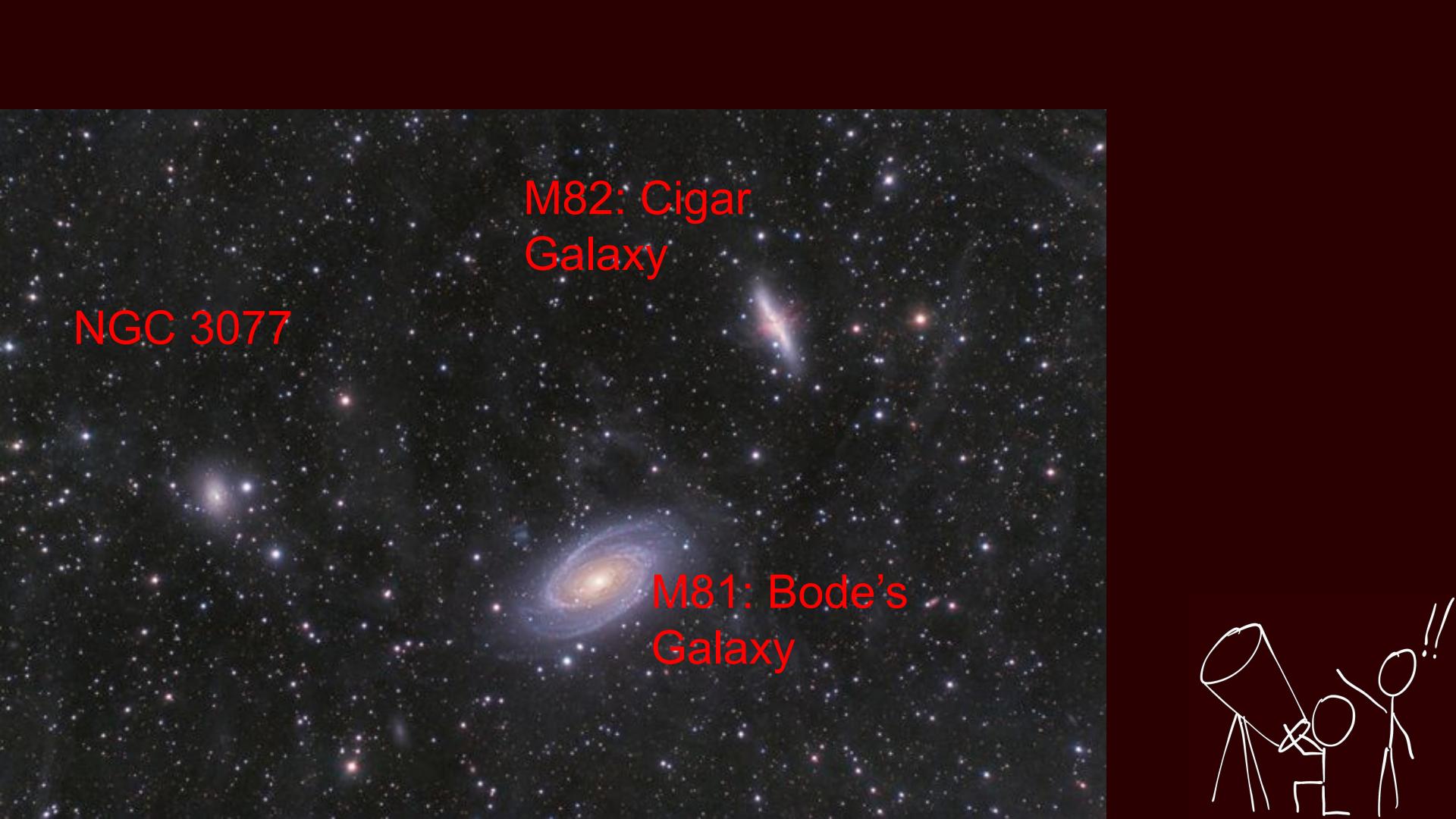
$$c = f\lambda$$

$$E = \hbar f$$

# Energy is related to frequency!

Demo time! [~ 10 mins]

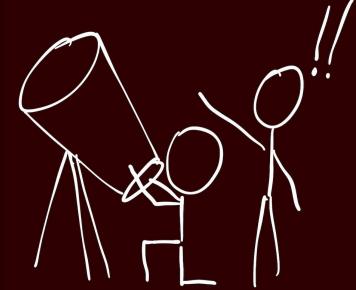


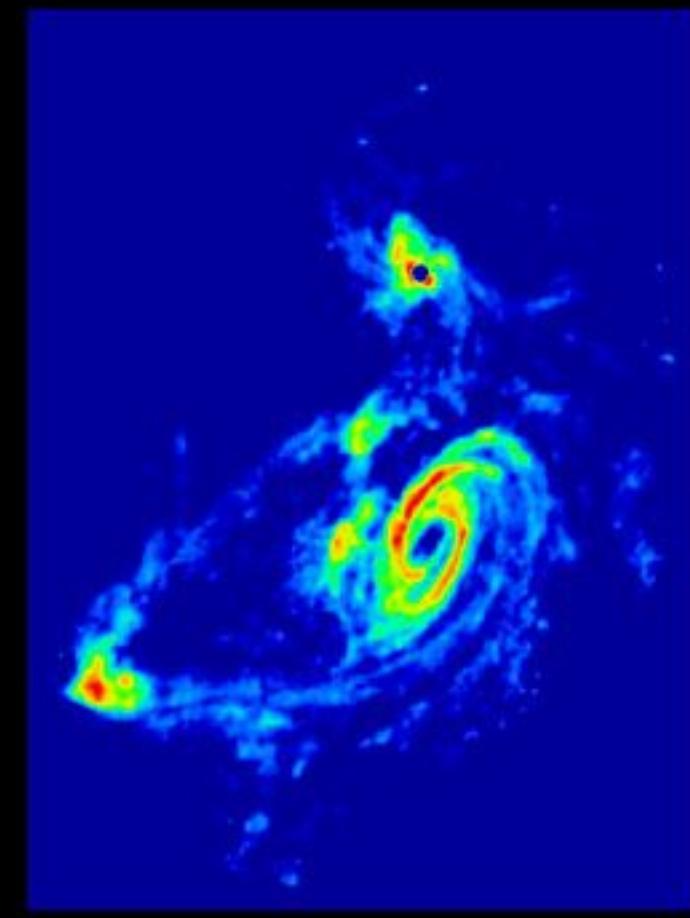
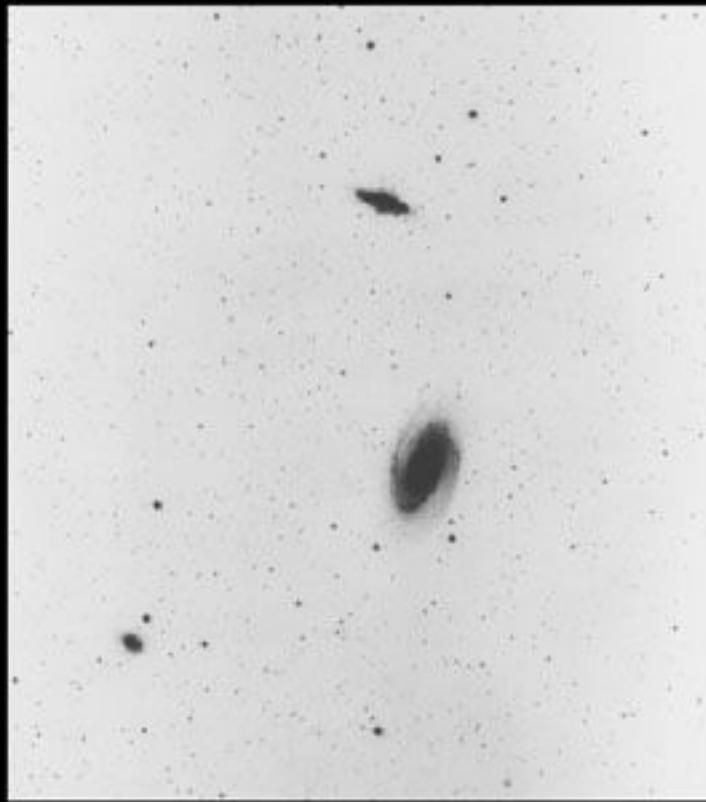


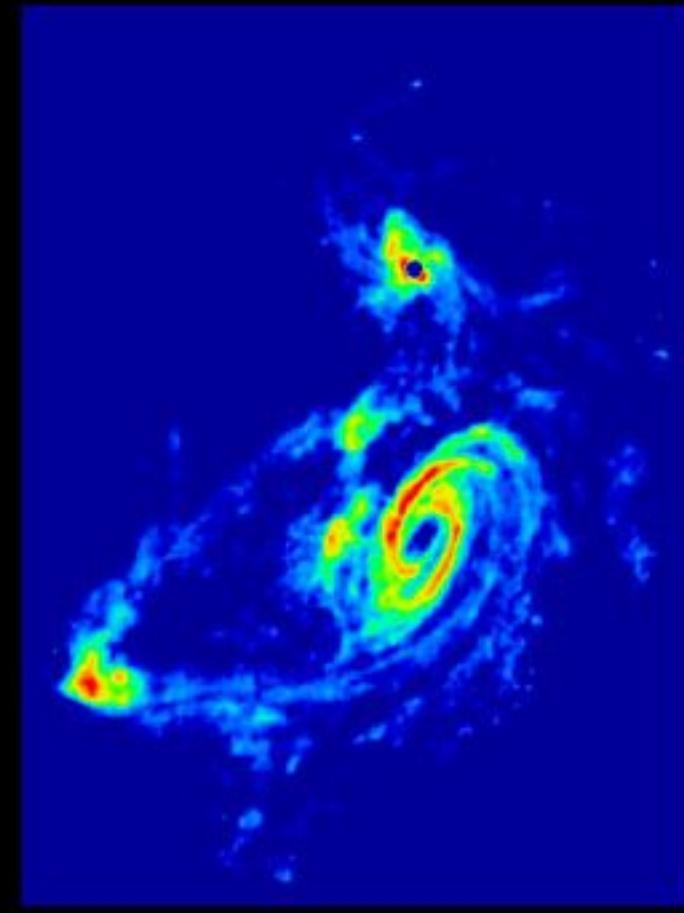
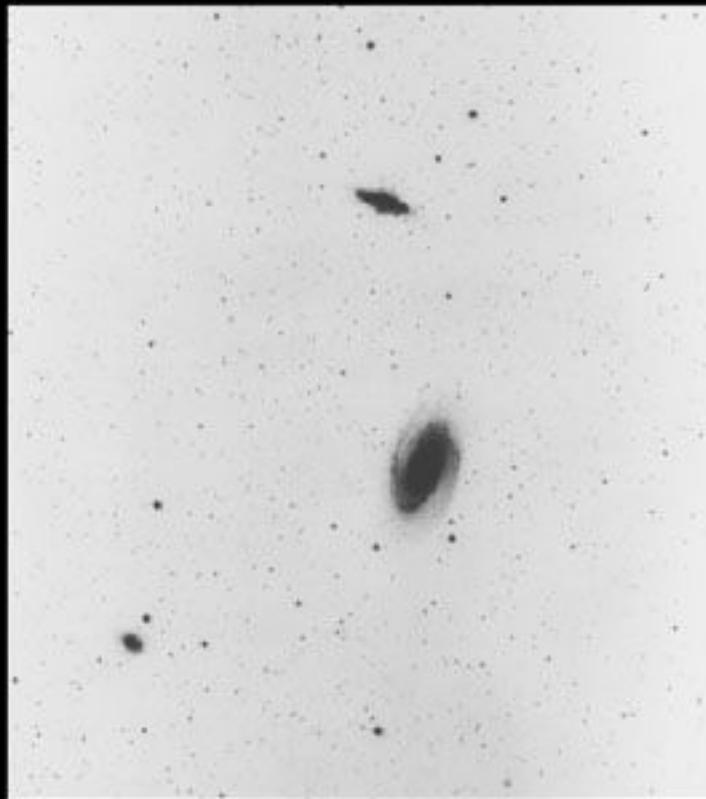
M82: Cigar  
Galaxy

NGC 3077

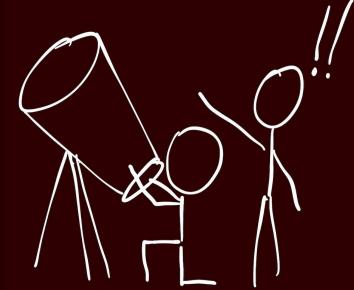
M81: Bode's  
Galaxy



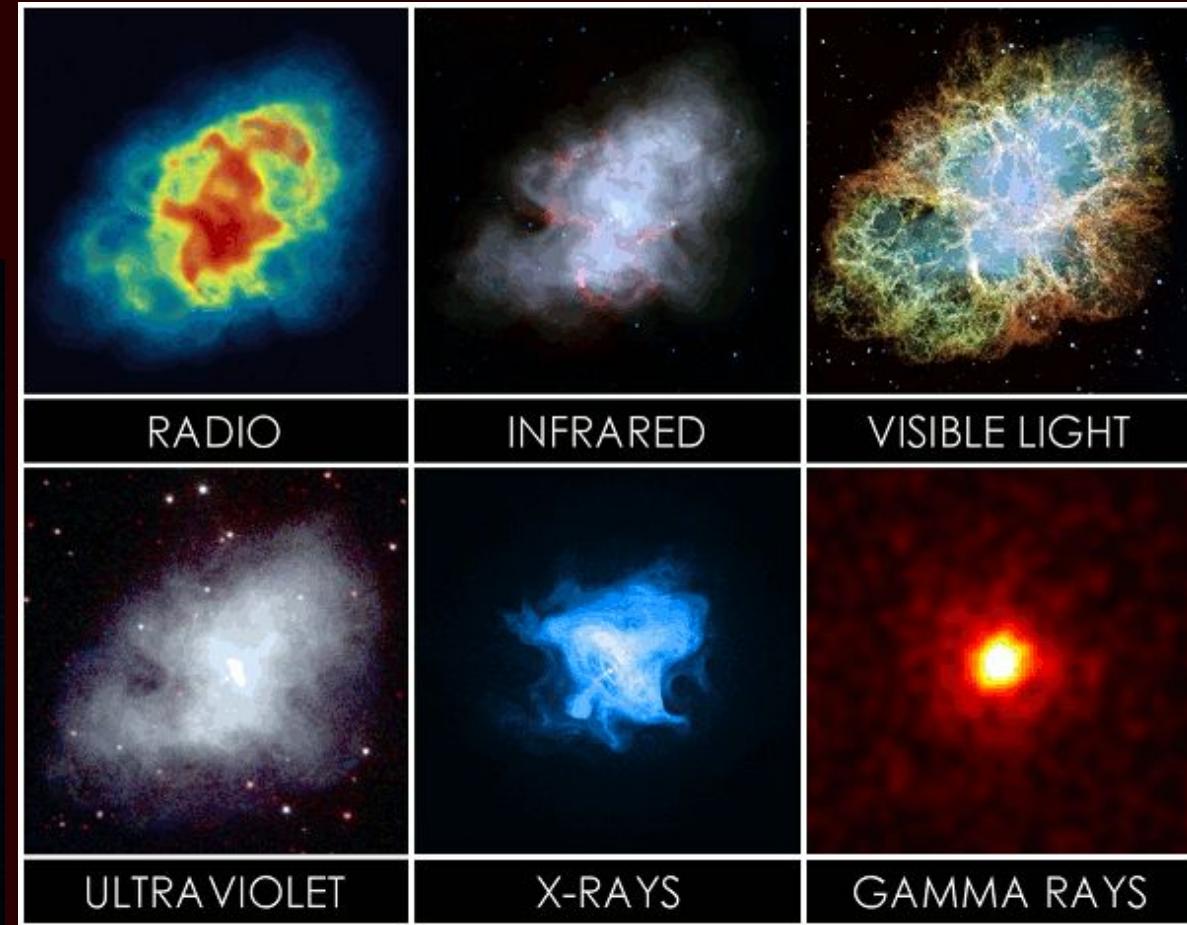




What is all that  
green stuff?



# Crab Nebula



# Questions?

## Attendance checkout:

See ya next time!

