Beyond the Rainbow

How Astronomers use light to study the universe.

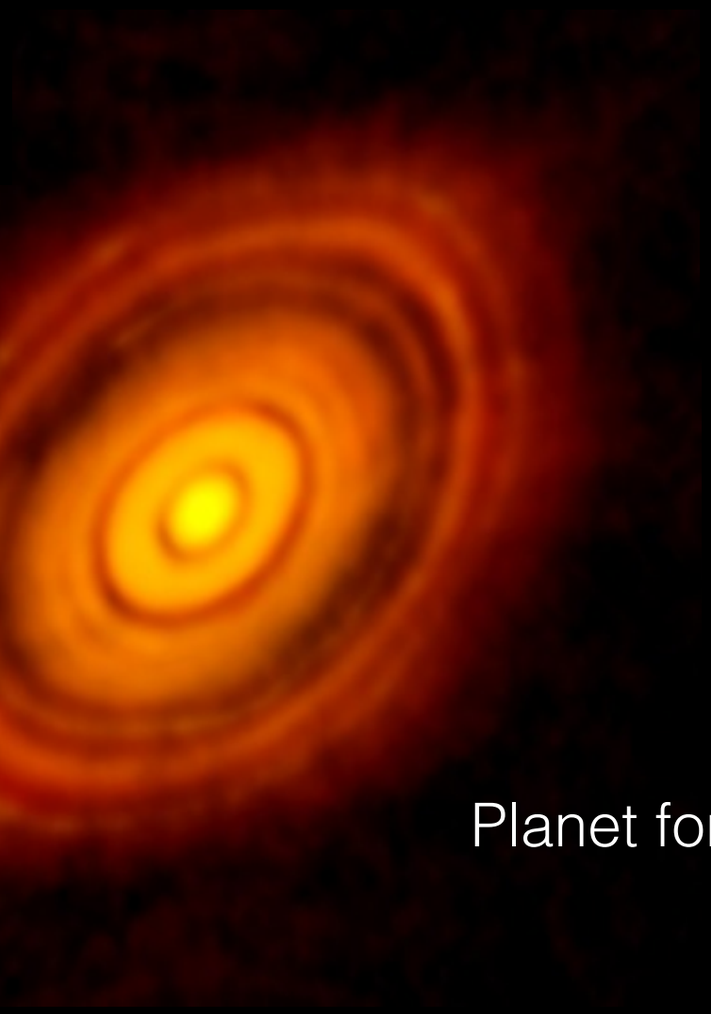
What is astronomy?

Astronomy is the study of celestial objects (such as stars, galaxies, planets) and the physics, chemistry, and evolution of such objects.

Astronomy is the study of planets

…both in and outside
our solar system

Saturn and moons

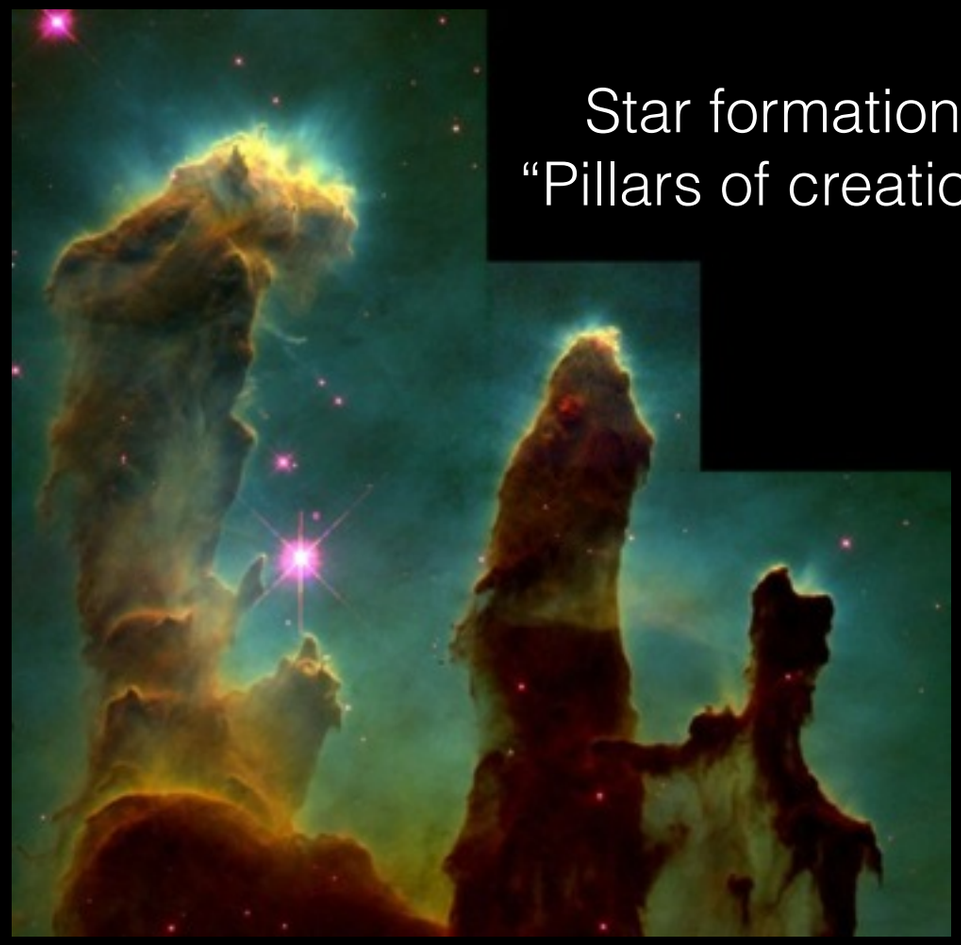


Planet formation

Jupiter

Astronomy is the study of stars

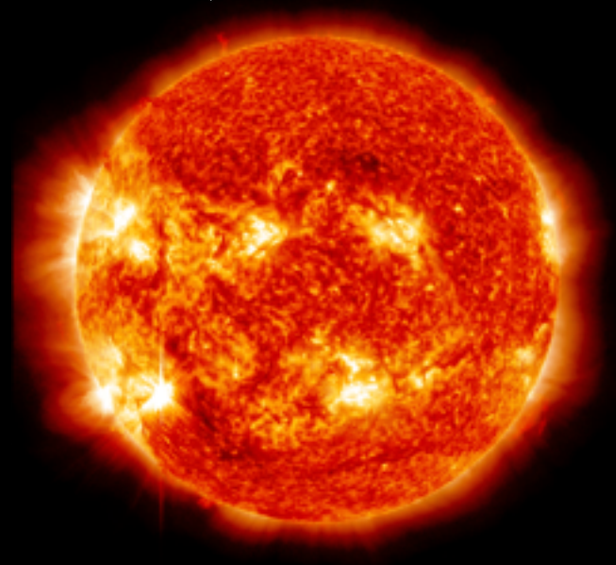
…including their birth, death, and evolution



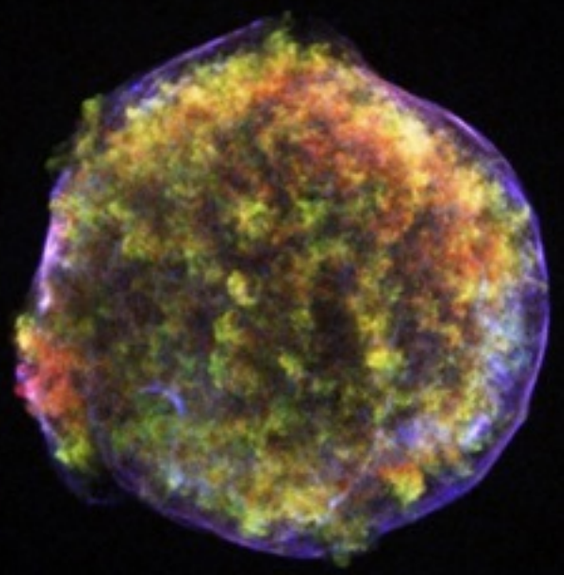
Star formation
"Pillars of creation"

Star clusters

The Sun, our closest star



Remnant of the death
of a massive star



Astronomy is the study of galaxies

Sombrero galaxy

Merging galaxies

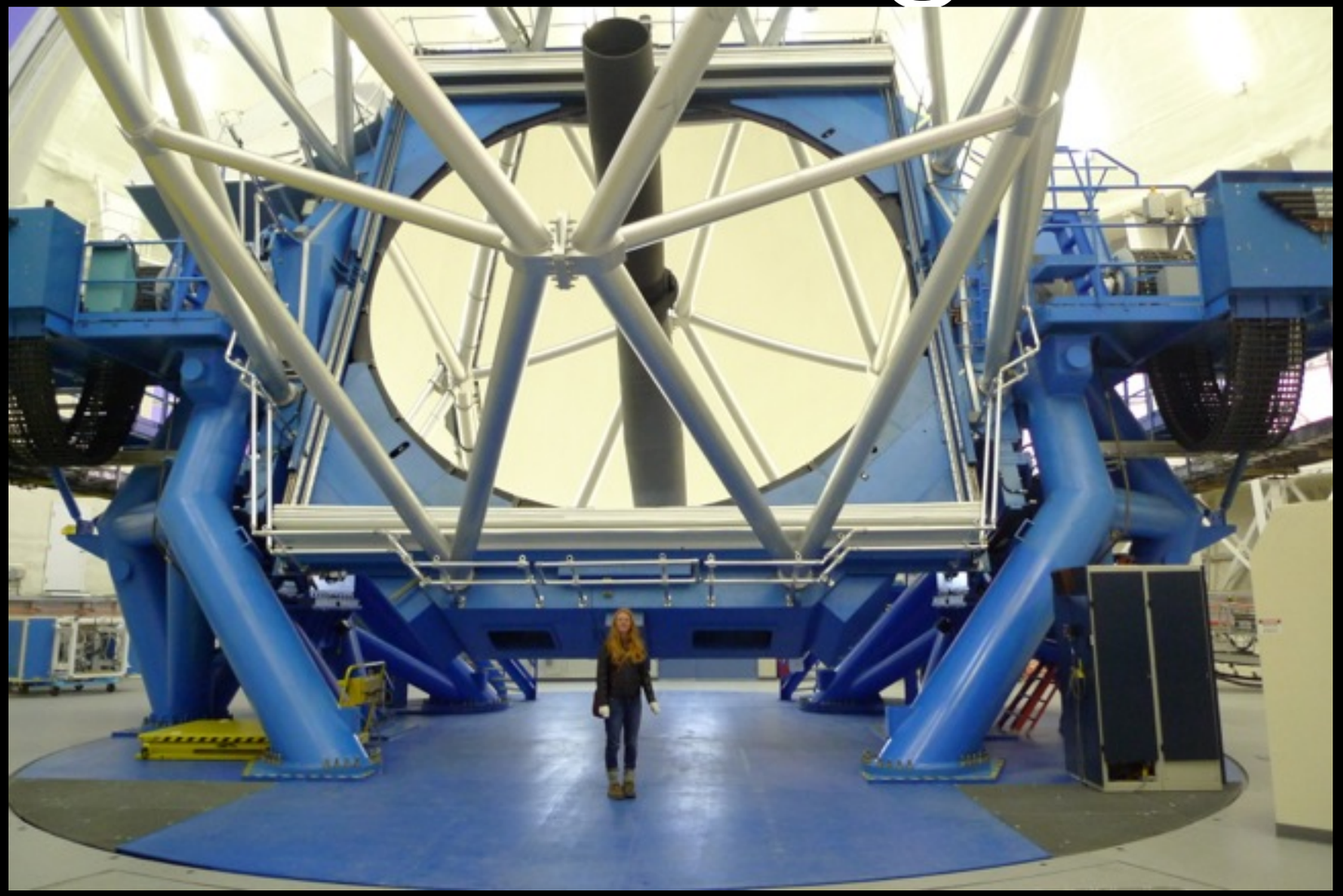
Our neighbor,
Andromeda

Astronomy is the study of the universe

…and everything in it

The Hubble Extreme Deep Field showing thousands of galaxies

Alexa's Background



- 1st year grad student in astronomy & astrophysics at UCSC
- Originally from Minnesota but my studies and research have taken me far…
- Went to a small liberal arts school in Vermont while working to pay for it.
- Undergraduate internships in Hawaii, Nantucket, Amherst

Alexa studies populations of stars

Stephen's quintet
red light = old stars, blue light = young stars

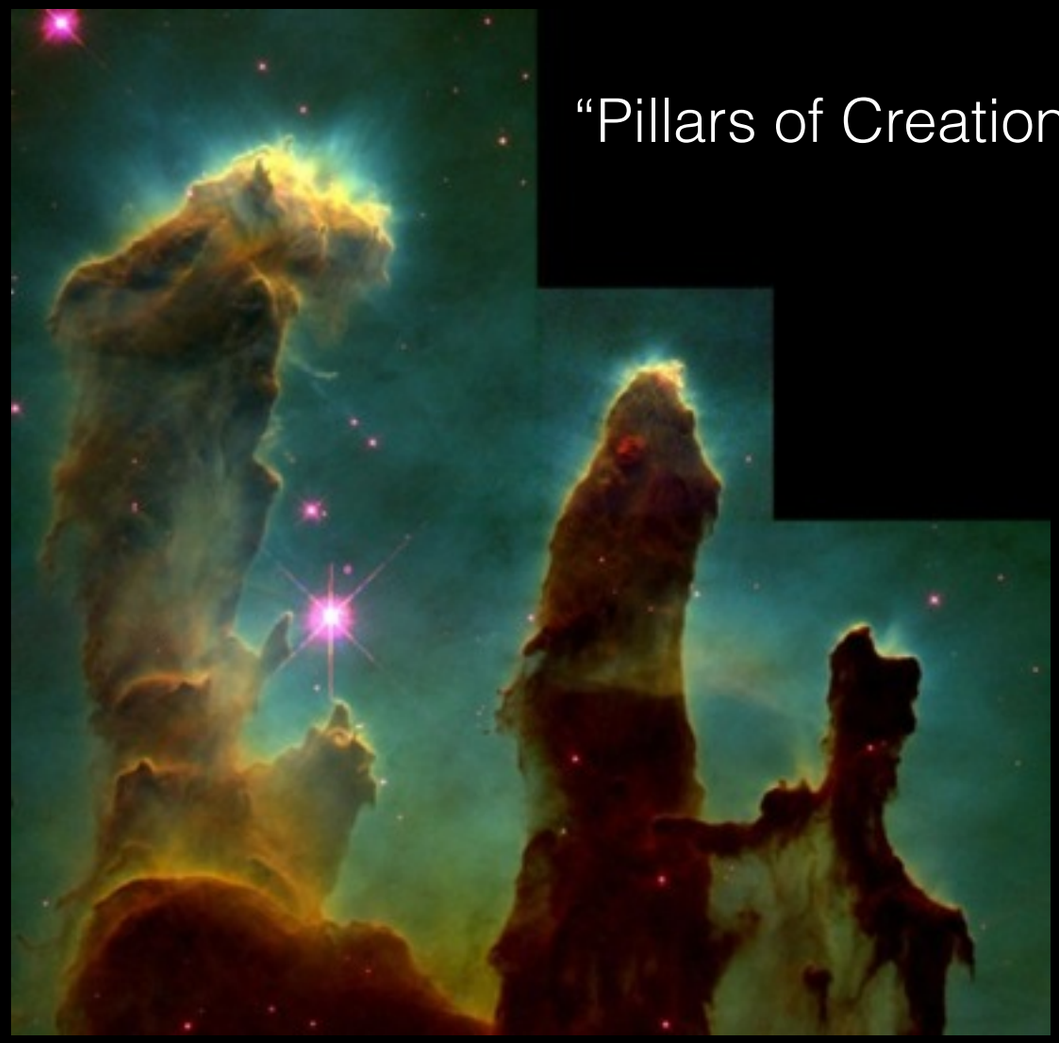
- Galaxies are made up of many things including stars
- Stars are born and have lifetimes
- Galaxies are billions of years old and form many generations of stars.
- Studying the different generations of stars help us understand galaxy evolution.

Anna's Background

Giving a talk about my research in Greece

- Originally from LA… (San Fernando Valley)
- Went to an alternative high school
- Went to community college at Pierce College in LA. Took night courses while working full time.
- Transferred to UC Berkeley - degree in Physics & Astrophysics
- Undergraduate internships at UC Davis & NASA Jet Propulsion Laboratory
- 5th year graduate student in Astronomy & Astrophysics at UCSC

Anna studies star formation



"Pillars of Creation"

- I use computational astrophysics to simulate the laws of physics!
- I focus on the birth of massive stars and massive star clusters

R136 - most massive star cluster in the local universe

Astronomers are studying all these awesome things…

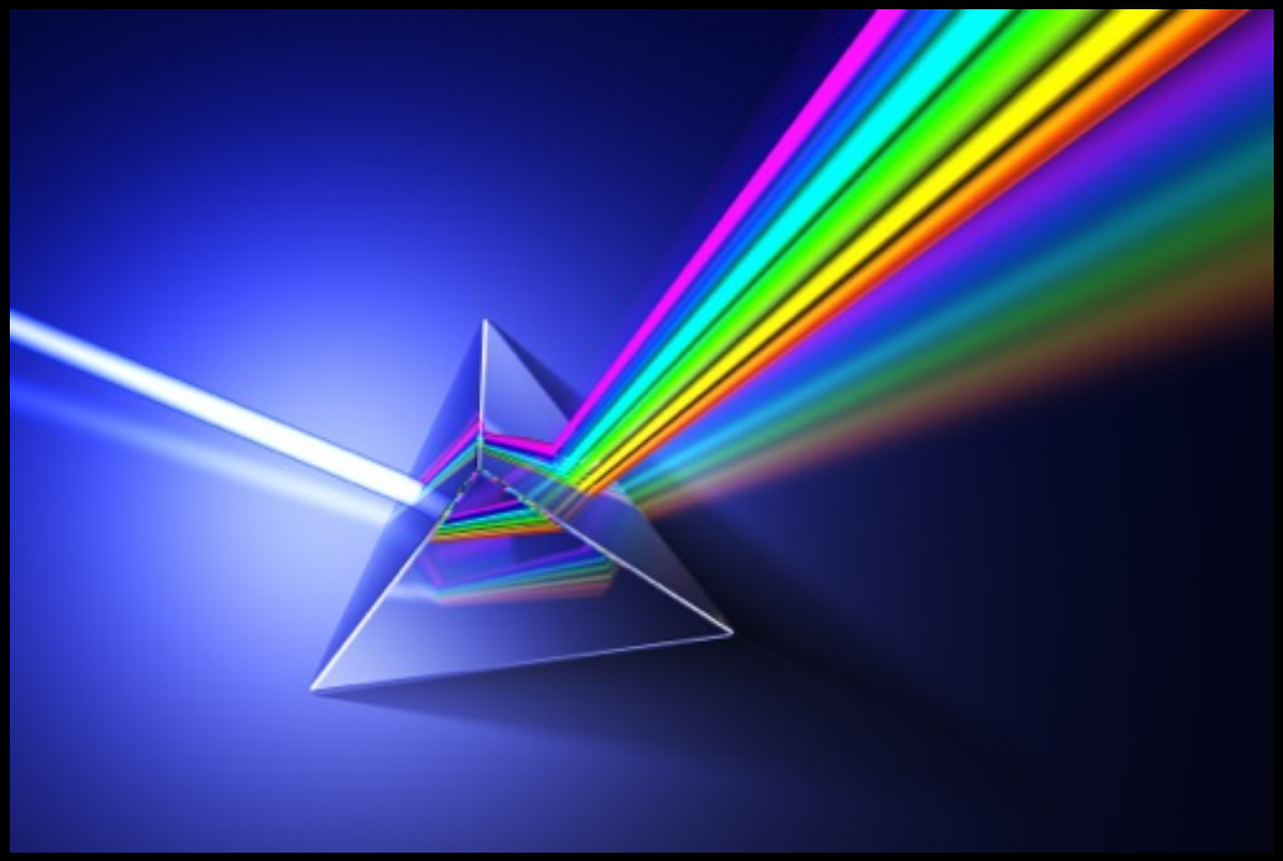
But how do we know anything about them?

All astronomers have is light.

Almost all other kinds of scientists are able to interact with what they study

What do you know about light?

Light is made up of different colors



Diffraction gratings divide light into those colors. Look at the light bulb! (You're seeing a *spectrum.)*

Different elements have different light signatures

Let’s experiment!

Can you tell the difference between different elements?

Different elements have different light signatures

Let’s experiment!

Can you tell the difference between different elements?

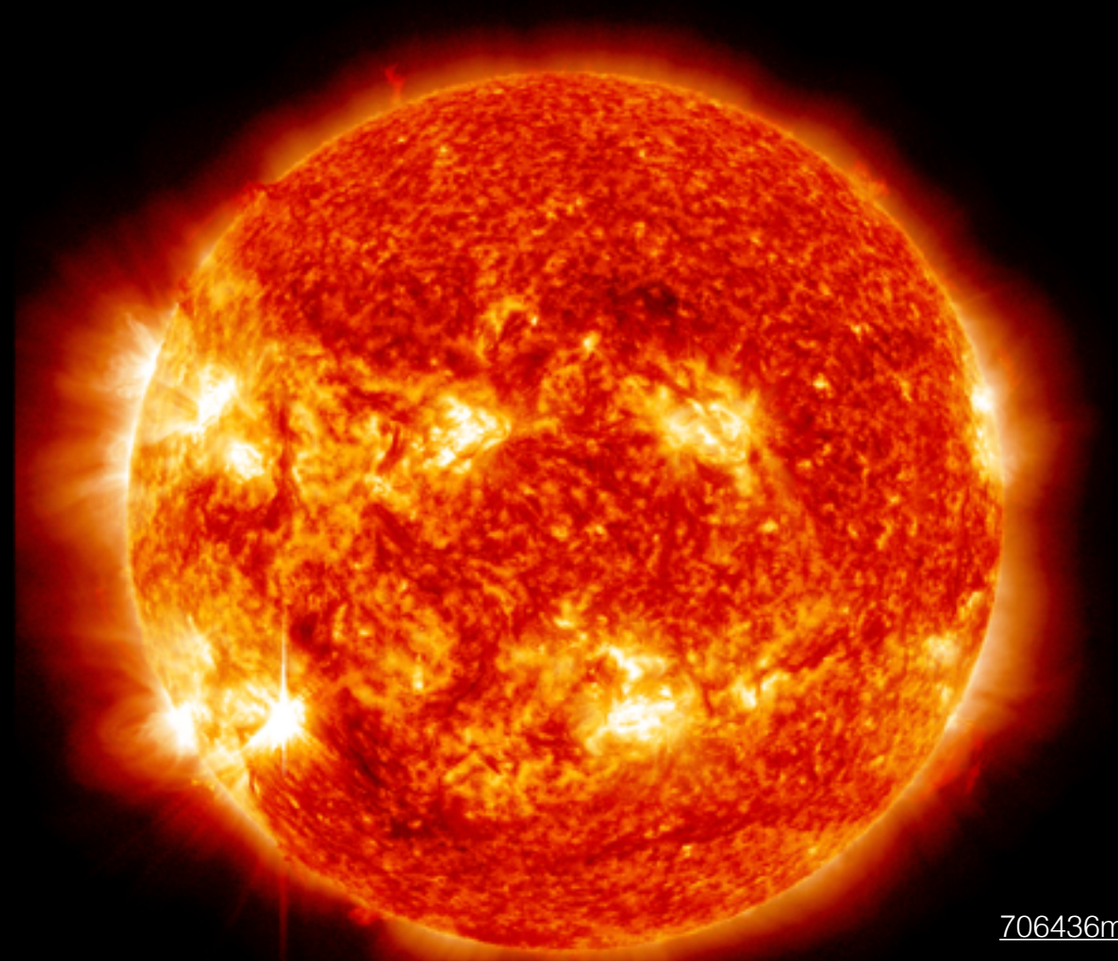
Element Lamp Activity

- As a team, go to your first element lamp.
- Draw what you see through each diffraction grating.
- We will let you know when it's time to go to the next lamp.
- After everyone has gone to each station, we'll hand out a sheet with the real spectra.
- As a team, decide which element was at each station. (Feel free to look at the lamps again!)
- Send a team member to the front to give us your answers.

Different guesses?

- If you could redo this experiment, what would you do differently?
- Repetition and doing an experiment different ways helps us get the “right” answer.
- Scientists don’t know the “right” answer when they start, so they use consensus based on data to figure it out. Science is very collaborative.

A real spectrum of the sun



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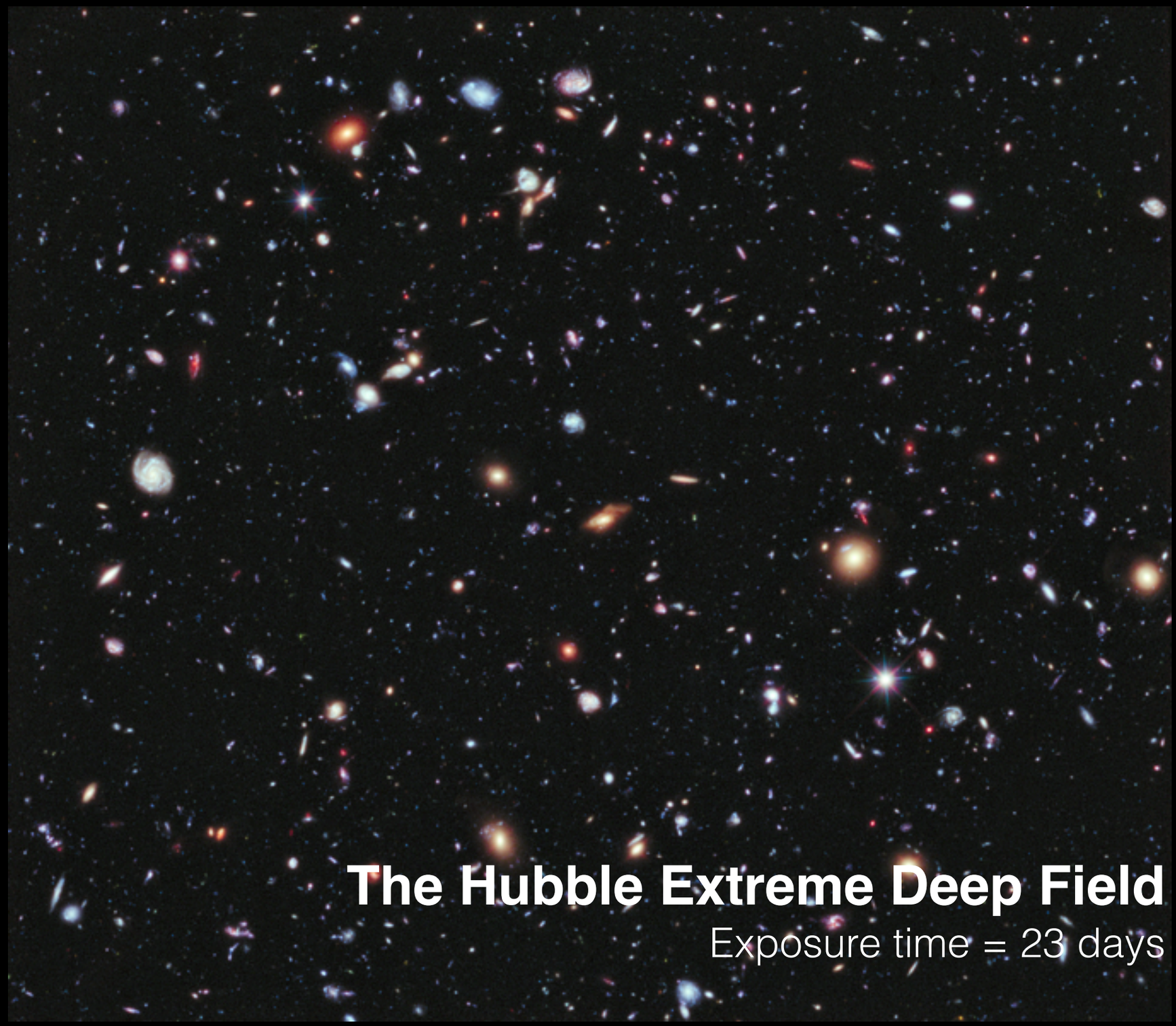
What can we learn about stars by observing their light?

- Chemical composition
- Temperature
- Mass
- Age

How far can light take us?



http://upload.wikimedia.org/wikipedia/commons/2/22/Hubble_Extreme_Deep_Field_(full_resolution).png

Any questions?

(seriously, anything you've ever wondered about astronomy)