NSTA WEB SEMINARS

LIVE INTERACTIVE LEARNING @ YOUR DESKTOP

NSDL/NSTA Web Seminar:

Celebrating Astronomy: A Star's Story

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Thursday, September 25, 2008

6:30 p.m. to 8:00 p.m. Eastern time

Agenda:

1. Introductions
2. Tech-help info
3. Web Seminar tools
4. Presentation
5. Evaluation
6. Chat with the presenters

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Supporting the NSDL Presenting Team is…

For additional Tech-help call:

Elluminate Support,

1-866-388-8674 (Option 2)

Jeff Layman

Tech Support

NSTA

jlayman@nsta.org

703-312-9384

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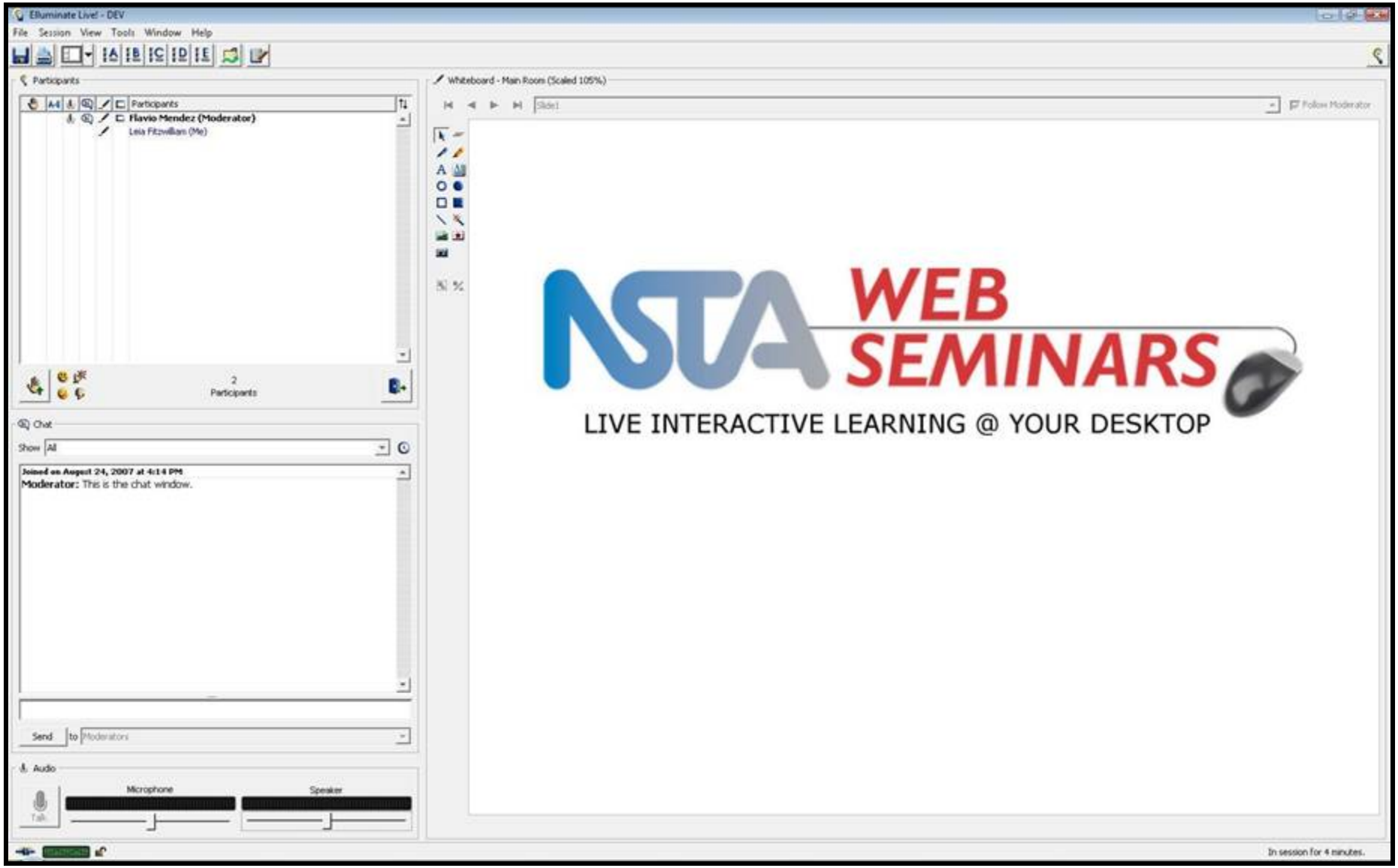
Screenshot


Elluminate Live! - DEV
File Session View Tools Window Help
Participants
Participants
Flavio Mendez (Moderator)
Leia Fitzwilliam (Me)
2
Participants
Chat
Show All
Joined on August 24, 2007 at 4:14 PM
Moderator: This is the chat window.
Send to Moderators
Audio
Microphone
Speaker
Talk
Whiteboard - Main Room (Scaled 105%)
Slide1
Follow Moderator
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In session for 4 minutes.

We would like to know more about you…

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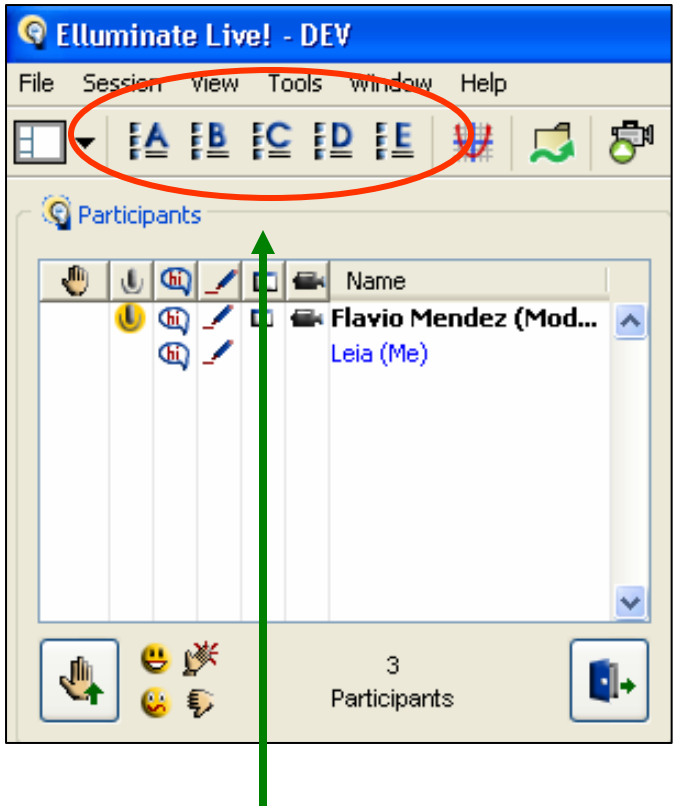
How many NSTA web seminars have you attended?



Use the letters A-E located at the top left of your actual screen to answer the poll

A. 1-3

B. 4-5

C. More than 5

D. More than 10

E. This is my first web seminar

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How many NSTA web seminars have you attended?

A. 1-3

B. 4-5

C. More than 5

D. More than 10

E. This is my first web seminar

Where are you now?

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What grade level do you teach?

A. Elementary School, K-5.

B. Middle School, 6-8.

C. High School, 9-12.

D. I teach college students.

E. I am an Informal Educator.

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Celebrating Astronomy: A Star's Story

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Thursday, September 25, 2008

Today's NSDL experts:

Dr. Susana Deustua, Researcher, Space Telescope Science Institute & Co-chair of the U.S. International Year of Astronomy

Dr. Cathy Ezrailson, Assistant Professor of Science Education University of South Dakota

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http://www.thephysicsfront.org

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To begin our celebration of the International Year of Astronomy 2009, let's investigate:

- Star birth and formation
- Stellar classification
- Star spectra
- Planet formation
- When stars die
- More resources

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comPADRE
Resources for Physics & Astronomy Education

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Test your star power

Which do you think is the most common element (by mass) found in stars?

A. Helium

B. Hydrogen

C. Carbon

D. Silicon

Sagittarius Star Cloud,
Center of the Milky Way Galaxy

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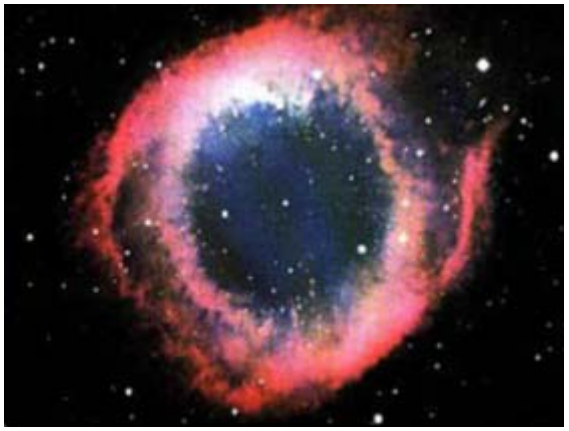
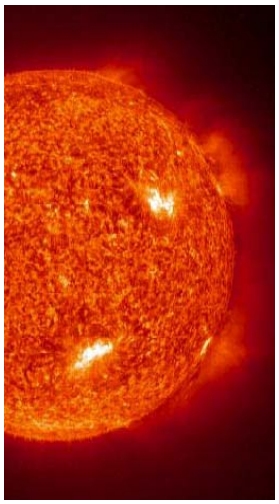
Stars are made of:

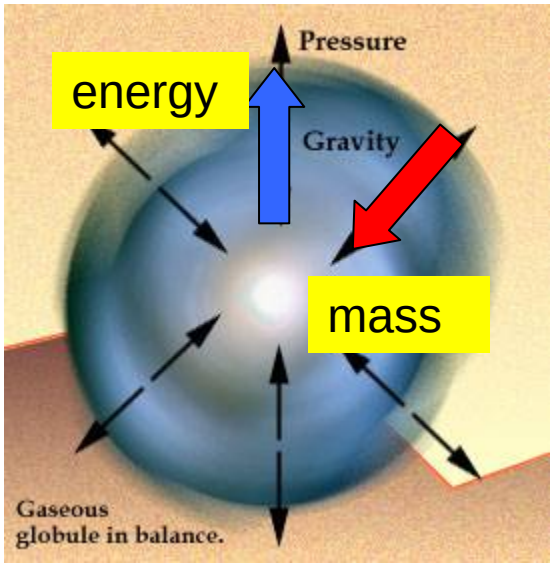
- (by mass)
- 70-80 % Hydrogen
- 20-30% Helium
- 1-2% Metals (everything else - C, N, O, Si, Ca, Fe, Zn)



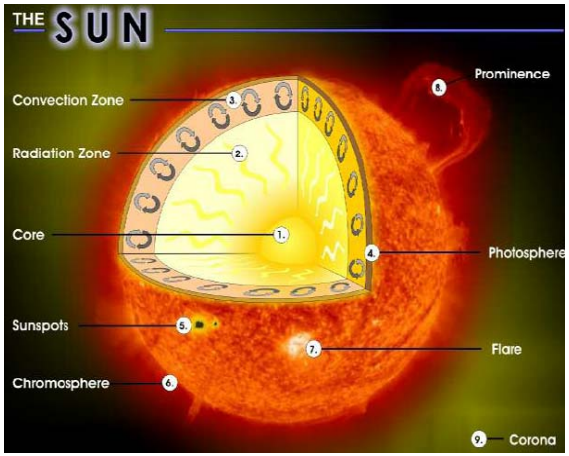
Stars….



…are massive, hot, glowing balls of gas



…lifestyles are determined by the struggle for **equilibrium** between **gravity and pressure**



…produce their energy via nuclear fusion in their cores

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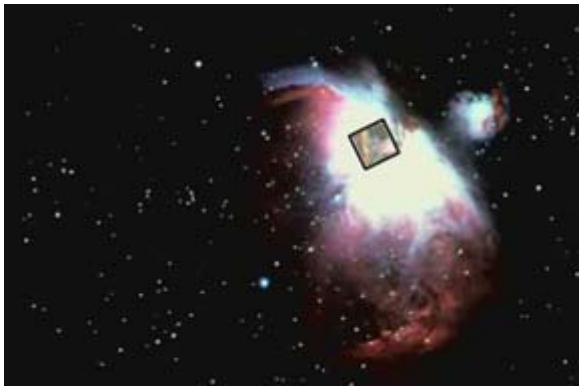
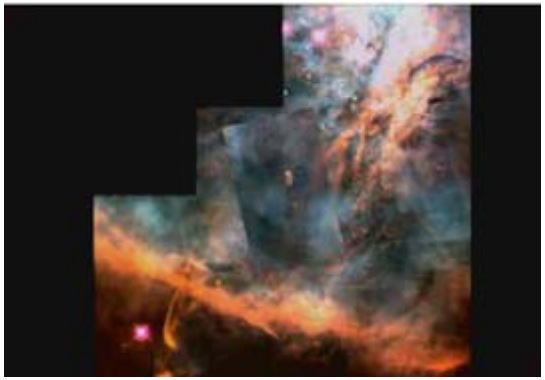
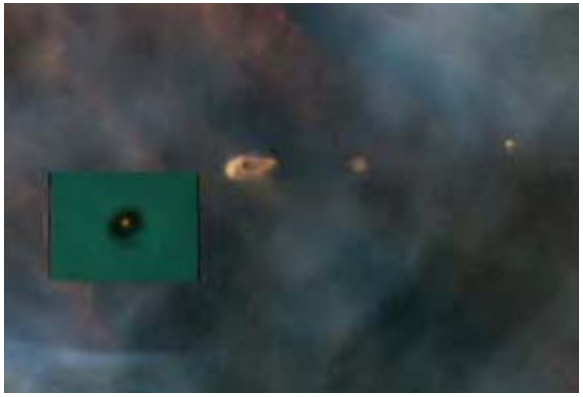
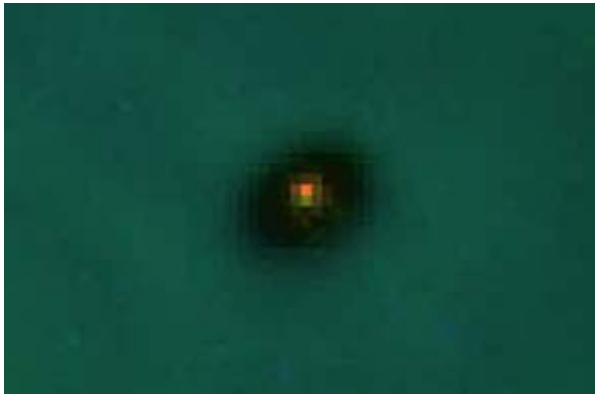
Star Nurseries …
a star is born in the Orion Nebula









Hayden Planetarium, American Museum of Natural History
http://haydenplanetarium.org/movies/ava/S0801starform.mpg

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What physical factors do YOU think most influence how stars are formed?

Consider:

- Mass of the initial gas cloud
- Temperature of the gas
- Speed of cloud rotation
- Other factors…

Type your responses in the chat

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The most important factor in how a star evolves and eventually dies is its initial mass.

Swan Nebula

A massive cloud can form thousands of stars ranging in mass from about 100 x the mass of the sun to about 1/100th of a solar mass.

- Smaller individual clumps may form single stars, binary stars, multiple star systems, planetary systems

- A star's life and death depend on:
  - how much fuel (mass) they have available
  - how quickly they expend their energy

A star is born…

From collapsing cold clouds of interstellar gas and dust… clouds rotate as they collapse … conserving angular momentum … forming the smaller clumps that will become stars

Orion Nebula

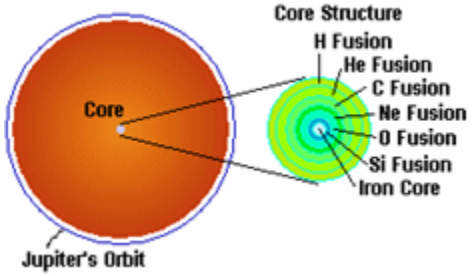
A star's initial mass determines its life

High Mass Stars

- Bright
- Burn "fuel" rapidly (hundreds of millions of years)
- Have very short lives
- Example: Rigel in the Orion Constellation

Low Mass Stars

- Less bright
- "Burn" for billions of years
- Have very long lives
- Examples: Sun, brown dwarfs



Let’s pause for questions from the audience….

Classifying stars

We classify stars based on their spectra, which provide us with information on:

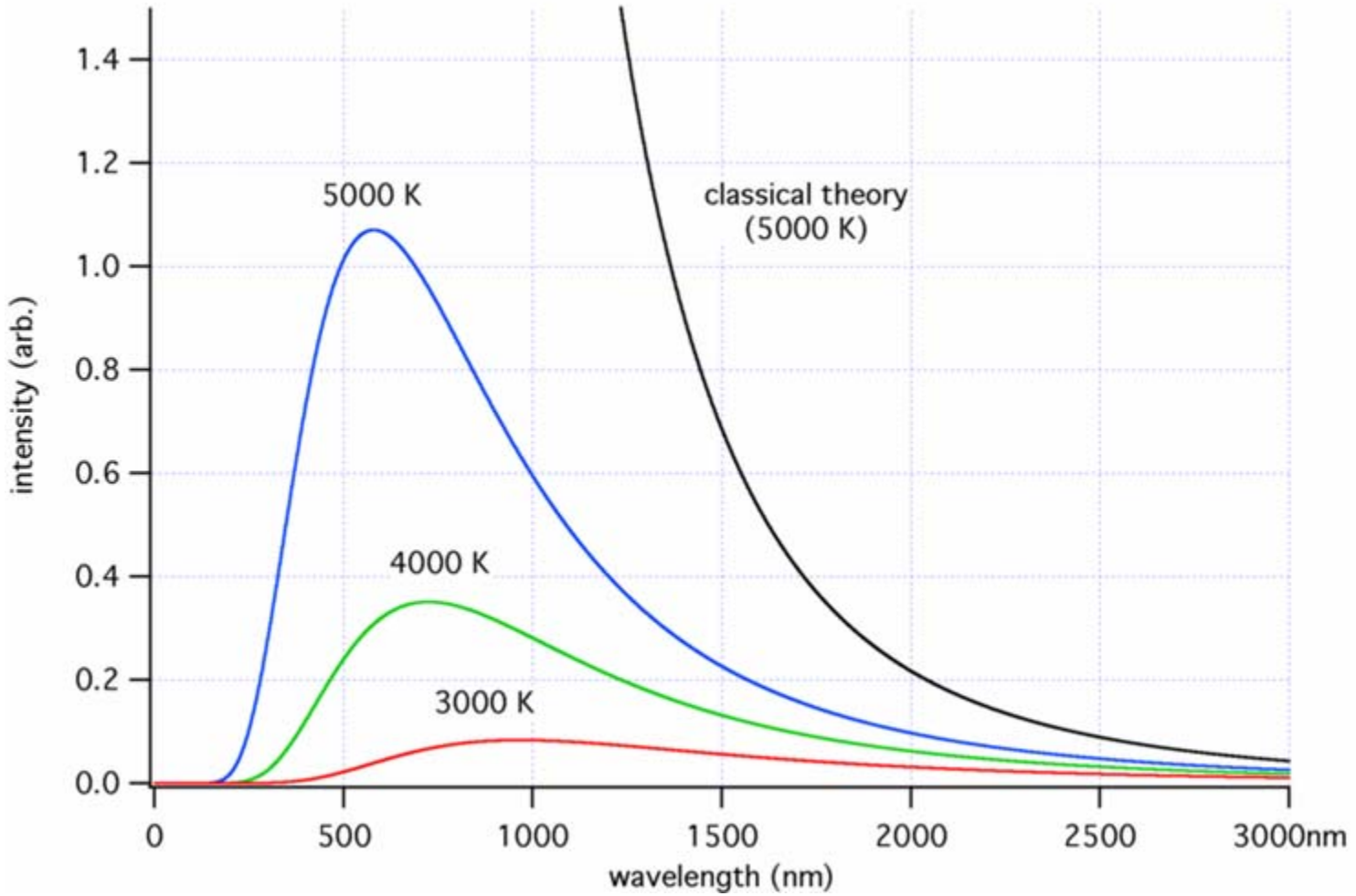
- Temperature
- Composition
- Brightness
- (and in some cases, Distance, but that's another story)

About light and energy

- Light is a particle and Light is a wave.
- A photon's energy is proportional to its frequency **$E = h\nu$** or inversely proportional to its wavelength, **$E = hc/\lambda$.** (h is the Planck's constant).

- Electrons in atoms and molecules
  - Absorb light when they jump from lower to higher energy levels.
  - Emit light when they jump from higher to lower energy levels.

About light and energy and stars



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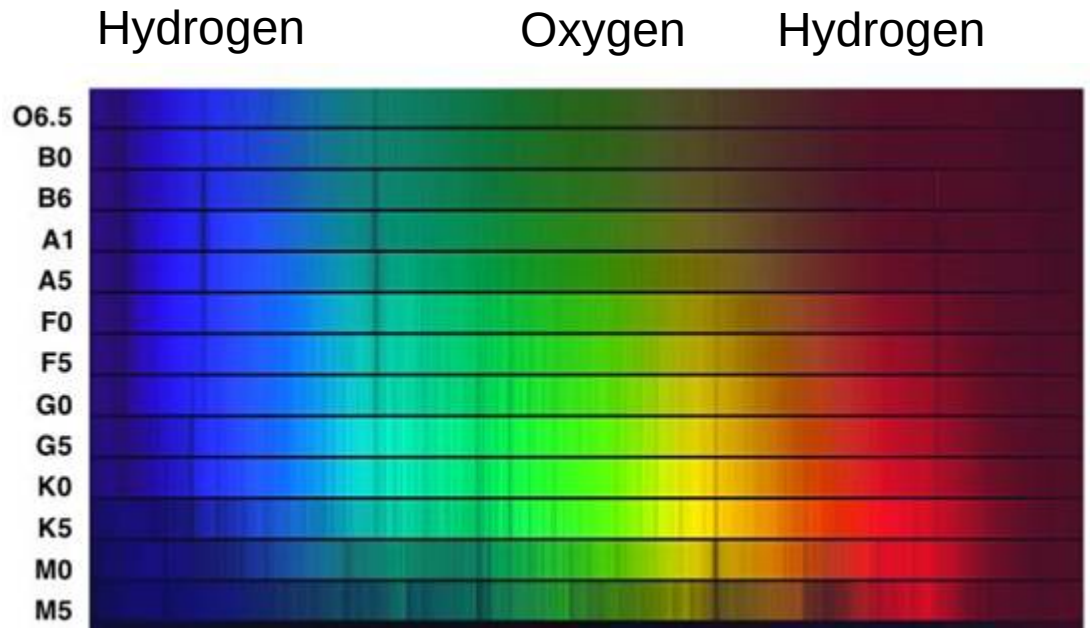
About light and stars

- Atoms and molecules in the cooler outer layers absorb light - so we observe an ABSORPTION spectrum.

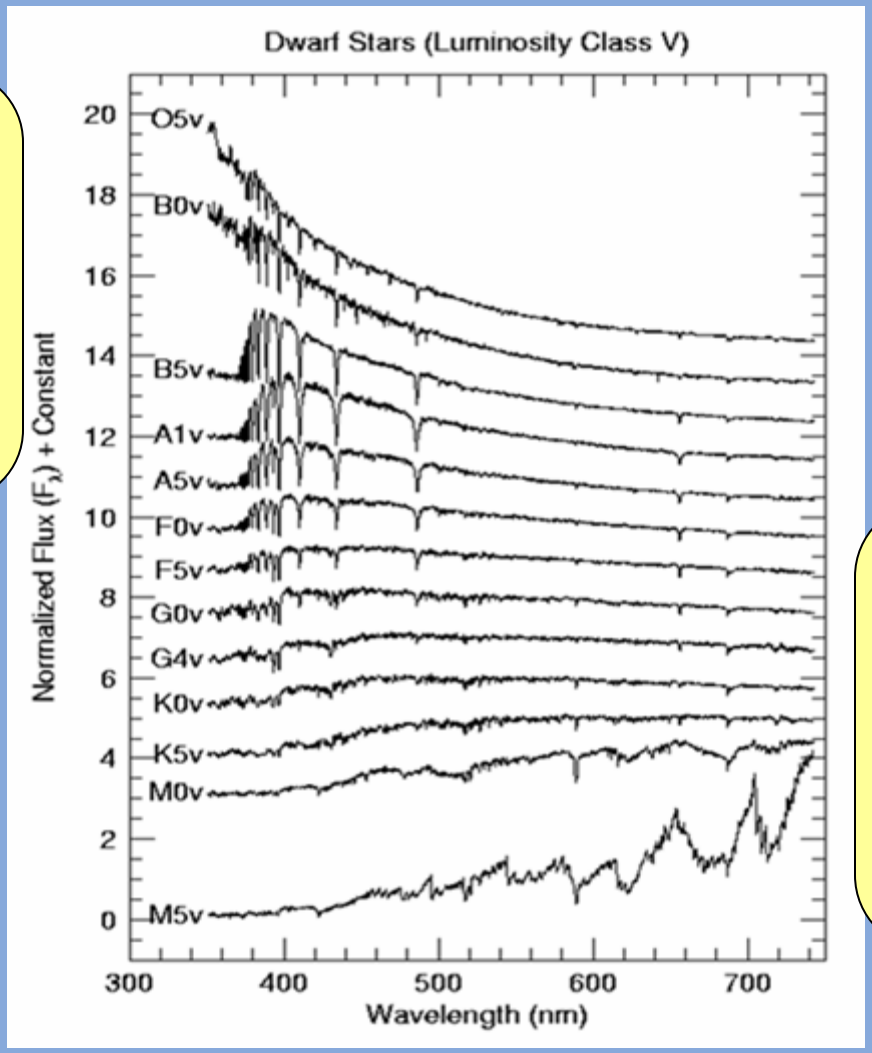
- Atoms and molecules in the hotter corona (as in the sun) emit light - so we observe an EMISSION spectrum.



Surface Temperature	Spectral lines from:
T > 10,000 K	Hydrogen
8,000 K – 10,000 K	Hydrogen and helium
T < 8,000K	Hydrogen, helium oxygen, iron, silicon, nitrogen, calcium
Coolest stars	Molecules

Profile of star spectra

The elements in the cooler layers absorb light, producing the absorption spectrum

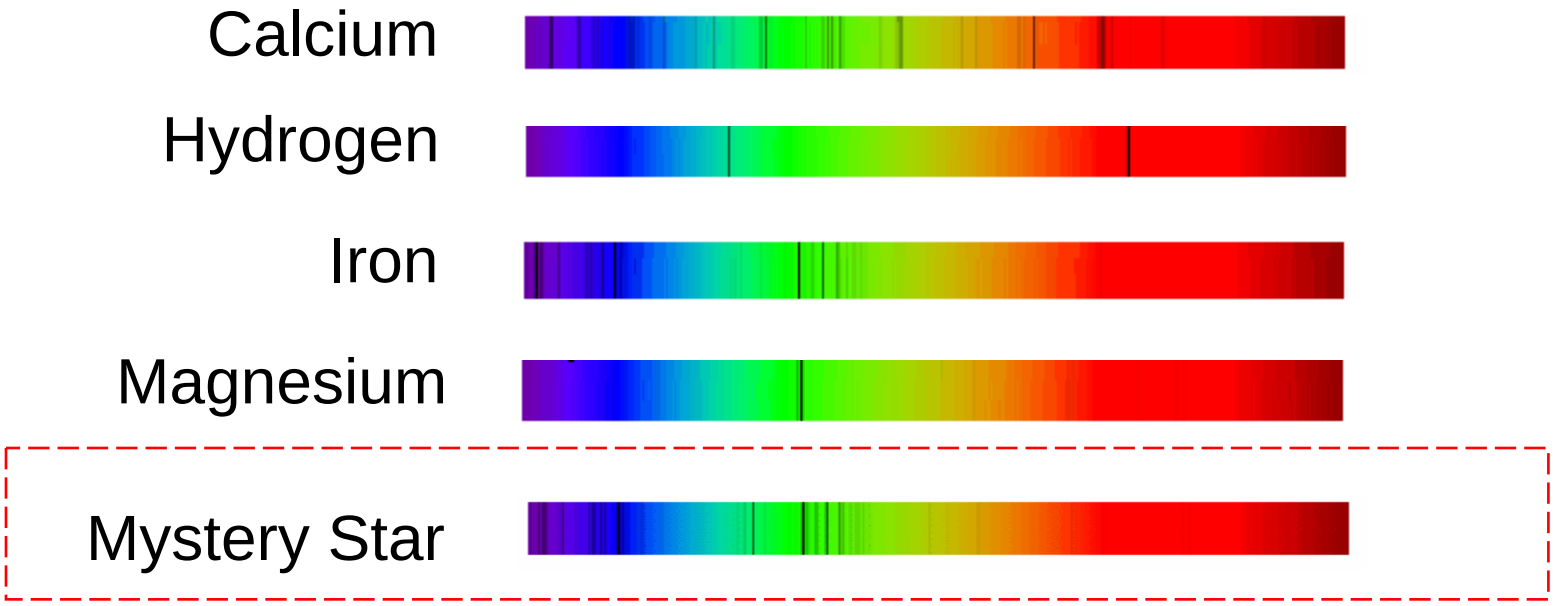


The distribution of energy emitted by a star produces a spectrum. (SED = spectral energy distribution)

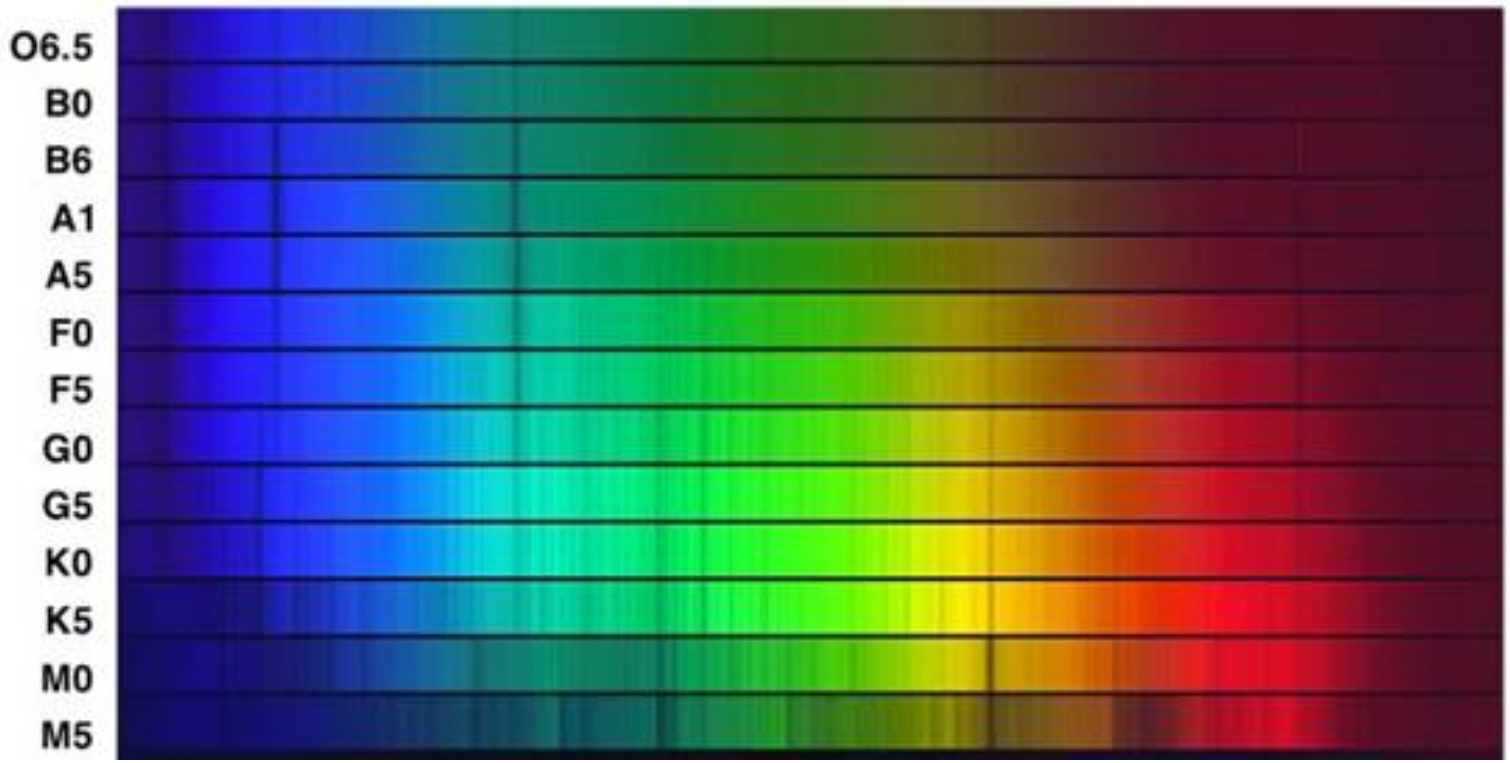
Light from the core produces a continuous spectrum

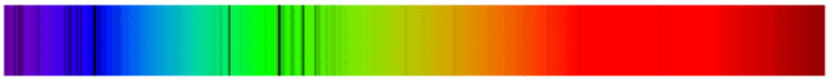
Which elements are present in the mystery star represented by the spectrum below? Stamp your answer(s)

Calcium	Hydrogen	Iron	Magnesium



Bonus: What is the mystery star's spectral type?



Mystery Star 

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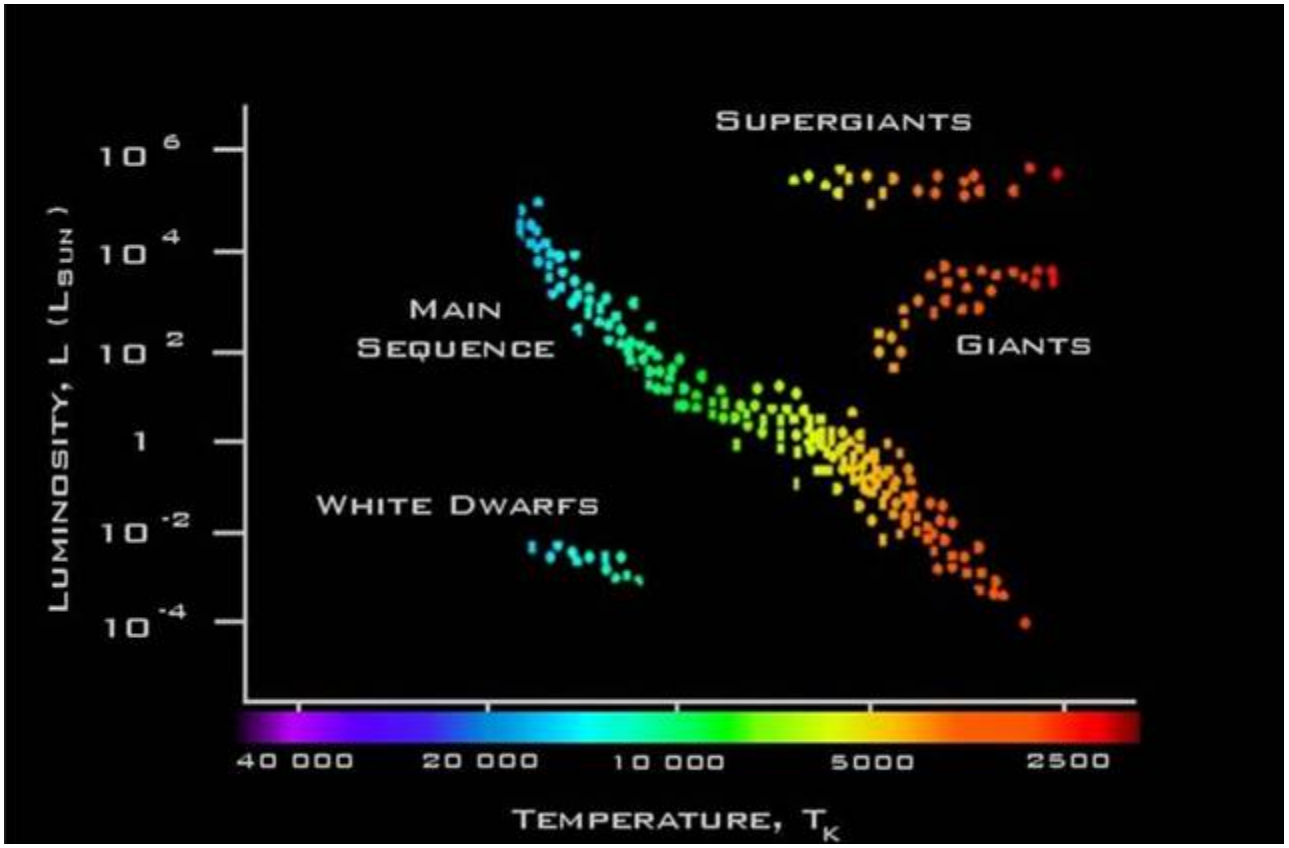
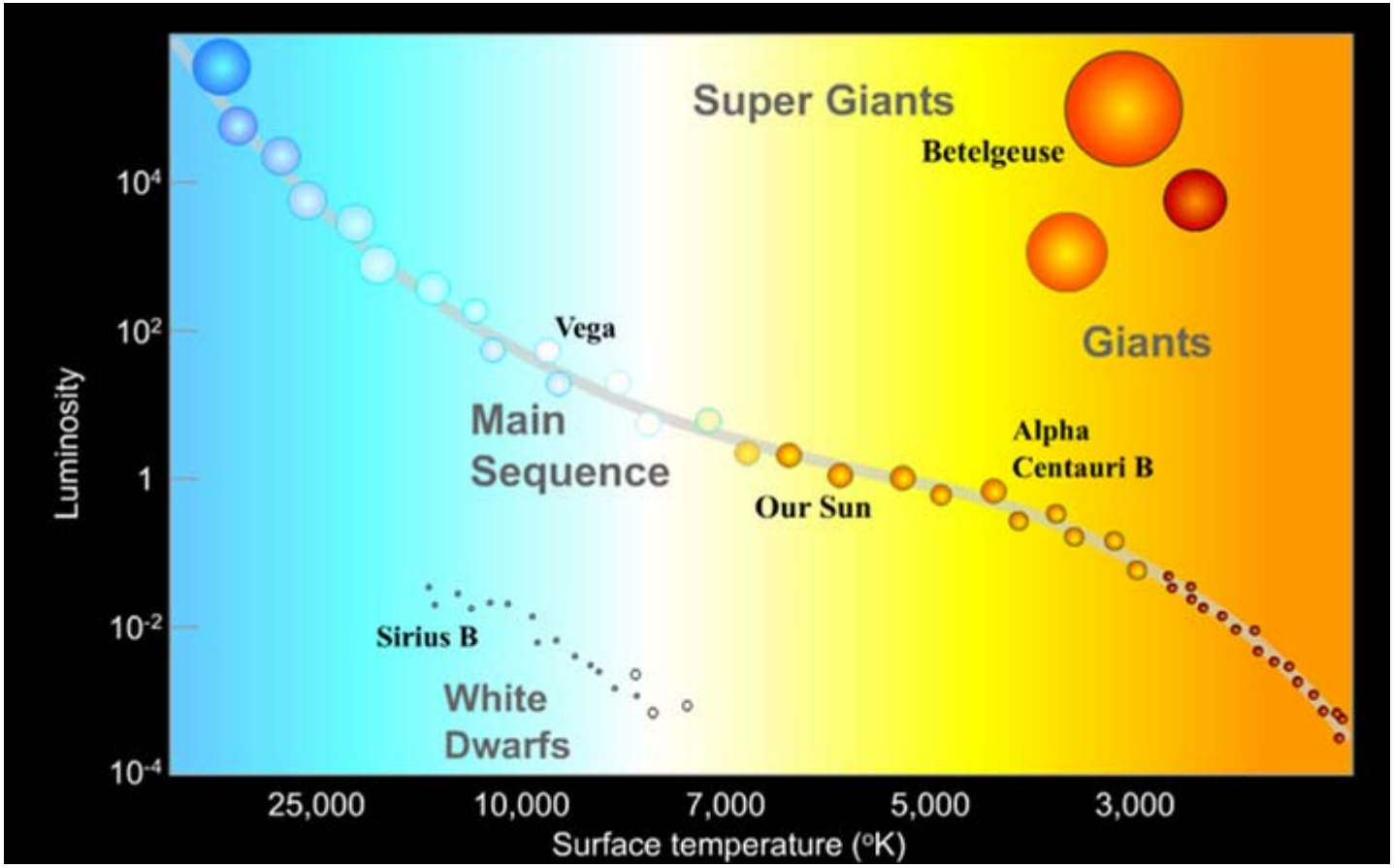
Plotting temperature against brightness, gives us an organizing diagram - The Hertzprung-Russell Diagram.



This diagram is to astronomy as the periodic table is to chemistry.

Interactive quiz: http://aspire.cosmic-ray.org/labs/star_life/support/HR_static.swf

Quiz Answers



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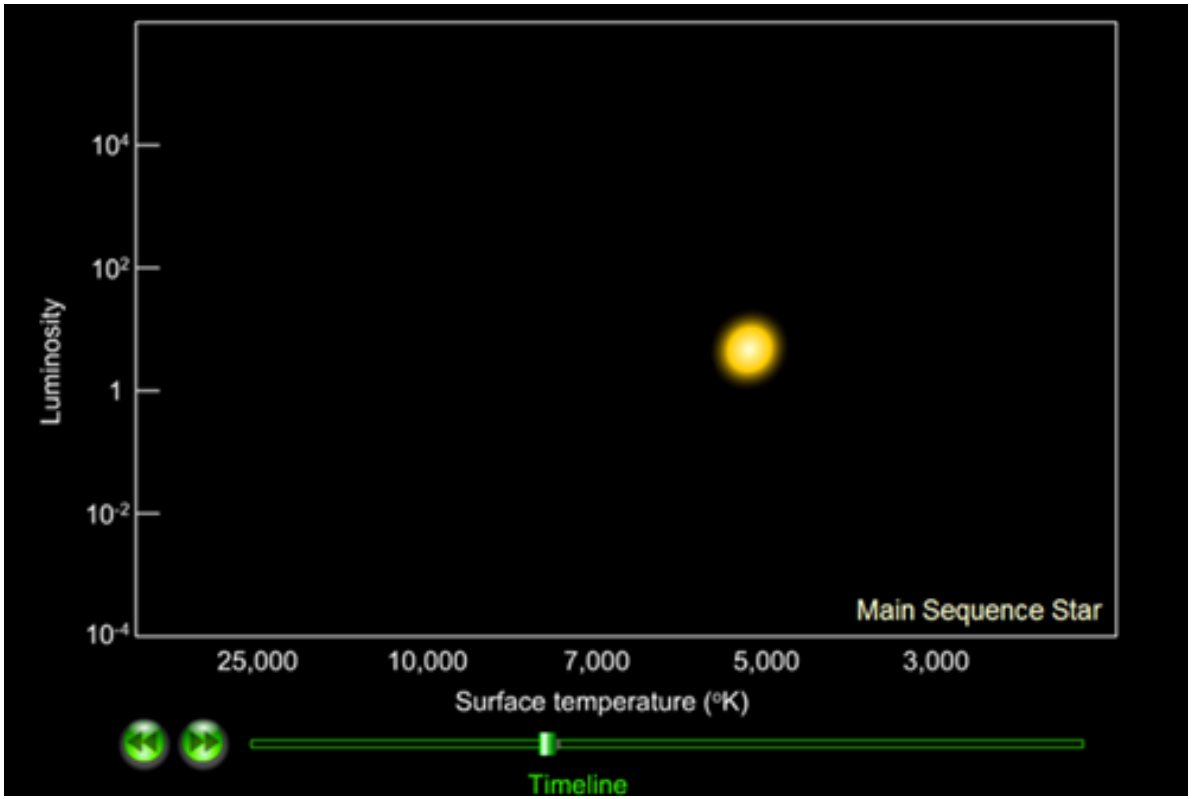
Simulated life cycle of a 1 solar mass star



http://aspire.cosmic-ray.org/labs/star_life/support/HR_animated.swf

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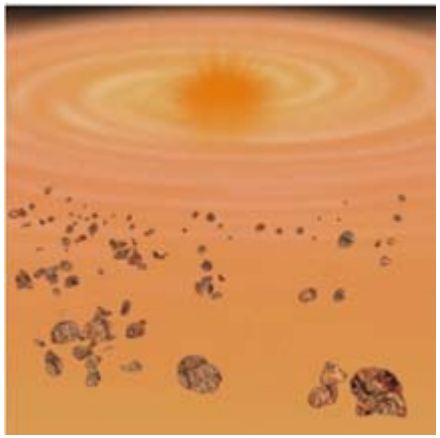
Let’s pause for questions from the audience….

How do planets form around stars?

Planets form around stars from accretion of smaller bits (planetesimals) after the central star forms, or from a clump orbiting the main star (jupiters).



planetesimals

jupiters

http://atropos.as.arizona.edu/aiz/teaching/a204/images/planetesimals.mov

http://atropos.as.arizona.edu/aiz/teaching/a204/images/ring_formation.mov

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When Stars Die

Very massive (> 10 Msun) stars die in energetic explosions - supernovae - producing black holes or neutron stars and release almost all their atmosphere into the interstellar medium.

www.teachertube.com/view_video.php?viewkey=35f9a631b9db584a264e

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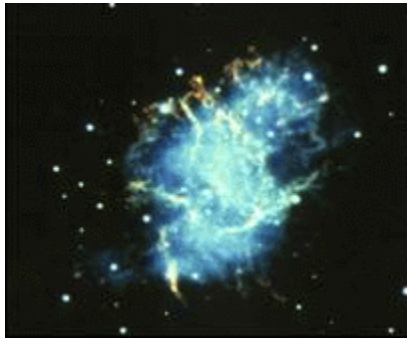
When Stars Die

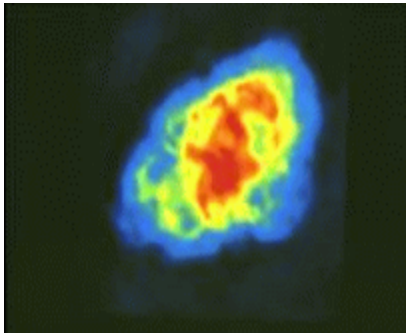

Medium sized (1-8 Msun) stars swell up, possibly engulfing planets, releasing outer layers into interstellar medium, the core becomes a white dwarf.

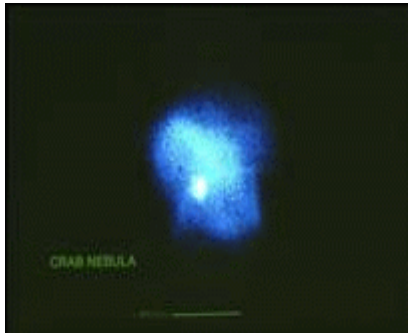
We think **Low mass (< 1 Msun) stars** also puff out, and eventually become white dwarfs. We do know they are very long lived -- longer than the universe is old.

Astronomy is a dynamic science. New discoveries add to our knowledge of the universe and our own solar system.

- New images brought to use by the Hubble Space Telescope show that star formation is more complex and violent than anyone had believed.
- Supersonic jets of particles and dense clots of dust warp glowing gas into a variety of fantastic shapes







More about stars can be found at…

The Astronomy Center

http://www.compadre.org/Astronomy

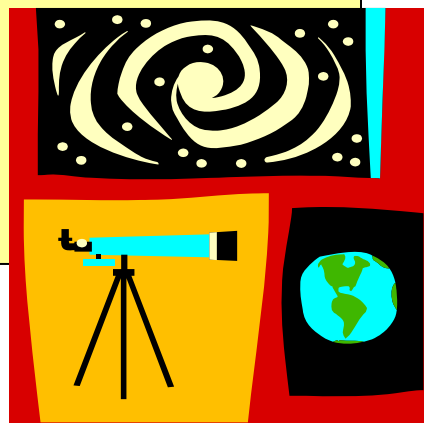
Hubble Space Telescope

http://hubblesite.org

International Year of Astronomy 2009

http://astronomy2009.us

http://astronomy2009.org



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More about stars can also be found at:

comPADRE
Resources for Physics & Astronomy Education

http://compadre.org

ThePhysicsFront.org

http://www.thephysicsfront.org

Let's interact with a final simulation from The Physics Front:

http://www.fourmilab.ch/yoursky

For further discussion, go to our blog at:

http://southdakotascienceeducation.blogspot.com

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Dr. Susana Deustua
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THANK YOU!

Dr. Cathy Ezrailson
Cathy.Ezrailson@usd.edu

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- Download our Seminar Resource List
- Find resources from archived seminars

Learn about new tools and resources, discuss issues related to science education, find out about ways to enhance your teaching at:

http://expertvoices.nsdl.org/learningdigitalK12

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NSTA: How to Maximize Your NSTA Conference Experience

October 8, 2008

NSDL: Beyond Penguins and Polar Bears: Physical Science from the Poles

October 29, 2008

http://learningcenter.nsta.org

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NSTA Web Seminars

Flavio Mendez, Senior Director

Jeff Layman, Technical Coordinator

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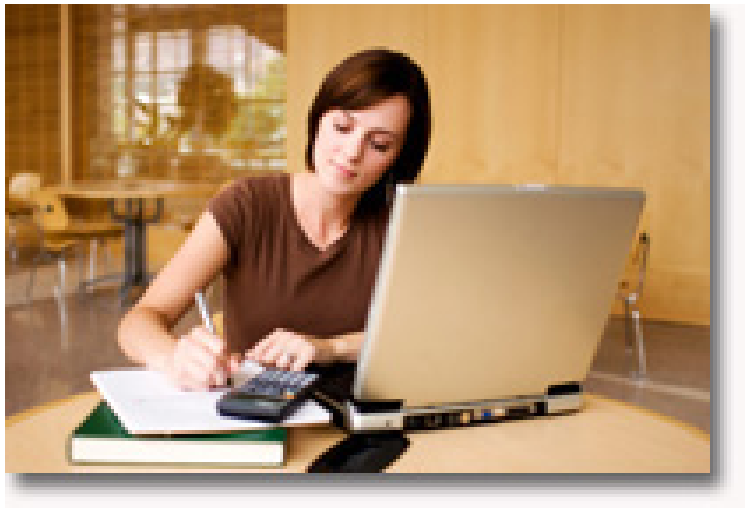
- Content expert and Moderator
- Live Web Sessions (5)
- Asynchronous discussions over 5 week period
- Course Materials
  - SciPack
  - SciGuide
  - Journal Articles
  - e-Book



Energy begins Sept. 30

8:00-9:30 p.m. Eastern

$322.50 (Member) | $367 (Nonmember)

Web Seminar Evaluation:

Click on the URL located on the Chat Window