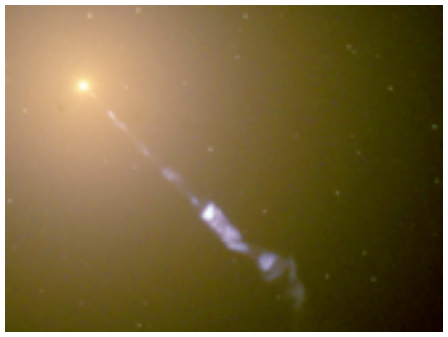
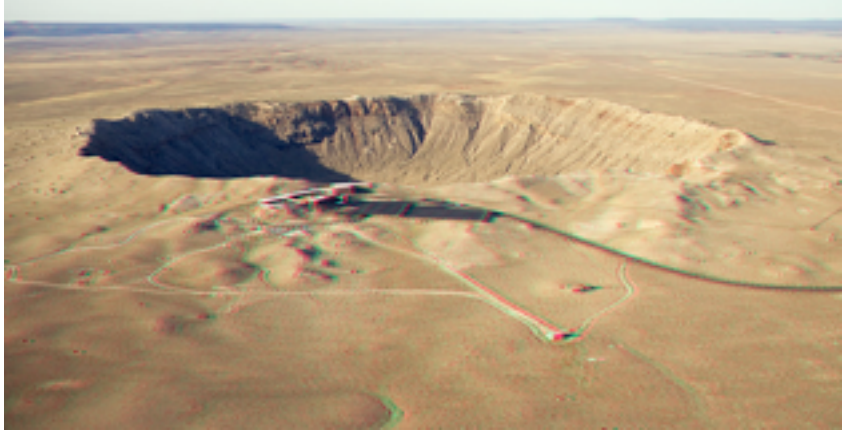




Welcome to Astronomy 150!

Syllabus

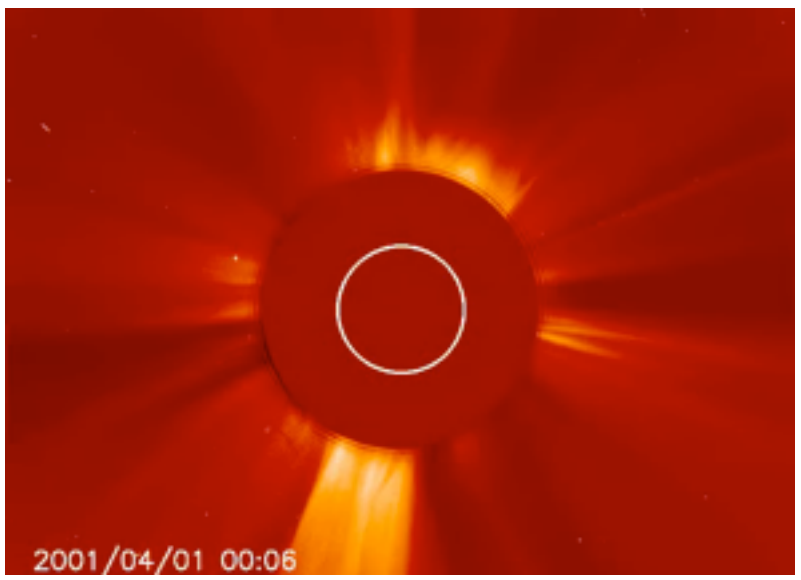
available online

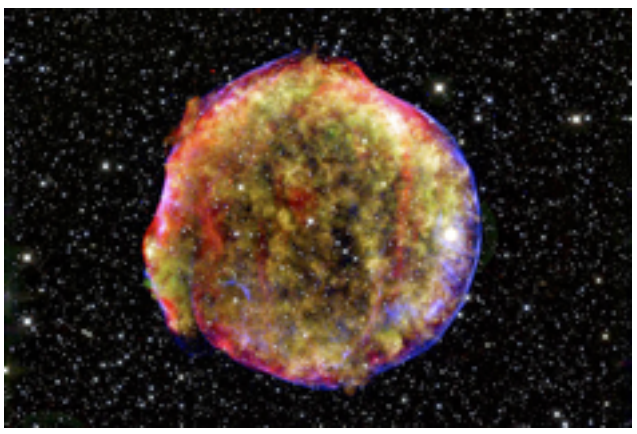
Today

Introductions

Preview

Business: Course Syllabus





Music: *Astronomy* – Metallica

Today:

meeting for the first time, so introductions are in order

then preview

and finally syllabus

Welcome to Astronomy 150!

It's a great time to take this course! Astronomy is undergoing a golden age--answering questions that have been mysteries for hundreds of years, and opening up new questions right now major discoveries about how the universe is made, down to how many planets are out there. And indeed astronomy is essential for life, We are here because of the big bang and all that happened in the 14 billion years since.

But the U is a dangerous place too. We know of so many ways that astronomy can kill you or your descendants.

That's the subject of this course.

Introductions:
Getting to Know Me

Instructor: Prof. Leslie Looney

Office Hours:

- W 12-12:30 pm, around the corner in Wohlers 120
- or by appointment (send email to arrange)

Office: 218 Astronomy Building

Email: lwl @illinois.edu

Phone: 244-3615

My life's story

Before we dive in.

Me: Professor in astronomy, so I really do this stuff for a living--you are getting it from the horse's mouth.

but I have a dark past, and if you promise not to tell my boss, I'll let you in on it
our little secret as an undergrad--a long time ago--I was actually an engineering major

So I know we have some science majors here, but most are not
no problem, don't expect you to have science background, only
curiosity and willingness to think in new ways.

Introductions:
Getting to Know You

Stand up

Repeat, filling in the blanks

Hello! My name is _____. I am from _____. I am majoring in _____. I am glad to meet you!

Seriously, stand up!

I'm not kidding!

I would like to go around room, one-by-one everybody says a bit about themselves
say, name, where from, major if you have decided on one

not practical, but will do next best thing

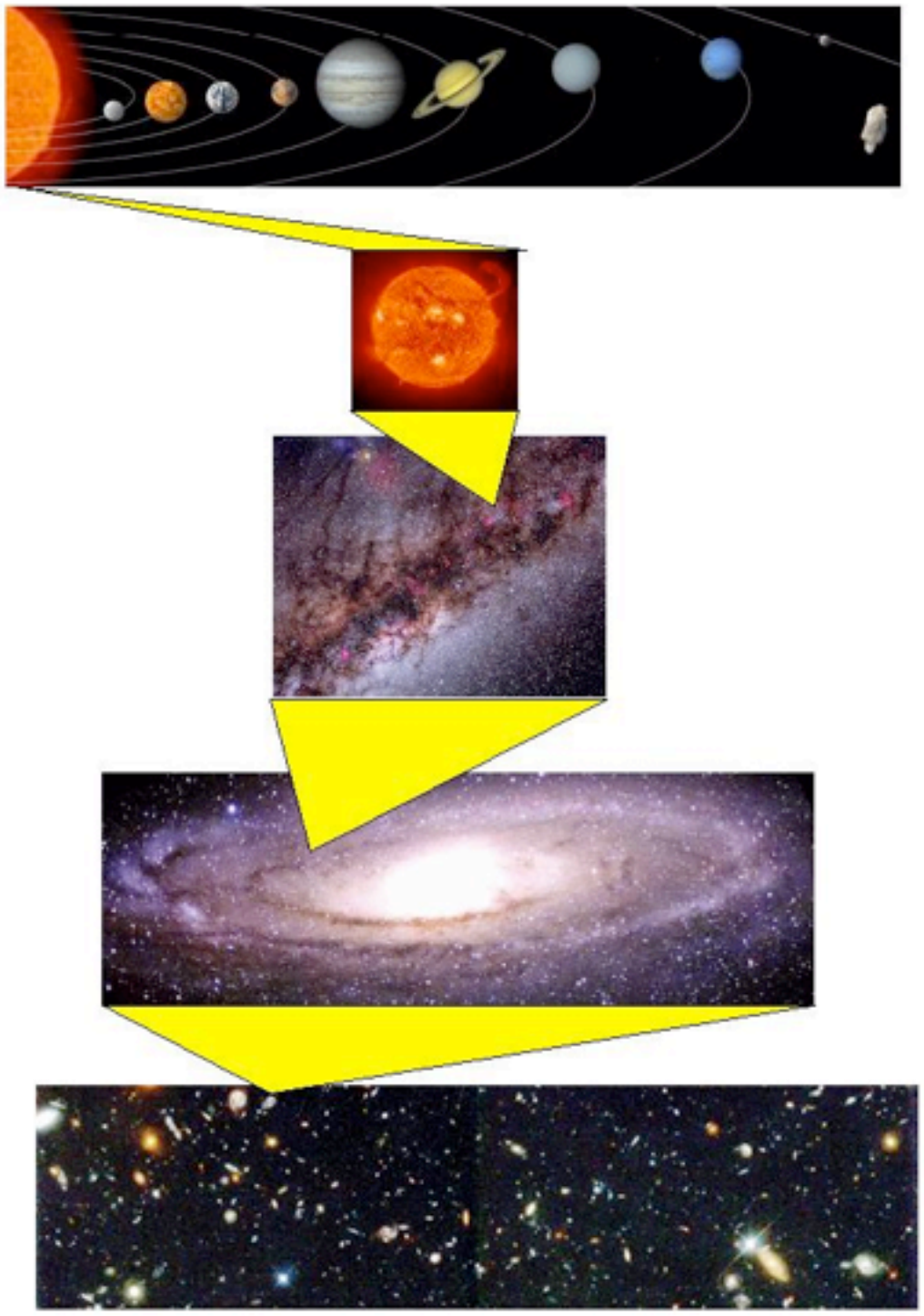
while sitting down again--maybe say hello to neighbor and repeat the
same info to her or him

Preview

now that we have gotten to know each other

give you and idea of what we will talk about this semester

The Big Picture



The cosmos is highly organized!

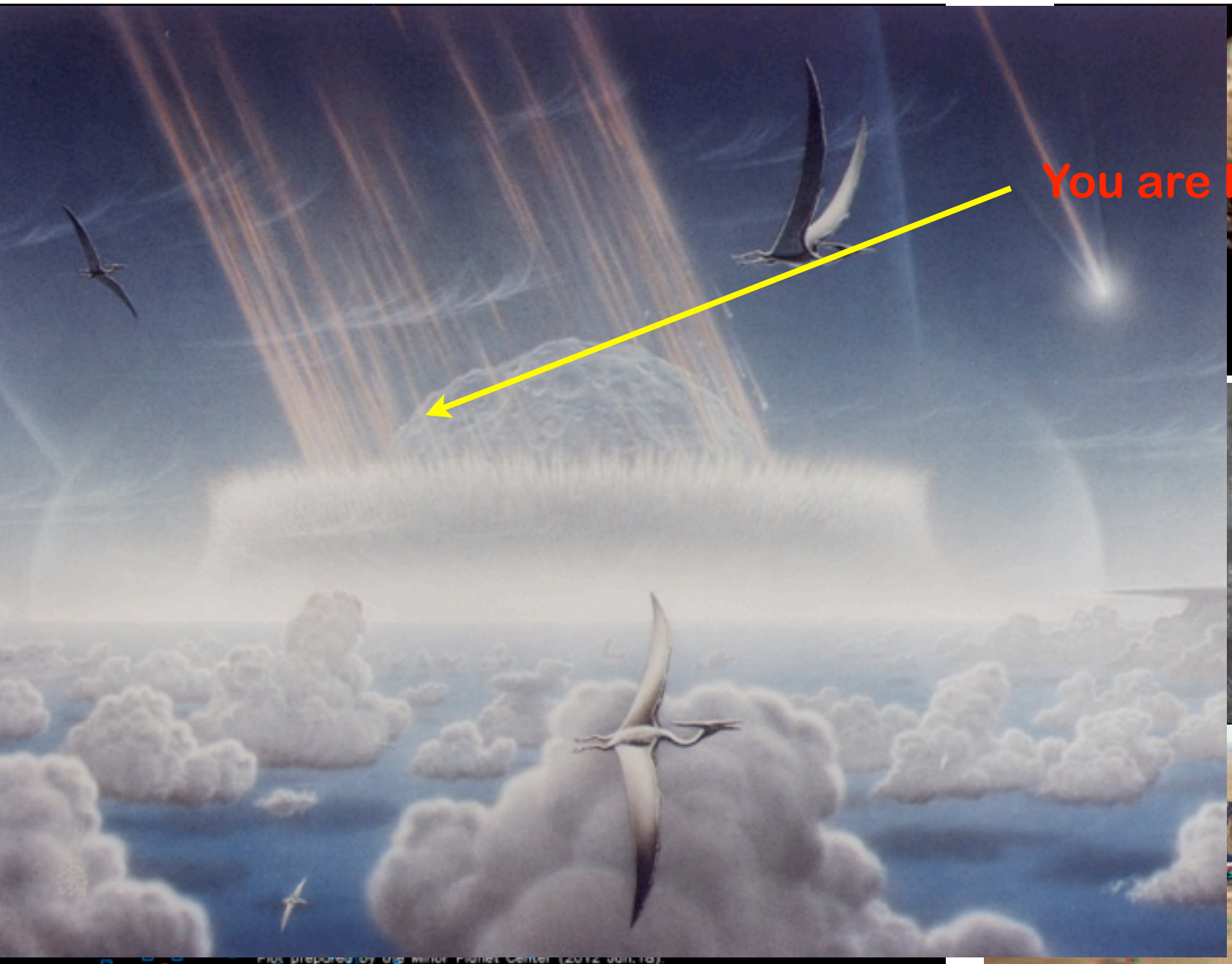
Gravity binds small systems together; these systems are bound into larger systems, and so on.

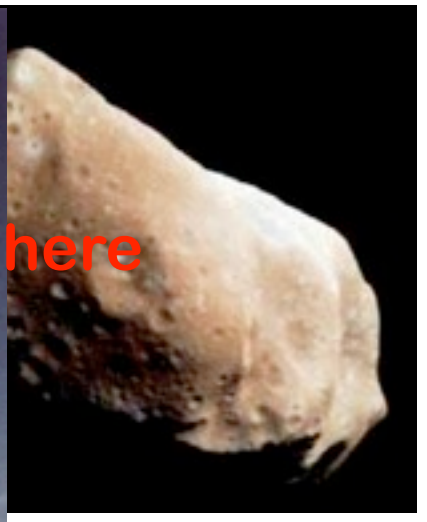
...and danger lurks at all levels!

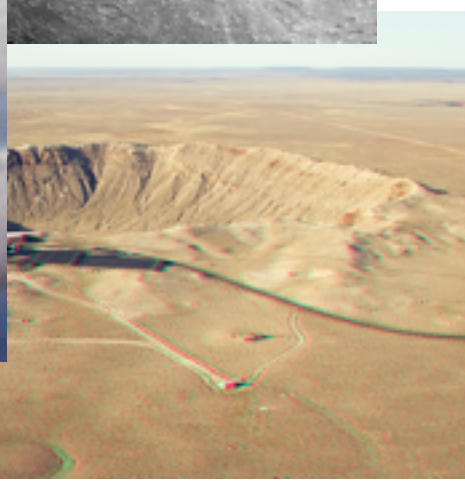
Astronomy is great because is gives the biggest picture in all of science--how the universe is constructed

and here is that picture

Solar System: Impacts







Uh oh.

will give a few examples of unpleasant things that can happen
starting on small scales and zooming out

first stop:
Here is a map of objects in the solar system: http://www.minorplanetcenter.net/iau/lists/InnerPlot.html
Note that it is current--where things are right now.

Point out Sun,
click to show Earth, also show Mercury Venus Mars Jupiter, each one dot

every other dot is an asteroid--large space boulder, all bigger than this room

don't need to be astronomer to see that it would be bad if one of these fell on your head

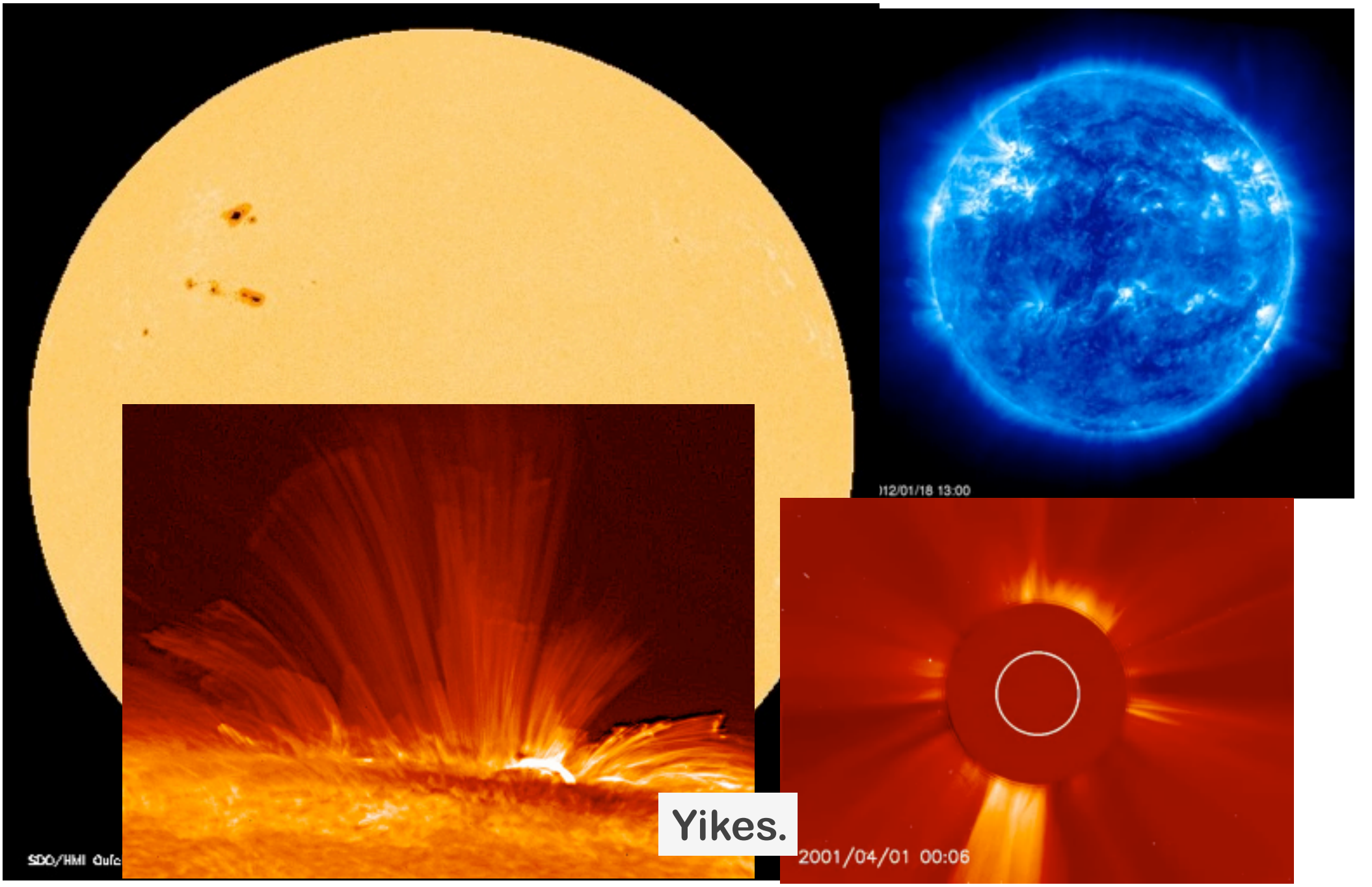
and it is bad--just look at Moon

but maybe we are spared on Earth? No!

okay that's bad for the poor unlucky schmos underneath, but can't affect entire global ecosystem? No!

bad day 65 million years ago, wiped out dinosaurs--not the largest mass extinction, but the only one with well known cause--and it was death from above

The Sun: Radiation Storms



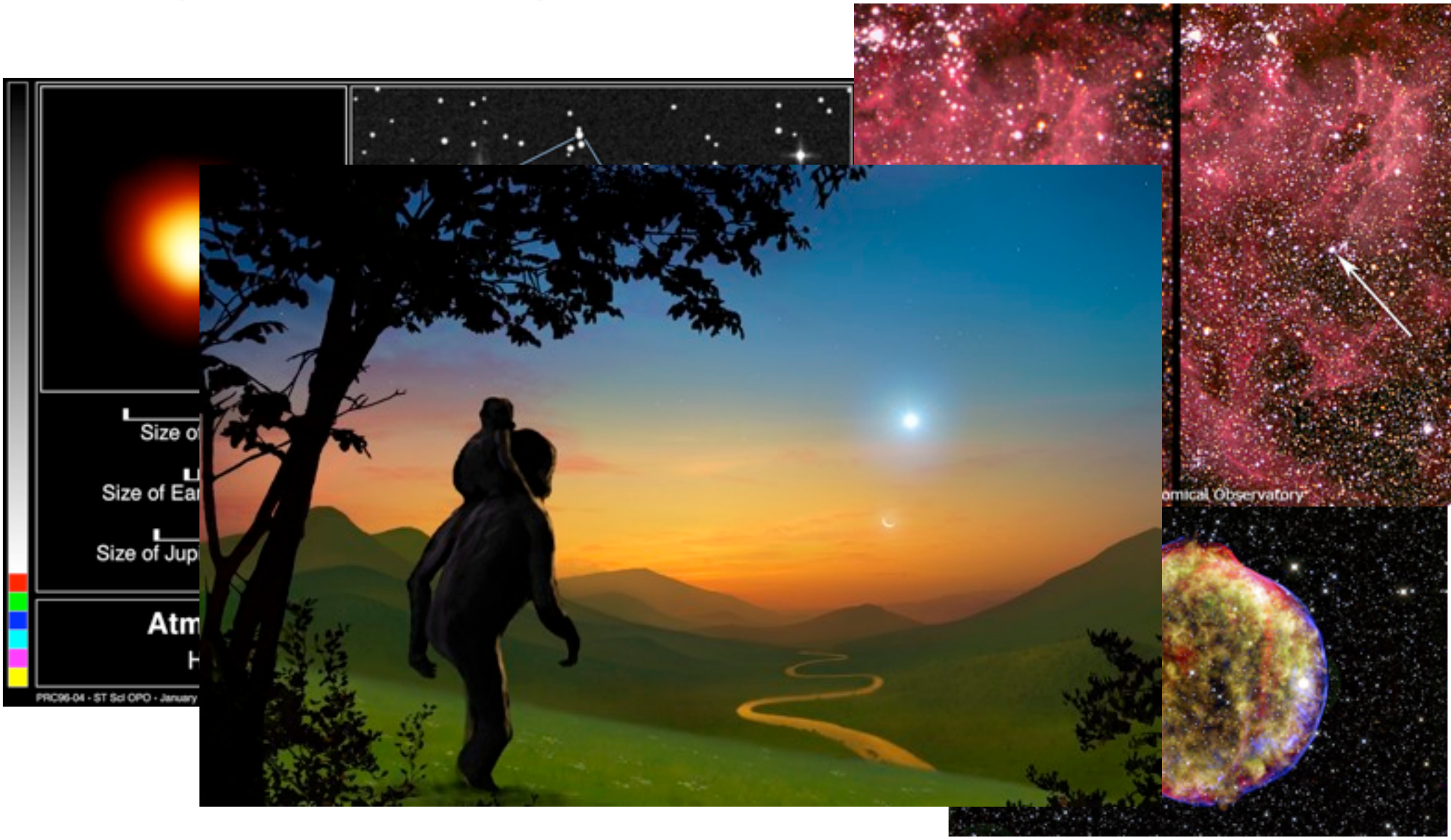
Here is a picture of the Sun, more or less what your eye would see
if you decided to go blind by looking at it (looking at Sun is baaaaad)
if you are in front, can read date--today!
(http://sohowww.nascom.nasa.gov/data/realtime/hmi_igr/512/ and
http://sohowww.nascom.nasa.gov/data/realtime/eit_171/512/)

Note that sun has zits--these spots on the Sun are called Sunspots
and show up better if look at Sun in UV light

can zoom in--these are regions of strong magnetism
looping filaments are following magnetic fields

Sun's magnetism changes over time, reverse polarity every 11 years
and a consequence of this is violent storms that can launch
high-energy particles--dangerous radiation that can zap earth

Other Stars:
Supernova Explosions as Cosmic WMD



I hate when that happens.

The Sun will die, and that will be bad, but not explosion (we will talk about how and why the Sun will die)

but very massive stars have a very different lifestyle
celebrities of the cosmos--live extravagantly, then flame out young

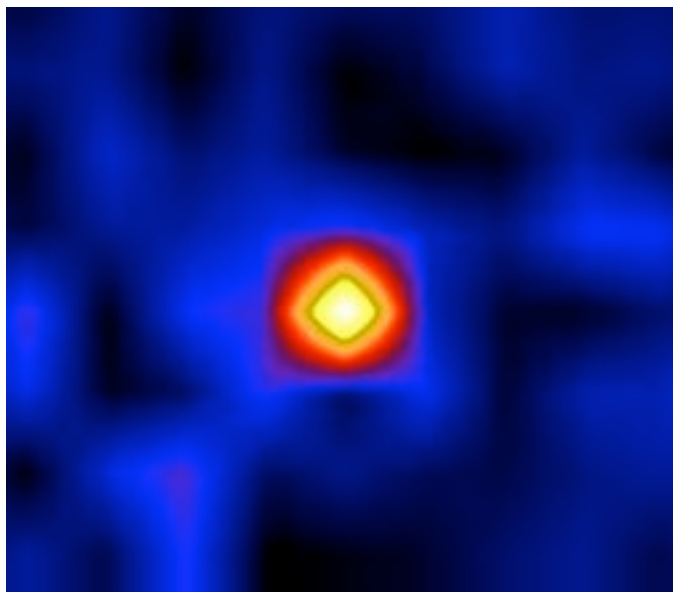
here is nearby massive star, doomed to die "soon" -- today, or 100,000 yrs from now
will see in night observing
note size

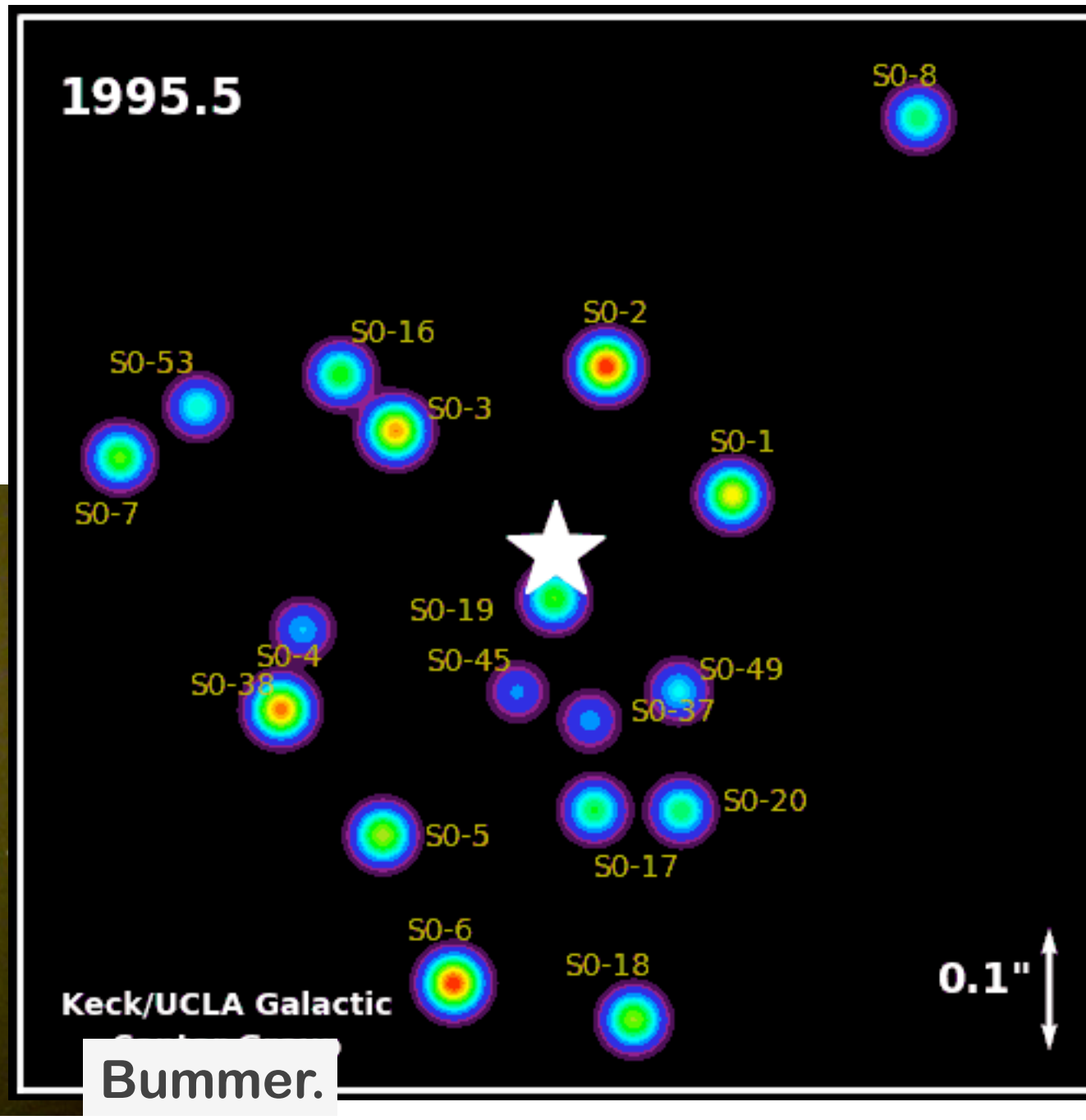
really will explode
example: before and after
90% of stars material blasted into space at 10% speed of light!
cosmic

remains: superheated gas--x-ray
and dense cinder -- ultradense neutron star, or black hole

if explosion near us, can ruin whole day

Black Holes





Bummer.

You probably already know something about black holes,
but we will take it to the next level

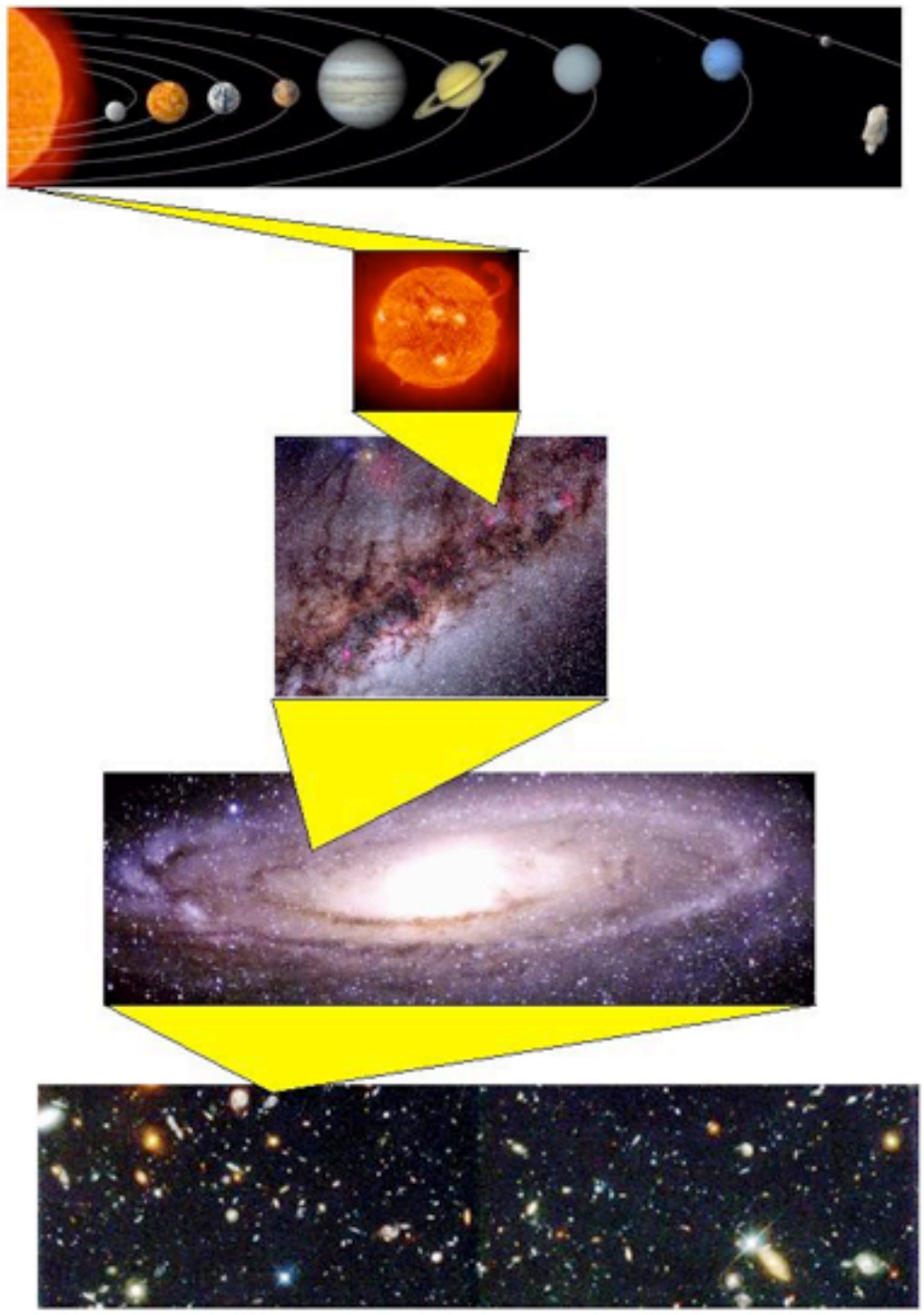
first we will see that black holes are not just science fiction
but absolutely real things that lurk out there

how do we know?
X-ray image
star is there, but the X-rays are not from star
instead, star is moving in circles
something makes it do this -- lots of gravity, mass
but unseen
expect that X-rays come out
material from star sucked onto black hole
X-rays are dying scream
BH several times more massive than Sun!

okay, sounds bad, but maybe thats the worst?
no: now zoom into heart of our galaxy
monitor star in very center, watch for more 10 years

okay, but not bothering us now, not even visible, so
fine as long as we keep our distance?
wrong!

The Big Picture



Universe as a whole made of galaxies

but they are sitting still

in 1929 Edwin Hubble--Hubble the man, not the telescope--discovered that galaxies moving away from us--the universe is expanding!

galaxies moving apart--once very close together--dense and hot early state:
big bang, 14 billion years ago

but then: if expanding now, what about the future? either expand forever and become cold and lonely--big chill
or gravity pulls galaxies back together, recollapse into big crunch
and now, even stranger fate: big rip

iClicker Poll:
Cosmic Threat Assessment

Vote your conscience = no wrong answers!

Which of these is the most likely cosmic threat to you and your descendants?

A. asteroid/comet collisions with earth
B. solar storms
C. supernova explosions
D. black holes
E. the end of the Universe

From the Home Office in Urbana Illinois

Top 10 Ways Astronomy Can Kill you or your Descendants

10. Alien Attack - Are we alone?

9. The End of Everything - Dark Energy and the Fate of the Universe

8. Galaxy Collisions - Milky Way vs. Andromeda

7. Death Ray -- The center of the Galaxy strikes back

6. Death by Black Hole - Black Holes don’t suck, but if they hit you it sucks

From the Home Office in Urbana Illinois

Top 10 Ways Astronomy Can Kill you or your Descendants

5. Gamma Ray Bursts - Cosmic Blowtorches

4. Nearby Supernova - Cosmic WMD

3. Solar storms - Magnetic bubble, coil, and trouble

2. Death of the Sun - Burn the land and boil the sea

1. Impacts! Splat.. Boom… Watch out for space rocks!

iClicker Poll:
Astro-Threats vs Other Dangers

Vote your conscience!

Which of the following do you think causes more deaths in the world than the others?

A. War	0.3%
B. Poisoning	0.61%
C. Melanoma (skin cancer)	0.12%
D. STDs (not counting HIV/AIDS)	0.32%
E. Astronomy related deaths	None known yet

Note, this is not asking about the most likely causes of death overall...

Answer B

CAUSES OF DEATH, USA, 2002

FORMAL NAME	INFORMAL NAME	% ALL DEATHS
(1) Diseases of the heart	heart attack (mainly)	28.5%
(2) Malignant neoplasms	cancer	22.8%
(3) Cerebrovascular disease	stroke	6.7%
(4) Chronic lower respiratory disease	emphysema, chronic bronchitis	5.1%
(5) Unintentional injuries	accidents	4.4%
(6) Diabetes mellitus	diabetes	3.0%
(7) Influenza and pneumonia	flu & pneumonia	2.7%
(8) Alzheimer's Disease	Alzheimer's senility	2.4%
(9) Nephritis and Nephrosis	kidney disease	1.7%
(10) Septicemia	systemic infection	1.4%
(11) Intentional self-harm	suicide	1.3%
(12) Chronic Liver/Cirrhosis	liver disease	1.1%
(13) Essential Hypertension	high blood pressure	0.8%
(14) Assault	homicide	0.7%
(15) All other causes	other	17.4%

http://www.benbest.com/lifeext/causes.html

Plenty to worry about, but not astronomy.

So sleep well tonight--nothing in this course is likely to kill you.

If you must worry...

FIVE LEADING CAUSES OF DEATH, USA, AGES 15-24, 1998

CAUSE	PERCENT OF TOP 5	NUMBERS
(1) Accidents	51.8%	12,752
(2) Homicide	21.3%	5,233
(3) Suicide	16.3%	4,003
(4) Cancer	6.8%	1,670
(5) Heart Disease	3.9%	961

http://www.benbest.com/lifeext/causes.html

One last morbid slide--causes of death in your age range.

Lesson: look both ways before you cross the street, and don't drink and drive!

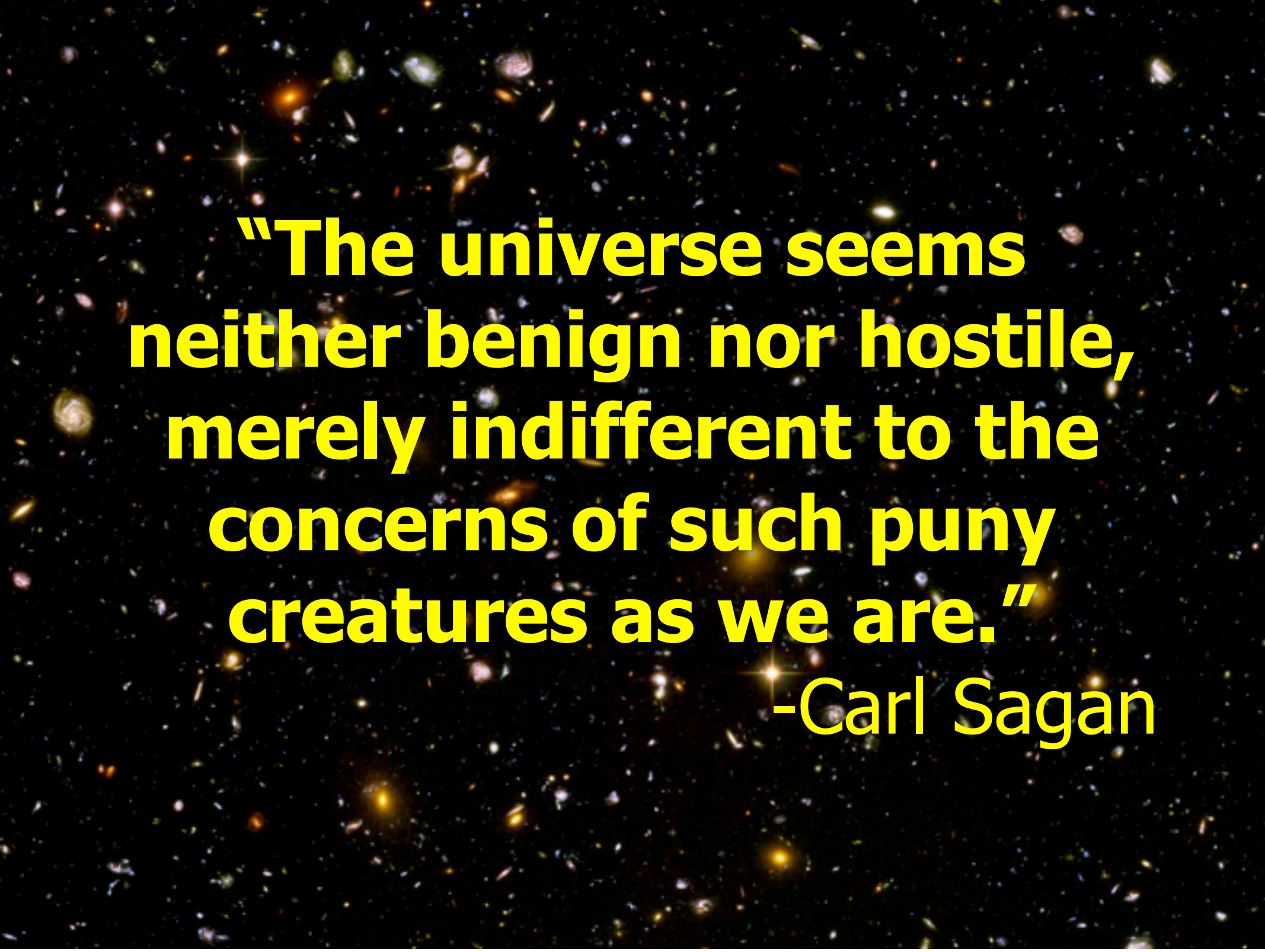
Astronomy Can Cause Death on Global Scale

- Disaster, actually means “bad star”
- Real chance of astronomy killing you is minimal
- But, astronomy can literally destroy the Earth (or at least, wipe out all life on it)
- Will set the limit on the eventual lifetime of our civilization

We will examine the top 10 ways that astronomy can kill you or your descendants.
I don’t want to keep you wondering.. so…

But Astronomy is also responsible for life!

- We are the products of the Big Bang and 14 billion years of cosmic history after.
- Most of the atoms in your bodies were created in supernova explosions.
- The creation of stars and planets leads to black holes, but more often leads to to homes for life.
- Within the last year, the first planets discovered that could be habitable!



The Universe cares not if we live or die.
But it is violent place, full of dangers...

questions so far?

This Course

Course Goals

After this course one should be able to:

- Understand our current scientific view of the Universe
- Understand and put in context the risks of astronomical disasters
- Make informed decisions about science policies in the future
- Appreciate and evaluate new discoveries and “discoveries”

Course Website

This course will make heavy use of its website (through compass)

https://compass2g.illinois.edu

Lecture notes

Online Homework

Online Lab Exercises

Information on Observing/Planetarium Sessions

Demo website

Course Grade

Component	% of Course Grade
Online Homework (10 of 11)	15% (10 at 1.5% each)
Observing Sessions (2 of 3)	10% (2 x 5% each)
Online Labs (2)	10% (2 x 5% each)
Participation: iClicker polls	10%
Exams (3)	55% (3 x 18.33% each)
TOTAL	**100%**

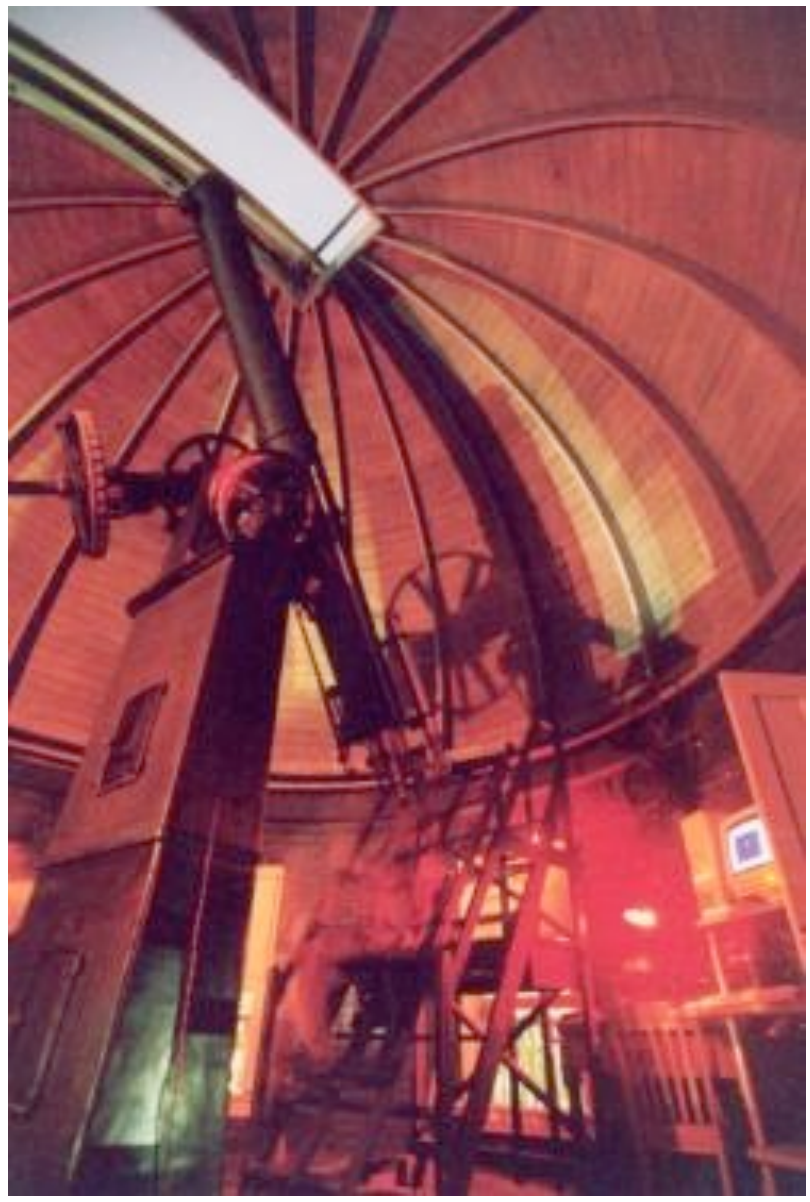
Online Homework

- Around 20 multiple-choice questions each
- Assigned ~weekly
  - Due by midnight on the posted due date (always Monday)
- 11 homeworks total
  - Lowest homework score dropped

Because of the rapid pace at which students encounter new concepts in astronomy courses, we will be giving ~weekly online assessments as a way of making sure everyone is keeping up with the material.

Observing/Planetarium Activities

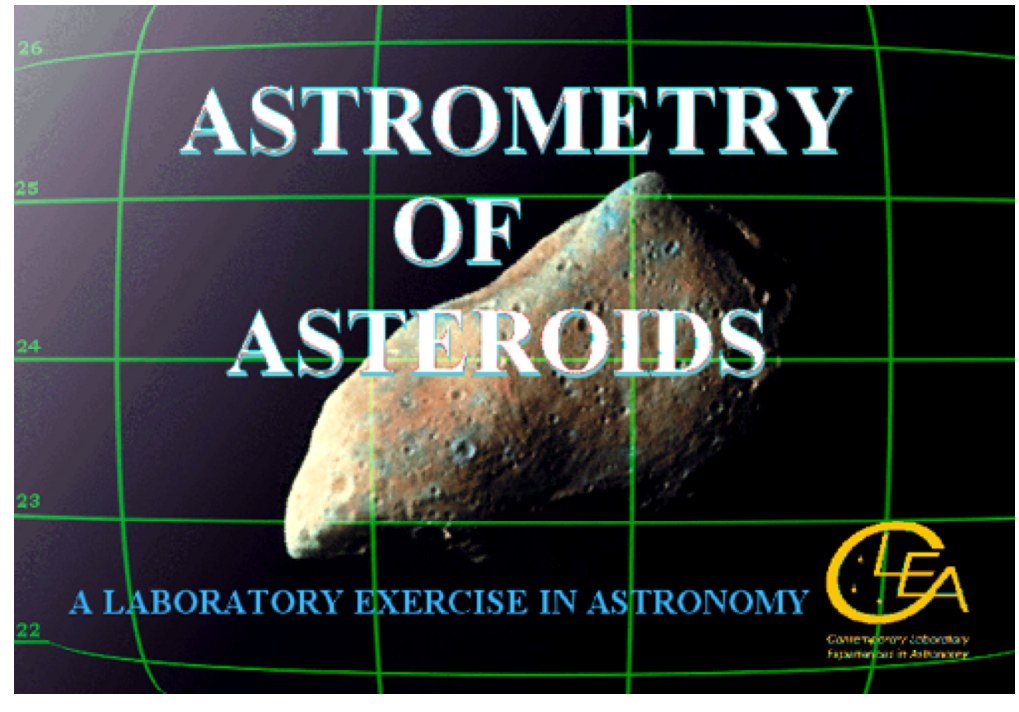
- 3 observing activities to complete this semester
  - Planetarium Session
  - Night Observing Session
  - Solar Observing Session
- Dates and times to be posted on class website
- Worksheet to turn in for each activity
- Contact me ASAP if you have a conflict with an activity



Planetarium: Sept
Night Obs: Late Sept/Oct
Solar: Nov
Worksheets posted on class website

Computer Labs

- Two computer-based lab exercises
- Astrometry of Asteroids
  - Introduces the methods that we use to detect asteroids
- The Sun and Solar Activity
  - Use observations of the Sun to explain sunspots and flares



The Asteroid Lab is installed on ICS lab computers (windows). I will make the software available for download.
The Solar Activity lab uses websites - can be done anywhere
Help sessions will be held for the labs before they are due.

iClickers

- Concept check questions and polls will be asked in class
- Each question worth 4pts
  - 3 point for attempting the question
  - 1 points for a correct answer
  - Averaged over 1 class
- About 5% will be dropped
- iClicker 1 or 2 okay

Why i>Clickers?

- Active learning lasts longer than passive listening
- When you answer a question, you remember the answer better than if I just told you the answer
- Discussion of questions with classmates promotes better understanding
- i>Clicker use can lead to higher grades
- Allow me to assess class understanding in a way anonymous to your fellow students

Registering Your i>Clicker

- To receive i>clicker credit, your i>clicker must be registered to your NetID (on Compass 2g)
- Your clicker's serial number is on the back of the unit
- Link on the class website to register your clicker
- Your clicker ID may contain the number zero, but will not contain the letter O

If your ID has worn off, I can help you determine the ID of your remote there is a site at bookstore to retrieve number if not, talk to me after class.

Exams

Three non-cumulative exams (no comprehensive final)

- Exam 1: Friday, Oct. 11th, in class
- Exam 2: Friday, Nov. 8th, in class
- Exam 3: Wednesday, Dec 11th, in class
- All exams in the regular classroom

Resources Permitted

- Calculator, pencils
- Note sheet: 8.5”x11” piece of paper (both sides)
- **Bring your University ID**

You must speak to me beforehand if you have a conflict with an exam (athletic competition, job interview, etc..). Speak to me as soon as you know about the conflict.

If you are ill the day of an exam, you must contact the Emergency Dean & me ASAP.

Grading Scale

Letter Grade(s)	Approximate Range
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	below 60%

For next time

Read Syllabus

Get ready to hit the ground running!

Questions?