HOW THIS CLASS WORKS

- First place to check for anything: this website
  - http://neutrino.d.umn.edu/ast1040/
- Daily assignments are there. These notes will be posted there after each class
  - To give you more time in class to think & understand, instead of just being a stenographer
- You have reading assignments to do before each class
  - Read them!

ONLINE HW

- To give you credit for reading, each day some “reading questions” will be do on the stuff you just read (easy ones), along with interactive videos to watch and respond to
- Each chapter there are also more involved HW assignments
- No late HW accepted (but will drop lowest score)
- See email for book/online HW instructions

CLICKERS

- To keep you thinking in class, the standard UMD “clickers” will be used. Get one if you don’t have one already (from the bookstore)
- Register your clicker number on Moodle, so you get credit for your clicks
- Will try it out in Wednesday’s class
- No makeup clicker excuses accepted (but will drop lowest score)

PLANETARIUM

- The planetarium will do some special shows for this class Real Soon Now
  - Best way to understand motions of the sky: look at it!
- There will be several. Going to one is required. Do this sooner rather than later.
- More details soon...

ASTRONOMY

What is it?

ASTRONOMY

- Literally - “Study of the Stars”
- Practically – study of stuff not on Earth, and how Earth fits into things
  - Stars are one part
  - Planets, Galaxies, stuff in between, spacetime itself are others
- is mostly physics applied to stuff out there
  - Chemistry, Biology, Math all mixed in too

IT'S A SCIENCE

- The oldest science, in fact
  - but what's that mean?
- Science is figuring out the rules by which things play
- How to do it?
- Observation, Experimentation
  - Could you figure out the rules of this game by watching?

SCIENTIFIC METHOD

- State the problem
- Think of a *hypothesis* to solve the problem
- *Predict* the consequences
- Do an *experiment* to test the prediction (or make an observation)
- State the simplest possible rule which organizes the whole story – a *theory*

GRAVITY

- For example:
  - Things stick to the ground. Why?
  - Hypothesis – the Earth attracts them
  - Experiment – drop something
    - Make a model – things fall! $F = mg$
  - Do more tests
    - Carefully measure *how* things fall $g = 9.8\ m/s^2$
    - Throw things.
    - Throw things really far, into orbit
  - Formulate Theory of Gravity

$$F = G\frac{m_1 m_2}{r^2}$$

CAVEATS

- Things don’t always go according to plan
- You might observe something weird first, then go back and try to figure out what’s up
- Your prediction is likely to be not right – change your hypothesis, test the new consequences
- Valid Theories get changed, updated, or superseded over time as new things are discovered

THEORIES

- There’s more than one way to solve a problem. How to decide which Theory is “right”?
  - Which makes more accurate predictions, and fewer just plain wrong predictions?
  - Occam’s Razor
    - The tiebreaker – go with the simpler theory

THE SAME RULES, EVERYWHERE

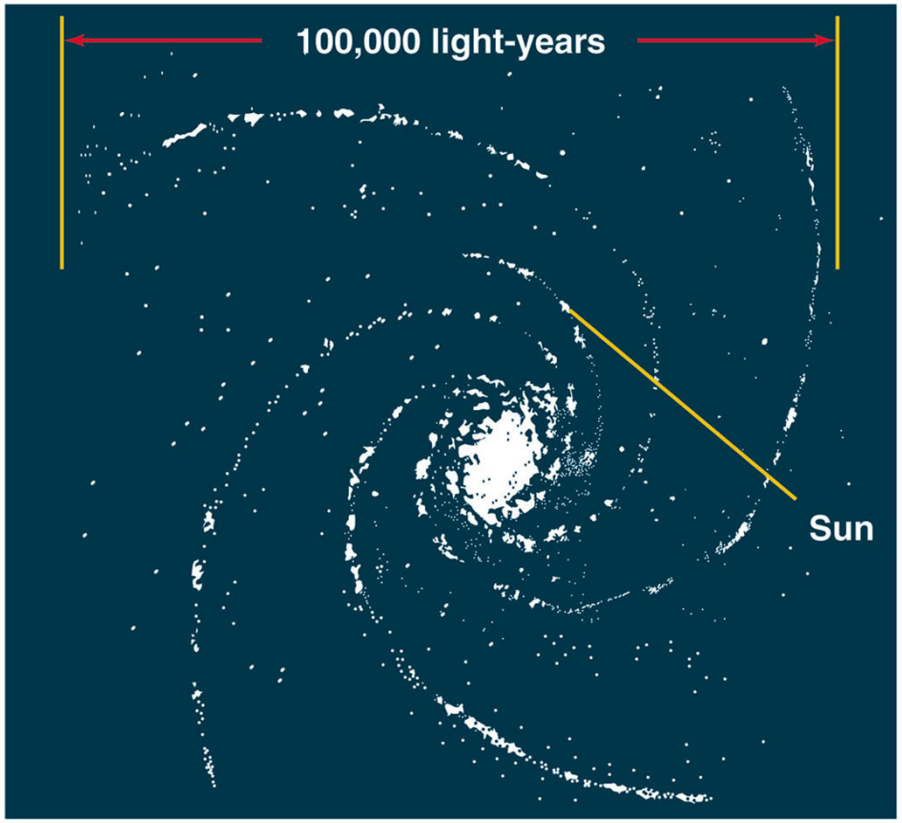
- In astronomy, we can't get out there to make up-close measurements:
  - *e.g.*, we can't build a star under controlled circumstances, poke it, and watch it go
- How can we say anything about Out There?
- Figure out the Rules of Physics on Earth.
  - They seem to be the same elsewhere
  - we will assume that everything everywhere in the Cosmos plays by the same rules

IN THIS CLASS

- Keep your eyes on what you're learning
  - What observations are testing which hypotheses?
  - Is there a model which simply describes a larger class of things or happenings?
  - Which things are fundamental groupings of well-tested models – Theories?
    - See how they've changed over time!

IN THIS CLASS

- Note that this last bit looks ahead till Ch.3 next week
  - but want you to keep it in mind
- The rest of Ch.1 & Ch.2 present you with what we know today, but we wait till Ch.3 to tell the story of how we figured it all out

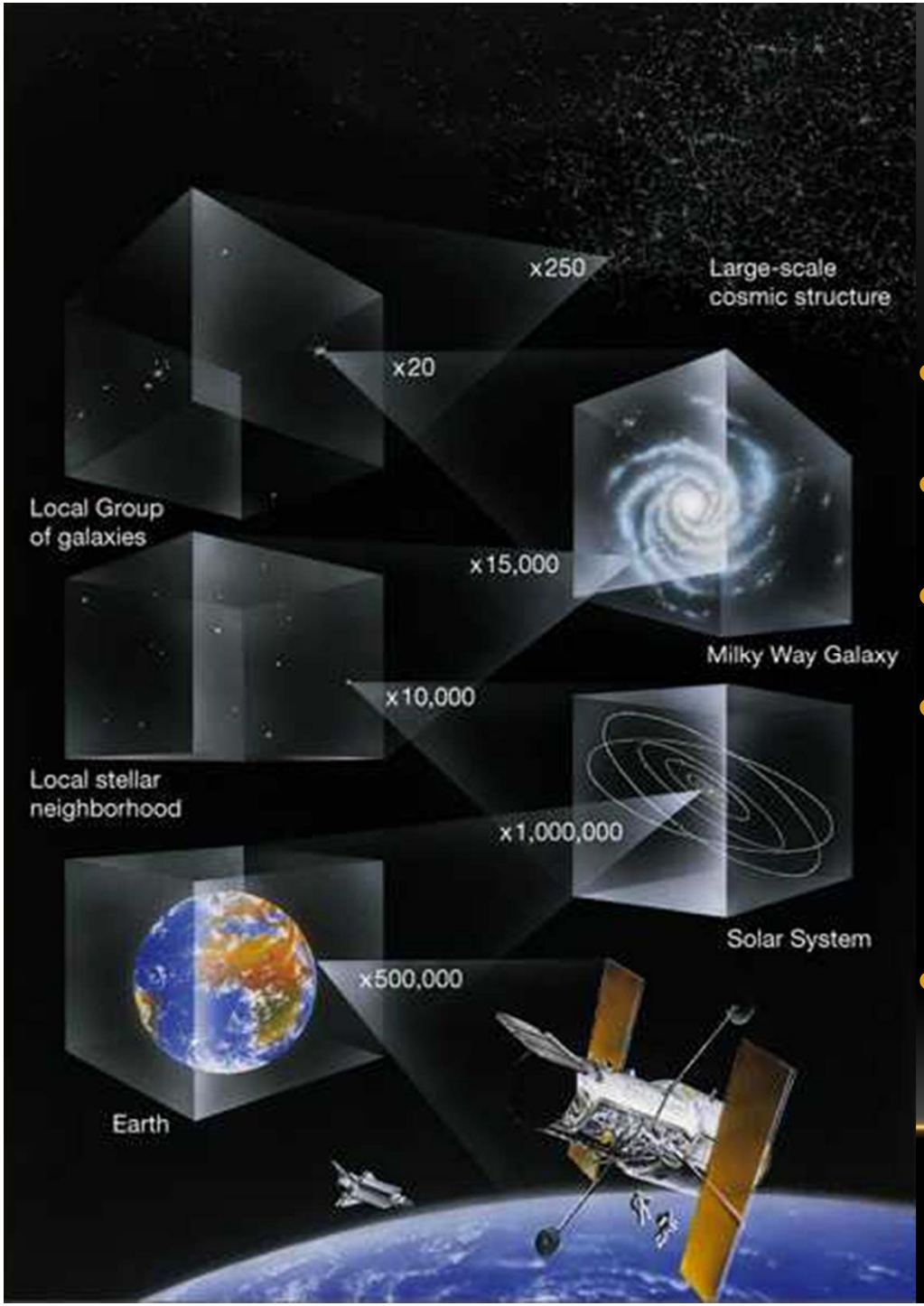


(a)

(b)

WHERE ARE WE?

- We now know –
  - On Planet Earth
  - Around Star Sun (Sol)
  - In Corner of Milky Way Galaxy
- (*note that this information took humans most all of recorded history to piece together!*)

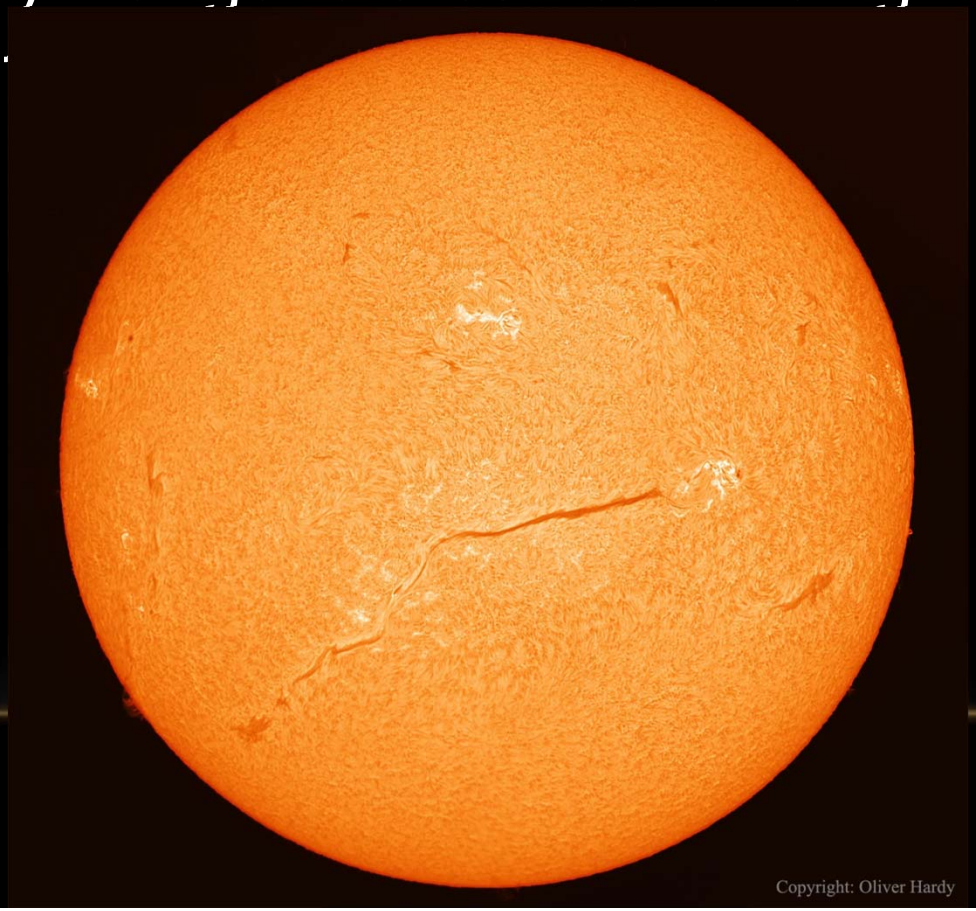


ZOOMED VIEWS

- We are Really Small,
- in a Really Big,
- Mostly Empty Universe
- http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/
- (*cf* book's Fig 1.1)

STAR

- A large, glowing ball of gas (*"plasma", more correctly*) that generates heat and light through nuclear

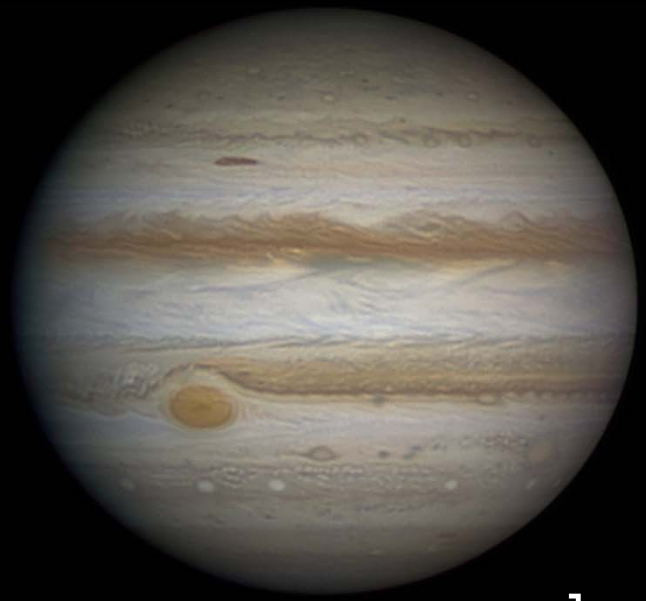


Sol
(the Sun)
our nearest star

PLANET

- A moderately large object that orbits a star; it shines by reflected light. Planets may be rocky, icy, or gaseous in composition.

Earth



Jupiter

SEN/D. Peach

MOON

- An object that orbits a planet

Ganymede
(a moon of Jupiter)

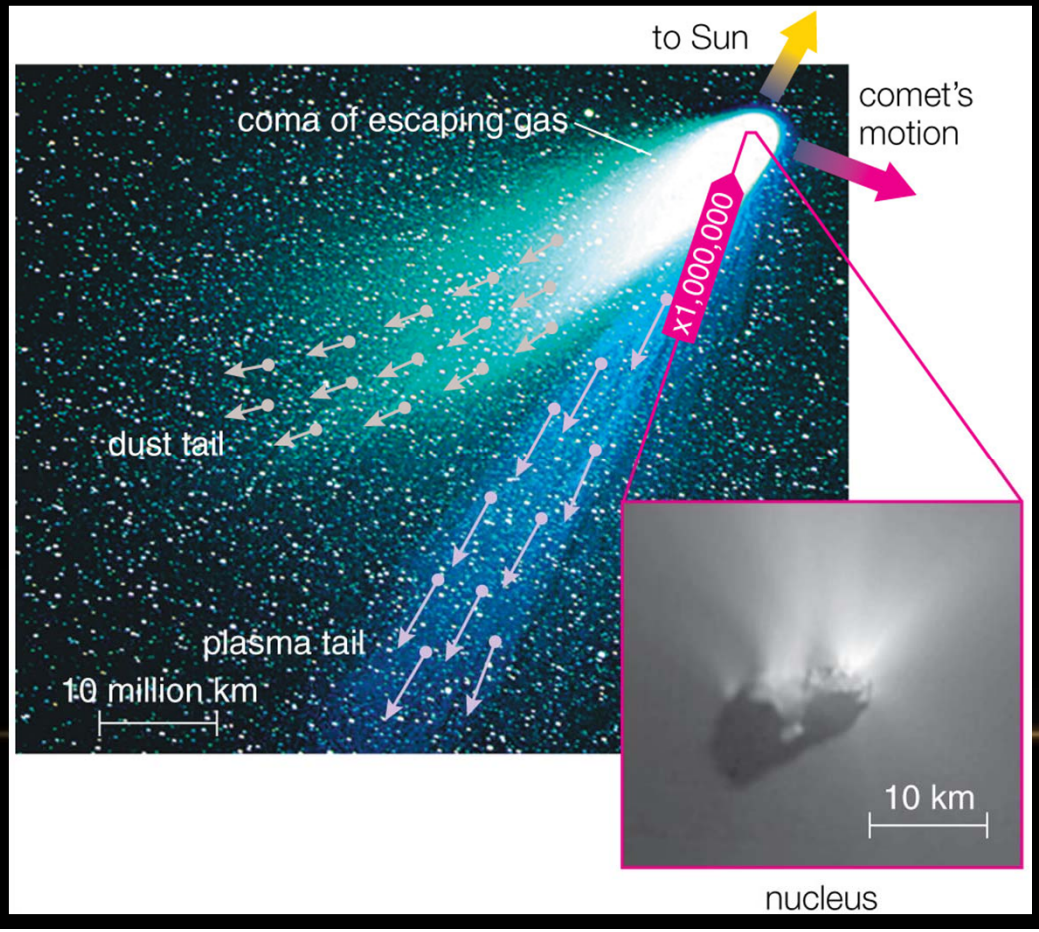
ASTEROID

- A relatively small and rocky object that orbits a star

Mathilde

COMET

- A relatively small and icy object that orbits a star



SOLAR (OR STAR) SYSTEM

- A star and all the material that orbits it, including its planets, moons, asteroids, comets, etc

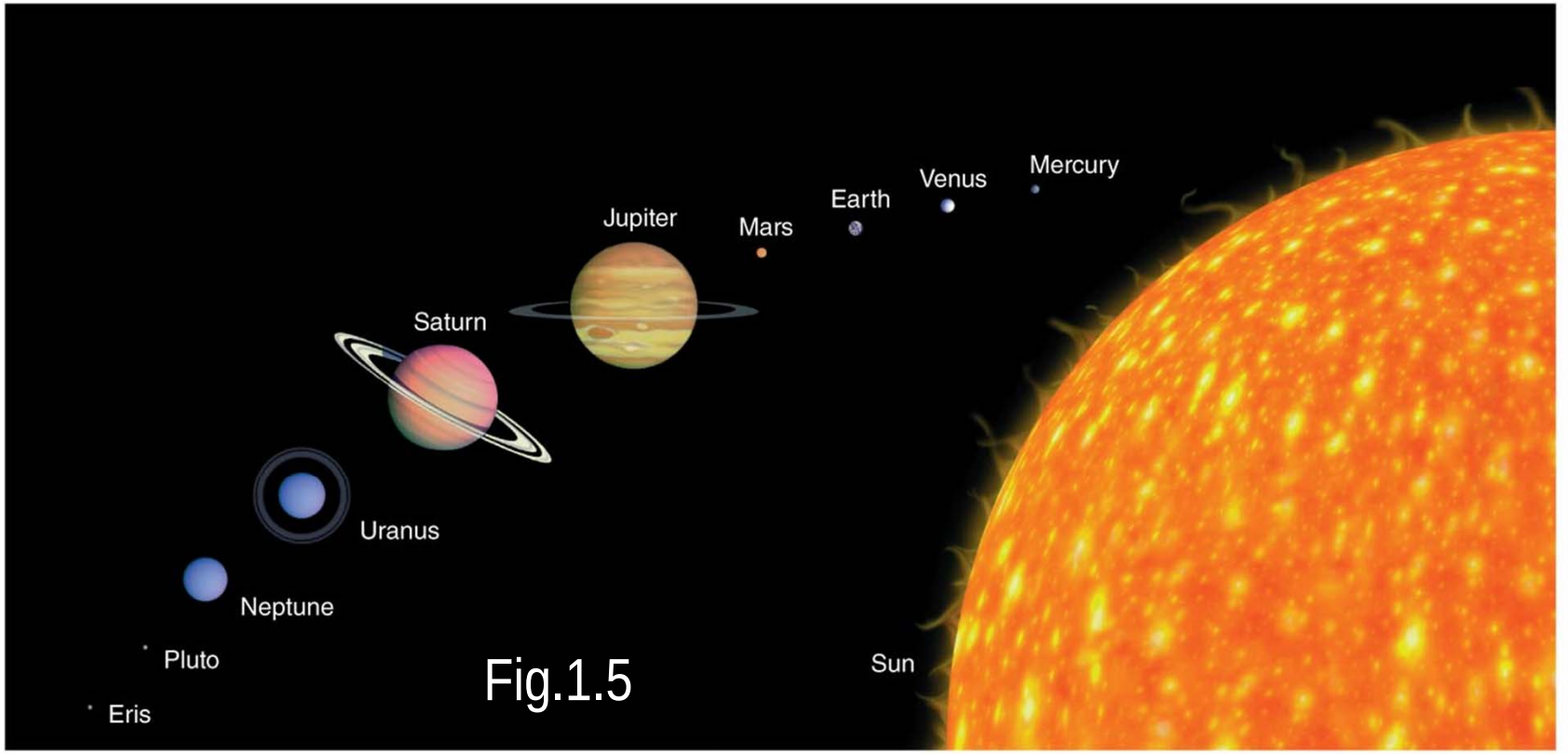


Fig.1.5

a The scaled sizes (but not distances) of the Sun, planets, and two largest known dwarf planets.

NEBULA

- An interstellar cloud of dust and gas

GALAXY

- A great island of stars in space, all held together by gravity and orbiting a common center

M31, the great galaxy in Andromeda

UNIVERSE

- Everything.
- The sum total of all matter and energy; that is, everything within and between all galaxies
- … including spacetime itself

SURVEY TIME

- The university likes to see what you know starting a course vs ending it.
  - So, now we see what you know coming in
- Please fill in your name and UMD ID# on the bubble sheets
  - Then take this short survey
- This is not a quiz that's part of your grade!
  - It's a tool we use to see how well the course works