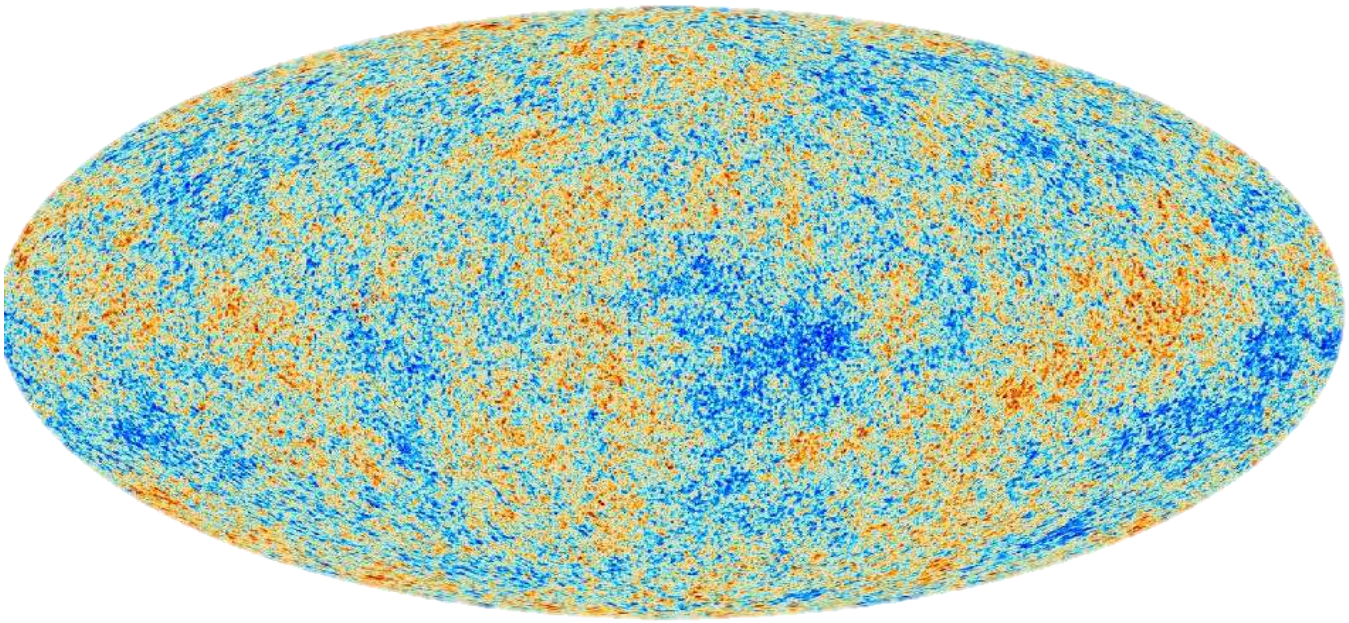

Astronomy for the Masses

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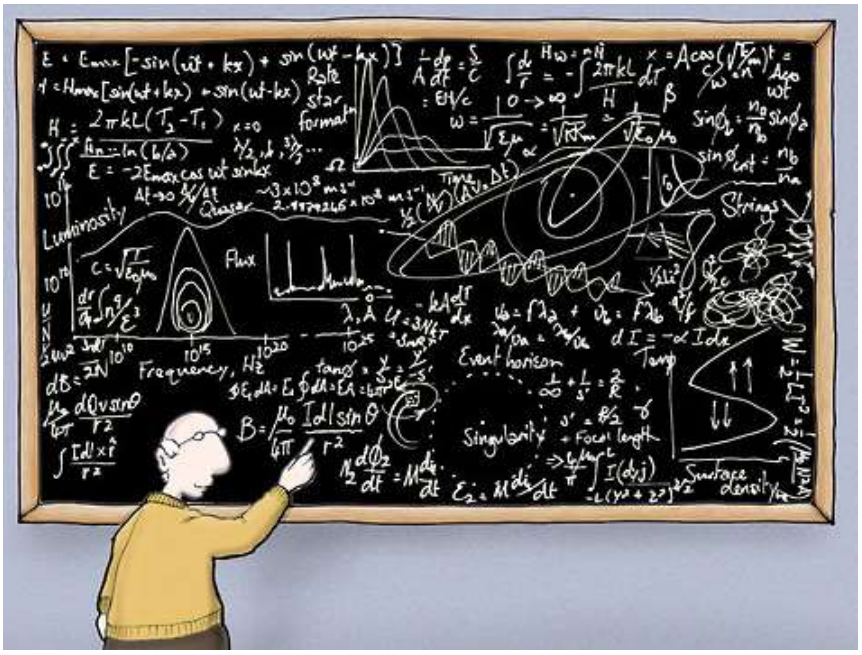
Updated 08/27/2015



Astronomy Made Easy…

Contents Overview

Quick Intro

This "textbook" is designed solely for *Astronomy* & *Honors Astronomy* students at Greenwich High School, Greenwich CT. After searching high and low, figuratively speaking, for a good Astronomy text, I simply couldn't find one that fit my two simple requirements; be general enough for my typical semester-long heterogeneous 11 & 12 grade group and be cheap enough to afford without breaking my entire Physics/Astro budget. There are several that match the former requirement, but none that met the latter. So, here we are. Typing, cutting & pasting, researching, fact-checking, and plagiarizing my buttocks off while making excuses to my wife as to why I can't help garden and mow and such. Besides, it's so darn hot outside because of that big ball of fire in the sky (Chapter 6)…

The text is set up similar to the way I teach. All units/chapters will cover only the material I'd require my own students to learn. Anything mentioned and covered here is fair game for an exam question. Most texts have either entirely too much reading material or are simply too long-winded to cover in my typical one-semester course. Each unit/chapter is based on the PowerPoint™ presentations I use in my own class. I rely heavily on resources from NASA, Universe Today, Dr. Phil Plait, and Space.com. I've included links to all my labs, activities, assessments, and full presentations. View the class website at DTFizzix.com. All images used are from Wiki Commons, NASA, or public domain and used freely under Open License unless otherwise stated. I think…

If you are not a Greenwich High School student in my class, help yourself. I have copyright privileges, but freely allow all content to be used for educational purposes unless specifically stated to the contrary.

Why Study Astronomy?

Sadly, like world geography, astronomy and earth science have fallen by the wayside in the past 15 or so years. This is, in my correct opinion, due in large part to the unreasonable push for standardized state and national testing. Most states, in order to follow the ill-advised and ill-implemented No Child Left Behind legislation, and more recently the ill-advised and catastrophic Race to the Top, have designed state testing requirements that have simply dropped all astronomy and physics to concentrate on biology and chemistry. In Connecticut, the SBAC, previously CAPT test (CT Aptitude & Performance Test), is given to all 11th graders[1]. Yes, 11th. This is supposed to be a graduation requirement. Yeah, right. ***UPDATE 08/21/2015****: CT just decided to kill the SBAC! Starting this academic year, CT students will take the SAT's as the state test. Smart move to get away from over-testing…*

Anyway, the general ignorance of the normal American citizen in geography and astronomy is frightful. A dreadfully large percentage of US 18-24 year olds can't even find the United States on a world map! In 2002, The ***American National Geographic Society*** [2] tested 3000 students in nine countries. Of the 56 questions, 42 were needed to be answered correctly for an 'A' rating; the US scored a dismal 23 pts. What were the results? I'm glad you asked!

1. *11% of the Americans tested **could NOT** locate the United States on a world map. 11% !*
2. *17% of the Americans tested **could** locate Afghanistan.*
3. *34% of Americans know the tiny Marquesas Islands, where the 2012 season of reality TV show "Survivor" was filmed, is located in the South Pacific, but only 30% could point to the exotic location of "New Jersey".*

Now for astronomical illiteracy, we have the vaunted ***Harvard-Smithsonian Center for Astrophysics*** study called ***A Private Universe***. This one-hour video is viewable online at Annenberg Learner [3]. This video includes several interviews with Harvard University graduates on their graduation day not being able to explain why we have the four seasons on the earth or even why the moon goes through periodic phases. One particularly disturbing interview was with a *mechanical engineer* who couldn't complete a simple electric circuit using a wire, a battery and a lamp. It is to weep. Another Harvard engineering grad thought the earth was closer to the Sun during the summer; that's why it's hotter then… sigh…

So, why astronomy? If one does not know one's place in the Universe, one could easily lose sight of any personal meaning. As my hero Dr. Sheldon Cooper of the *Big Bang* TV crew said, "One can get beaten up just for referring to oneself as one."

Introductory Details and Stuff The following items are needed before we can seriously even think of taking that first step into real astronomy. So, take the time to learn each and every item below.

Metric System (SI) We will be using lots and lots of huge numbers and all measurements will be in the *Standard Internationale System*, the famous Metric System. If you don't know it by now, get it down. Let's try our best not to do conversions between Metrics and our antiquated bizarre English system. Who really cares how many nano-meters are in a mile? Or how many centigrams are in a pound? Not me.
What you do need to know is the actual meaning of the numbers we will be using. This means a working knowledge of ***scientific notation***. SciNot is nothing more than short hand for big and small numbers. For instance, the distance from the Sun to us here on Earth is 150,000,000,000 meters or 150,000,000 kilometers. Do you want to write this type of number every time we need it? Nope. Try this one on for size (pun intended…); the mass of the Sun is 1,990,000,000,000,000,000,000,000,000,000 kilograms! That darn number is so dern huge it doesn't even have a name other than "Big Honkin' Number". So, these numbers mentioned can be written as $1.5x10^{11}m$ and $1.99x10^{30}kg$, respectively. Now, these numbers are manageable. Make sure you know how to input these Sci Not numbers into a calculator. They are NOT multiplication problems…

Units of Measurement and Physical Constants Following is a list, not necessarily in alphabetical or and other order, of units and constants we will be using. Learn them now. There will be many more, but this is a start.

Light year (***ly***) : The distance light travels in the empty almost vacuum of space in one Earth year. It is equivalent to

Speed of Light (***c***): Wow! Fast! $3x10^{8}\,{}^{m}\!/_{s}$. This is equivalent to approximately $186{,}212\,{}^{miles}\!/_{s}$.

Astronomical Unit (***AU***): The radius of Earth's orbit around the Sun. Equivalent to $1.5x10^{11}m$.
Meter (***m***): SI unit for length. Know it. Learn it. Love it.
Kilogram (***kg***): SI unit for mass.
Solar Mass (***M*** $_{\odot}$): Mass of our Sun. It is used to indicate masses of other stars; like mass of Betelgeuse = 20 ***M*** $_{\odot}$ or 20 *times* the mass of our Sun.
Newton (***N***): SI unit of force (analogous to the weird "pound"). Named after… well, you know…
Hertz (***Hz***): SI unit of frequency. Literally equivalent to $\,{}^{things}\!/_{\mathrm{second}}$.

Full list of physical constants, like ***G*** and ***g*** and ***K***, can be found at the Index pages.

Emphasis Graphics Used There are a few color highlighting thingees you should be aware of while perusing this text. The BLUE highlight indicates a new section; sort of like a new mini-topic within the chapter. A YELLOW highlight indicates a LAB or other class activity you should either be doing, have done, or will do soon. A RED highlight is a simple shout out to the Honors Astro group that they NEED this material; Regular Astro kids SHOULD know it, but will not be required to on their exams.

Be sure to pay close attention to the "Scaling" activities and such in the PowerPoint presentation listed below.

Intro Resources

Powerpoint: http://dtfizzix.com/AstroPPTs.html

DIRECT LINKS: Full PPTX - http://dtfizzix.com/PPTs/AstroIntro-Scaling-2012-PST.pptx
PDF Format (Smaller) - http://dtfizzix.com/PPTs/AstroIntro-Scaling-2012-PST.pdf
Narrated Video - http://dtfizzix.com/PPTs/Astro-Intro-2011/

Homework:

Complete List: http://dtfizzix.com/AstroHWSchedule.html

Preview Chapter Specific:

1. Google Form: 5 Questions

2. Scaling Activity: http://htwins.net/scale2/
   -Play with the website and send an email report. Did you learn anything? Anything surprise you?

3. ANOTHER Scaling Activity: http://www.nikon.com/about/feelnikon/universcale/index_f.htm
   -Play with the website and send an email report. Did you learn anything? Anything surprise you?

   Play around with both #2 & #3 above. After you play a while, compose a little email story explaining what you learned. Fire it off to daryl_taylor [at] greenwich [DOT] k12 [DOT] ct [DOT] us. ***NOTE: The 2nd one may not run on older slower computers. If so, do this at school sometime this week.***

4. View 12 minute video: ***PART1*** *Introduction to Astronomy* at Astronomy Crash Course
   -Just watch, no write-up.

LABS:

Scaling 1: Link live AFTER class completion
Scaling 2: Link live AFTER class completion