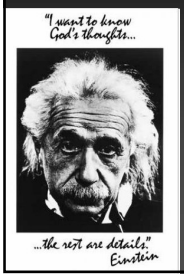


I want to know God's thoughts; the rest are details

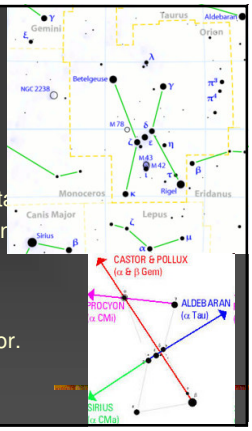
Albert Einstein

Agenda

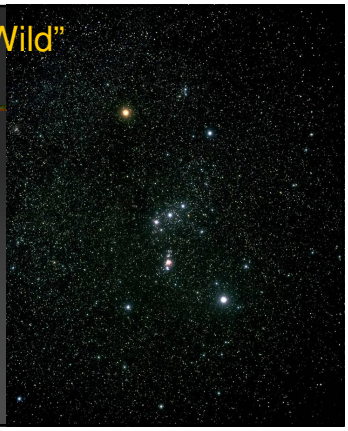
- What did we see last night?
- How go projects?
- Stellarium (open source): Constellation Art
- COTD: Orion
- Review for test 2 next Tuesday
- Debate: Manned or Just Robotic Space Exploration

COTD: Orion

- A Winter Constellation
- Brightest stars: Betelguese (alpha; shoulder), Rigel (beta
- Distinctive belt..three stars in row
- The hunter stands by river Eridanus accomp. by dogs, Canis Major and Canis Minor.
- The Great Orion Nebula



Orion in the "Wild"



Review for Test: Chs. 5-8

Ch. 5—
The Universal Laws of Motion

- Difference between speed, velocity and acceleration
- Acceleration of gravity
  - Depends on properties of planet
  - Doesn't depend on mass of object
  - Difference between mass and weight

Momentum & Force

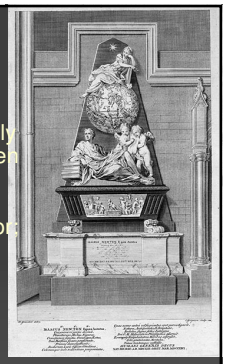
- Momentum—
  - mass x velocity
  - Conserved for systems with no external/outside/net force
- Force—
  - effect which changes momentum
  - Net force sum total of forces

Weightlessness

- Free-fall—
  - only force on you is gravity
  - Parachute or friction or elevator cable not allowed because it opposes gravity
  - Fall off a balcony, cut an elevator cable, or reside in Earth satellite
- Weightlessness
  - No apparent weight because of being in free fall
  - If you and scale in free-fall, then no apparent force
  - Near Earth orbits are in free-fall, but still have gravity

Newton's Laws of Motion

- Newton never married, apparently never had a lover, and never even had a real friend, as we use the word in our sociable times. He never had a scientific collaborator; indeed, he fought bitterly and ruthlessly with other great philosophers. Having been a fellow and professor at Trinity College, Cambridge, for most of his adult life, he left behind not a single person who claimed to have been his student.



More on Newton's weirdness

- What Keynes found in these manuscripts amazed him: ethereal spirits, a secret fire pervading matter, a fixation on quicksilver—mercury—as "the masculine and feminine semens … fixed and volatile, the Serpents around the Caduceus, the Dragons of Flammel." We know now that Newton, the alchemist, hid behind a pseudonym, Jeova sanctus unus, as he slowly and unwittingly poisoned himself with the mercury he continually touched, smelled, and tasted.

One final Newton tidbit

- In one experiment, to prove that colour perception is caused by pressure on the eye, Newton slid a darning needle around the side of his eye until he could poke at its rear side, dispassionately noting "white, darke & coloured circles" so long as he kept stirring with "ye bodkin."

Newton's First Law of Motion

- If no force acting on an object, it remains constant in its state of motion or rest (its velocity doesn't change)
- Examples:
  - Walk around on train or even jump off it
  - "Cut ties"….Sun disappears, rope breaks…
  - Space ship in outer space w/ no thrusters

Newton's Second Law

- Equation relating acceleration and force: F=ma
- For the same force, a smaller mass will accelerate more
- To get the same acceleration, need a larger force

Newton's Third Law

- For any force, there is an equal but opposite force
- If you lift dancing partner, s/he exerts an equal and opposite force down
- As air accelerates from an air brush, there is an equal but opposite force on your hand via the brush
- Similar to rocket thrust of a spaceship

Conservation of Momentum

- First Law: if no force, momentum stays same
- Second Law: a force can change momentum BUT…
- Third Law: since there's an equal but opposite force on another object…
- The total momentum of both objects stays the same

Other stuff

- Conservation of Angular Momentum
  - Mvr
  - For a spinning object w/ constant mass, moving it to smaller r means bigger v
  - Conserved unless there's a torque
- Universal Law of Gravitation:
  - Force proportional to product of masses
  - Inversely proportional to distance squared
  - Explained the "why" of Kepler's laws
  - Newton's version lets us calculate bigger mass
  - Orbits ellipse (bound) or parabola/hyperbole (unbound)

Tides

- Gravity causes two daily tides
- Sides closest to and furtherest from the Moon experience high tides
- Sun's effect only about 1/3 that of Moon
  - Additive…Spring tides
  - Subtractive…Neap Tides
- Tidal friction
  - Slows Earth's rotation, prolongs day
  - Earth's tidal friction on Moon slowed rotation bringing it toward ***synchronous rotation***

Lab & Labwork

- Lab is about repeatability
- Need to record uncertainties
- Comparison of two quantities not simple
- Need to be able to compute % diffs or % errors
- Lab/science research requires judgement (hence always subject to more testing)

Telescopes & Light

- Light "bends" at interfaces of two different materials
- Some light reflects and some refracts
- Lenses produce images…characterized by a focal length
- Focal length, object and image distance related
- Telescope consists of (at least) two lenses (eyepiece and objective)

Ch. 6—Light

- Why is light important for astronomy?
- Difference between power and energy
- How does light interact w/ matter?
- What's the dual nature of light all about?
  - wave versus particle
  - Which variables apply to each?
- Electromagnetic spectrum…what goes where?

Spectra

- What is it?
- How do we get one?
- What can we tell from them and how?
- What's absorption/emission/doppler?

Aspects of Observing

- How do you recognize a planet?
  - Location?
  - Properties of its image?
- What are ideal sky conditions?

Ch.7—Telescopes

- Angular Resolution
  - What is it?
  - Do you want it big or small?
  - How do you design telescope for best?
  - What happens if you have poor resolution?
- What are fundamental properties of a telescope?
- How does magnification fit in?
- Under what conditions to telescopes have to be in specific places?

Telescopes & Light

- Telescopes come w/ finders, why?
- Finders need to be aligned, how?
- Mounts come in two flavors
  - Which are they?
  - Advantages/disadvantages?
  - Which ones need alignment? How?