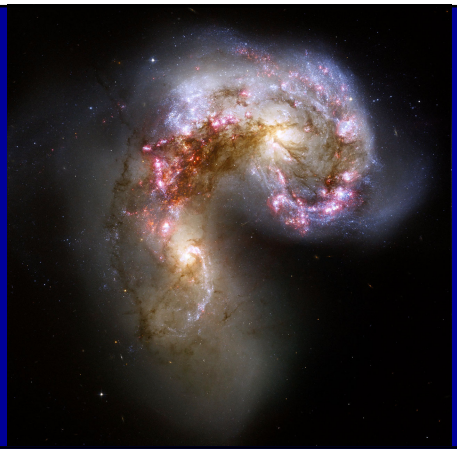
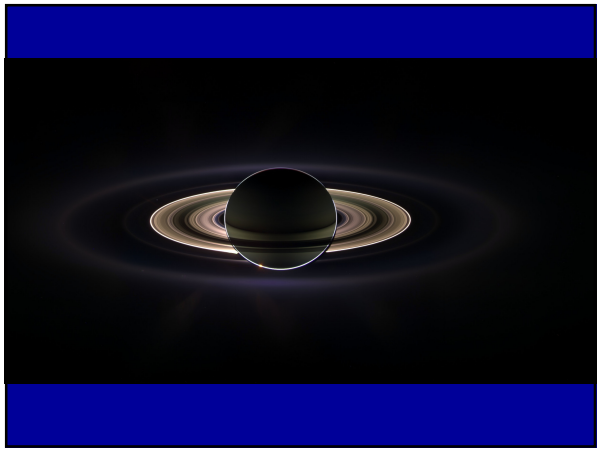
Tuesday Oct 24

Agenda

- Announce:
  - Test on Thursday
  - Lunar Observations due
  - Online quizzes/tutorial due by Thursday
  - Need to schedule extra credit talks
  - Read Ch. 7 for next week
- Review Special Relativity
- Review Physics
- Review Labs
- "Einstein's Big Idea"





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- On the “Wayne’s World” soundtrack…
- Brian May of Queen:

co-author of the book "Bang! The Complete History of the Universe," "I think there's a sort of purity about both of them," he said recently, according to The Guardian newspaper. "Because you can immerse yourself in thoughts of the universe, or in music, and you're really abstracted. You're a million miles away from all your worries and personal problems and the dust and smoke of where you are."

Review Relativity

Starting Point for Relativity

- Laws of physics/nature same for all observers
- Speed of light is same for all observers

- Why? How do we know?

Consequences/Implications of Theory

- Quantities dependent just on space or just on time will, in general, depend on the observer:
  - Time runs slower for moving frames (w/r/t us)
  - Length contracts for moving frames (w/r/t us)
  - No agreement on simultaneity
- Special quantities constructed from time and space (spacetime) are invariant with respect to observer…not everything is relative

Length Contraction

- Only lengths in direction of relative motion are contracted

Effects on Space Travel

Experimental Tests of Relativity

- Testing ongoing…APS 2006: Session E6: Experimental Tests of General Relativity
- Constancy of speed of light
- Time dilation:
  - Particles
  - Flights / satellites
- Various consistency checks
- E=mc^2

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- No
- Only by making careful experiments

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(no experiment is even *possible* to discover if you are moving)

Suppose you are traveling at 500 km/hr. You shine a flashlight in the direction you are going. Someone not moving with you will see the light pass them:

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- At the same speed as you see the light move
- Neither of the above

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Why do we think the speed of light is the same for all observers?

- This makes the laws of physics simpler
- Einstein thought of this, and everything he thought has proven to be correct
- Experiments showed this to be true
- It isn't, really, this is just an approximation that we use
- None of the above

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- Time would appear to be running slower for them, and they would think that time is running slower for you
- Time would appear to be running slower for them, but they will think time is running *faster* for you.
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Time dilation – the slowing down of time for objects moving at nearly the speed of light

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- Happens in science fiction, but not in reality
- Has been observed for subatomic particles that decay after a certain time. Their lifetime actually increases as they speed up.
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Review Physics

Newton's Laws

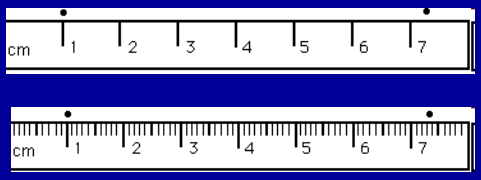
Conservation Laws

Review Lab

Review Labs: Uncertainty

- Every lab experiment has uncertainty no matter how good the equipment
- Has little/nothing to do with error
- Dishonest/Unscientific to report with unc
- See a recent paper pulled completely at random from the web

Review Uncertainty



Review Labs: Significant Digits

- Bad to report too many
  - Dishonest/misrepresentation
  - Messy/silly/unprofessional
- Would it make sense for me to give someone with a final grade of 90 an A- and someone with an 89.99999 a B+?
- Want to buy some knives for $19.99

Review: Significant Figures

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  -
  -
- Speed:
  - V = d/t =

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  - V = d/t = 1334.3 cm / 3.5 s = 381.228571428571428571428571428557cm/s
  - V= 3.8 x 10^2 cm/s
  - V=1334.3/3.6= 370.6388888888888888888888888888889cm/s
  - V=1334.3/3.4= 392.44117647058823529411764705882cm/s