Physics 1A, Section 6

October 2, 2008

Contacting Your Section 6 T.A.:

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- Office hour:
  - Caltech/Downs 101
  - Tuesdays 4:00 - 5:30 PM
- Section web site:
  - http://www.submm.caltech.edu/~cdd/PHYS1A_2008

Course Web Page

- http://www.its.caltech.edu/~tmu/ph1a

Grading

- Final exam: 50%
- Quizzes: 30%
- Homework: 10-15%
- Section participation: 5-10%

- 50% to pass

Course Readings

- The Mechanical Universe: required
  – No chapter summaries, so get used to finding the formulas you need, and fast.

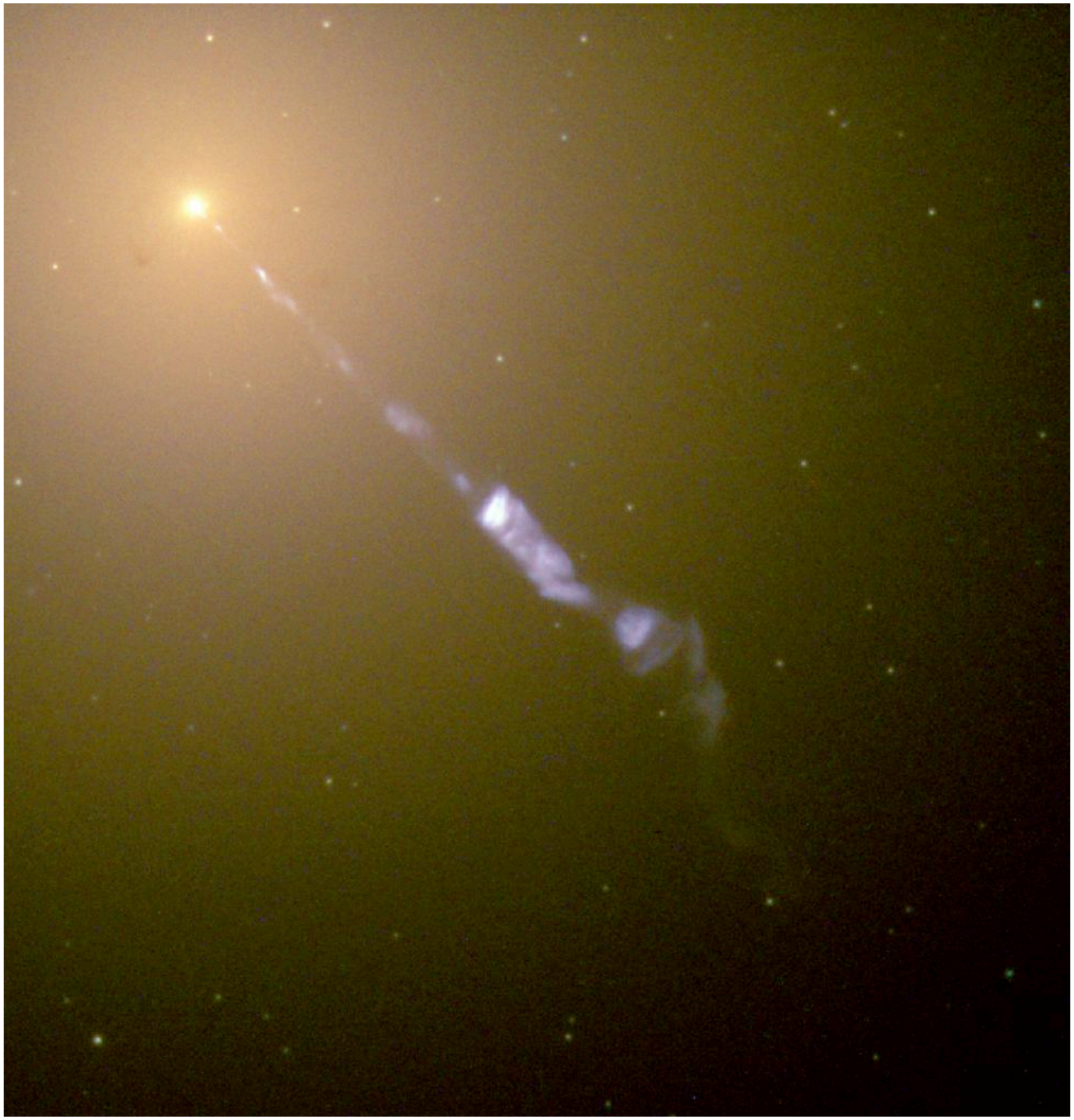
- Feynman: broader context, underlying principles, occasional anecdotes

Section Goals

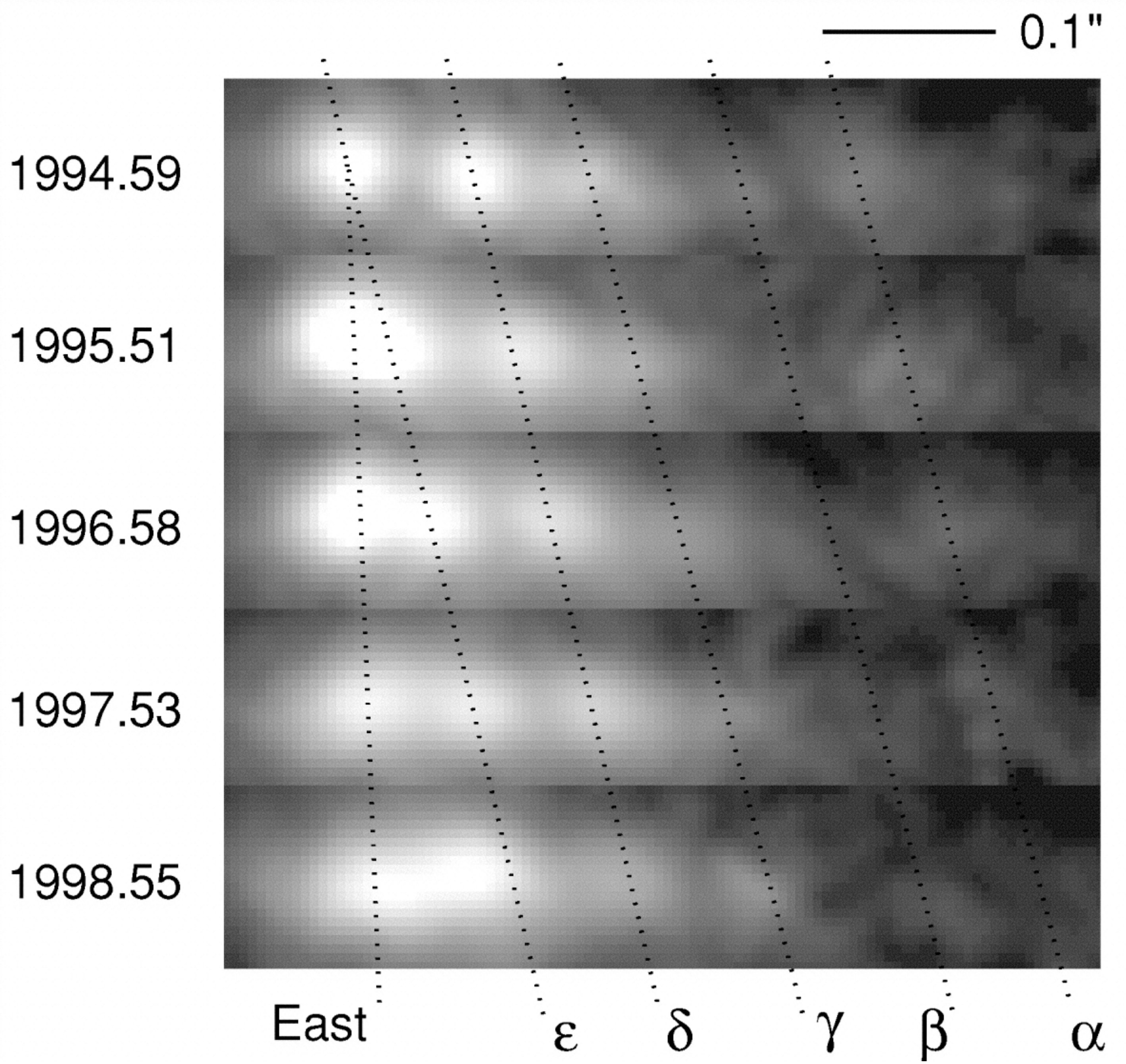
- Practice problem solving
  - unassigned Quiz and Final Problems
  - some problems from TMU
  - other examples from astronomy & physics
- Review concepts covered in TMU and the lectures
  - Discuss the ones that you are having the most trouble with. *I need some feedback from you.*

Today's problem: unit conversion, velocity, and an optical illusion

- elliptical galaxy Messier 87, 15 Mparsecs away



- Jet of ionized gas seen with Hubble Space Telescope


0.1"
1994.59
1995.51
1996.58
1997.53
1998.55
East
ε
δ
γ
β
α

apparent speed of the gas blobs

- 0.08 arcsec in 4 years
- distance d = 15 Mparsec

  1 parsec = 3.086×10^{16} m

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  = 5 c (c = speed of light)

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- Our mistake was in assuming that the velocity is perpendicular to our line of sight.

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- Our mistake was in assuming that the velocity is perpendicular to our line of sight.

- If the velocity is nearly toward us, and the gas is moving near the speed of light, the apparent speed is boosted:

$$v_{apparent} = v \sin \alpha / [1 - (v/c) \cos \alpha]$$

Monday, October 6:

- “If daVinci and Galileo had calculus” (related to TMU chapter 2)
- Quiz Problem 46
- Quiz Problem 35

- *Optional, but helpful, to look at these in advance.*

Quiz Problem 47

Problem 2: Bicycling Lesson

This problem is intended to help you answer the question of whether it is safer to ride your bike against traffic or with traffic.

Suppose you are riding your bike against the flow of traffic (see Figure 1) at a speed of $v_b = 10m/s$, and a car comes around a blind curve directly toward you at a speed of $v_c = 15m/s$ only $x_0 = 20m$ ahead of your current position. Assume both you and the car begin braking instantaneously at this point, and both your bike and the car can each decelerate at a maximum rate of $5m/s^2$.

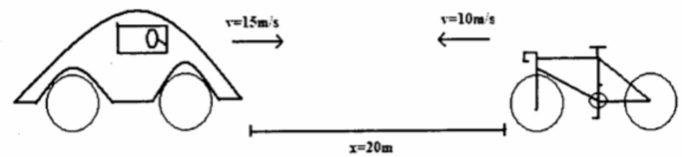

Figure 1: The figure illustrating the action in part (a)

(4 points) (a) Will you hit the car, and if so what are the speeds of your bike and the car at impact? If you find you will not hit the car, how close did you come to colliding with the car (in meters)?

Now suppose you are riding your bike with the flow of traffic (see Figure 2) still at a speed of $v_b = 10m/s$. A car comes from behind you around a blind curve at a speed of $v_c = 15m/s$ only $x_0 = 20m$ from your current position. Since the car is behind you, and you do not see it, you continue riding at $v_b = 10m/s$. The car brakes immediately upon seeing you, and it can again decelerate at a rate of $5m/s^2$.

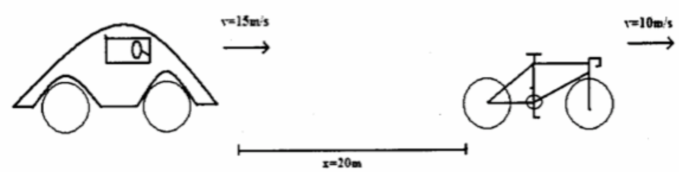

Figure 2: The figure illustrating the action in parts (b) and (c)

(4 points) (b) Will the car hit you in this situation?

(2 points) (c) What is the minimum deceleration the car needs to avoid hitting your bike?