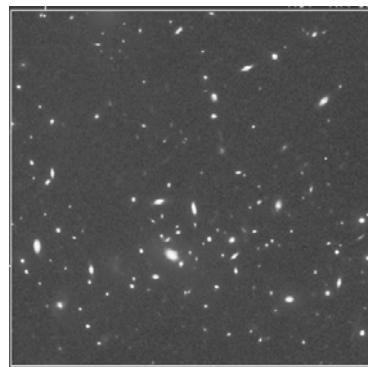


AST 207 The Science of Astronomy

- Ed Loh, Loh@msu.edu, 884-5612
- Syllabus on angel.msu.edu
- Course goals
 - Learn astronomy as a scientist. Emphasize the discovery.
 - Einstein discovered the key idea for his theory of gravity, when a painter fell off a roof: “Then there occurred to me the happiest thought of my life, in the following form. The gravitational field has only a relative existence... for an observer falling freely from the roof of a house there exists... no gravitational field” —A Einstein 1920
 - Focus on cosmology, rather than on all of astronomy
- Outline of cosmology
- Course mechanics
- 51 Pegasi—Example of a scientific discovery

Cosmology

1. What is a science? How was science born?
 - Ancient—200AD
 - Copernican Revolution—1600
 - Beginning of science
2. The stars —1830-1930. What powers the sun? What is the future sun? Where does oxygen come from? “We are stardust.”
 - The sun turns H into He to produce energy.
 - The sun formed & will die.
3. The universe: What is the universe made of? How old is the universe?
 - The Big Bang—1927
 - Galaxies are moving apart because of the Big Bang.
 - Cosmic Radiation—1965
 - The isotropic 1-mm radiation comes from the Big Bang.
 - What is the universe made of?—Present
 - The universe is made mostly of “dark energy,” which repels matter.



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- Announcements
- Up-to-date syllabus
- Class slides by the end of the day.
 - Click on the date on the syllabus

Clickers

- Purpose for in-class exercises
 - Assess whether an idea is clear
 - For the student: Did I understand the idea?
 - For the instructor: Do I need to say more about the idea?
- In-class exercises require i-clickers
 - New textbooks have a coupon for a clicker.
 - If you have one already, you don't need to buy a new one.
 - 10% of clicker questions are dropped.
 - You may turn in clicker questions on paper for at most 2 classes.

Registering your i-clicker



Until you register your i-clicker, your responses are tied to your clicker remote ID (located on the back of your clicker), rather than to you.

If you do not register, your answers are recorded, but you will not get credit.

When you do register, your previously recorded answers will be assigned to you.

Registering your i-clicker online

1. Go to www.iclicker.com.

2. Click "REGISTER."

3. Enter these 4 details and click "submit."

IMPORTANT!!
You **MUST** enter your **MSU email** in the **STUDENT ID** field to ensure proper crediting.
My email is LOH@msu.edu
My **STUDENT ID** is **LOH**

REGISTER AT www.iclicker.com

Other stuff

- Homework
 - Purpose is to help you think about ideas.
 - You have a week to complete it.
 - If you have questions
 - Ask during office hours.
 - Ask during Missouri (show me) Club during the class before the due date.
- Course grades
 - Exercises: 9% Test 2: 15%
 - Homework: 25% Test 3: 15%
 - Test 1: 5% Final exam: 31%

The method of AST207

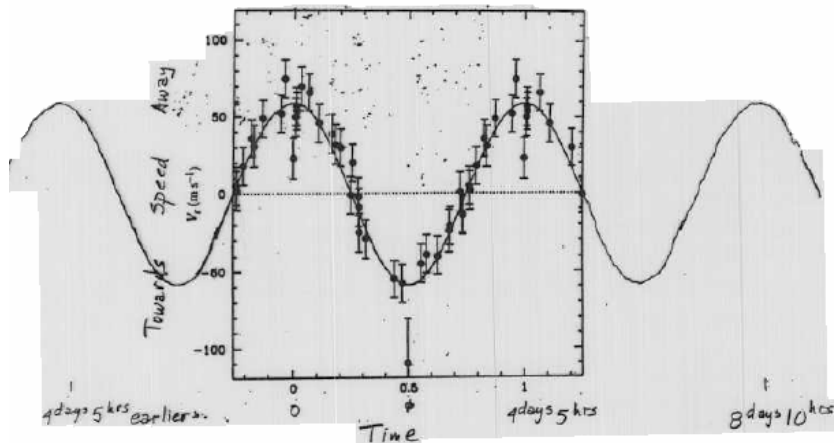
- Goals
 - Ideas & ways of thinking for astronomy, a physical science.
 - How are discoveries made?
- NOT goals
 - Memorize facts
 - Constellations
- After each class, test your understanding
 - What are the one or two big ideas? You must understand these.
 - What are less important ideas? How are they related to the big ideas?
 - What are details?

51 Pegasi

- Big idea: Scientific discovery
 - You should be able to describe scientific discovery and point to the main features using this example.
- Michael Mayor & Didier Queloz discovered something important by studying the star 51 Pegasi.
- The steps to discovery
 1. Examine the data for the facts. What is the evidence? Collect clues.
 2. Brainstorming. What are models that explain the evidence?
 3. Developing your idea
 4. Testing your idea Does any clue refute any part of the model?
 5. What was discovered?

Motion of 51 Peg Away & Towards Us

- In 1994, Michel Mayor and Didier Queloz began to observe the motion of the star 51 Pegasi. They found that it moves towards us and then away from us and the towards us, etc. It repeats every 4 days and 5 hours. The fastest it moves is 60m/s or 120mi/hr, which is unusually slow for an astronomical object. (Earth moves 5000 times faster.) — Kids' College, 1998



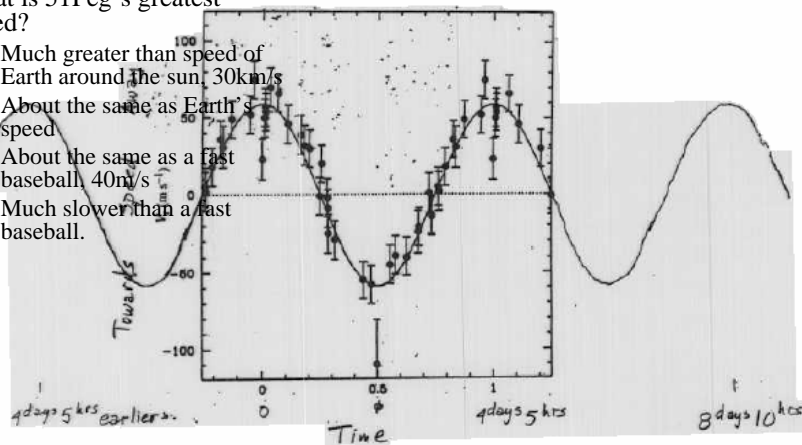
Clues: Examine the data for the facts.
What is the evidence?

1. Clue 1 is valid; clue 5 is valid.

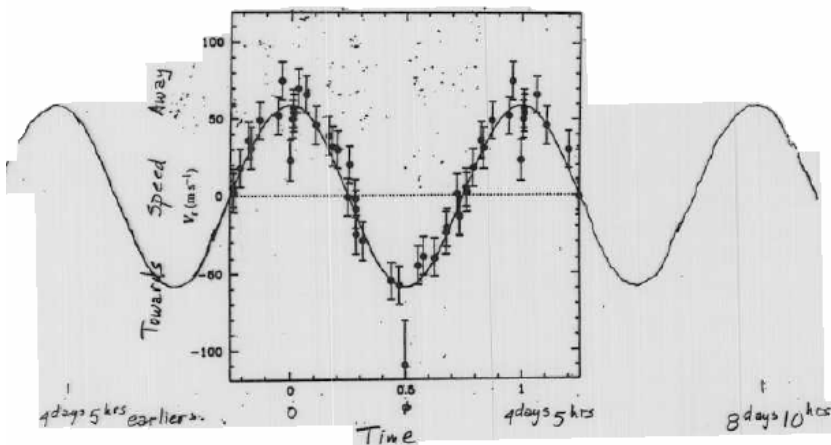
- A. TT
- B. TF
- C. FT
- D. FF

2. What is 51Peg's greatest speed?

- A. Much greater than speed of Earth around the sun, 30km/s
- B. About the same as Earth's speed
- C. About the same as a fast baseball, 40m/s
- D. Much slower than a fast baseball.



Brainstorming. Devise models that may explain the evidence?



Possible models

1. The star 51 Peg is in a circular orbit.
2. Two planets orbit 51 Peg and pull it towards them.
3. 51 Peg and a planet orbit each other around a point that is very near 51 Peg.
4. 51 Peg orbits an unseen black hole.