Astro 301/ Fall 2005

(48310)

Introduction to Astronomy

Instructor: Professor Shardha Jogee

TAs: David Fisher, Donghui Jeong, and Miranda Nordhaus

Lecture 16 + 17: Tu Oct 25 + Th Oct 27

http://www.as.utexas.edu/~sj/a301-fa05/

Lecture 16: Announcements

-- Homework 3 due back today

-- I am away on Thursday Oct 27.
Miranda will go over solution set of Hwk 3 (this will not be discussed later)
+ show a movie

-- Quiz 4 on Tue Nov 1 : Questions based on Lectures 14 to 17 + movie

-- Exam 2 on Nov 8 or Nov 10.

Recent and Upcoming topics in class

--- Energy
-- Forms of Energy.
-- Principle of Conservation of Energy
-- Equivalence of Mass and Energy or $E=mc^2$
-- How efficiently do processes convert mass into energy?
  -Chemical reaction
  - Nuclear fusion
  - Nuclear Fission
  - Accretion of matter onto a black hole
-- General Principles of Nuclear Fusion

--- Electromagnetic Radiation

How efficiently do processes convert mass into energy?

- Energy E stored in Mass M = Mc^2
  (Einstein)

- E < 0.007 Mc^2 from fission of Ura. or Plu.

  à Aug 6, 1945: Hiroshima hit by an atomic fission bomb powered by fission of 1 g of Uranium. Energy released is equivalent to that from exploding 20 kilo-tons of TNT

  à Aug 9, 1945: Nagasaki hit by an atomic bomb powered by the fission of 1 g of Plu

- E= 0.007 Mc^2 from Hydrogen fusion

  à Hydrogen bomb in 1952

- E= 0.1 Mc^2 = energy relased (X rays, etc) as mass M falls onto the accretion disk of a black hole

Atomic Fission Bomb: Nagasaki

The atomic bomb mushroom cloud seen from an American aircraft

Nagasaki bombed on Aug 9 1945 with an atomic bomb powered by the fission of 1 g of Plutonium

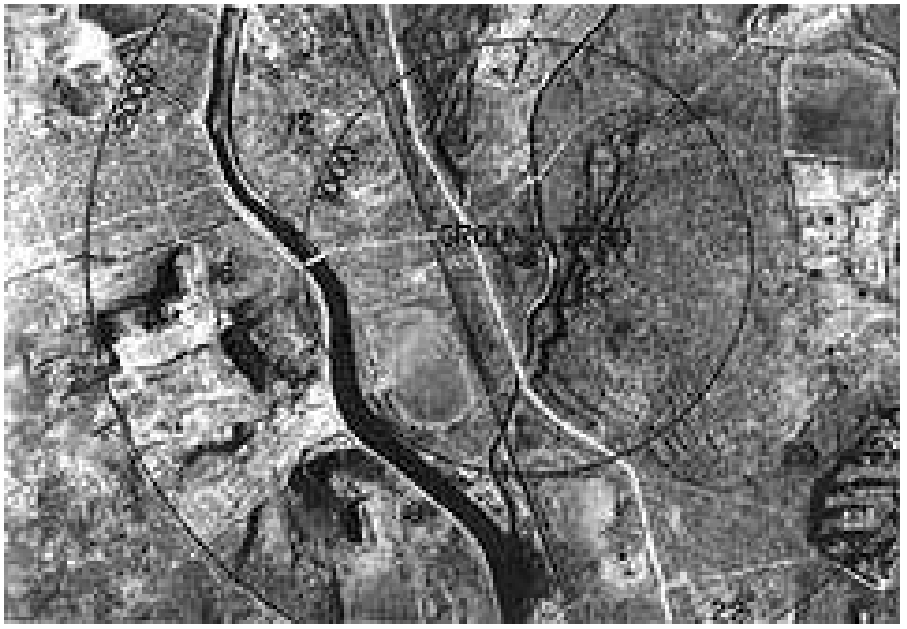
à $E < 0.007\ M\ c^2$ from fission .

à The fission bomb is less powerful than a fusion bomb, but it is still extremely devastating

The atomic bomb mushroom cloud over Nagasaki on August 9, 1945

Atomic Fission Bomb: Nagasaki

Nagasaki 2 days before the atomic bombing



Nagasaki 3 days after the atomic bombing

Atomic Fission Bomb: Nagasaki

DAMAGE CAUSED BY THE ATOMIC BOMB EXPLOSION

* Levelled Area.....6.7 million square meters

* Damaged Houses:

Completely Burned ------11,574

Completely Destroyed-----1,326

Badly Damaged----------5,509

Total----------18,409

* Casualties

Killed------73,884

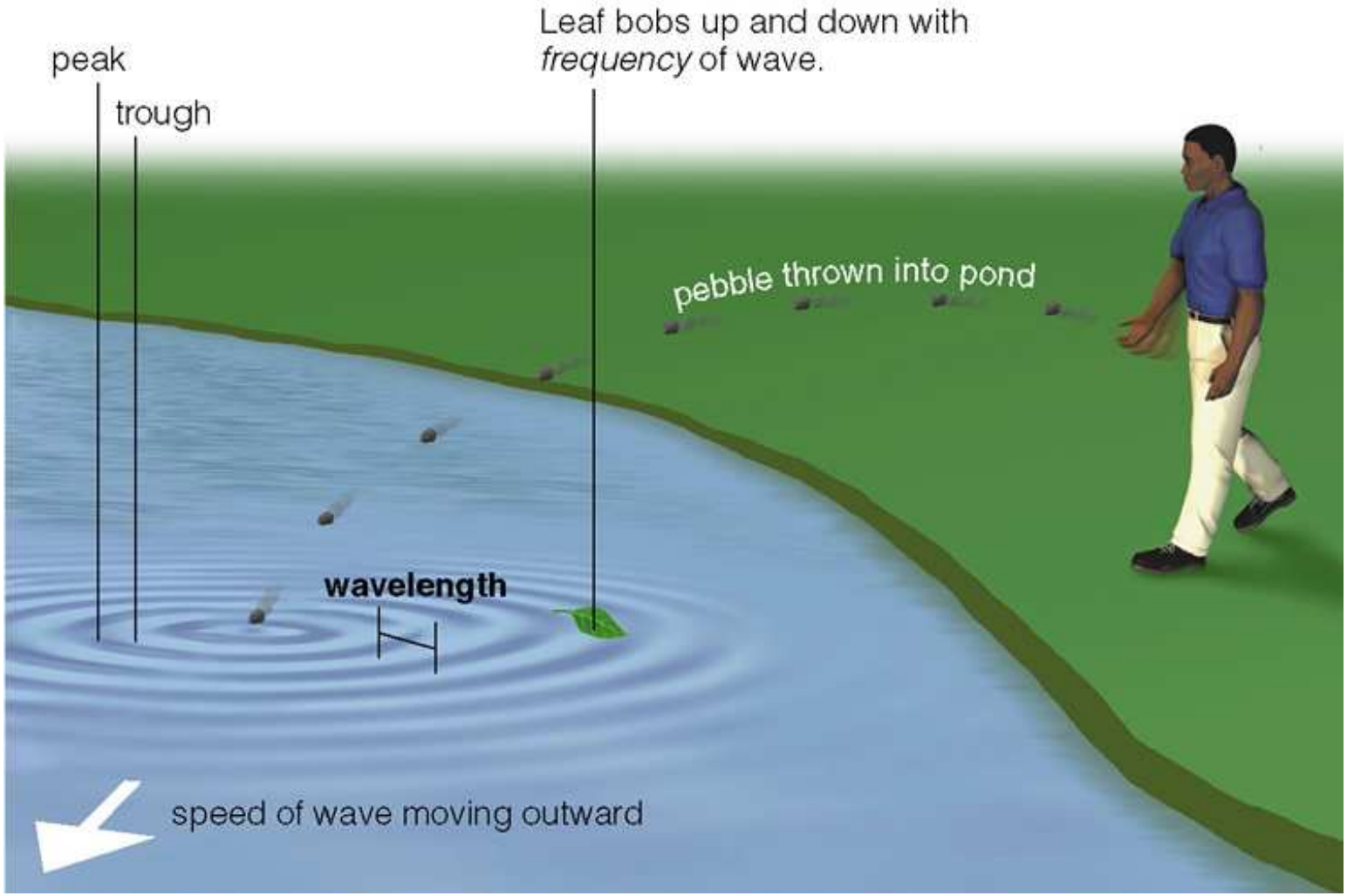
Injured-----74,909

Total------148,793

(Large numbers of people died in the following years from the effects of radioactive poisoning.)

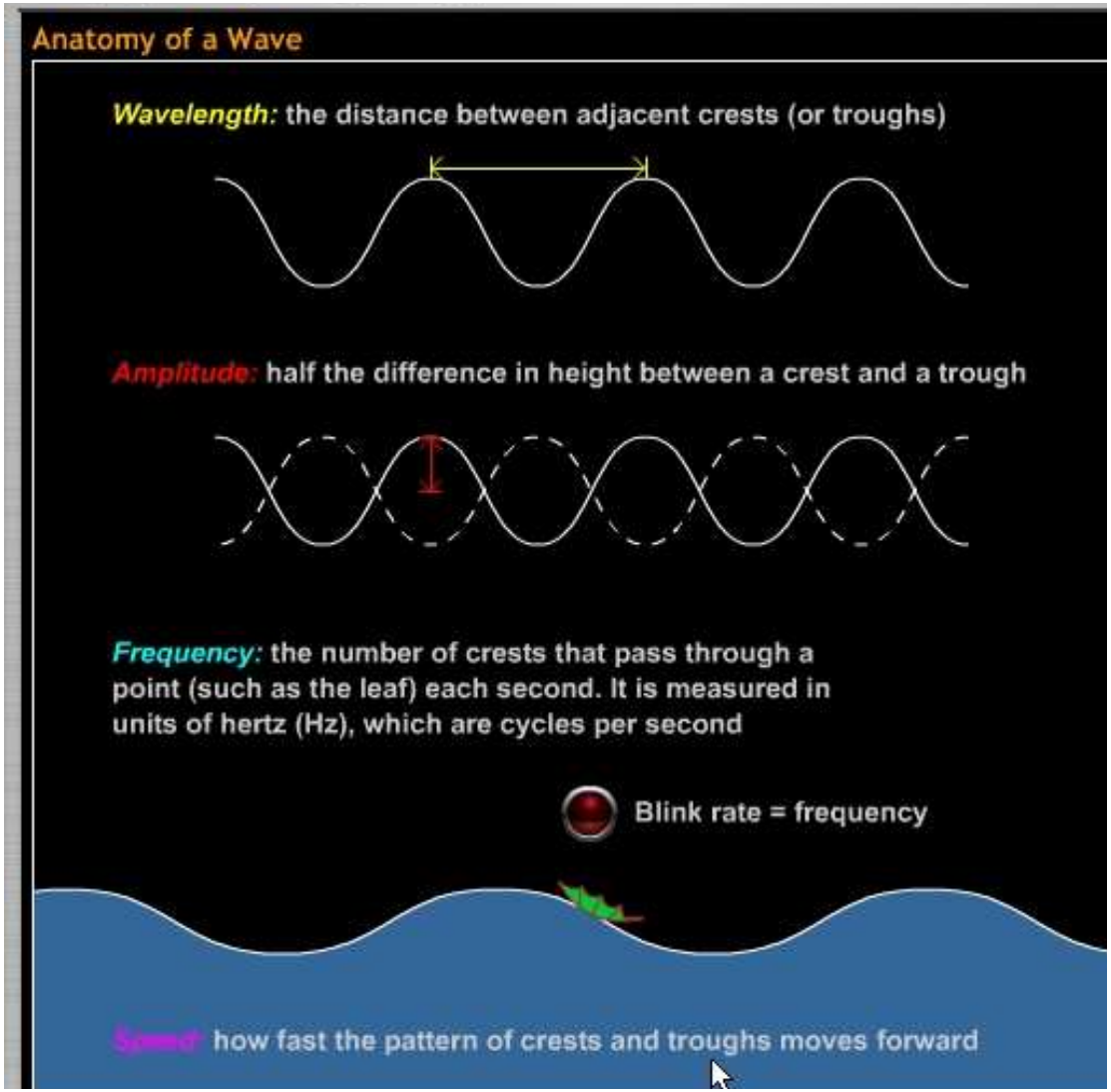
Nature of Light

Waves



Different types of waves: surface wave, sound waves, EM (light) waves,

Waves: Wavelength, Frequency, Speed, Energy



In-class animation : Anatomy of wave