11/20/06

Exam 3 grades posted soon, returned Wednesday

Extra Credit due today by 5PM

Nova PBS Film on Gamma-Ray Bursts on Wednesday (unless UT formally cancels classes)

Wheeler in Washington tomorrow, probably back in time for class Wednesday, maybe a little late.

News? Type Ia supernovae give more evidence for Dark Energy

Pic of the day: M42, star birth in the Orion Nebula.

Reading:

Next topic: Cosmic Gamma-Ray Bursts, part of old Chapter 11 in book, new separate Chapter 11 posted.

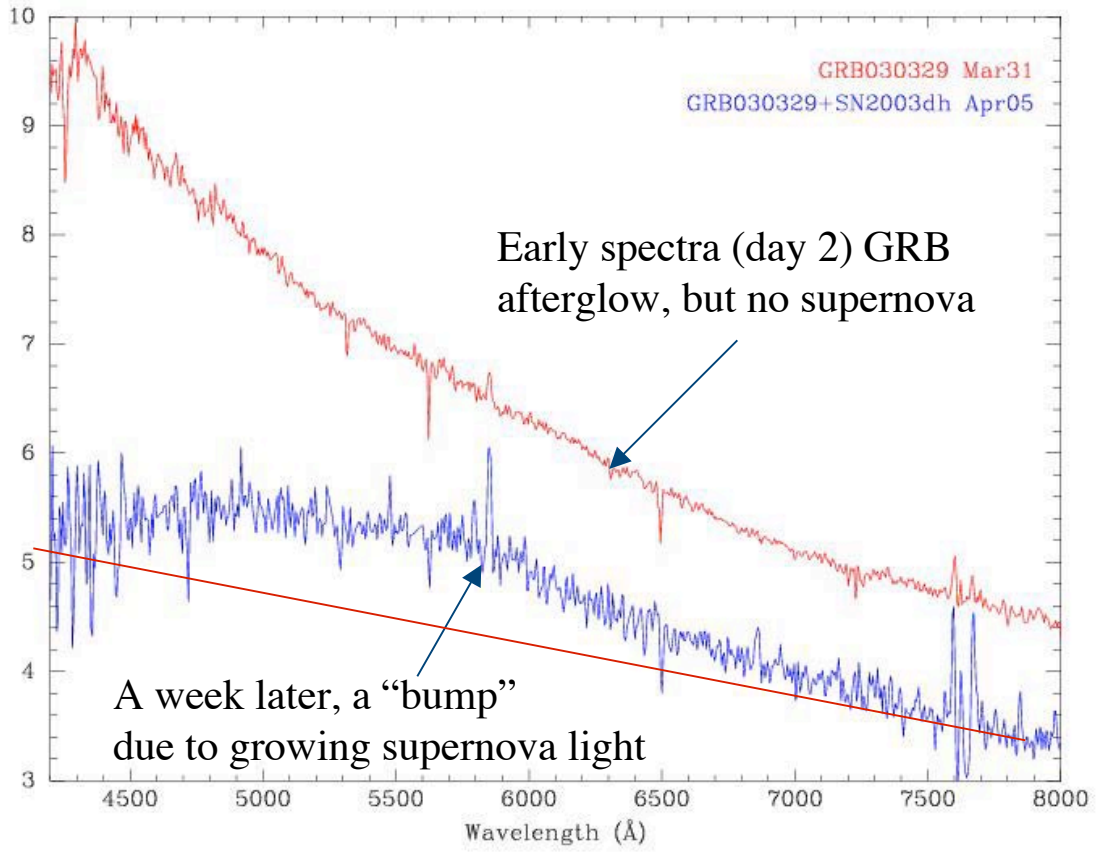
Then Supernovae and Cosmology, part of old Chapter 11 in book, new separate Chapter 12 posted.

The raging issue: are gamma-ray bursts produced in some form of core collapse supernova? Circumstantial evidence...

THEN PROOF!

GRB 030329 was nearby, only 3 BILLION light years away! Relatively bright, an ideal target.

SN2003dh was discovered a week later! Spectrum of a Type Ic supernova



The current picture: Gamma-ray bursts result from the collapse of a massive star, probably to produce a black hole, that emits a tightly focused, highly relativistic jet.

Every burst, twice a day somewhere in the Universe - the birth of a black hole aiming its jet at us?

~100 aimed elsewhere for every one aimed at us.

NASA Animation: Black Hole Forming in Star, producing jet and Gamma-Ray Burst

One Minute Exam

It is important to understand that gamma-ray bursts emit their energy in tightly collimated beams because otherwise

A) Estimates of the distance will be wrong

B) Estimates of the mass of the black hole formed will be wrong

C) Estimates of the energy emitted will be wrong

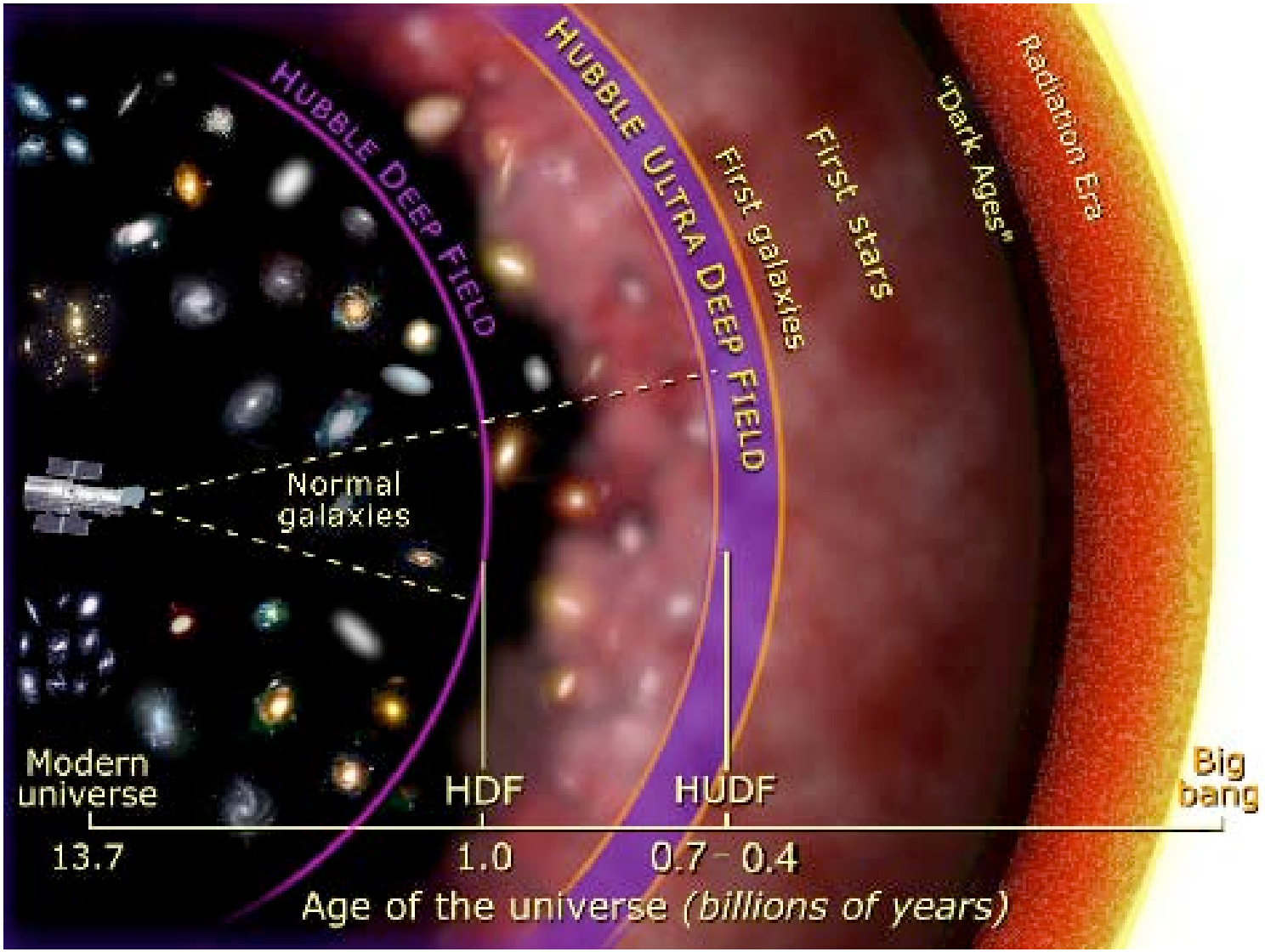
D) Estimates of the type of supernova in which they explode will be wrong.

Gamma-ray bursts are intensely bright lights

Can be seen at great distance

Probe cosmology, the early Universe

Dark Ages, after the Universe cooled off a million years after the Big Bang, before stars and Galaxies first formed half a billion years later



Gamma-ray bursts could be the first objects seen at the end of the Dark Ages as the first stars are born and die, over 13 billion years ago.

What's Next?

The Swift satellite was launched
Wednesday, November 17, 2004

Swift is discovering a gamma-ray burst
every few days!

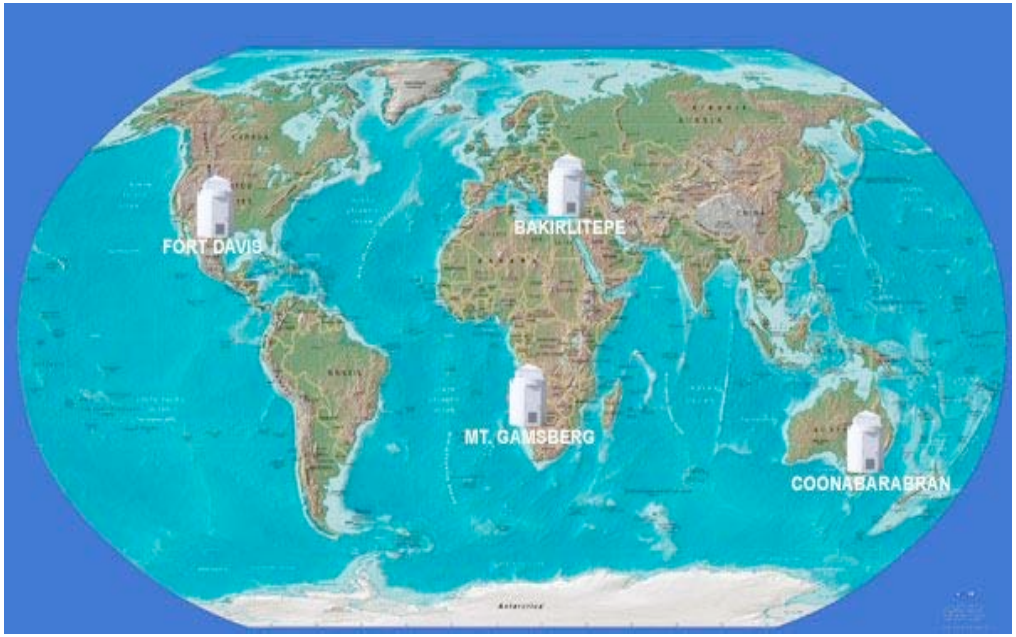
Detailed follow up taxes all the
world's great observatories.

Swift can do optical observations,
but needs a minute to swivel - too long!

We have joined the U. of Michigan RObotic Transient Source Experiment (ROTSE) collaboration.

Four ROTSE telescopes around the world. Texas, Australia, Namibia andTurkey.

18 inch mirrors, 1.85 degree squared field of view.



ROTSE can point and shoot within 6 secs of electronic satellite notification,take automatic snapshots every 1, 5, 20, 60 secs.

ROTSE will:
Discover the optical transient ***during*** the burst;
Follow the light in unprecedented detail;
Relay the discovery and coordinates to the HET for spectroscopic follow up.

Short, hard bursts

Evidence has gathered that there are two kinds of gamma-ray bursts. Most last for about 30 seconds, but some last only a few tenths of a second (hence short) and had higher energy (hence hard) gamma-rays.

Major advance in summer of 2005. Found first “afterglow” of a few short, hard bursts. They are in distant galaxies, but not as distant as the “regular” bursts, not as bright, and they can occur in old galaxies no longer forming stars. NO SUPERNOVAE!!!

Most popular idea (but with problems): binary neutron stars spiralling together by radiating gravitational radiation and then merging.

http://www.nasa.gov/mpg/135241main_neutronstar4lunch-magic.mov_NASA%20WebV_Oct3.mpg