3/1/06

Exam 2, Chapter 6, this Friday March 3, review sheet posted review Tomorrow, 5 PM RLM 4.102

Chapter 6 posted - revised, updated for second edition

Wheeler on travel M, W, Washington DC, Space Studies Board (oversees NASA), visit Congress. Marcelo will cover class.

News?

Pic of the day - Multiverse?

Fast explosion of C/O in Type Ia, shock hitting layer of Si in Type Ib, Ic make element closest to iron (same total p + n) with #p = #n

Nickel-56: 28p 28n total 56 -- Iron-56: 26p 30n total 56

Ni-56 is unstable to radioactive decay

Nature wants to produce iron at bottom of nuclear "valley"
decay caused by (slow) weak force p → n

Nickel -56	γ-rays heat	Cobalt-56	γ-rays heat	Iron-56
28p	"half-life"	27p	"half-life"	26p
28n	6.1 days	29n	77 d	30n

Secondary heat from γ-rays makes Type I a, b, c shine

Type Ia are brighter than Type Ib and Ic because they produce more nickel-56 in the original explosion.

The thermonuclear burning of C and O in a white dwarf makes about 0.5 - 0.7 solar masses of nickel-56.

A core collapse explosion that blasts the silicon layer makes about 0.1 solar masses of nickel-56.

Type II also produce about 0.1 solar mass of nickel-56, but the explosion energy radiated from the red giant envelope in the plateau tends to be brighter. After the envelope has expanded and dissipated, the remaining radioactive decay is seen.

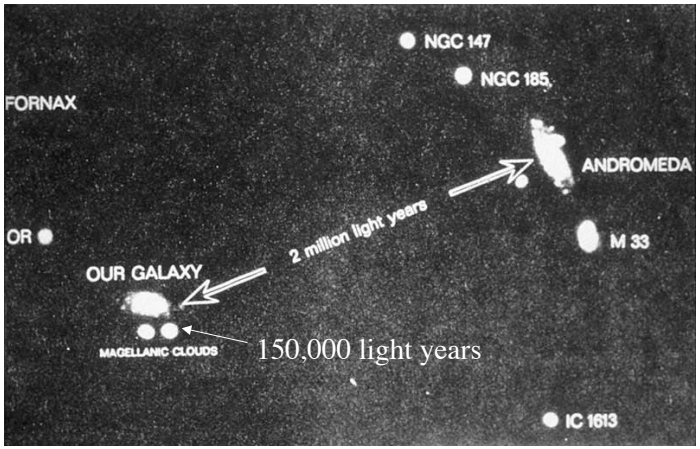
End of Material for Test 2

Kepler

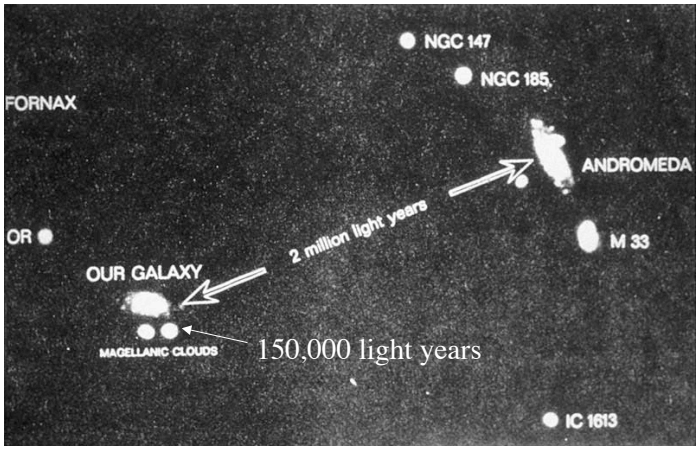
SN 1987A
first naked eye
supernova since
Kepler's in
1604

Tycho

Local group

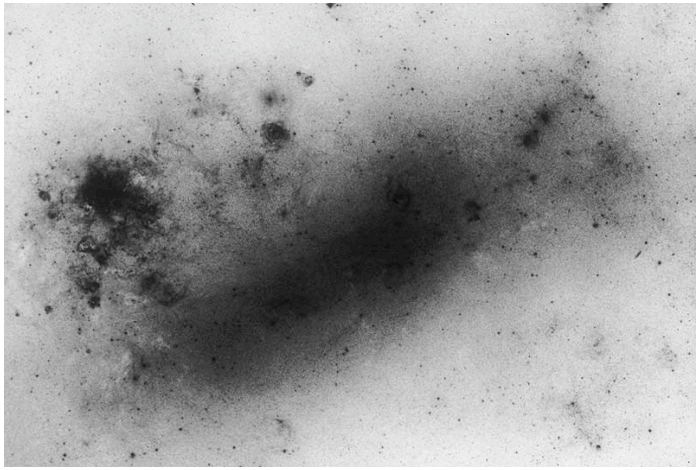


Local group



Large Magellanic Cloud, irregular galaxy (color)

LMC negative



Rob McNaught patrol photos - the day before

2-22-87

The first known photo of SN 1987A hours after shock breakout

2-23-87

One day later

2-24-87

Near maximum light

5-20-87

About when I saw it

8-23-87

LMC w/arrow

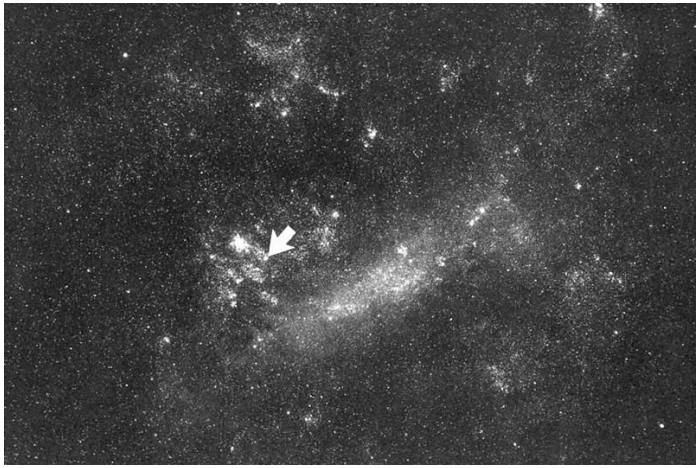
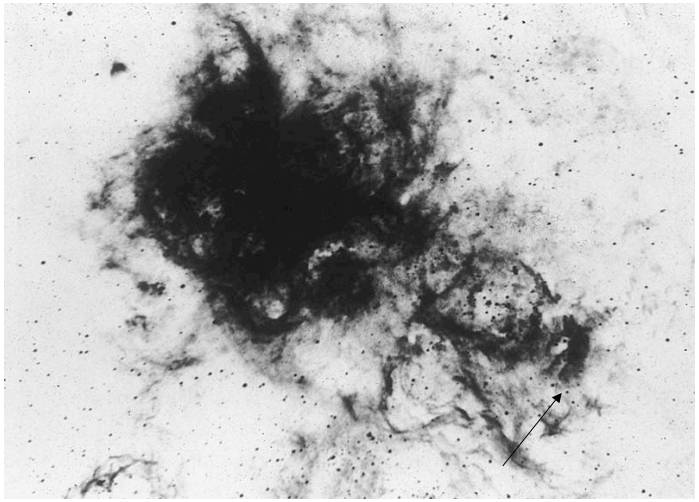
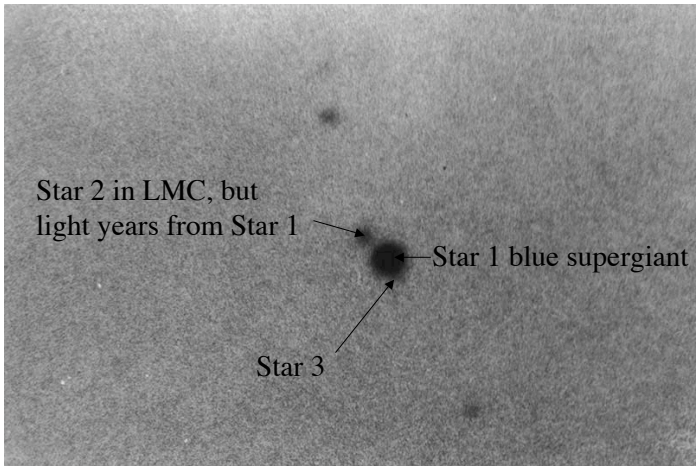


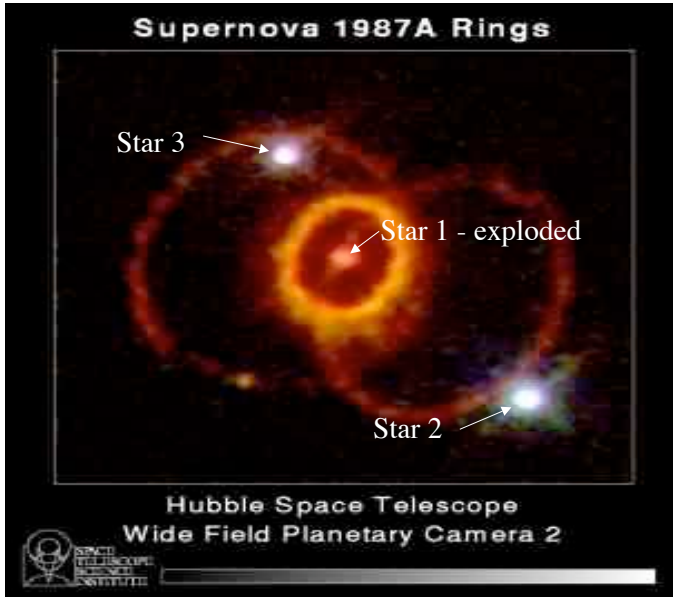
Photo of progenitor star (giraffe)

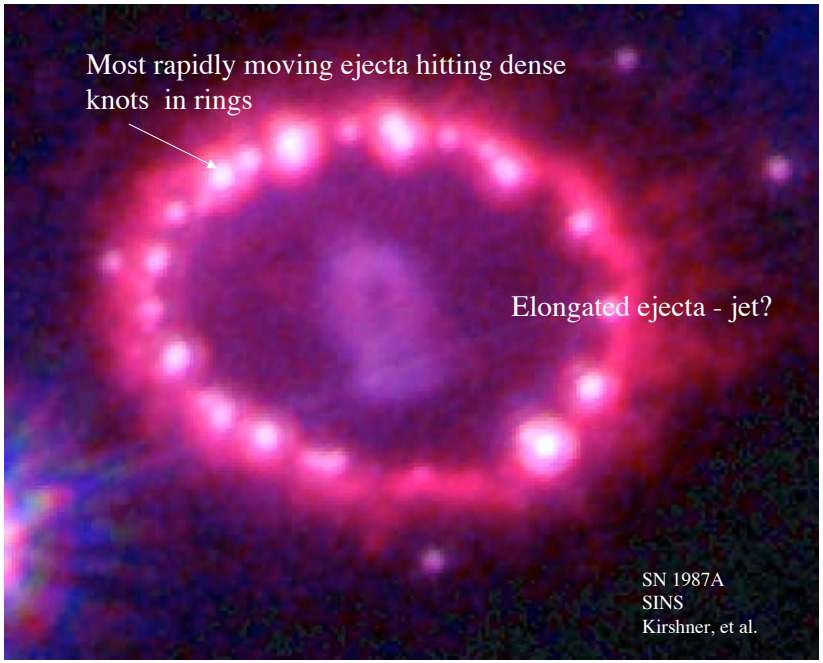


Stars 1, 2, 3



Close-up



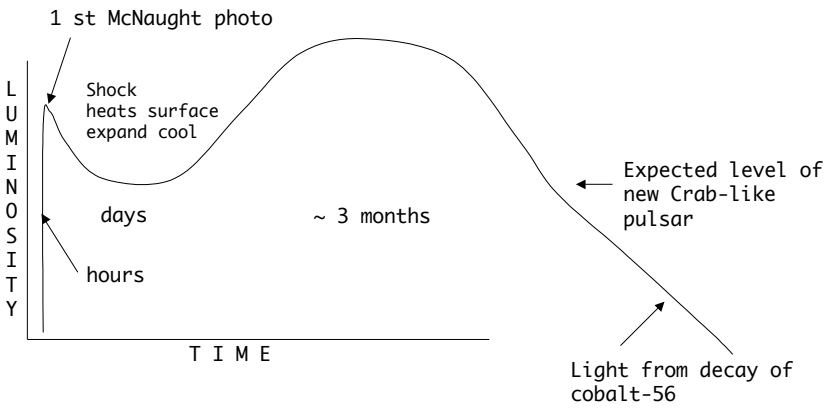


The single most important thing about SN 1987A is that we detected the neutrinos!

It was definitely a core-collapse event

10^{57} neutrinos emitted, most missed the Earth. Of those that hit the Earth, most passed though since neutrinos scarcely interact.

About 19 neutrinos were detected in a 10 second burst.

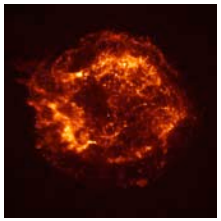


SN 1987A had a rather peculiar light curve because it was a relatively compact blue supergiant, not a red supergiant, brief shock heating, rapid cooling by expansion, no plateau, subsequent light all from radioactive decay

Neutrinos from SN 1987A proved a neutron star formed and lasted for at least 10 seconds while neutrinos were detected - where is it?

Expected to see it in ~ 1 year - still looking 19 years later

Any neutron star is dimmer by at least a factor of 10 than 1000 year-old Crab pulsar



If similar to object in Cas A, much too dim to detect
100 to 1000 × dimmer than Crab pulsar

Possibly black hole, not neutron star??
Don't know. Can't rule out.

Neutron star could be "hidden," or a slow rotator, or with a weak magnetic field, but counter to notion of jet - some evidence for jet