

ASTR 1020: Stars & Galaxies

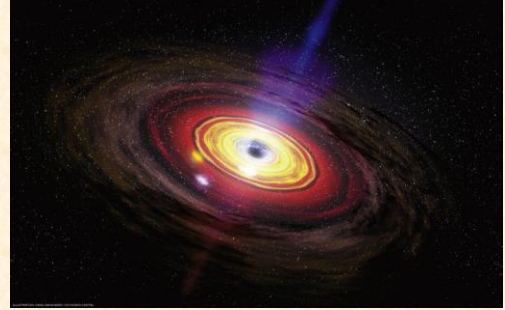
October 11, 2013

- Reading: Chapter 18, section 18.1.
- *Mastering Astronomy* Homework on **Star Birth** is due tonight at midnight; **The Lives of Stars** due on Oct. 18.
- Need volunteers for *Astronomy in the News!*
- Meet next Wednesday at Fiske Planetarium.
- Next Thursday, Oct. 17, SBO extra credit observing, 7:30 pm.
- All grades now posted on D2L.



Astronomy in the News: Colossal Explosion from Supermassive Black Hole at Center of Galaxy Revealed

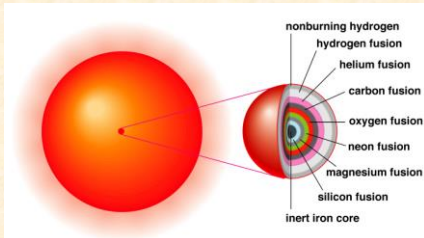
Carl Barnes



An artist's conception of a black hole generating a jet. Two million years ago the supermassive black hole at the center of our Galaxy was 100 million times more powerful than it is today.

High Mass Star

- Core structure keeps on building successive shells—
- Lesser elements on the outside, heavier ones on the inside



Clicker Question: Basketball & Super ball Demo

What do you think will happen?

- The two balls will bounce up together
- The little ball will bounce higher than the basketball
- Nothing interesting the first time: he'll have to do this three or four times to get it to "work"

Supernova!

b) The little ball will bounce higher than the basketball

- The lightweight atmosphere impacts on the heavy core and is "bounced" off in a huge explosion
- Huge energy release from neutrinos!


How does a high-mass star die? Supernova!

- Exploding remnant of a massive star, disperses and spreads heavy element through the galaxy.
- Inside is a neutron star—a remnant core of pure neutrons.
- For the highest mass star, remnant is a black hole (next Wednesday's Fiske show!)

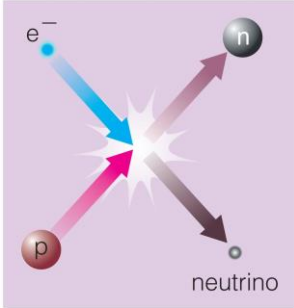


"The Crab", aka Messier 1, went off July 4th, 1054 A.D.
Visible in the daytime!

- Petroglyph from Chaco Canyon:
- Correct configuration relative to the new moon for the Crab Supernovae
- You can check this on your SkyGazer planetarium software....



Supernova Explosion

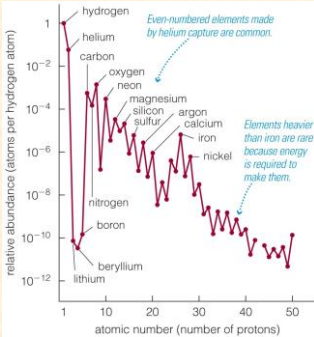


- Core degeneracy pressure goes away because electrons combine with protons, making neutrons and neutrinos.
- Neutrons collapse to the center, forming a **neutron star**.

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Creation of the Elements

- Should (and mostly DO) follow the pattern of fusion reactions
- Heavier elements are made during the explosion, as helium nuclei are slammed into heavier elements




This is Deep

- All heavy elements are created and dispersed through the galaxy by stars
- Without supernovae, nothing heavier than carbon
- **WE ARE STAR STUFF**
- Our atoms were once parts of stars that died more than 4.5 billion years ago, whose remains were swept up into the solar system when the Sun formed



Observing Supernovae

- About 1 per century per galaxy (none in Milky Way since 1604) ☹ =>
- Bright explosion visible for weeks/months- some visible in daytime!
- Remnant visible for 100's of thousands of years as huge bubbles and "veils"



Supernovae in Other Galaxies

- Bright enough to be seen as a sudden, bright point in other galaxies.
- Scores of amateur and professional astronomers monitor nearby galaxies nightly to catch them.
- 1 per 100 years per galaxy means that monitoring 100 galaxies will get you 1 supernova per year.

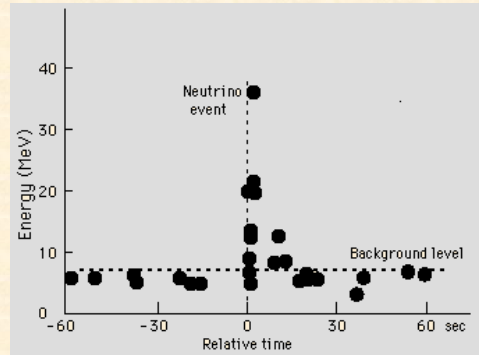


SN 1987 A: nearest one since 1604

- Exploded in Large Magellanic Cloud (companion dwarf galaxy to Milky Way, 200,000 ly distance)
- Seen only from southern hemisphere

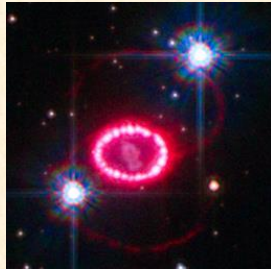


Possible neutrino burst? SIX extra neutrinos were detected when SN1987A went off.



SN 1987 A

- Precursor: massive blue star (!?)
- Ring structure: illuminated remnants of an earlier stellar wind?
- Ejecta are now starting to hit this region- brightening
- Double ring- traced by energy jet from unseen companion????



SN 1987 A

