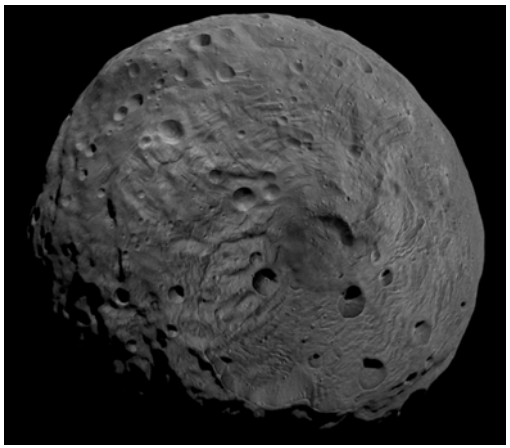
Monday, September 19, 2011

Astronomy in the news?

Pic of the day: closeup of asteroid Vesta from recently launched Dawn mission.

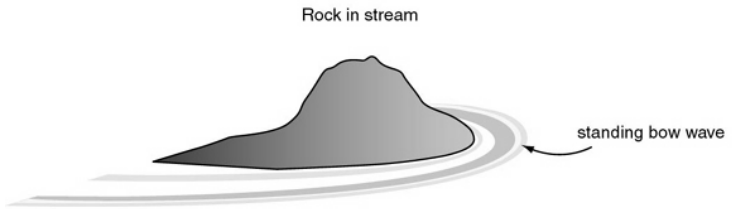


Goal

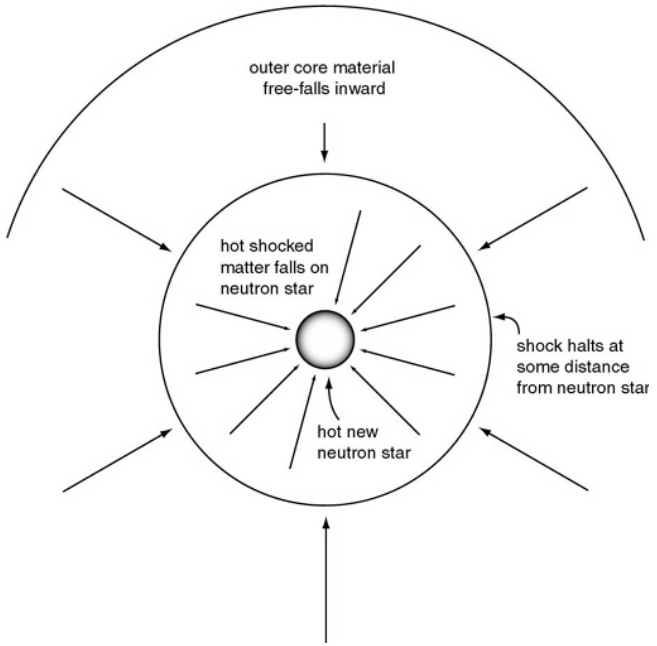
To understand what happens after a massive star forms an iron core

New-born neutron star over compresses and rebounds - potential mechanism for explosion,

DOES NOT WORK!




Form ***standing shock wave***, and outer material just continues to fall in, pass through shock front and settle onto the neutron star.



One Minute Exam:

Most of the energy liberated in the formation of a neutron star is emitted in the form of:

 Neutrons

 Protons

 Neutrinos

 Photons

One Minute Exam

What happens to the ***shock wave*** produced when an iron core collapses to form a neutron star and bounces?

 It fades away

 It propagates out through the star and causes an explosion

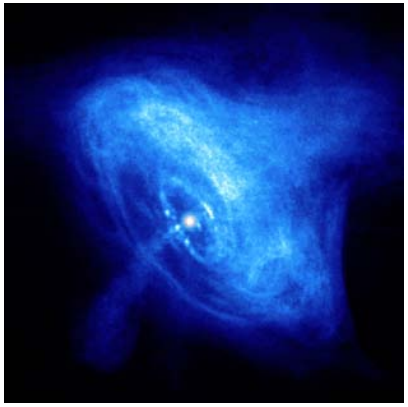
 It stalls at some distance from the neutron star

 It traps neutrinos

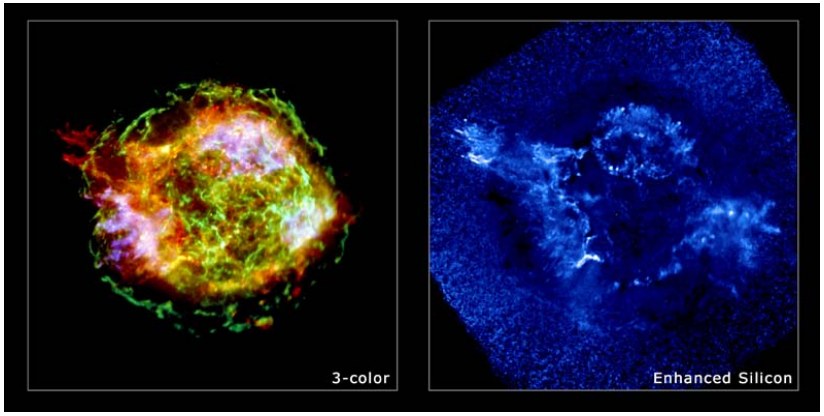
Goal

To understand how jets may trigger a core –collapse supernova explosion

# New possibility - Jet-induced supernova (Ch 6, p. 94)



Crab Nebula




Cassiopeiae A

SN 1987A

Are jet-like flows typical? Are they important?

Studies (last 10 years) show that all Core Collapse Supernovae (massive stars: Type II, Ib, Ic) are out-of-round.

Perhaps combination football, frisbee, or something else.
Death Star Explosion (YouTube)

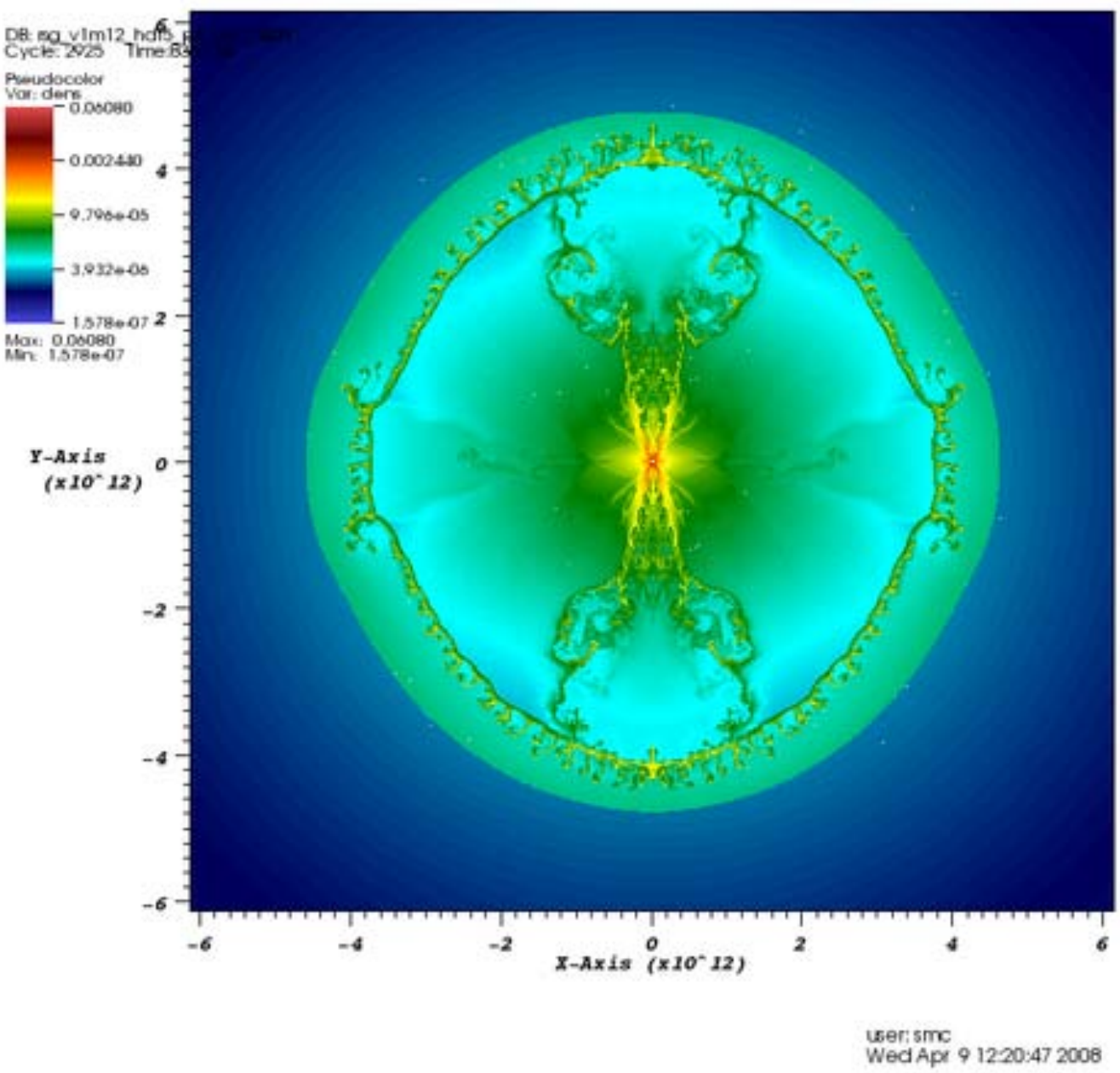
Supernovae show shapes consistent with (but not necessarily proving) jet-like flow.

Calculations show jets emerging from newborn neutron star can explode the star, make it out-of-round.

Predict a jet/torus “bagel and breadstick” shape

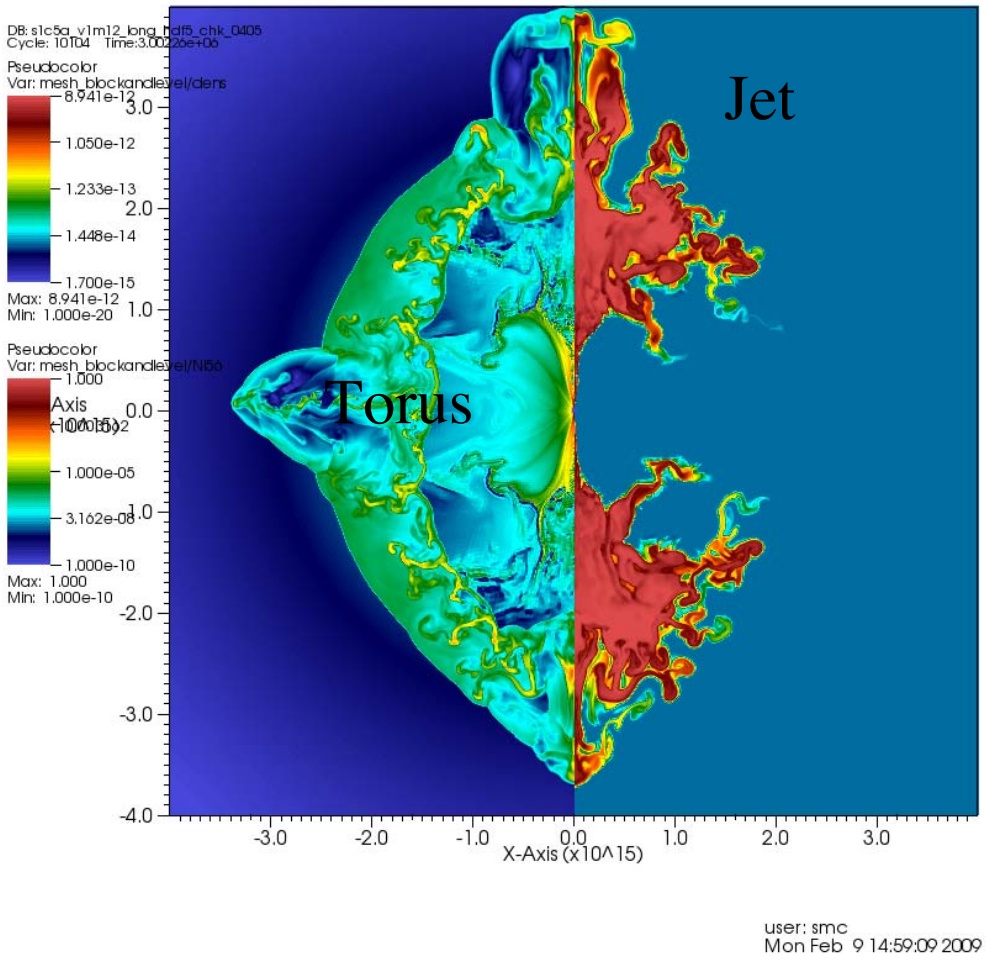
***What jets do*** -

Bagel and breadstick, jet/torus shape “natural.”




Explosion of two identical jets in a red giant star like Betelgeuse

Couch et al. 2009




Computer models predict a jet/torus, "bagel and breadstick" structure

Couch et al. 2009

*This is the first new idea to understand these supernovae in thirty years.*

Goal

To understand how jets may trigger a core –collapse supernova explosion

Discussion points

How does a supernova determine a direction is space?

How does a supernova produce a jet-like flow?

How to define a particular direction in space?

Rotation - rotation axis.

How to make a jet? Some variation on squeeze and squirt (toothpaste mechanism)

Rotate magnetic neutron star, amplify the magnetic field, eject mass if field is strong enough.

***Magnetic lines of force***, locus of equal field strength, act somewhat like rubber bands, they are elastic and tend to rebound if deformed and can be twisted and coiled.

Twisted magnetic fields have tension along them and exert pressure sideways and along the lines of force.

Rubber band - twist moves along the rubber band.