

February 15, 2010

Reading, Sections 6.4, 6.5. Sections 1.2, 2.1, 2.4, 2.5 for background.
Next week, Section 6.6, Chapter 7.

Astronomy in the News? Walter Morrison, inventor of the Frisbee, died at 90 on February 11.

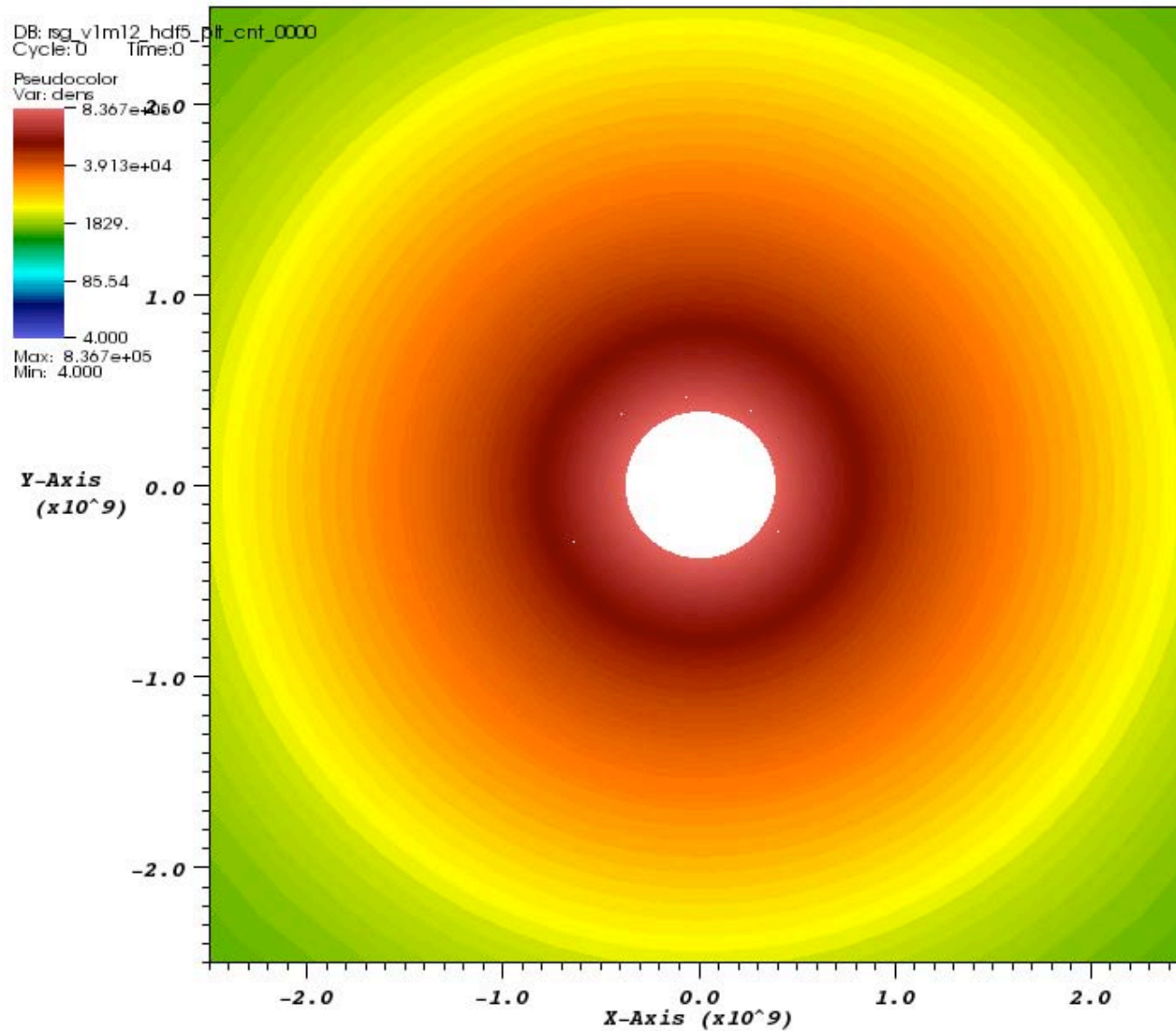
Astronauts are installing the last major module on the International Space Station called Tranquility after the first Lunar landing site (not Colbert)

Pic of the Day - Cassini spacecraft crosses plane of Saturn's rings.



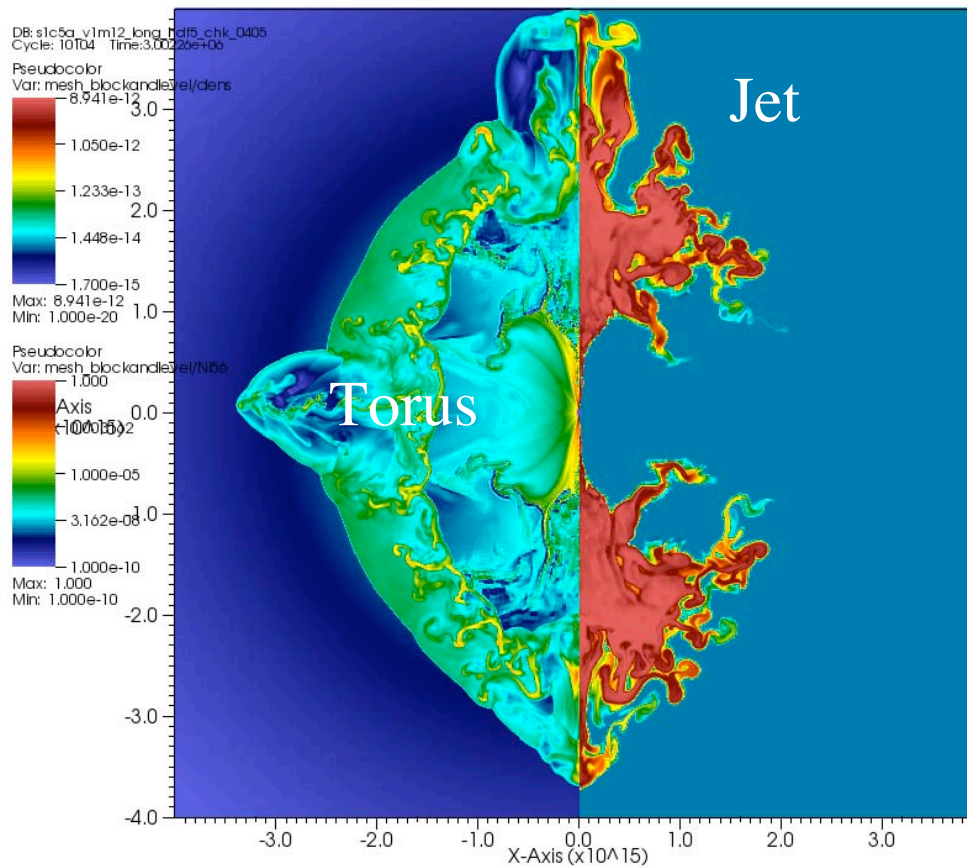
What jets do -

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



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

Couch et al.
 2009



user: smc
 Mon Feb 9 14:59:09 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.

Bagel and
Breadstick
Halloween
costume, 2008,
Marquette
University,
Milwaukee



Discussion points

How does a supernova determine a direction in 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.

What jets do -

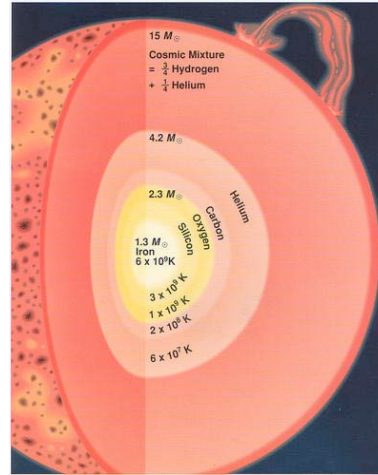
Bagel and breadstick, jet/torus shape “natural.”

Strong enough jet can explode the star, but neutrinos also play a role - complicated problem!

Account qualitatively for out-of-round polarization.

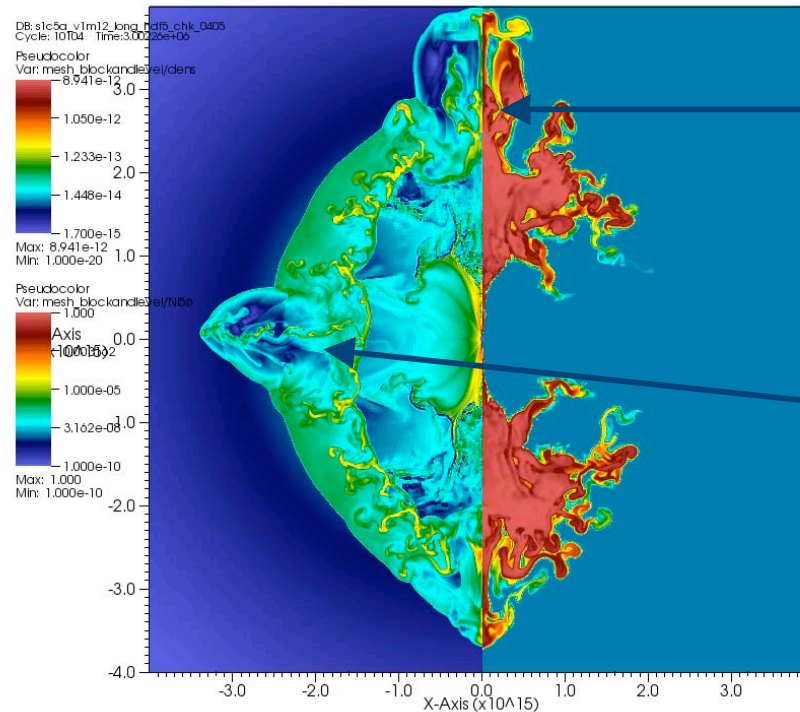
Test for shape (jet/torus), prediction of different elements exploded in different directions.

Initially spherical model,



Spherical Explosion oxygen, silicon, calcium, and iron would be exploded in all directions

Jet-induced Explosion axis/torus structure



jet
 “iron”
 bread
 stick
 torus,
 O, Ca,
 bagel

One Minute Exam

Why do astronomers think that jets may be involved in the core collapse explosion of massive stars?:

➡ Iron makes jets

← Jets make calcium and oxygen

↑ Cassiopeia A has a collapsed object in the center of the explosion

↓ All core collapse supernovae are out of round