

10/18/06

Exam 2, Chapters 6, 7, **This Friday**

Review sheet posted

Review session **Tomorrow** 5 PM RLM 4.102 [NOTE different room than help sessions].

News? Earthquake in Hawaii,
some damage of telescopes,
instruments on Mauna Kea

Pic of the day - bubble blown by a
stellar wind



Start of material for Test 3

Chapter 8, Neutron Stars

NEUTRON STARS (Chapter 8)

mass of Sun

radius ~ 10 km, size of a city

density like atomic nucleus (even a few times more!)

gravity at surface huge - crush human

highest “mountain” ~ 1 foot

Pulsars - rotating magnetic neutron stars

~600 radio pulsars known

“active” for ~1-10 million years, then magnetic field decays or aligns → *no radiation*

Probably ~ billion “inactive” neutron stars ~1% of all stars in the galaxy

To radiate, pulsars must be magnetic:

Wiggle magnetic field \Rightarrow wiggle electric field
 \Rightarrow wiggle magnetic field \Rightarrow *Electromagnetic radiation*

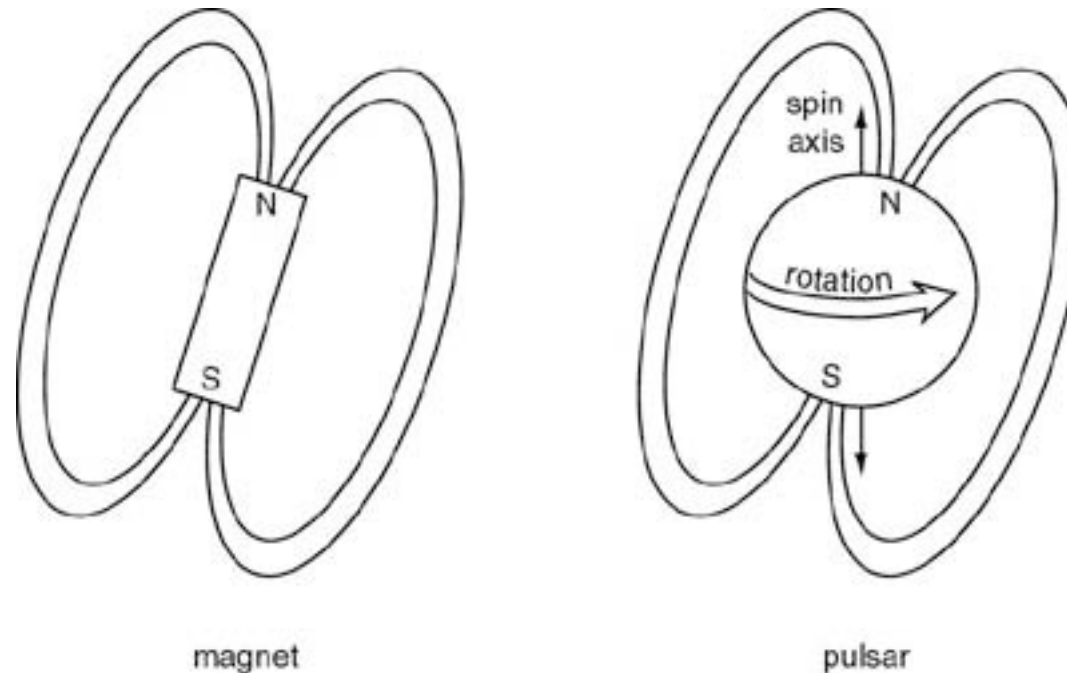
Simplest configuration North, South poles *Dipole*
“lines of force” connecting poles

Magnetic axis must be tilted with respect to the rotation axis

If the magnetic axis is aligned with the rotation axis, the system is too symmetric to “wiggle”

Magnet, filings

Pulsars are rotating, magnetic neutron stars with magnetic axis tilted with respect to spin axis.



Most pulsars rotate about once per second, young ones faster, Crab pulsar rotates 30 times per second - would rip apart anything but a neutron star

Radio emission from “sparks” “thunderstorms” at poles or “speed of light” cylinder

Poles: whip magnetic field around \Rightarrow huge Electric fields create huge currents, “thunderstorms” \Rightarrow radio “static”

Radiation is beamed from magnetic poles, see “pulses” by “lighthouse” mechanism

Flashlights

Combination of quantum pressure from neutrons and repulsion of neutrons at very close distances by strong nuclear force \Rightarrow pressure to withstand gravity.

Analog of Chandrasekhar mass - maximum mass of neutron star - uncertainty over nuclear repulsion, maximum mass $\sim 2 M_{\odot}$

Vast majority of 600 pulsars are alone in space

~ dozen have binary companions

Binaries special - use Kepler's laws to measure mass

orbital decay \Rightarrow Gravitational Radiation Nobel Prize 1993

Recent discovery 2 radio pulsars in eclipsing binary system, fascinating new laboratory, extra information from eclipses.

Binary radio pulsars - no mass transfer, would kill radio mechanism.

With mass transfer \Rightarrow X-rays, another story