

## SOLAR ECLIPSE

SUN, MOON, AND EARTH  
LINE UP WITH THE MOON IN THE MIDDLE



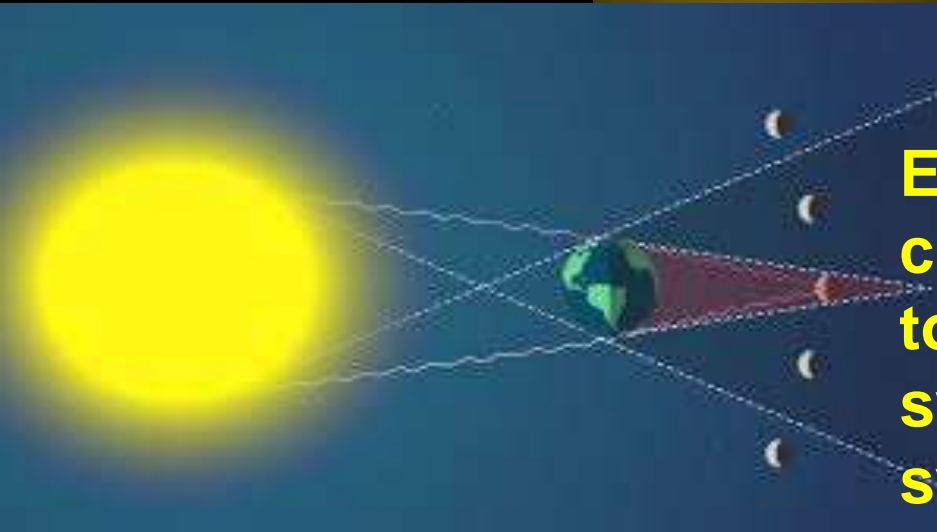
FULL SHADOW  
(UMBRA)

PARTIAL SHADOW  
(PENUMBRA)

MOON

EARTH

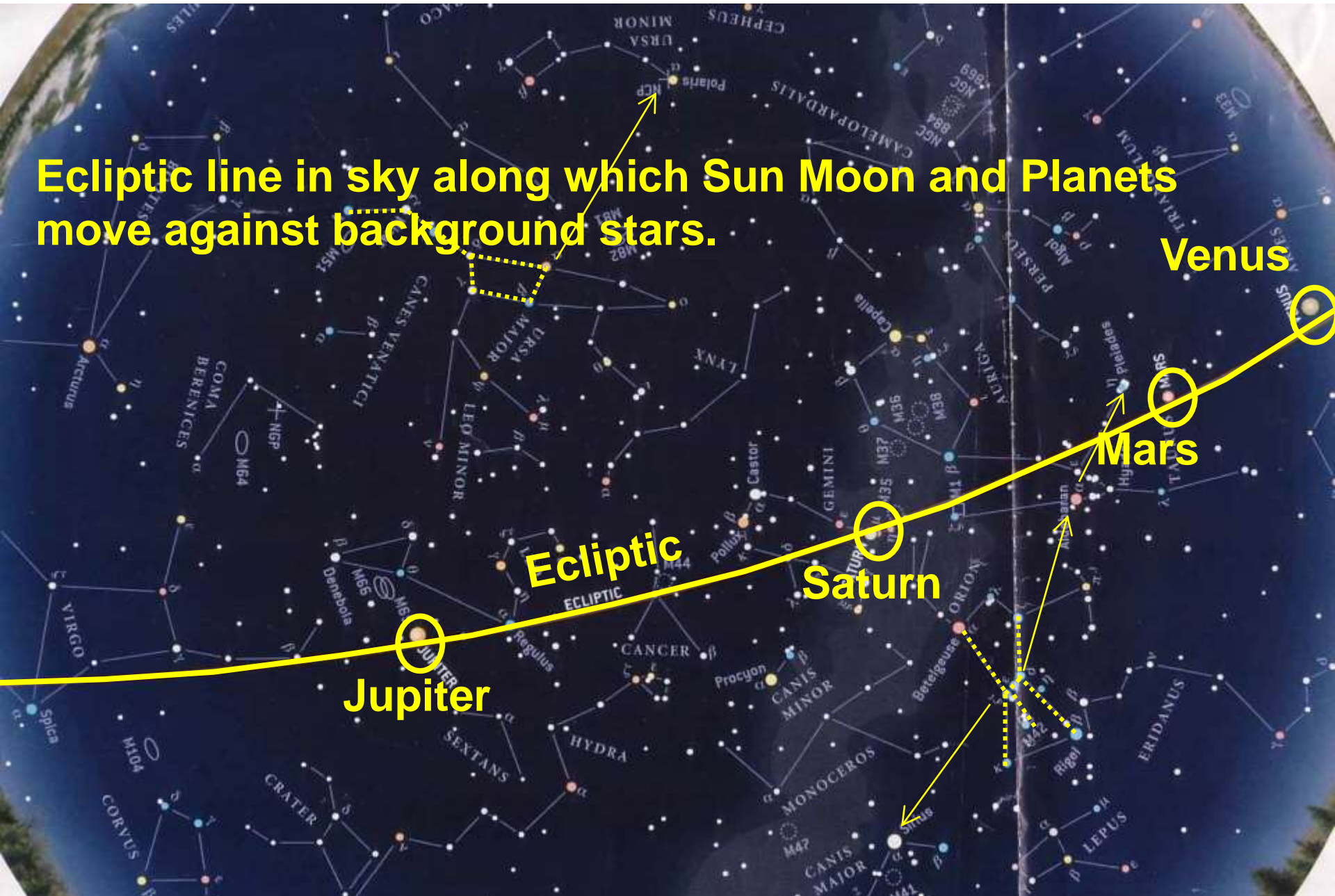
MOON'S ORBIT



Eclipse reminds us that rotating cloud gravitationally collapses to a pancake shaped solar system. (same for planet-moon systems)



**Ecliptic line in sky along which Sun Moon and Planets move against background stars.**



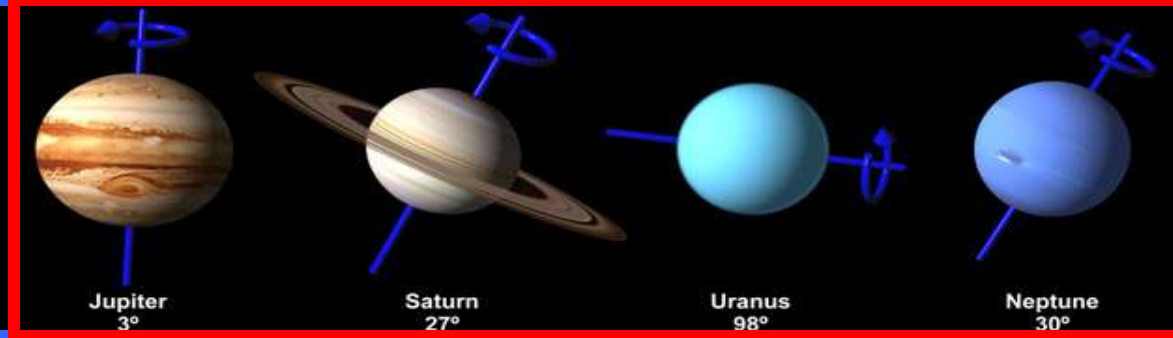
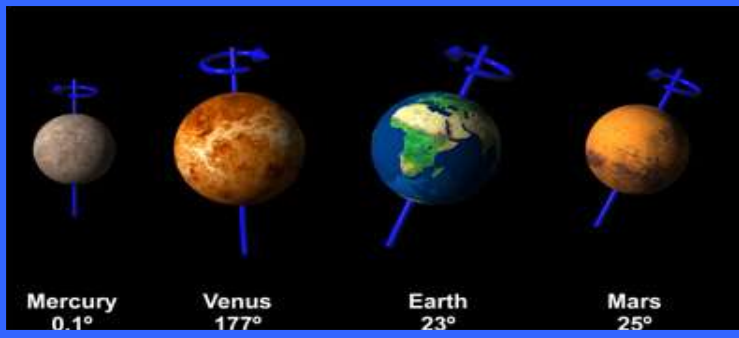
**Venus**

**Mars**

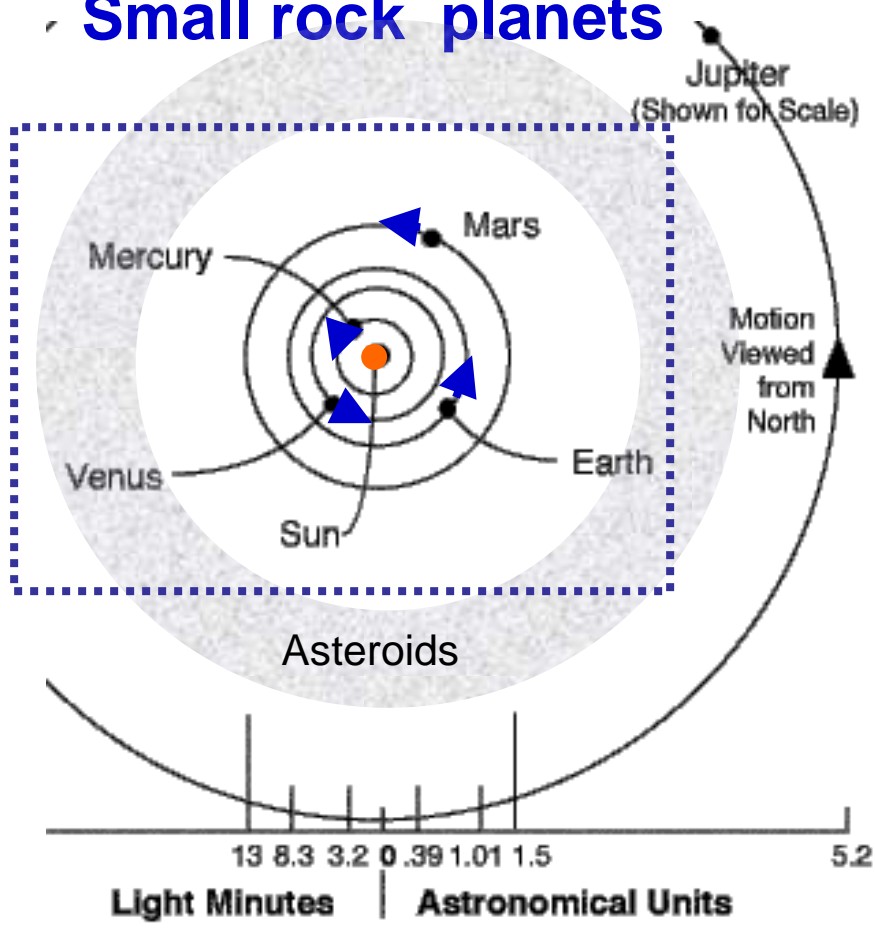
**Saturn**

**Jupiter**

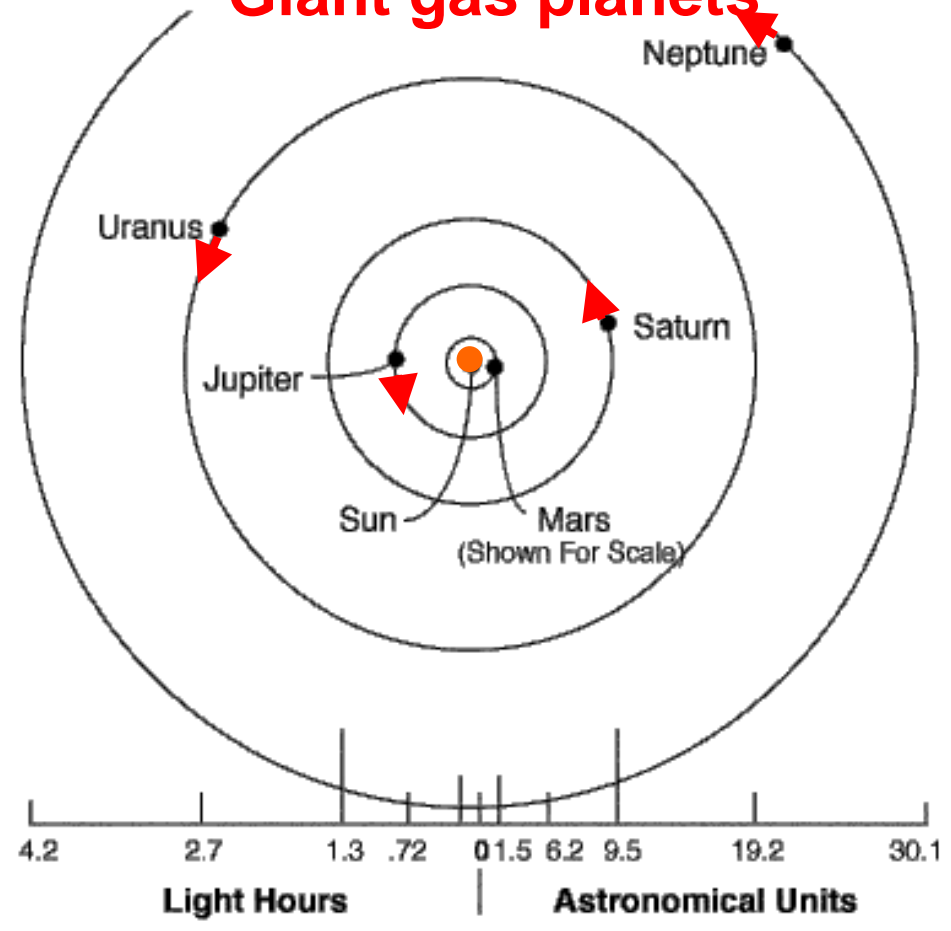
**Ecliptic**



**Small rock planets**



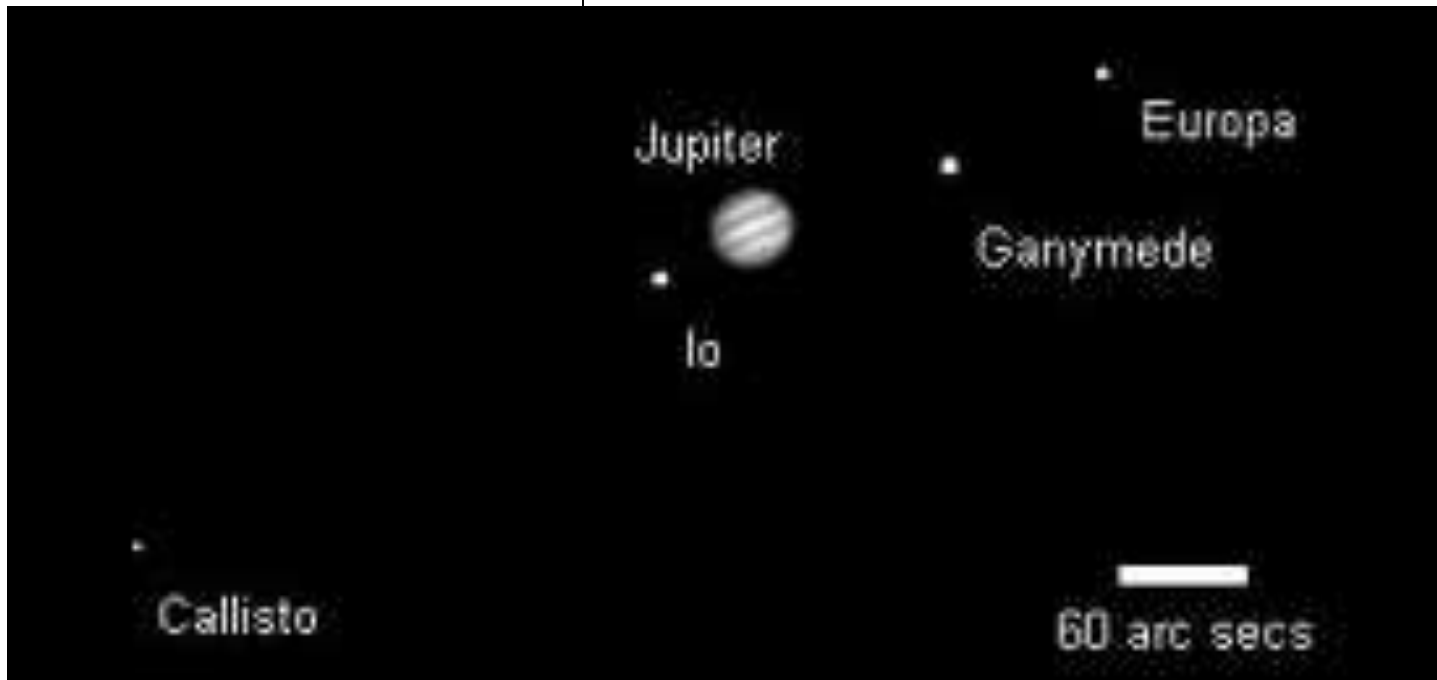
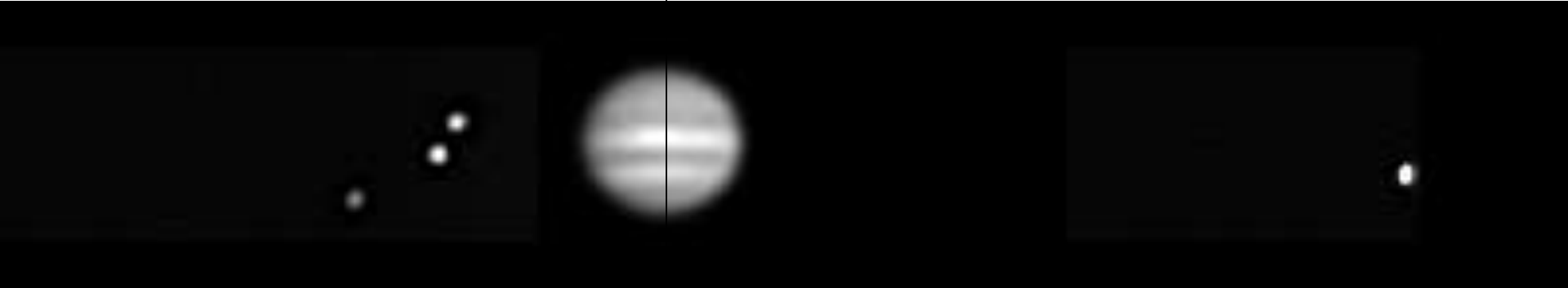
**Giant gas planets**



**Note : all rotate the same direction**

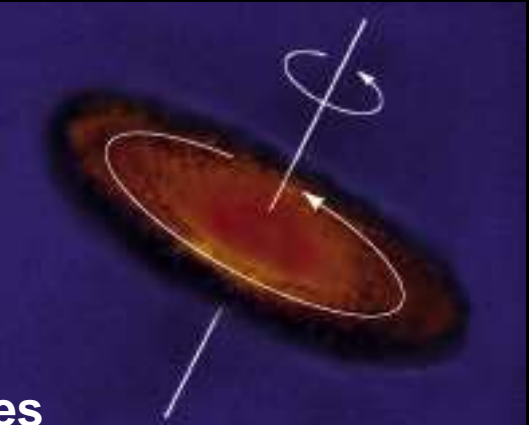
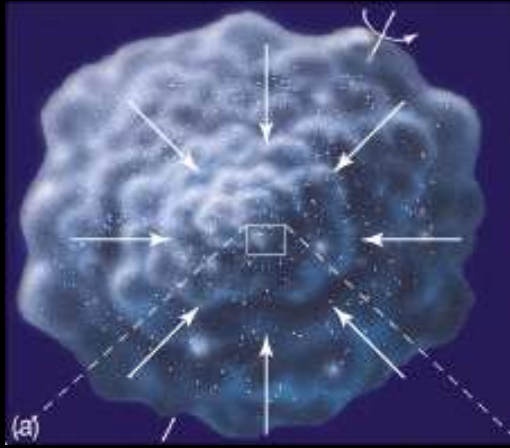
# Even moons all rotate the same direction

Jupiter & moons  
Io, Europe, Ganymede, Callisto

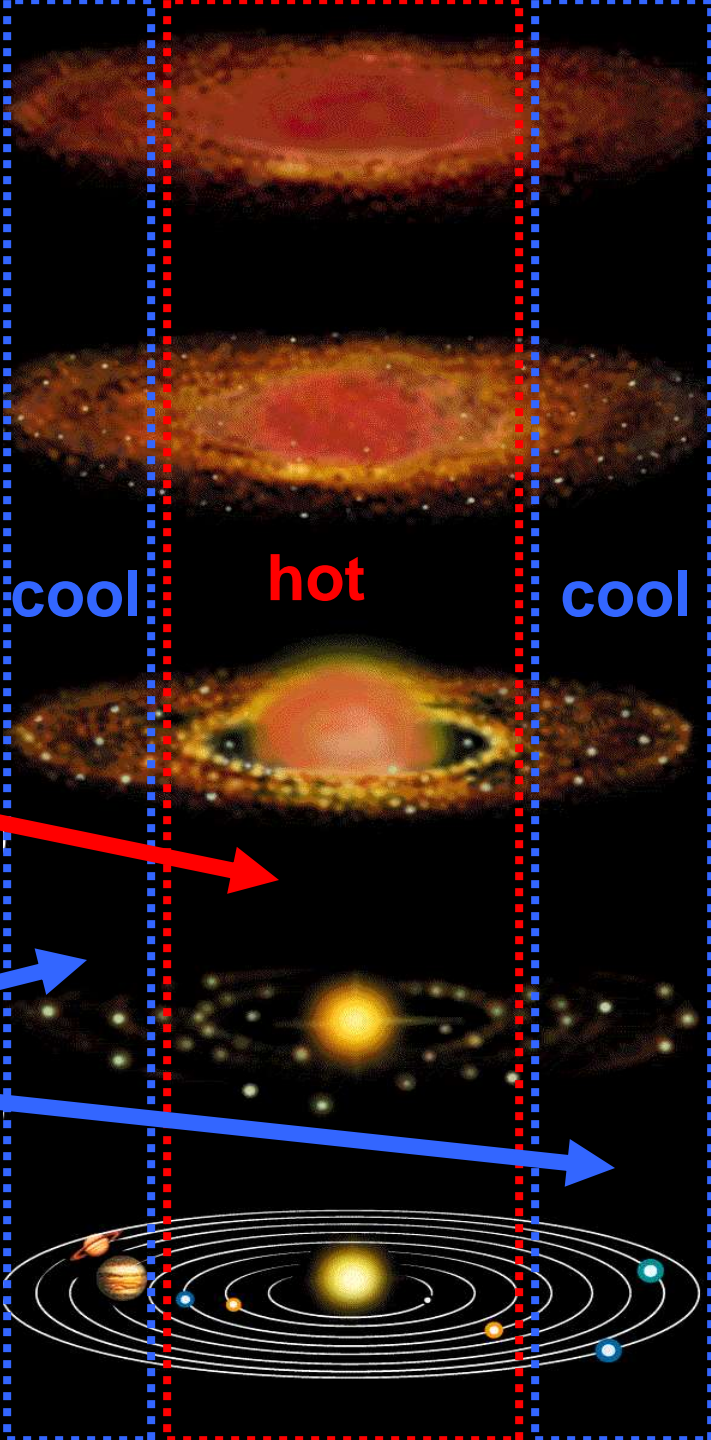




# Sun/solar system- gravity causes cloud to collapse



Rotation of cloud causes pancake shape of solar system



In hot inner part rocks and metals condense

In cool outer part ices H and He condense

Solar system rotation from the cloud rotation

# Why pancake shape ?

“ to keep rotation constant” [Angular Momentum]

Measure quantity of rotation

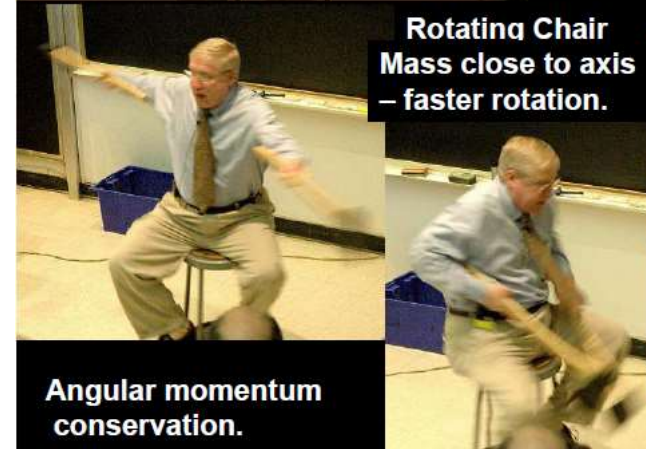
$$L = m r v$$

L: angular momentum

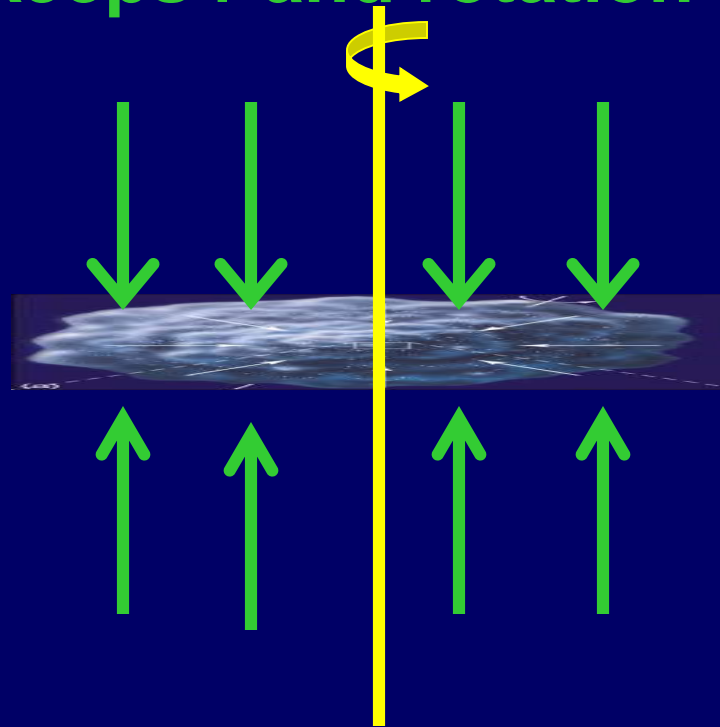
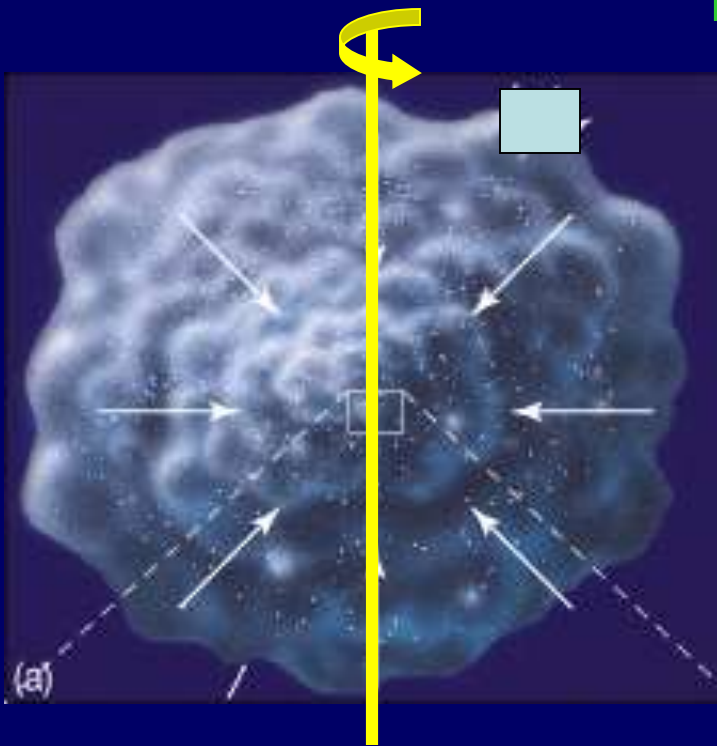
m: mass v: speed

r: distance from rotation axis

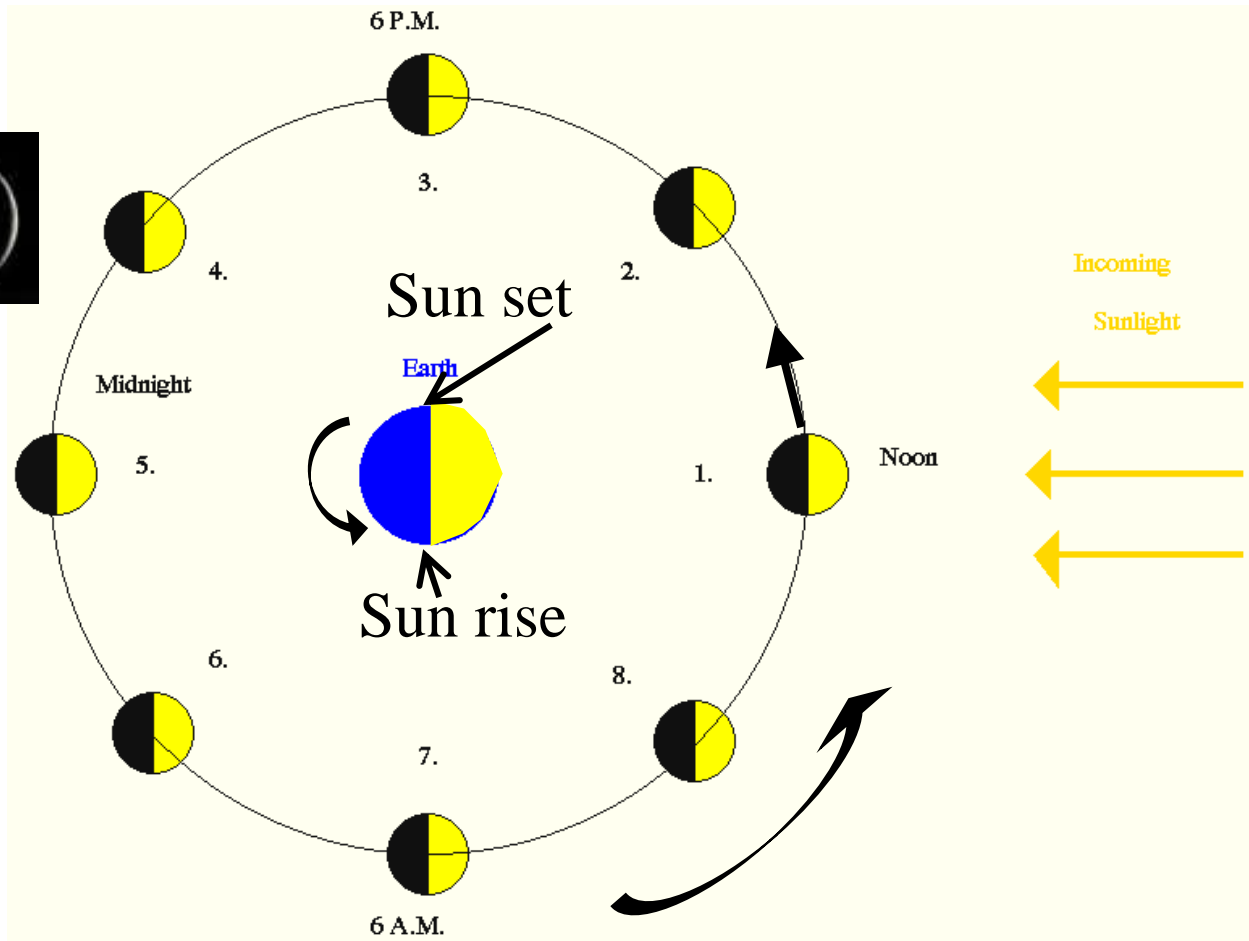
(r is very important)



Collapse in this direction  
keeps  $r$  and rotation constant



# Lunar Phases



1

2

3

4

5

6

7

8

New Moon

Waxing Crescent

First Quarter

Waxing Gibbous

Full Moon

Waning Gibbous

Last Quarter

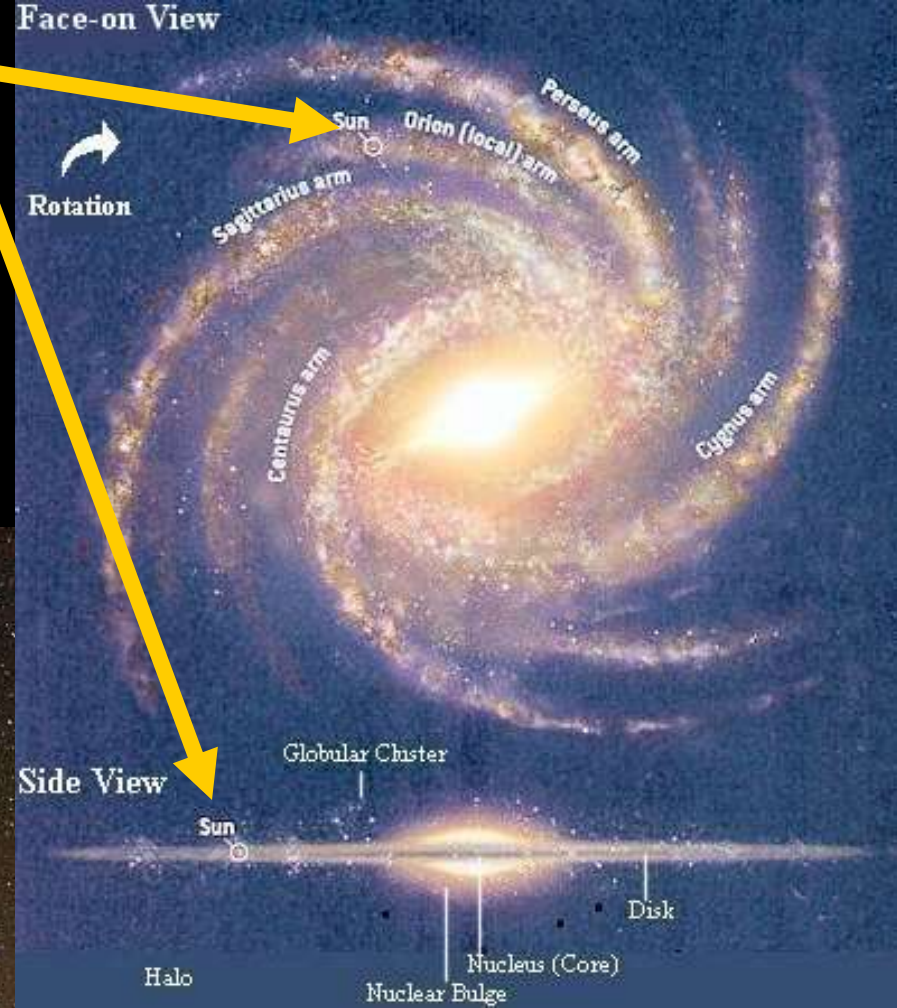
Waning Crescent



# Our Galaxy "The Milky Way"

A Spiral Galaxy

# Sun

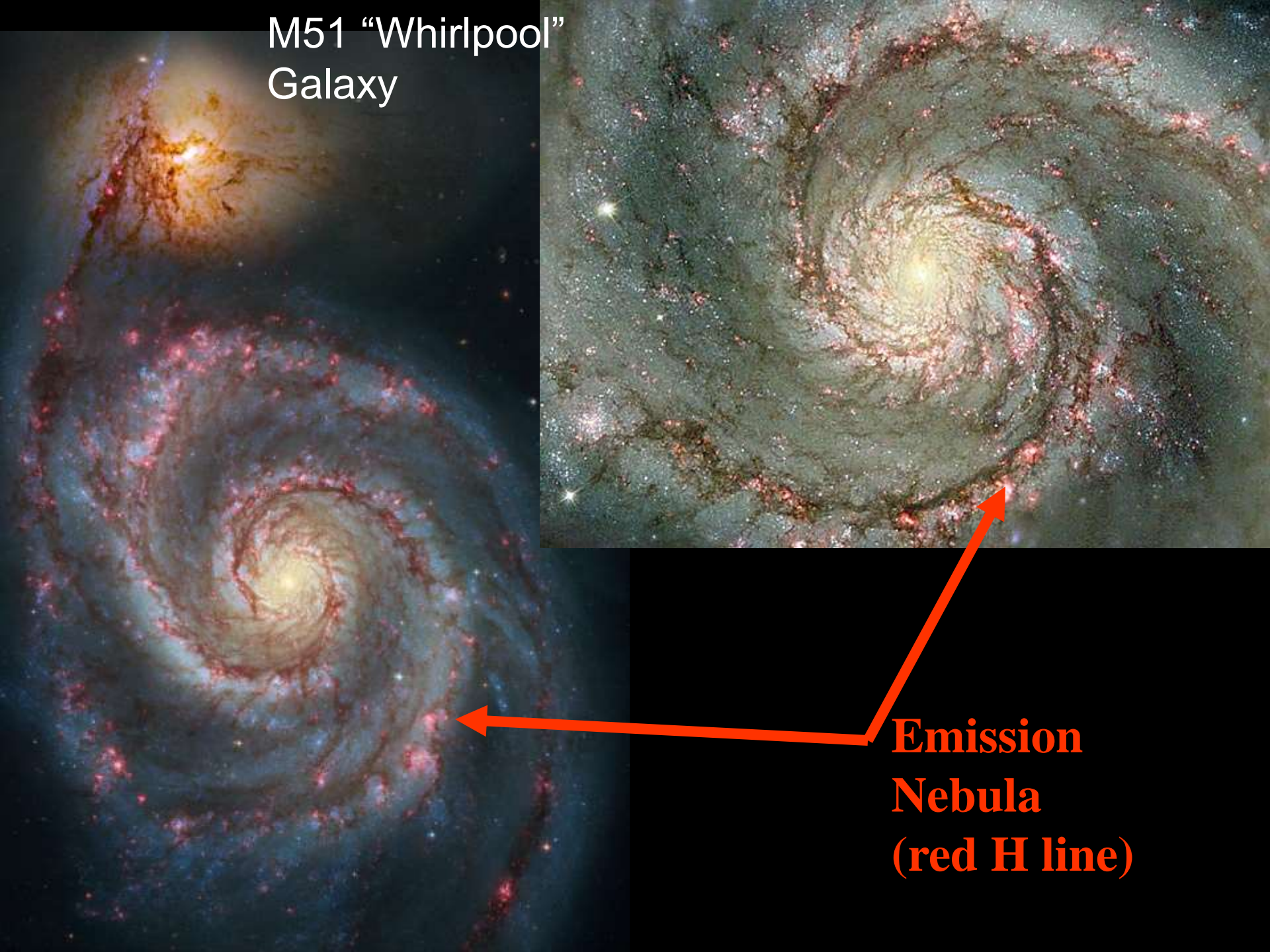


# Andromeda Galaxy





M51 “Whirlpool”  
Galaxy



**Emission  
Nebula  
(red H line)**

