

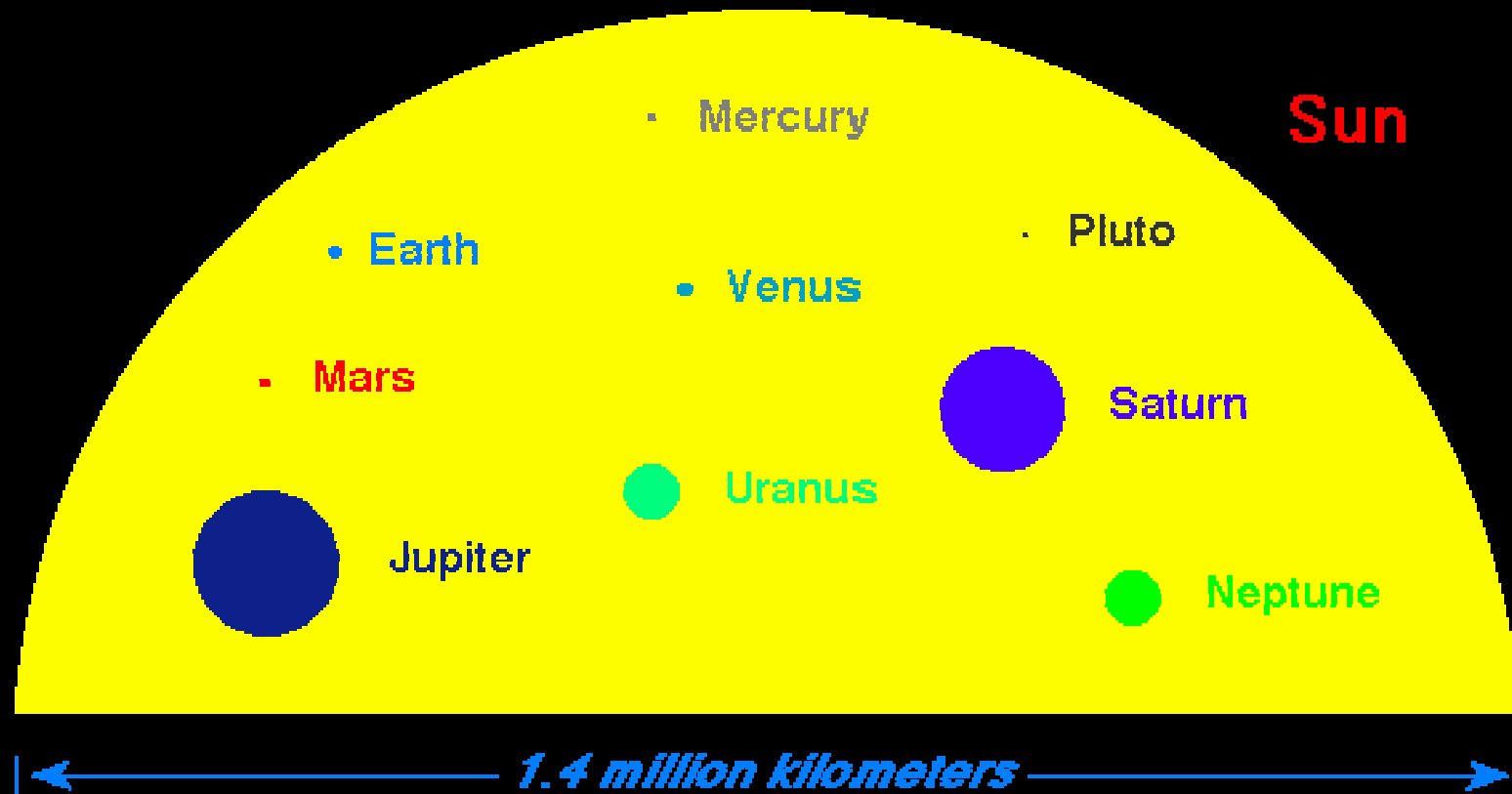
# The Jovian Planets



**The properties of the Jovian Planets (Jupiter, Saturn, Uranus, Neptune) are much different than those of the Terrestrial Planets. Most of our knowledge of the Jovian planets comes from observations by Pioneer 10 and 11, Voyager 1 and 2, Galileo and HST. The Cassini flew by Jupiter and is on its way to Saturn**

# Jovian Planets: Density

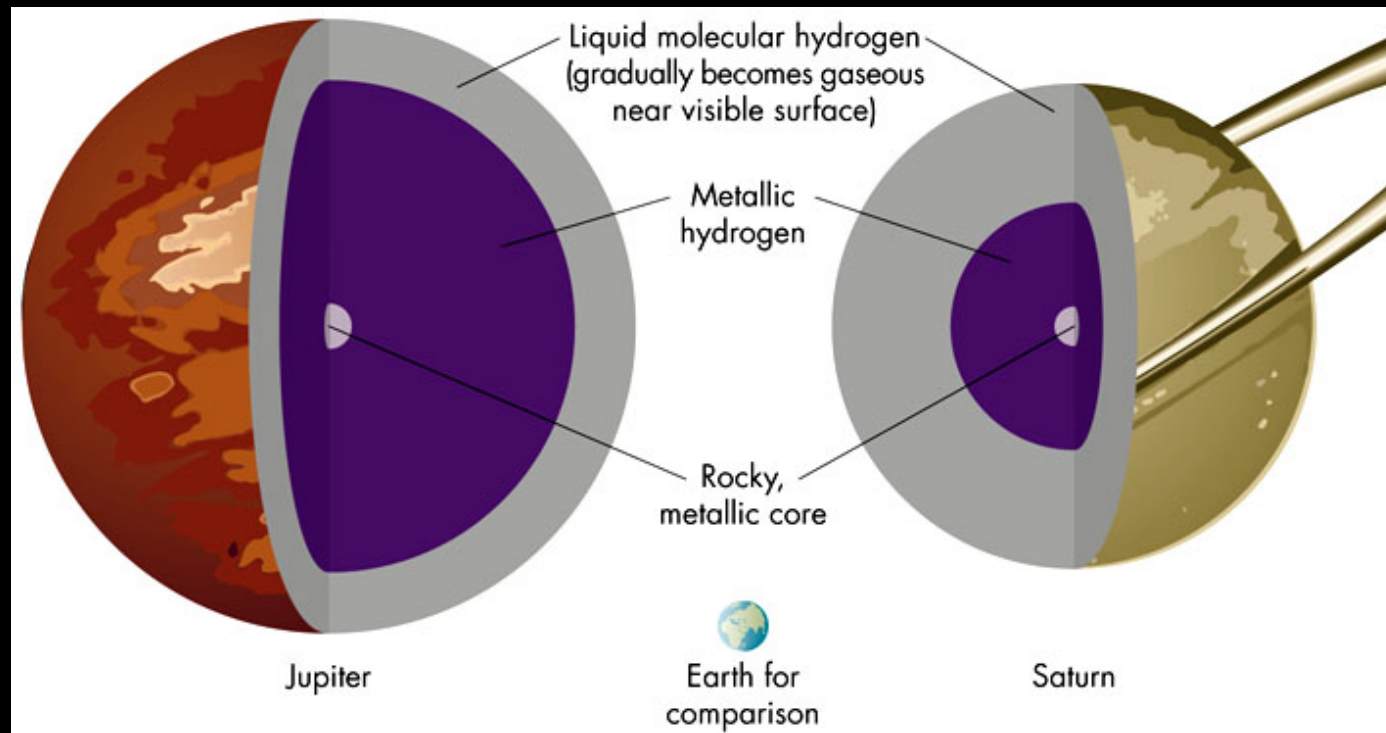
While the Jovian Planets have much larger diameters and are much more massive than the Terrestrial Planets, their densities are much smaller.



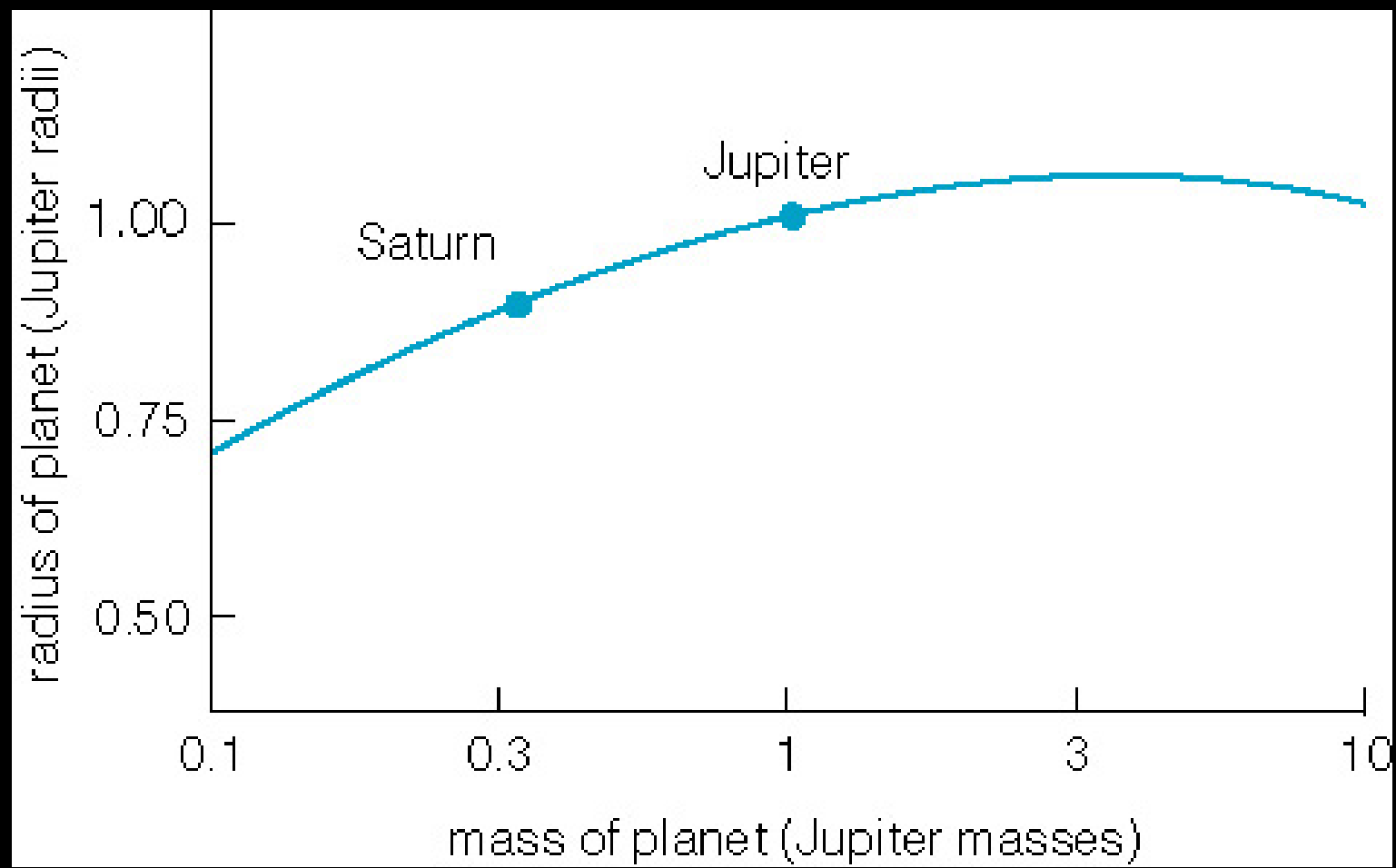
## Jovian Planets: Density

<b>Earth</b>	<b>5520 kg/m<sup>3</sup></b>
<b>Moon</b>	<b>3340 kg/m<sup>3</sup></b>
<b>Neptune</b>	<b>1600 kg/m<sup>3</sup></b>
<b>Jupiter</b>	<b>1330 kg/m<sup>3</sup></b>
<b>Uranus</b>	<b>1300 kg/m<sup>3</sup></b>
<b>Water</b>	<b>1000 kg/m<sup>3</sup></b>
<b>Saturn</b>	<b>690 kg/m<sup>3</sup></b>

# Jovian Planets: Composition



**The densities suggest that the composition of the Jovian Planets is dominated by lighter material. Jupiter and Saturn likely have a small rocky metallic core, surrounded by liquid metallic hydrogen (which forms under extreme pressure). Temperature in the core many times hotter than Earth.**



# **Jupiter and Saturn: Magnetic Fields**

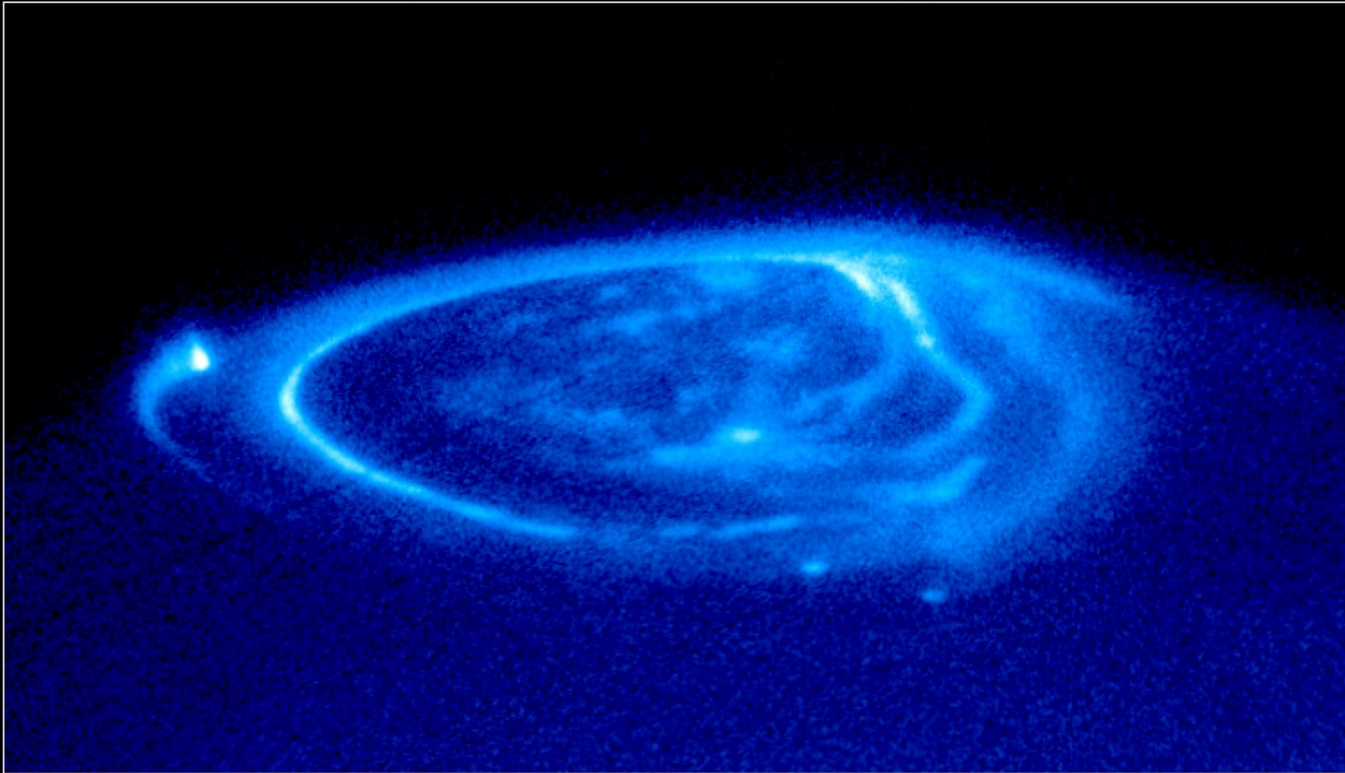
**The rotational periods of Jupiter and Saturn are short:**

**Jupiter 9.9 hours**

**Saturn 10.7 hours**

**Both Jupiter and Saturn have magnetic fields that are very strong compared to Earth and thus they have magnetospheres and aurora.**

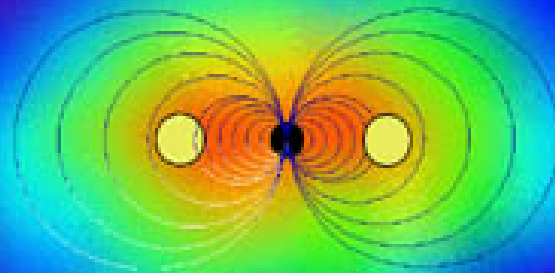
# Polar Aurora on Jupiter (from HST)



**Jupiter Aurora**  
**Hubble Space Telescope • STIS**

NASA and J. Clarke (University of Michigan) • STScI-PRC00-38

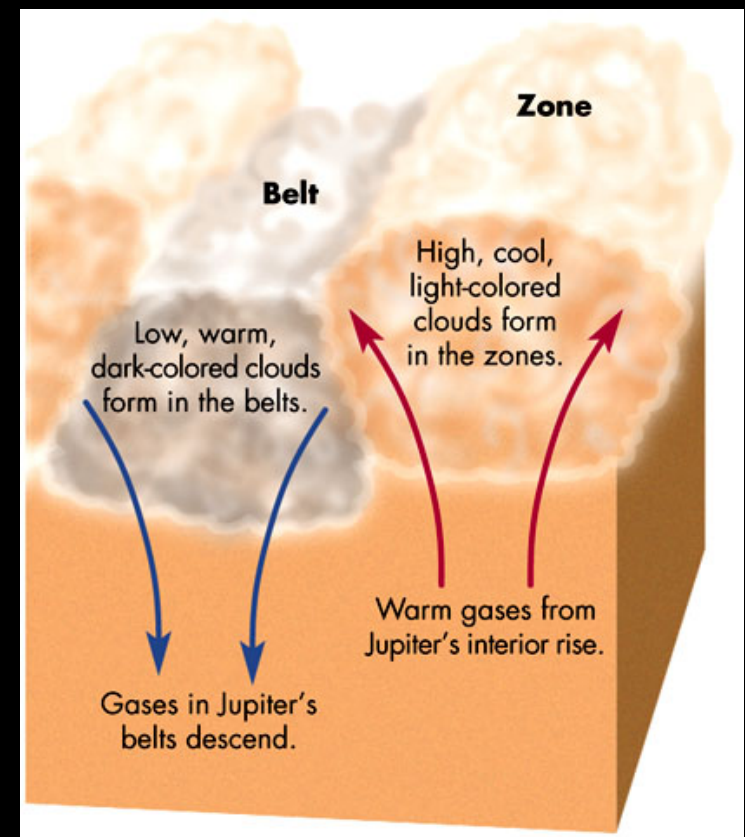
# Energetic Neutral Imaging (Galileo) of Jupiter's Magnetosphere



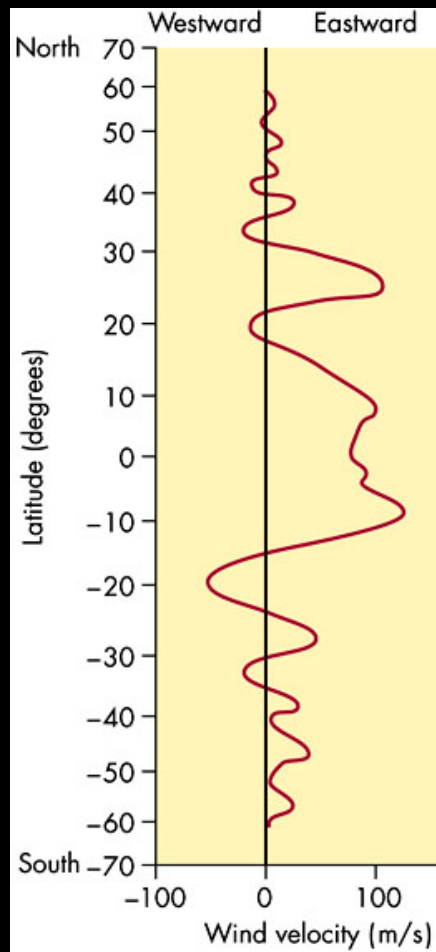
## Polar Aurora on Saturn (from HST)

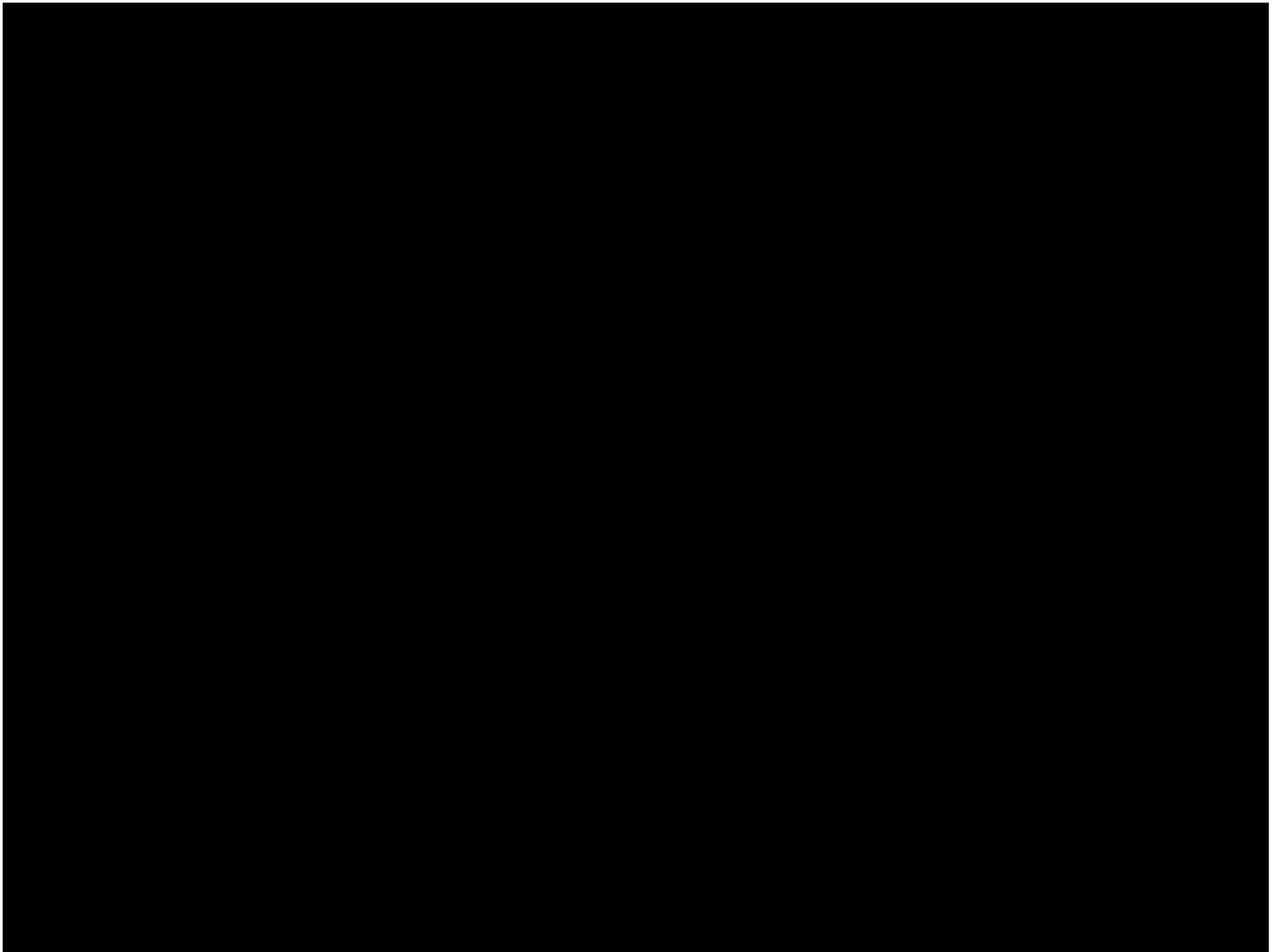


# Jupiter Bands and Zones



# Jupiter: Zonal Winds





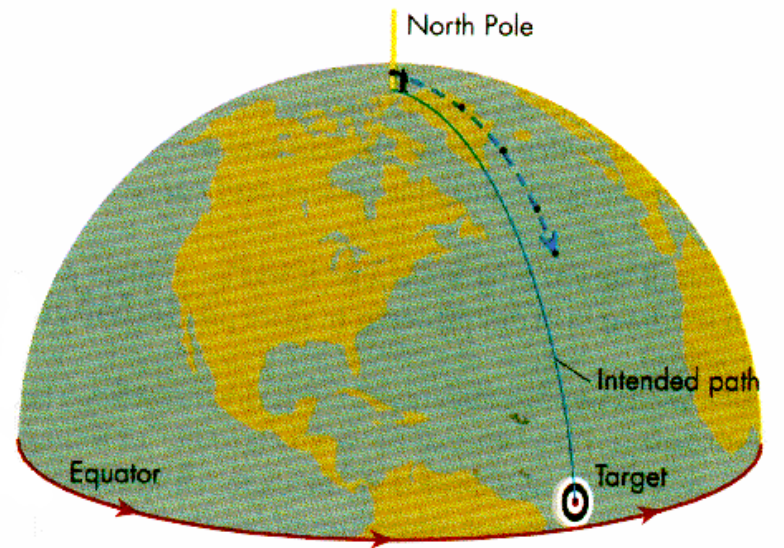
# Coriolis Effect

**The Coriolis effect is an apparent deflection of a moving object due to the rotation of the Earth. To us who are rotating with the Earth, it appears that the object experiences a force. However there is no push or pull on the object (we are actually experiencing the force).**

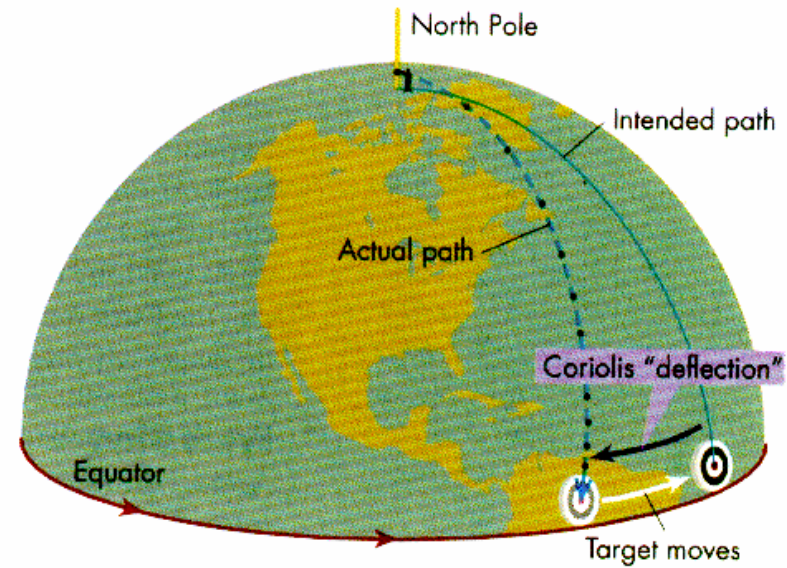
# Coriolis Effect

As observed by someone on Earth, the equatorward (southward) moving object appears to be “deflected” to the West.

If the object were moving polrward (northward), it would appear to be “deflected” to the East.



Rotating Earth



Rotating Earth

## Rotation and Coriolis

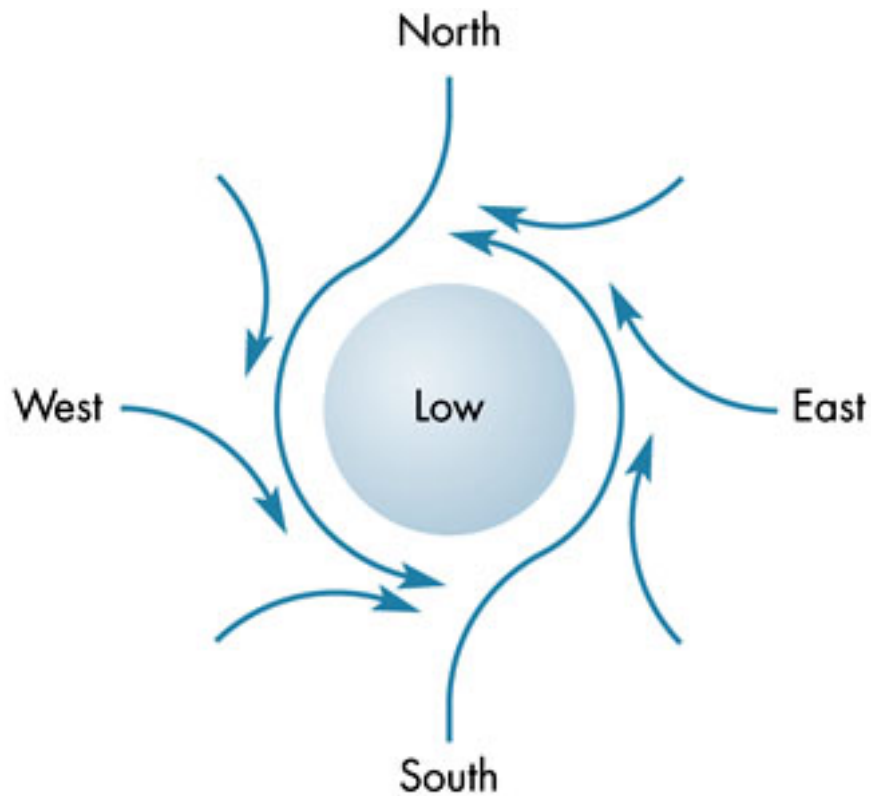
**Suppose that there was a localized region of low pressure in the *northern hemisphere*. Since air (or any fluid) flows from high to low pressure, air would converge from all directions on the low pressure region.**

**Due to the Coriolis Effect air moving equatorward toward the low pressure region would be “deflected” to the West.**

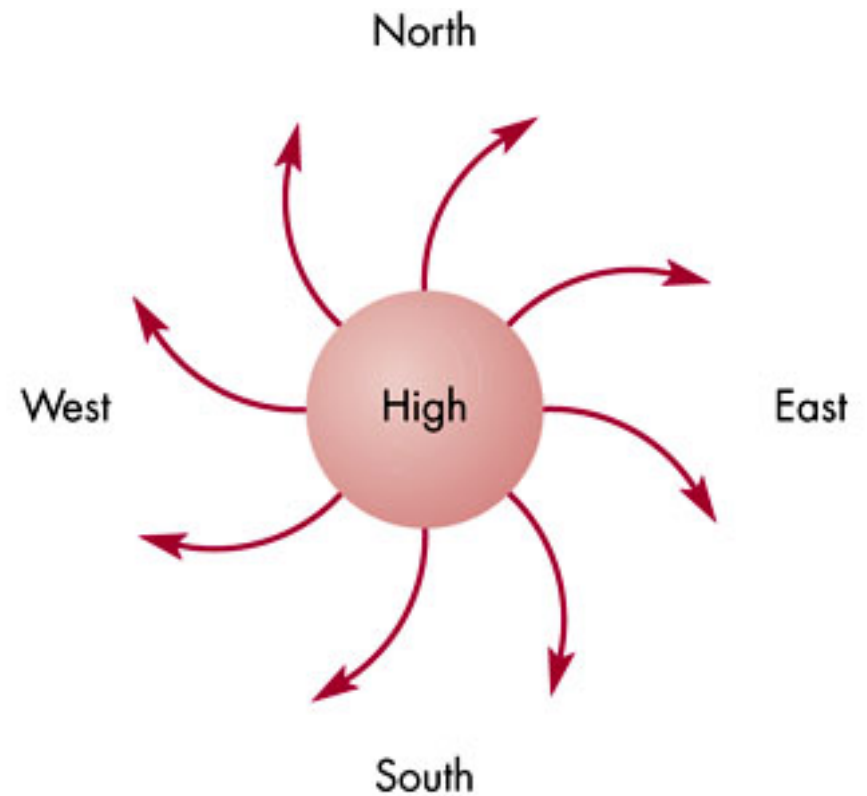
**Due to the Coriolis Effect air moving poleward toward the low pressure region would be “deflected” to the East.**

**Looking down on the Earth a counterclockwise circulation pattern (such as that observed with a hurricane) would be established. (Clockwise circulation is established in the *southern hemisphere*.)**

# The Circulation Pattern Around Low-Pressure and High Pressure Regions



**A** Low-pressure region in northern hemisphere



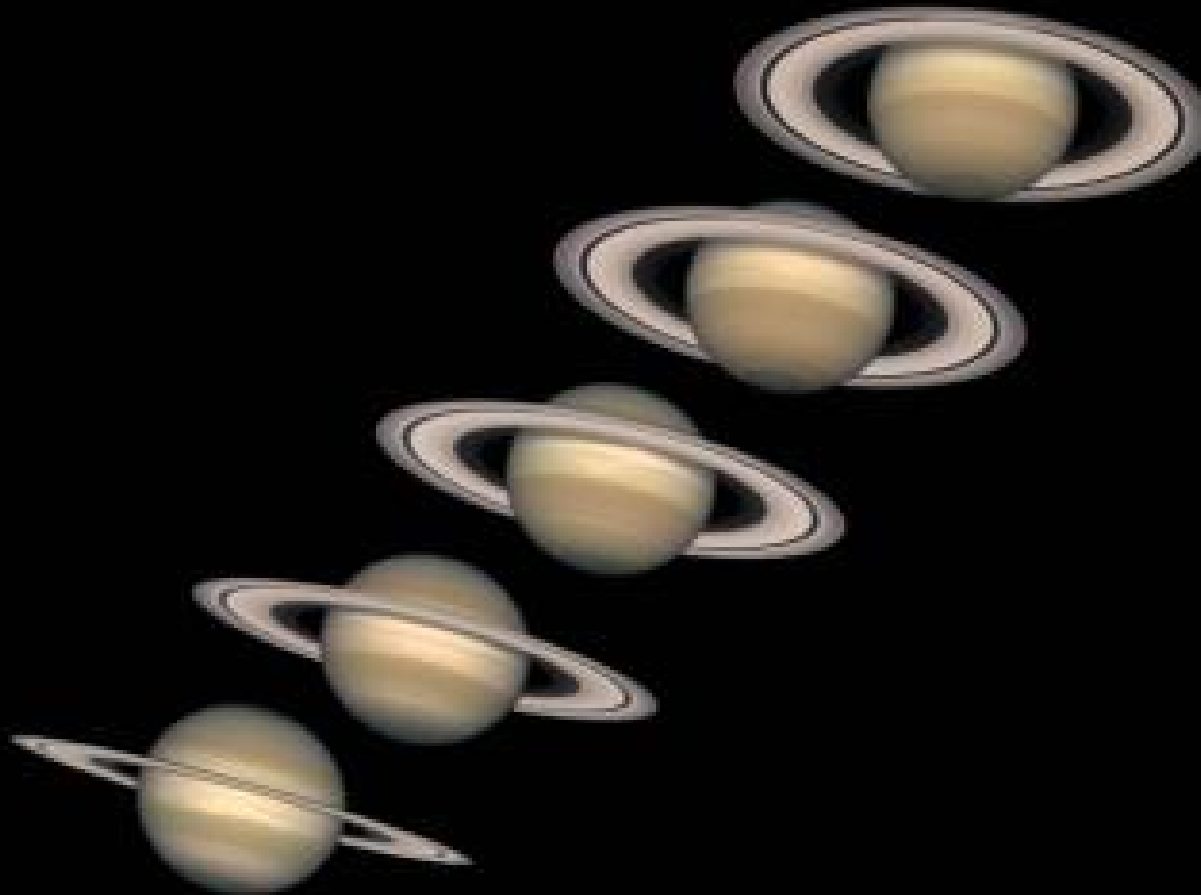
**B** High-pressure region in northern hemisphere

# Jupiter: Great Red Spot

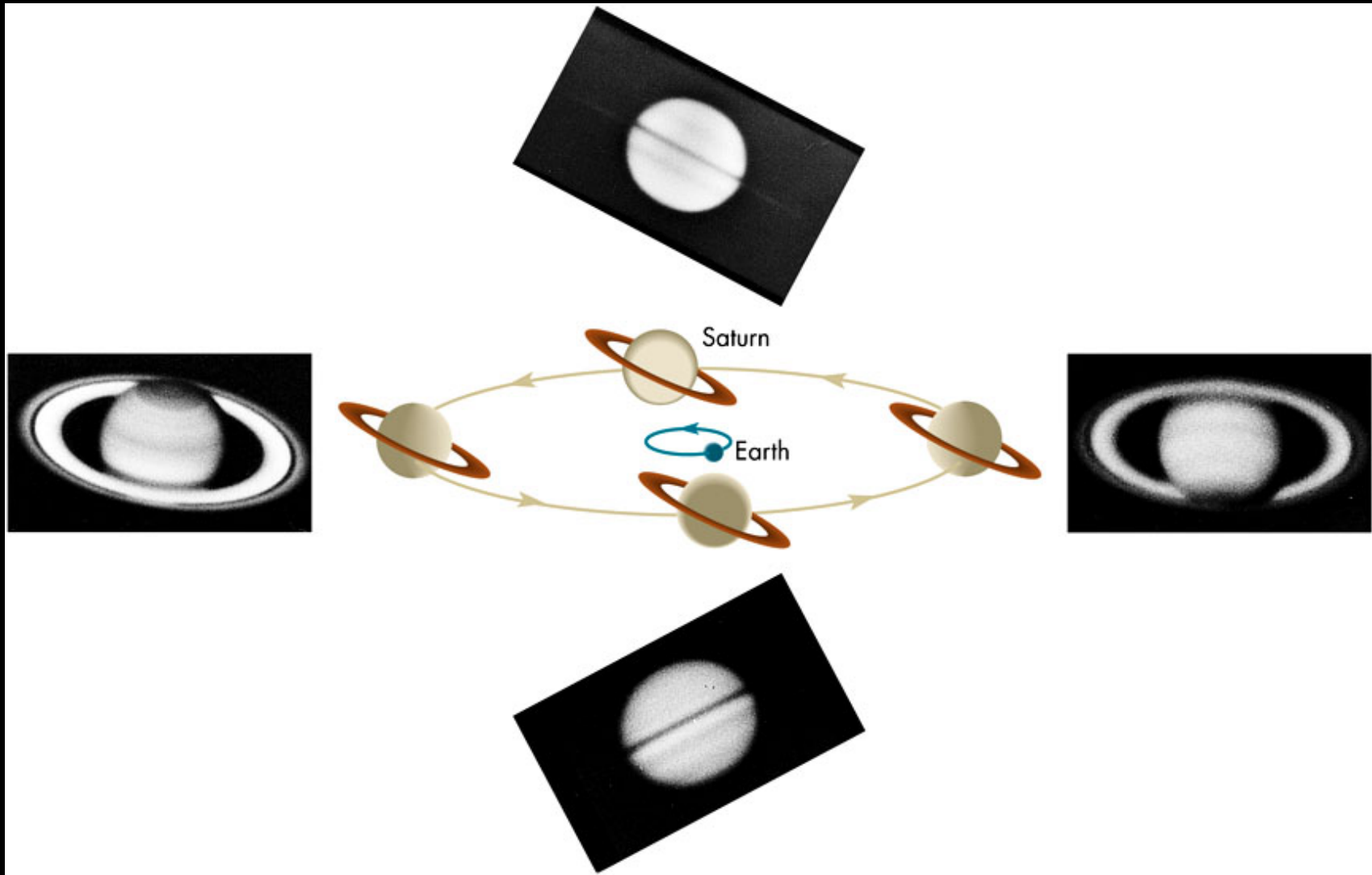


**Jupiter' Great Red Spot has a counter clockwise rotation which for the southern hemisphere is consistent with a region of high pressure**

# Saturn From Earth 1996 to 2000



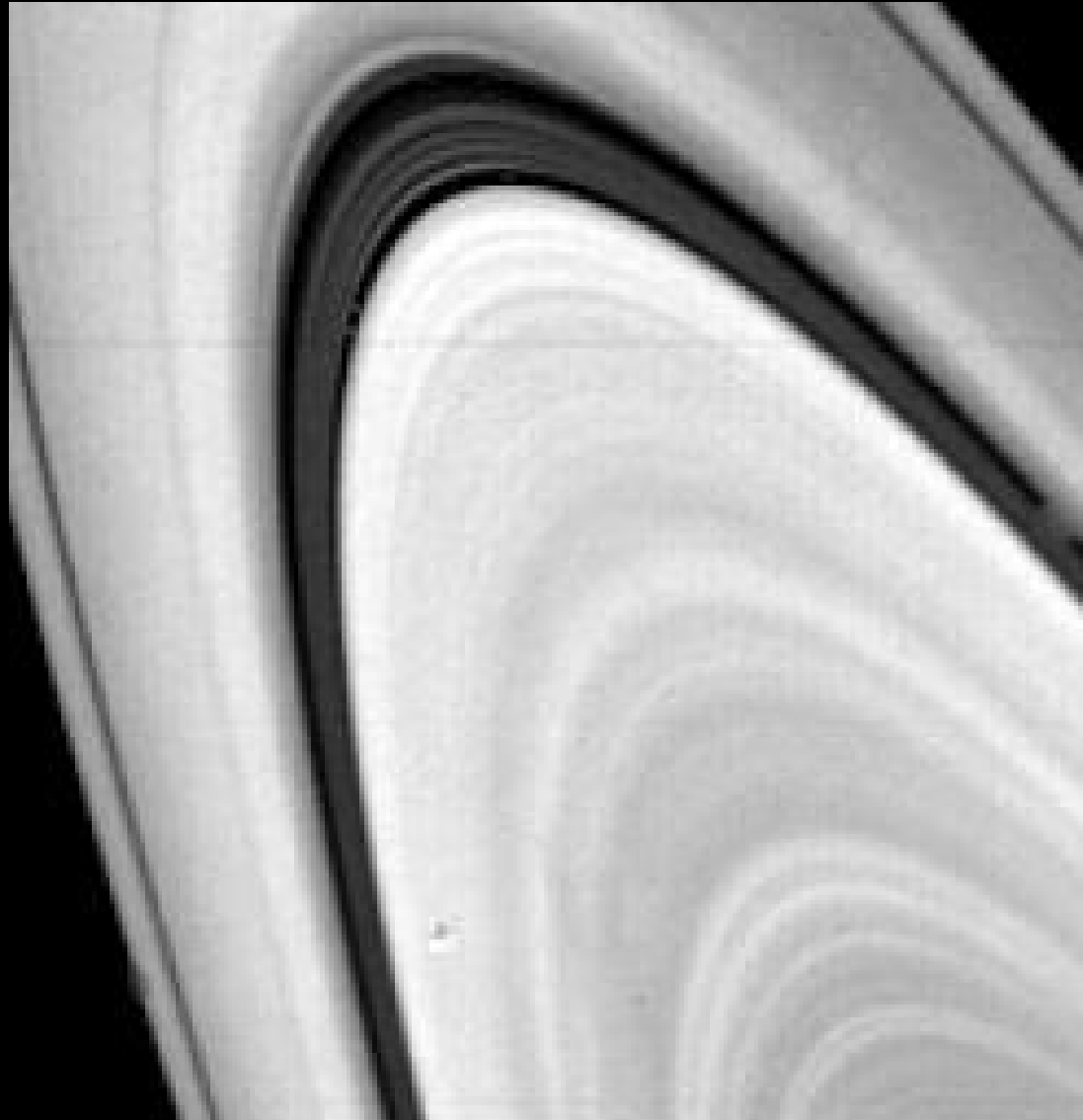
# Saturn: Views from Earth



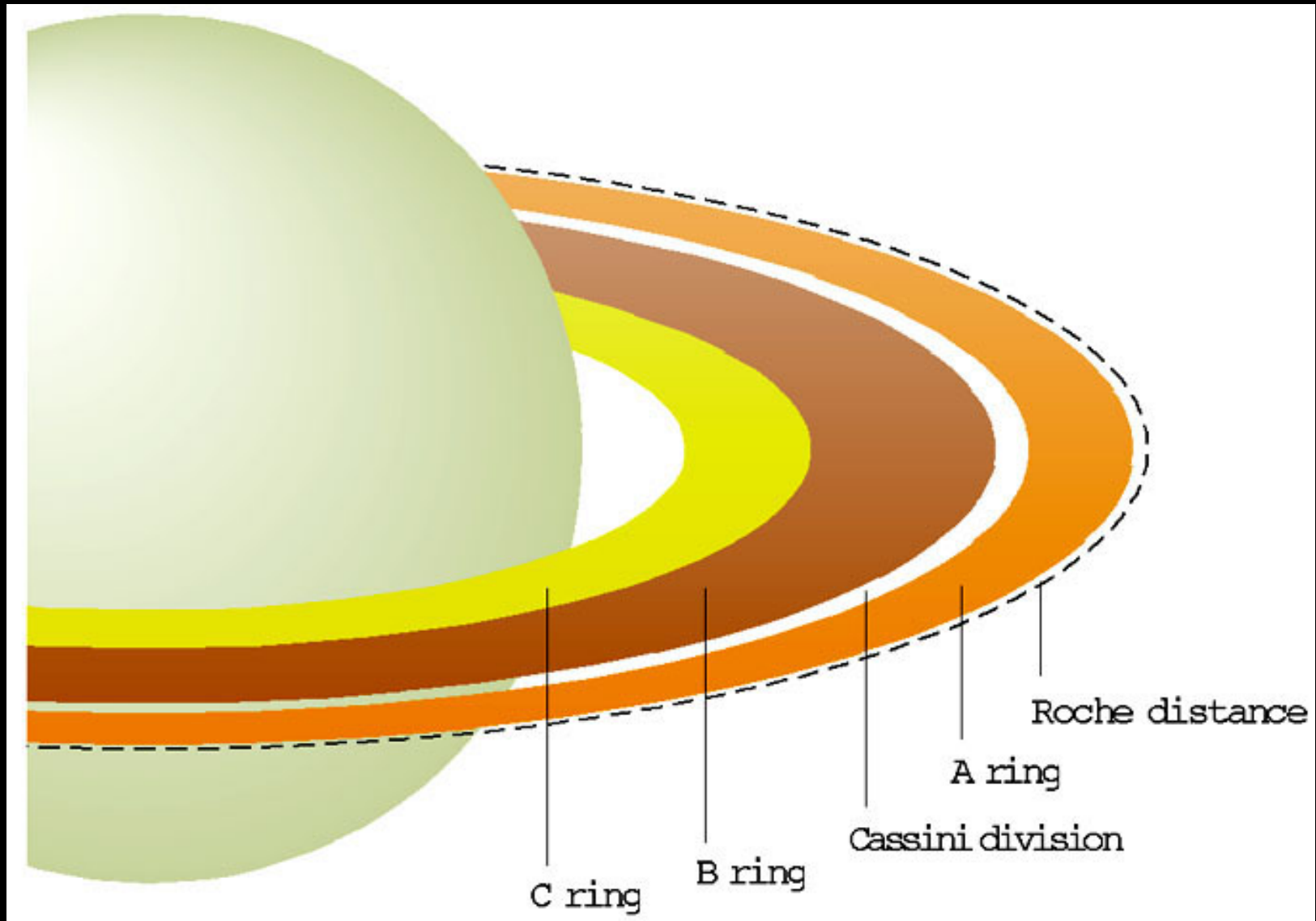
# Saturn: Rings



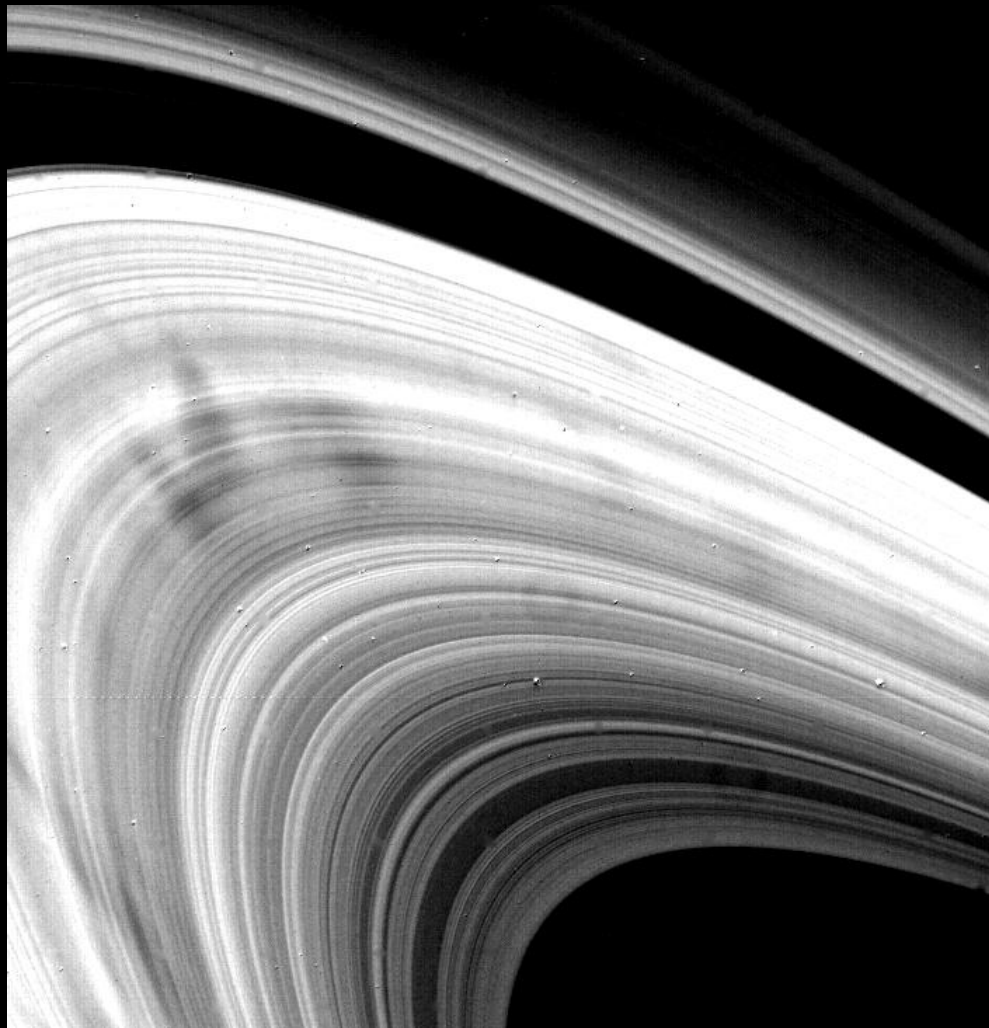
# Saturn: Rings

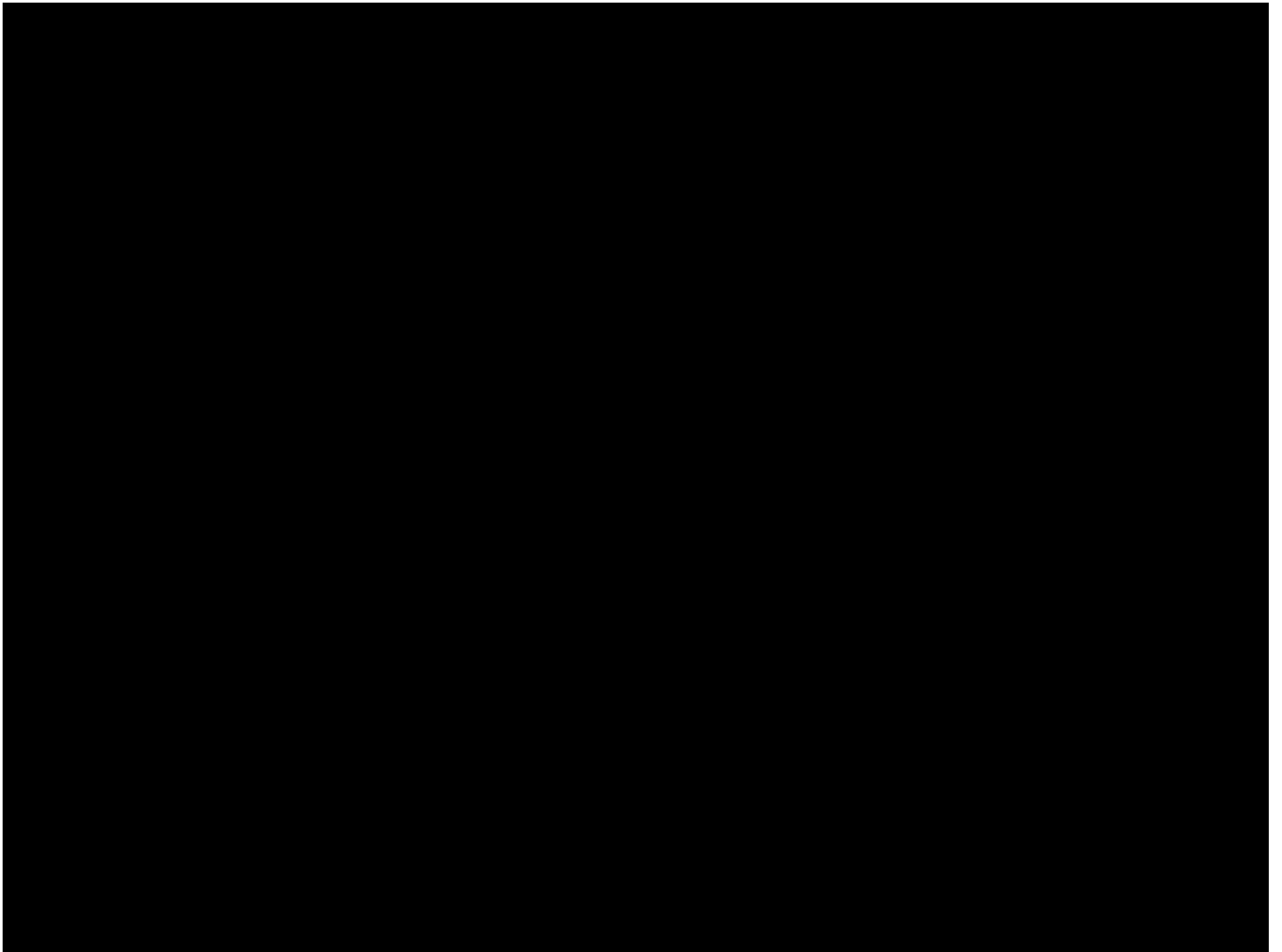


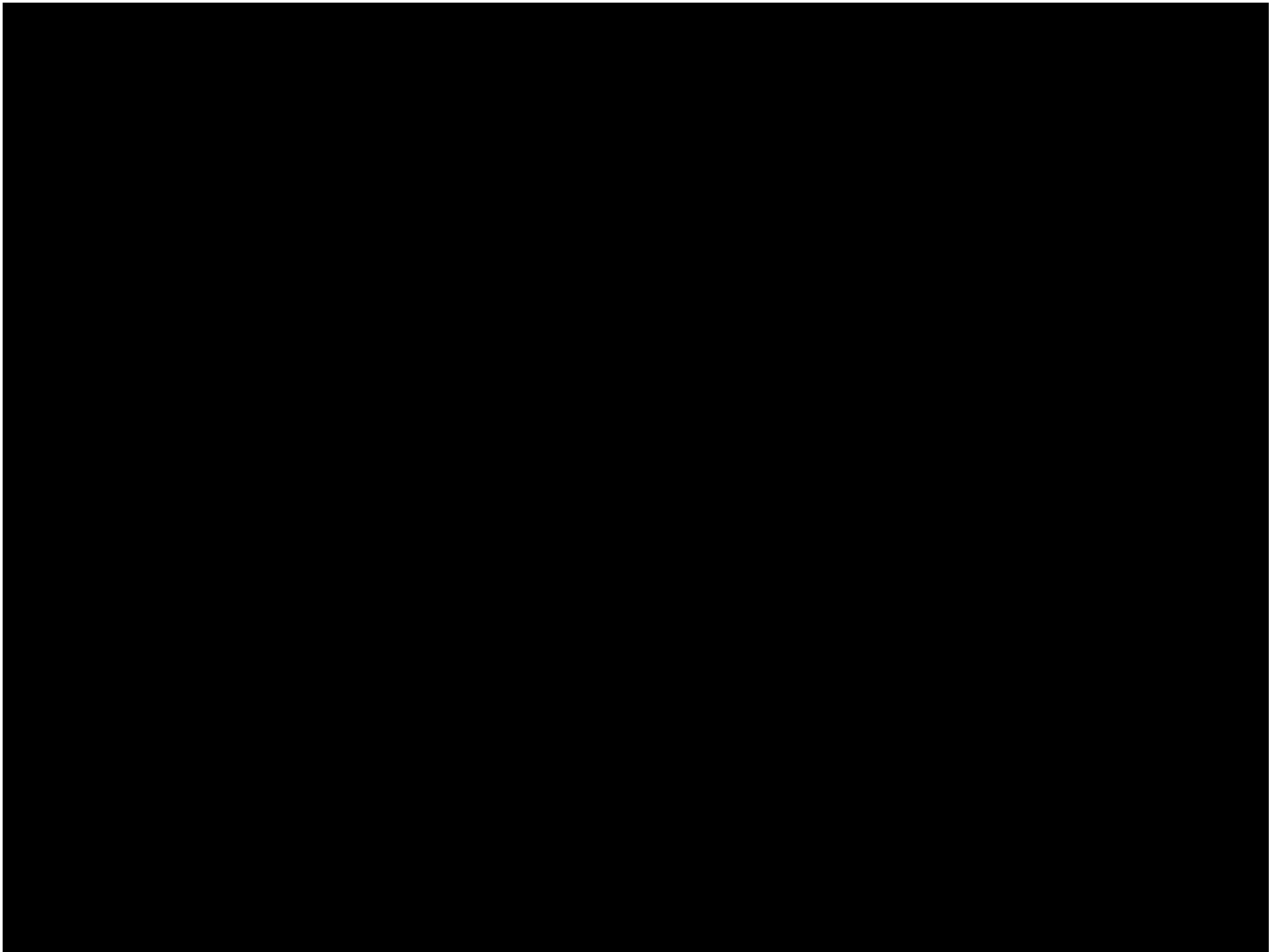
# Saturn: Rings

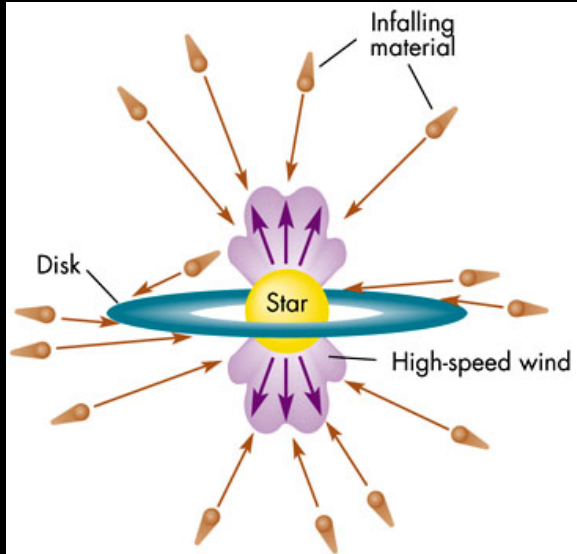


# Saturn: Rings, Spokes

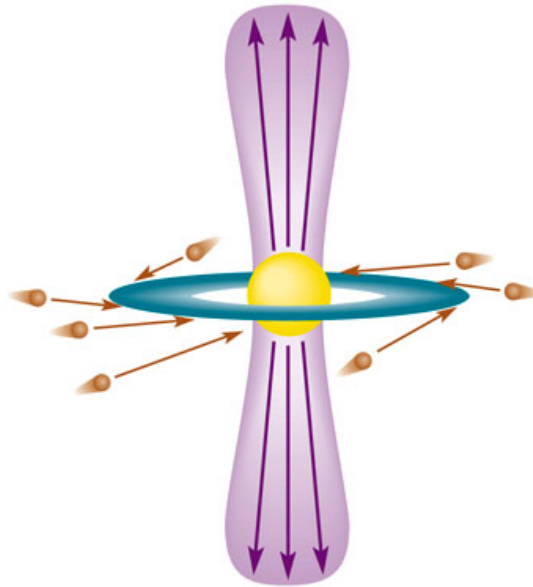




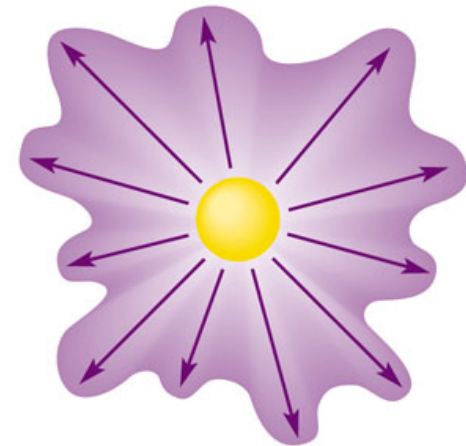




**A** Infalling material suppresses the wind.



**B** Eventually the wind becomes strong enough to break through along the polar axes.



**C** Later the wind sweeps away the disk and blows outward in all directions.

