The Giant Planets – “Gas Giants”

Jupiter
Saturn
Uranus
Neptune

Mostly H and H compounds under very high pressure in interior + small rocky core
Jupiter

Distance 5.2 AU from Sun
Diameter 11 x Earth
Mass 318 x Earth
Mean density 1.3 gm/cm³

17 moons, 4 large terrestrial Galilean satellites

Space missions
Pioneer 10 & 11, 1973, 1974
Voyager 1 & 2 1979
Galileo 1996
Jovian atmosphere, cloud layers

H, He
Methane
Ammonia

Great red spot – large anti-cyclonic, high pressure region
Atmosphere and Interior

From models based on Hydrostatic equilibrium

Increasing temp and pressure inwards

Rocky core – 10 – 20 Mearth
Magnetosphere

Ring System
Juno mission 2016 – orbiter

Infrared camera  First images of polar regions – aurora
4 Galilean satellites

Io                      Europa                 Ganymede                  Callisto

These are terrestrial planets
Io - most active surface in solar system
Europa

Smooth young surface, layer of ice, crustal faulting
Ganymede and Callisto
Saturn -- rings and Titan

Distance 9.5 AU from Sun
Diameter 9.4 x Earth
Mass 95 x Earth
Mean Density 0.7 gm/cm³

18 moons, Titan largest

Space missions
Cassini-Huygens orbiter and lander on Titan 2005
Atmosphere and Interior

![Diagram of atmospheric layers and temperature profile](image1.png)

- Stratosphere
- Haze
- Troposphere
- Ammonia ice
- Ammonium hydrosulfide ice
- Water ice

![Image of atmospheric layering](image2.png)
Rings

274,000 km across, < 1 km thick

Thousands of narrow ringlets, individual particles of frozen gas, mostly H$_2$O

What formed the rings -- Roche lobe
Atmosphere, N and N compounds, methane

From Cassini mission