The size and structure of Saturn’s ring

The ring extends out to about 2.4 Saturnian radii,
And is composed of 3 main rings and a prominent gap

The existence of Saturn’s ring due to “tidal disruption”

- Tidal “stresses” due to a difference of the gravitational force on the front and rear side of a moon near a planet.
- If a moon gets closer to a planet than about 2.4 planetary radii, the tidal stresses pull the moon apart
- In case of Saturn, a moon probably moved within the “tidal disruption radius” and was torn to rubble.
Saturn’s ring is a nearby example (and the first discovered) of a very broad class of astronomical phenomenon called an \textit{accretion disk}. Accretion disks surround large black holes, and in a sense the disk of the Milky Way galaxy is one.

Further out from the Sun...new planets

Way Out ... exploration of the outer solar system

The basic facts on the planets Uranus and Neptune

- Semimajor axes: 19.19 au (U) and 30.06 (N)
- Orbital periods: 84.01 years (U) and 164.8 years (N)
- Diameters: 4.0XEarth (U) and 3.9XEarth (N)
- Masses: 14.5XEarth (U) and 17.1XEarth (N)
Uranus as seen from Voyager 2

The “blue marble”

Neptune as seen by Voyager 2

The basic facts on Uranus and Neptune

Atmospheric structure of Uranus and Neptune: it's cold out there
Uranus and Neptune appear to be in yet a new class of planets. Much different than the terrestrial planets, but not like Jupiter and Saturn either. There is much variety in the major planets.

In 1989, Voyager 2 left Neptune and went deeper into space. It is still in communication with us.
Locations of the Voyager

- Voyager 1: 105.9 au from Sun (March 2008) = 9.82 billion miles = 14 light hours
- Voyager 2: 85.5 au

The Heliospheric boundary: between the solar wind and the interstellar medium

The University of Iowa radio instruments on Voyager 1 and 2 "picked up" the termination shock years before we got there

Radio emission from deep space

Voyager spacecraft radio receiver