Survey of the Solar System

The Sun **Giant Planets Terrestrial Planets Minor Planets** Satellite/Ring **Systems**



Mercury

Mass

Orbit

Rotation

- Radius ~ 2440 km
 - ~ .39 AU
 - ~ 58.6 days

New false color image from the Messenger mission



Mercury

Rocky surface \rightarrow 4-5x higher density than giant planets, iron rich Diffuse 'heavy' Atmosphere No satellites Internal magnetic field Slow rotation No Rings Aurora ??

Messenger image of volcanic vent

Venus

- Mass
- Radius
- Orbit
- Rotation

~ .72 AU ~ -243 days

~ 6052 km

~ 4.9 x 10²⁴ kg



From the Pioneer Venus Orbiter, 1979



Recent false color image of Venus' surface structure from Magellan

Venus

Dense dynamic atmosphere, mostly CO_2 (~96%) Strongest Greenhouse effect in the S.S. (733 K) No satellites No magnetic field **Retrograde rotation** No Rings Aurora ??



Venera 14

Earth

- Mass ~ 6.0 x 10²⁴ kg
- Radius ~ 6371 km
- Orbit ~ 1 AU
- Rotation ~ 23.9 hr





Earth

Composed mostly of iron, oxygen & silica by mass Atmosphere is $N_2 \& O_2$ (78%, 20%), dynamic Internal magnetic field

1 Satellite: Moon No Rings Aurora





Aurora observed from the space shuttle, and cloud vortices over Madeira Island from MODIS.

Mars

- Mass
- Radius
- Orbit ~ 1.5 A
- Rotation
- ~ 1.5 AU ~ 24.6 hrs

~ 3390 km

~ 6.4 x 10²³ kg





Viking mosaic of Olympus Mons Slope flows on crater wall

Mars

Dynamic surface, extreme geologic features

Thin atmosphere (~7 mbar)

Active weather/seasons

2 satellites

Remnant magnetic field

No rings Aurora History of water





MRO: polar avalanche seen from orbit

Dust devil viewed by Spirit

Mars

Spirit dust devil movie



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Pluto



July 11, 2012

What Happened to Pluto?

A planet as defined in 2006 by the IAU (International Astronomical Union):

- 1. Orbits the sun
- 2. Is large enough to have become round due to the force of its own gravity
- 3. Is not a satellite
- 4. Must dominate the neighborhood around its orbit (cleared its orbital path)

What Happened to Pluto?



Definition of a dwarf planet

- 1. Orbits the sun
- 2. Is large enough to have become round due to the force of its own gravity
- 3. Is not a satellite
- 4. Must dominate the neighborhood around its orbit (cleared its orbital path)

Currently there are 5 recognized by the IAU: Ceres, Pluto, Haumea, Eris and Makemake

Though due to difficulties in confirming KBO roundness there are probably >100 known objects

Minor / Dwarf Planets



Image credit: NASA

Asteroids

Minor planets with unconfirmed roundness and generally < 500 km in radius.

Most reside in the asteroid belt (2.1–3.3 AU) between Mars' and Jupiter's orbits.

Other populations include centaurs, Trojans, Kuiper belt objects (e.g., Pluto).

They actually can, and several do, have confirmed satellites.

Vesta



July 24, 2011

Vesta



Asteroids and Comets Visited



Comets

Ice-rich objects that lose mass in the form of water vapor and ice/dust grains when exposed to sufficient solar heating.

Mostly reside in the Oort Cloud (1-5 x 10⁴ AU) and Kuiper Belt region



Hale-Bopp, 1997

Comets: Revisiting Tempel 1



July 4, 2005

February 14, 2011

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- **Minor Planets**
- Satellite/Ring Systems



Satellites

All but two planets (Mercury & Venus) have satellites, as do several asteroids and minor planets

The giant planets have tens of satellites each

Have a broad spectrum of variability

