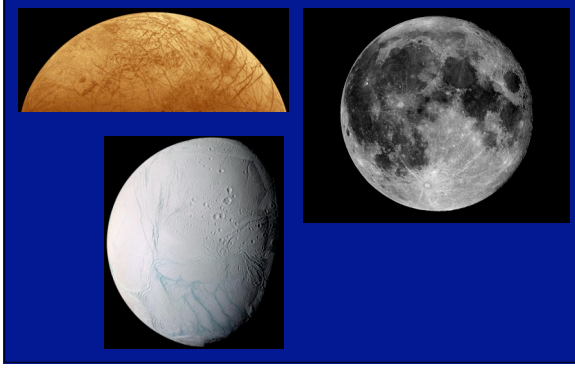
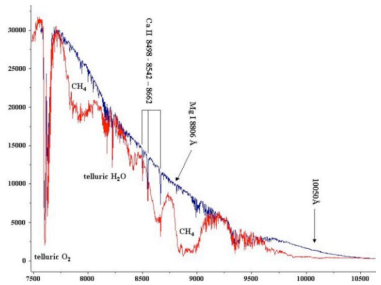
Moons of the other planets



An observational indicator of hydrogen in the atmosphere of Jupiter: absorption lines of hydrogen-bearing molecules in the spectrum of Jupiter

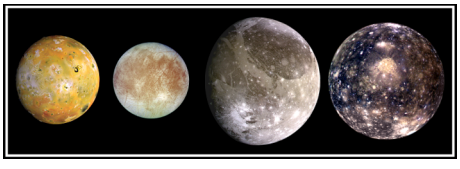


In earlier lectures we saw how much we learned from studies of the Earth's moon (the Moon). It is the key to understanding the solar system

How much can we learn from the moons (or satellites) of the other planets?

Of the three solar system objects most interesting from the viewpoint of exobiology (existence of life in outer space), two are satellites of planets. Or possibly 3 of 4. The only one we have discussed is the planet Mars

Satellites in the solar system are an example of the fact that Nature always has surprises for us. The famous film *2001 A Space Odyssey* was insufficiently imaginative concerning the Galilean satellites of Jupiter

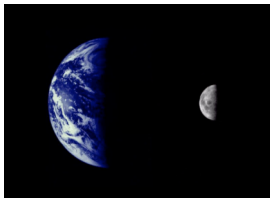


Why we knew so little about the Galilean satellites prior to the space age…. From Earth, they subtend a very small angle

During our observing session, the angular diameter of Saturn was 19 arcseconds (remember what an arcsecond is).

At that time, the angular diameter of the moon Titan (the star off to the left that night) was 0.84 arcseconds, smaller than the "seeing disk" due to the Earth's atmosphere.

Review of what we have learned: the Earth is *almost* the only terrestrial planet with a moon

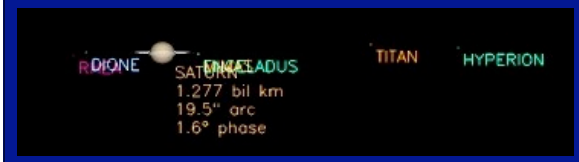


Not quite true: Mars has two very small moons, with diameters of 14 and 25 kilometers

This is definitely not the case with the 4 outer planets in the solar system

What you would see if you looked at Jupiter tonight in a small telescope (or use the JPL solar system simulator

Saturn has prominent moons, too



The "top 7" moons in the solar system

Satellite	Planet	Diameter(km)	Mass (relative to Moon)
Ganymede	Jupiter	5262	2.03
Titan	Saturn	5150	1.83
Callisto	Jupiter	4820	1.46
Io	Jupiter	3640	1.21
Moon	Earth	3476	1.00
Europa	Jupiter	3122	0.66
Triton	Neptune	2700	0.29

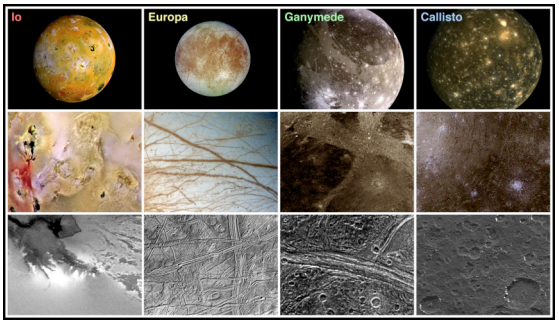
Let's start with the moons of Jupiter (especially the Galilean satellites)

Virtually nothing was known about the Moons of Jupiter prior to the arrival of spacecraft in the 1970s

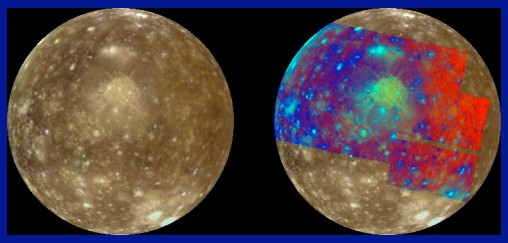
- Io
- Europa
- Ganymede
- Callisto
- 8 others known before space age
- A total of 63 now known (mostly tiny)

The Galilean satellites of Jupiter

The Galilean satellites of Jupiter (cont)



Callisto: most distant of Galilean satellites



Distance from Jupiter = 1883 thousand km; diameter = 4820km

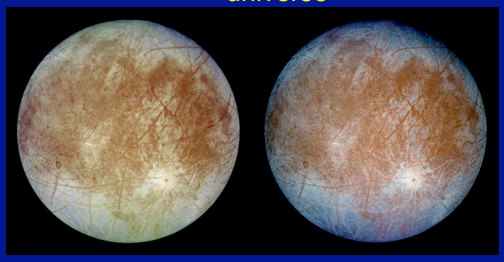
Ganymede: largest moon in solar system

Distance from Jupiter = 1080 thousand km, diameter = 5262

Ganymede has a magnetic field…interior with conducting water

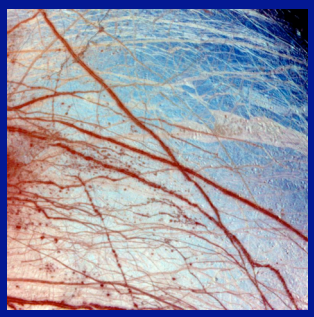
U. of Iowa instrument detects radio waves during a flyby of Ganymede

Europa and the origins of life in the universe



Distance from Jupiter = 671 thousand km, diameter = 3122 km

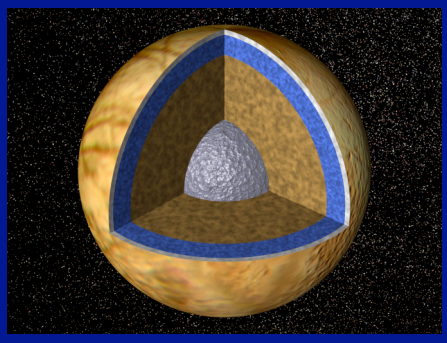
Cracks in the ice crust of Europa



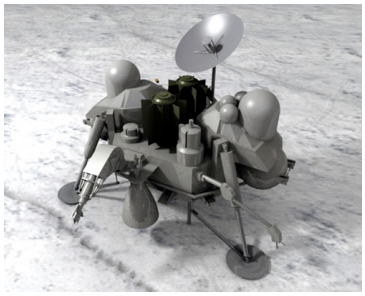
Evidence of water flows from the interior

Views of the cracks from Galileo

Speculations on interior structure of Europa



A future Europa Lander could tell us much about the possible subsurface ocean of Europa

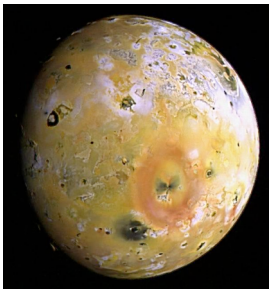


Speculations on Europa of 4.5 Gyr ago

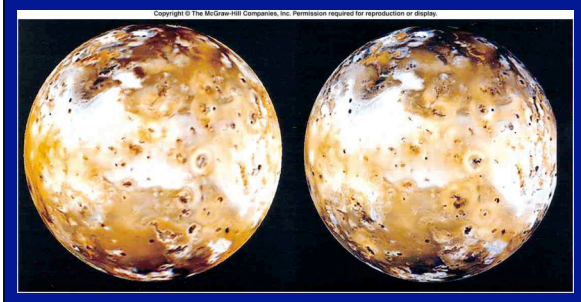
Io … world of rapid changes

Distance from Jupiter = 422 thousand kilometers, diameter = 3640 km

Io



Changes on Io: 1979-1999



The lesson from study of the Galilean satellites: the primary geophysical process is tidal flexing or squeezing due to the strong tides of Jupiter. The tides aren't strong enough to disrupt these satellites, but they do control their geology