Atmosphere thickness of jovian planets

As a group, the planets Jovian (Jupiter, Saturn, Uranus and Neptune) can best be described as large gas balls - or better yet, rotating droplets of liquid. In particular, Jupiter and Saturn consist mainly of hydrogen and some helium - both of which are gases in terrestrial conditions, but are ultradense liquids deep inside Jupiter and Saturn. Jupiter and Saturn contain the same elements as the Sun, mainly hydrogen and helium. Traces of atmospheric components of water, methane and ammonia. They are probably tiny rocky/slushy nuclei, which are the seed around which the gas mantle accumulated during the formation of the solar system. Under extreme pressure, gases on these planets behave more like liquid (and even conduct electricity like metal). Uranus and Neptune are not as massive as Jupiter and Saturn. Although they may have thick gas robes, their rocky/slushy cores can make up half a planet's radius or more. Astronomers often refer to this pair as ice giants. It is believed that these planets formed more slowly and thus had less capacity to gravitationally collect gas from the solar nebula. Because they are mostly atmospheres, the clouds of these planets represent their apparent surface. The highest white clouds of Jupiter and Saturn are made of ammonia crystals, while the clouds of Uranus and Neptune are methane ice. Jupiter and Saturn have enough heat to make methane gas. On Uranus and Neptune, the temperature is low enough in the upper atmosphere to form methane ice. The lower cloud decks of Jupiter and Saturn are ammonium hydrosulfide and conventional water clouds. Unknown chemical compounds provide cloud colors. Due to the rapid rotation and large size of these worlds, atmospheric circulation is organized into a number of belts and zones. All four of these planets have large systems of moons of Jupiter and Saturn, each of which has 63 and 33 known moons respectively, and their number is growing every day. Most of the latest discoveries are more like large rocks/asteroids than significant satellites. All four of Jupiter's Galileo moons are planetary in size. So titanium (Saturn) and Triton (Neptune), both of which hold the atmosphere. All four of these planets have rings. Saturn are the most visible. This section is relatively short because .... Ok.. we really don't really know much about the giant, gas-powered planets that inhabit the outer regions of our solar system. The probes and orbiters we sent to these worlds have returned volumes of data that raise more questions than give specific answers. The relative size of the Jobian planets, as indicated in the introduction, all the planets of Jorian have rings (Saturn is the most pronounced), and each planet has a family of moons. We know that the rings are made up of much smaller particles of ice circling around planets, some of them the size of dust. Astronomers have often wondered how these functions are related. For example, are rings a permanent feature on every planet? Were the satellites of the images made of rings? Do incoming asteroids and comets, sometimes, crash into the moon, ... blasting it into small pieces, which later becomes raw for the rings? Made the comet get too close to the planet, and tidal forces pulled it to pieces, ... providing raw materials for making rings? Lots of questions ... No definitive answers! By far Jupiter Credit NASAJupiter is the most massive of all the planets (and it is the largest). Its mass is 318 times the mass of the Earth. It has (like all Jovian planets) low density. The reason is that it consists of lighter gases that are very similar to the composition of the Sun, 90% hydrogen and 10% helium (at least on the surface). Why quotes? Because Jupiter does not show a solid surface (although astronomers believe that a solid body exists deep under gases). When we look at Jupiter, we see a chaotic, swirling, stormy, dense atmosphere. It is basically a giant gas planet. The pressure of this hydrogen gas becomes so high as you move down the atmosphere that it behaves more like a liquid than a gas, so maybe we should call Jupiter a liquid hydrogen planet. Jupiter has a very strong magnetic field (20,000 times stronger than the Earth's magnetic field). This suggests that Jupiter has a fairly active interior. Perhaps the swirling liquid hydrogen acts as a huge dynamo to create this effect. In addition, Jupiter emits much more energy into space than it receives from the Sun. This excess energy can come from one or all of the sentences below: the heat released by the radioactive decay of the elements? heat generated by some chemical reactions? heat generated by nuclear reactions in the center? Jupiter collapses and heats up the gases? The heat still eludes the time it was formed? The great red spot Of the Upper atmosphere of Jovian shows various light and dark bands of turbulent gases. The exact reason why these groups appear in the first place is still unknown. The planet rotates only once on its axis, but since it is a gas planet, the area near the equator rotates a little faster than gases at higher latitudes. It has been suggested that these bands represent areas where gases rise and sink in the atmosphere. In other words, a complex system of convection cells where ammonia clouds are exposed to the lower layers. In one of the bands in the southern region there is a large storm that has raged for more than 300 years. It is known as a great red spot. Apparently, the storms on Jupiter last a long time. Jupiter's moons, perhaps the most interesting features of Jupiter are the satellites that orbit the planet. More than 65 moons have already been found around Jupiter, but the focus remains on four Galilean satellites - Io, Europa, and Callisto. Io Europa Ganymede Callisto Credit NASA (Click on each for for See) Io has the most dynamic surface known in the solar system. This pizza moon rotates quite close to Jupiter, where tidal forces become extremely high. This generates a lot of internal heat as the Io is constantly re-formed. The results are the most active volcanic surface known. Every day, the surface is reformed as sulfur erupts from the interior. Europe has an icy surface covered with cracks. Astronomers believe that under the ice there may be an ocean of liquid water. As tidal forces generate internal heat, and stress on ice,... It cracked ... and liquid water from below moves to the surface and freezes. Oh! Someday we will have to land on this moon to see if it can harbor life. Ganymede is the largest of all the moons in the solar system. It is even larger than Mercury (or Pluto), but since it revolves around Jupiter, its status is reduced to a simple satellite. Callisto is the least active of the Galilee satellites. It has far more crater impacts than the others listed, which tell us it probably has a much older surface. Saturn Credit NASAJupiter and Saturn are actually very similar to each other. Saturn, of course, has a much more impressive ring system than Jupiter and lower density too. Saturn's density is so low that it can float on water. This is probably because Saturn has a smaller solid part (buried deep under gases) or much less hydrogen in liquid condition (or both). We learned a lot more about this system when we received data from the Cassini probe that reached Saturn in July 2004. Perhaps the most interesting features of Saturn are the beautiful ring system and one of its many moons - Titan.Rings of Saturn As mentioned earlier, the rings are just smaller pieces of debris that revolve around Saturn on a flat plane. The rings are, in fact, incredibly flat, ... several tens of meters thick (near the height of a typical tree). Some parts are most likely water ice, but also solid fragments. They range from the size of a small building to the size of a dust particle. Italian astronomer Giovanni Domenico Cassini (1625-1712) noticed gaps in the rings that are still known as Cassini. Astronomers still do not have a complete understanding of these divisions, but they should include a complex gravitational interaction between individual ring particles and moons that rotate inside the rings. Even Saturn's magnetic forces are likely to be involved in the formation of this complex structure. Astronomers are still a long way off. However, one big mystery has been solved. Are Saturn's rings a permanent or temporary feature? One of the last things cassini's probe did before it was deliberately burned in Saturn's atmosphere is a journey very close to Saturn's inner rings. The idea was to observe tugs (outrage) on the ship to determine the mass of the rings. Evidence suggests that the rings do not have enough mass to make the object a permanent structure. Structure. the rings were supposed to form recently (moon collision? comet?) but there is no answer yet, what to expect in the future. Moon - Titan from Voyager 2 Credit NASA Titan from Cassini -credit VIMS Team, USA Arizona, ESA, NASATitan is Saturn's largest moon, and the most unusual. It, like Ganymede, is bigger than Mercury (or Pluto). Titan has captured the imagination of early astronomers ever since they discovered that it has an atmosphere consisting mainly of nitrogen (as well as our own atmosphere). Even more bizarre spectral analysis shows that Titan's atmosphere is the smog of methane, ethane and carbon dioxide. We had to go there!!!! In 2005, the Cassini spacecraft released the Guygens probe, ... which landed on Titan in January 2005. He showed us gullies carved with liquid hydrocarbons. These dark spots in the image above are mostly lakes of liquefied natural gas. It's raining with methane on Titan! Luna - The Enceladus cassini probe made a rather interesting discovery in 2005. Flying past the small moon Enceladus, he watched as icy geysers shot from the moon's south pole. This gives astronomers another place to wonder if the liquid ocean lies under the ice (which all the data point to). Can life exist there as well? Uranus and Neptune Uranus and Neptune Credit NASAThis two medium gas planets lie far from the Sun. They are also mostly hydrogen and helium in composition, but appear blue due to the small amount of atmospheric methane that absorbs most of the spectrum and reflects blue light. Uranium is unusual in that its axis is tilted 98 degrees to the plane of the ecliptic, giving it the most extreme seasons of any planet. It mostly rotates on its side. Neptune is one of the windiest planets, with speeds of up to 700 mph. Neptune's atmosphere seems to be caused by internal warmth, not warmth from the sun. Miranda Surface Miranda Credit NASA (click on the image to zoom in)One of the moons of Uranus is pretty ordinary. Miranda's surface looks like a random mixture of stone and ice. This suggests that this moon was recently reassembled. That is, it may be that some moons are formed when ring material merges under the influence of gravity. Does this mean that the rings may be a time phase in the evolution of the planet? Astronomers warn that this can only happen if tidal forces (attracted by the planet) can be overcome. For example, Saturn's rings do not form in the moon because the rings are within the planet's extreme. That is, they lie too close to Saturn... so close that tidal forces will disrupt any attempt to assemble them into a larger body. It may still be that Saturn's rings are a temporary feature, but they won't become the moon. Another interesting moon that orbits Neptune is What makes this moon interesting is how it revolves around Neptune, which is retrograde in the direction of Neptune How can this happen? It may have formed in the Kuiper Belt and was captured by neptune's gravity???? Exploring the Kuiper Belt Downgraded planet, Pluto, continues to lose prestige. The New Horizons spacecraft reached Pluto in July 2015. It would be interesting to know that Pluto's largest moon, Charon, is large enough to consider the system a double object Not only has Pluto been downgraded to a dwarf planet, it must now share the scene with a partner. By 2014, there were five known moons associated with Pluto. Charon... Pluto's younger brother. Charon attracted a lot of attention, as its icy surface shows evidence of tectonics. These stretch marks are probably formed from an earlier time when liquid water once existed beneath the surface, then eventually froze and expanded. Pluto and Charon show spotted reddish areas. It is best to guess that the red areas are from a chemical called tolin. When compounds such as methane are exposed to ultraviolet radiation, they blush. There have been other guesses for these features on Pluto and Charon so the issue has not been resolved. Creating the Solar System ... or just when you thought you understood it... Something going on believes they knew how our solar system was formed and why it has common properties we find in our solar system today. Our sun, in their opinion, was formed from a large cloud of gas known as the solar nebula. As the gases within the nebula condensed and faded, they eventually formed the sun. However, a small amount of material is left behind that form a debris disk (known as an accretion disk). This orbital material will become the raw material for the creation of planets. This part of the story is even backed up by photos of other star systems. Credit C. Burrows and J. Crist (STScI), WFPC2 IDT team, NASA, ESA Beta Pictoris We now know that many young stars have a flat accretion disk of debris around them. These could be solar systems in the making. Astronomers believed that solid planets quickly come together to make planets. The inner planets are small and dense because it is too hot for icy (low density) planetesimals to form in this region. Further from the Sun (where it is much colder) can form planets of rocks and ice. This means that the planets of Jobian are able to grow much larger and more massive. After all, they gain so much mass that they are able to gravitationally attract much lighter gases such as hydrogen and helium. Bingo... You just made a giant gas world. The problem is ... astronomers have since discovered many star systems with planets... but they don't look like our solar system. These systems show giant gas planets that rotate very close to their parent star. It's like finding a super Jupiter lying inside Mercury's orbit hence the name of hot Jupiters. Astronomers didn't think it was possible, so the model needs to be revised. Is it possible that these planets are planets in a more distant sector of its solar system and then migrated closer to the parent star? Another question ... Is our solar system a typical or planetary freak? It is too early to answer these questions. Rogue planets (orphan planets) have become more fluffy with the discovery of rogue planets. These are planets drifting in space and not connected to any parent star. The origin of these orphans is perplexing. Were they images around the star and were thrown out? Were they in the open space on their own? How many rogue planets? Could one of these planets be captured by an approaching star? More questions than answers! Another Earth? The list of exoplanets continues to grow (more than 3600 in 2017). The hunt to find the Earth's Gemini is underway. The goal of the Kepler Observatory (and the transit exoplanets view satellite or TESS, launched in 2018) may succeed in finding another world like ours my my my planet. Several close matches have been confirmed. I plan to make this issue a topic for discussion class, so I will resist posting any results. When our planetary brother is found, will it orbit in the habitable zone (which makes liquid water possible)? Will we be able to discover life ... intelligent life? This is a very exciting time in astronomy!