7-2. How do the swirling atmospheres of Jupiter and Saturn compare?

Both have similar composition, mostly hydrogen, but Jupiter has far more helium in its atmosphere than Saturn. Both atmospheres exhibit dark reddish-brown belts and light, almost white, zones which form bands parallel to their equators. Because of its greater size and greater nearness to the sun, Jupiter’s atmosphere is both warmer and denser than Saturn’s. Saturn’s colder temperatures cause it to have more high altitude ammonia clouds than Jupiter. These partially transparent, hazy clouds cause Saturn’s bands to appear more muted in color than Jupiter’s. Furthermore there is far less evidence of convective turbulence in Saturn’s atmosphere than in Jupiter’s.

7-4. What are the belts and zones in the atmospheres of Jupiter and Saturn? Is the Great Red Spot more like a belt or a zone? Explain.

They are clouds of different colors, resulting from different temperatures, resulting from different atmospheric heights. The colors are due to ammonium hydrosulfide, \( \text{NH}_4\text{SH} \), and other chemical impurities in clouds of water, both ice and droplets, and ammonia. In color the Great Red Spot looks more like ammonium hydrosulfide, but it is very high in the atmosphere. It various times it has been seen both within belts and within zones and often is on or near a boundary between the two.

7-6. Briefly describe the evidence supporting the idea that Uranus was struck by a large planet-like object several billion years ago.

It is believed that Uranus may have experienced such a collision which caused its polar axis to have tipped virtually into its orbital plane, in fact slightly beyond which now makes its rotation retrograde.

7-8. Why are Uranus and Neptune distinctly greenish-blue in color, while Jupiter and Saturn are not?

The greenish blue colors of Uranus and Neptune are due to much methane in their atmospheres. Methane, \( \text{CH}_4 \), is much less abundant in the atmospheres of Jupiter and Saturn because heavier atoms like carbon are more abundant in the outer solar system than in more inward regions such as occupied by Jupiter and Saturn.