THE IONOSPHERE

(COURTESY QST AND WB81MY)

If it wasn't for the ionosphere, long-range Amateur Radio communications on the HF bands would be impossible. The ionosphere is a region 30 to 260 miles above the Earth's surface where ions and free electrons are concentrated. The ionosphere affects HF radio waves by refracting (bending) the waves back towards the ground. Depending on the type of antenna used, the transmitted waves are refracted by the ionosphere and arrive at the surface thousands of miles from where they originated. Sometimes the waves can bounce between the Earth and the ionosphere many times, allowing them to encircle the entire planet!

Ultraviolet rays from the sun act on atmospheric ozone to create the ionosphere. The ionosphere isn't a single sheet of particles. It's actually layered like a cake (see Fig. 1 on Page No. 14). During the day there are usually several layers, but at night only one later exists.

The lowest layer is known as the D layer. Its effects are most pronounced during daylight hours. The higher the Sun's elevation, the large the D layer becomes. As your might guess , the D layer is thickest during the summer months when the sun is higher in the sky. This is bad news for hams because the D layer acts like a sponge for radio waves. Solar flares can really stir things up, increasing the size of the D layer until virtually all HF radio waves are absorbed for hours, or even days. under these spooky conditions, the HF bands will appear to be dead! (Many hams start wondering if something is wrong with their equipment.)

The E layer is much more useful. It begins at an altitude of about 65 miles. At around local noon it becomes a good refractor of HF radio waves. After sundown, it practically disappears. In the E layer there are huge clouds of ionized particles that drift slowly around the globe. These clouds are responsible for a type of propagation known as sporadic-E. Signals on 10 meters, as well as 6 and 2 meters, can be refracted by these roaming clouds.

The layer that is of greatest interest to hams is the F layer. It's responsible for most of our long distance HF communications. In the daytime, the F layer splits into two layers: F1 and F2. At night they combine into a single layer.

The F layers ionize very rapidly at sunrise. Signals radiated from an antenna with a low angle of radiation (such as a vertical) will be bent by the F layers and strike the surface as far as 2500 miles away! The refractive qualities of the F layers peak in the early afternoon. After sundown, the layers combine and decay very slowly, offering longdistance communication well into the night - WB81MY