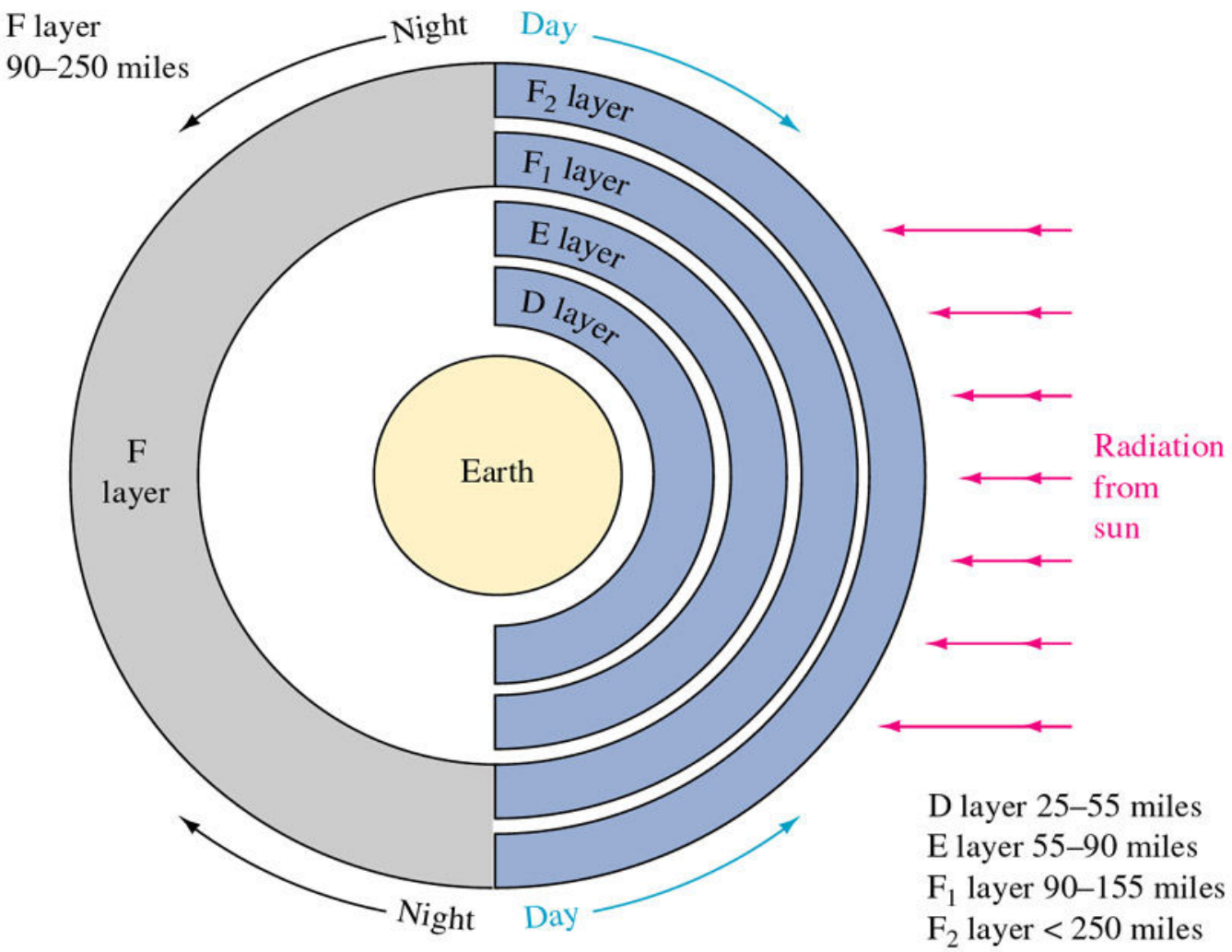
ANTENNA AND WAVE PROPAGATION

Ionospheric Layers

- ✓ Each region is subdivided into layers called the D, E, F1, and F2 layers, also according to height and ion distribution.
- ✓ These are not distinctly separated layers, but rather overlapping regions of ionisation that vary in thickness from a few kilometres to hundreds of kilometres.
- ✓ The number of layers, their heights, and their ionisation (electron) density vary both geographically and with time.
- ✓ At HF all the regions are important & must be considered in predicting the operational parameters of radio communication circuits.

THE IONOSPHERIC LAYERS CONT'D



THE IONOSPHERIC LAYERS CONT'D

D layer:

- is the **innermost layer**, **50 km to 90 km** above the surface of the Earth. when the sun is active with 50 or more sunspots, During the night cosmic rays produce a residual amount of ionization as a result high-frequency (HF) radio waves aren't reflected by the D layer.
- **The D layer is mainly responsible for absorption of HF radio waves**, particularly at 10 MHz and below, with progressively smaller absorption as the frequency gets higher. The **absorption is small at night** and **greatest about midday**. The layer reduces greatly after sunset. A common example of the D layer in action is the **disappearance of distant AM broadcast band stations in the daytime.**

THE IONOSPHERIC LAYERS CONT'D

D layer

- Because of the low electron density, the D region does not reflect useful transmissions in the frequency range above 1 MHz.
- The electron density is relatively small compared with that of the other regions, but, because of collisions between the molecules of the atmosphere and free electrons excited by the presence of an electromagnetic wave, pronounced energy loss occurs.
- This energy loss, dissipated in the form of thermal energy of the electrons or thermal (electromagnetic) noise, is termed absorption.

THE IONOSPHERIC LAYERS(Contd.)

The E layer:

- is the middle layer, 90 km to 120 km above the surface of the Earth.
- can only reflect radio waves having frequencies less than about 10 MHz.
- has a negative effect on frequencies above 10 MHz due to its partial absorption of these waves.
- At night the E layer begins to disappear because the primary source of ionization is no longer present. The increase in the height of the E layer maximum increases the range to which radio waves can travel by reflection from the layer.
- Maximum Electron density occurs at 110 Km.

THE IONOSPHERIC LAYERS

The F layer:

- is **120 km to 400 km** above the surface of the Earth.
- is top most layer of the ionosphere (Imp. For HF Comm.)
- Extreme ultraviolet (UV) (10-100 nm) solar radiation ionizes atomic oxygen (O).
- The **F layer combines into one layer at night**, and in the presence of sunlight (during daytime), it divides

into two layers, the F1 and F2. The F layers are responsible for most skywave propagation of radio waves, and are thickest and most reflective of radio on the side of the Earth facing the sun.

THE IONOSPHERIC LAYERS(Contd.)

- The F1 layer is of importance to communication only during daylight hours. It lies in the height range of about 200 to 250 km and undergoes both seasonal and solar cycle variations, which are more pronounced during the summer and in high sunspot periods.

- The F2 layer is located between 250 to 350 km above the earth's surface. During the night the F1 and F2 layers combine into a single layer

Effect of Solar Flare Radiation on the Ionospheric layers