The Antenna Pattern

We can plot $D(\theta, \phi)$
in at least <u>two ways</u>:

1) A Polar Plot

2) A Cartesian Plot

Half-power beamwidth(HPBW)
First null beamwidth(FNBW)

Minor lobes   Major lobe   HPBW   Side lobe   Back lobe   FNBW

$D(\theta, \phi)$ D_0

π $\pi/2$ 0 $\pi/2$ π θ
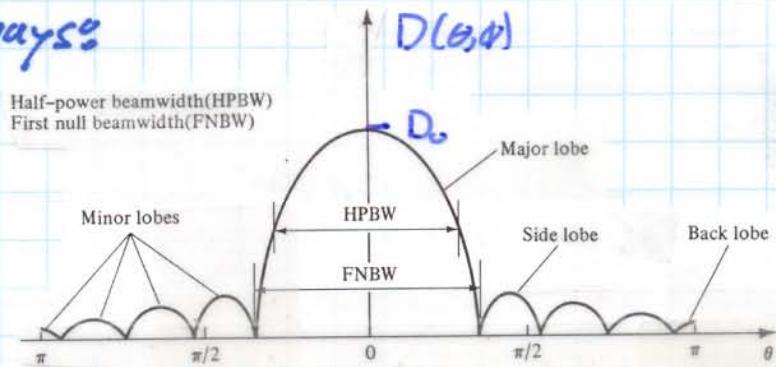
From either plot, we can
extract <u>fundamental</u> <u>parameters</u>
about our antenna performance.

First null beamwidth (FNBW)   Major lobe
Half-power beamwidth (HPBW)
Minor lobes   Side lobe   Back lobe   Minor lobes

1) <u>D_0</u> - Maximum value of Directivity Pattern $D(\theta, \phi)$

2) <u>Main beam</u> - The <u>major lobe</u>
of the antenna pattern. It
has both a <u>direction</u> and a <u>width</u> (i.e.,
beam width). The peak value of the
main beam is the antenna directivity D_0.
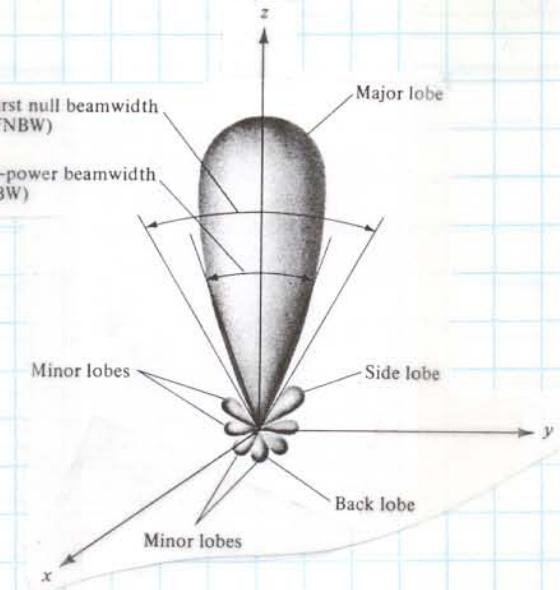
3) <u>Side lobes</u> — These are <u>minor</u> lobes, in other words <u>small</u> lobes ($D(\theta, \phi) << 1$) indicating small ammounts of intensity radiating into directions other than that of the main beam. Ideally, antenna side lobes are <u>very</u> small, as we generally want all available power to be propagated in the main beam direction. We can look at side lobe radiation as "leeks" in our antenna — power that is <u>wasted</u> by propagating it in the <u>wrong</u> direction!

Typically, we want an antenna with a "side lobe level" at least 40dB smaller than D_0 (the main lobe level).

4) <u>Beamwidth</u> - The <u>angular width</u> of the main <u>beam</u>. A subjective value, generally defined as the $\frac{1}{2}$-power (i.e., 3dB) beamwidth. It can be expressed in <u>steradians</u>, but is often is expressed as <u>two</u> <u>angle</u> of radians (or degrees). These two angles represent the width of the main beam in each of two orthogonal planes, (e.g., an azimuthal beamwidth $\Delta\phi$ and an elevation beam width $\Delta\theta$.).

3