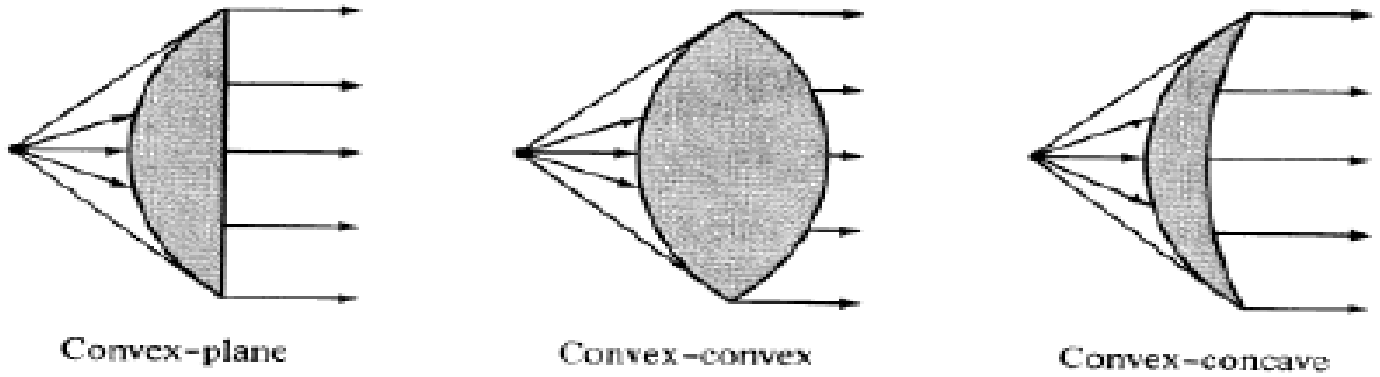
LENS ANTENNAS

DIELECTRIC (LENS) ANTENNAS

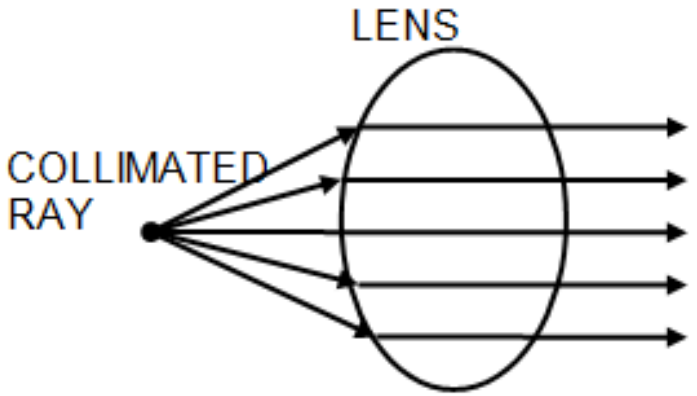
- Lenses play a similar role to that of reflectors in reflector antennas: they collimate divergent energy.
- Used at the higher microwave frequencies (often preferred to reflectors at frequencies > 100 GHz) and are useful in mm microwave region.



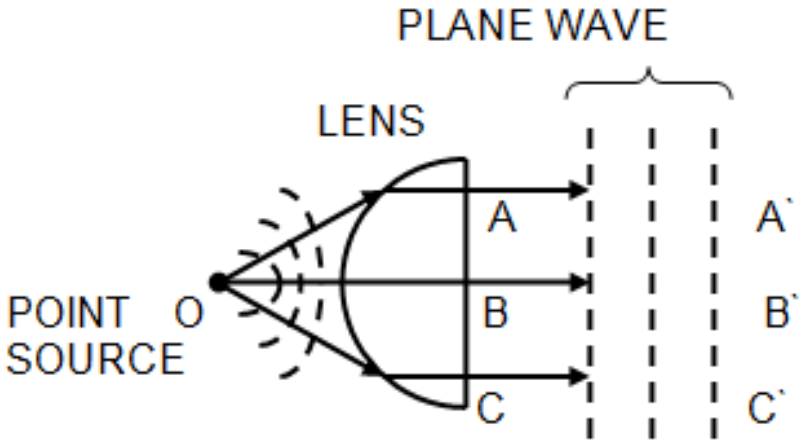
(a) Lens antennas with index of refraction $n > 1$

DIELECTRIC (LENS) ANTENNAS cont.

BASIC PRINCIPLE



DIELECTRIC LENS ANTENNA



Spherical wavefront changed to plane wavefront through dielectric lens.

LENS ANTENNA AS WAVE COLLIMATOR

DIELECTRIC (LENS) ANTENNAS cont.

- The velocity of em wave through a dielectric materal is less than that in free space.
- The section of spherical em wave that travels through the center (the greatest thickness) of the dielectric material will travel most slowly compared to both end.
- The velocities of the spherical wave entering the lens will be controlled and the curved wavefront will become a plane wavefront with constant phase in front of the dielectric antenna (refraction based on Snell's law).

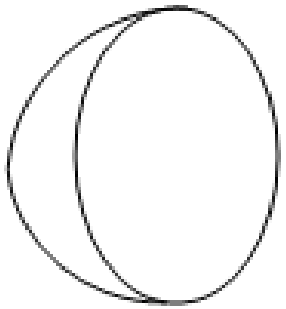
E) DIELECTRIC (LENS) ANTENNAS cont.

- Are contructed from polistyrene, teflon or any denser dielectric material to produce large diffraction (belauan) although its size and weight is small. The material use will cause the wave to attenuate greatly (losses and absortion of signal - greatest attenuation at center – thickest lens).
- To avoid this situation, zoned and stepped dielectric antennas are used so that the optical path can be divided into paths differing by integral multiples of a wavelength from one zone to another.

DIELECTRIC (LENS) ANTENNAS Cont.

- Basic dielectric lens :-
  - Requires a specific wavelength due to its thicness.
  - Its usage is not practical as compared to the stepped or zoned dielectric lens antenna which has different path for different wavelength.

BASIC DIELECTRIC LENS



DIELECTRIC (LENS) ANTENNAS Cont.

- Stepped or zoned dielectric lens antenna :-
  - Used to reduced the lens thickness and to decrese the curveture of the spherical wave.