## ANTENNA AND WAVE PROPAGATION

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# **Radiation Intensity**

### Steradian

- One steradian is defined as the solid angle with its vertex at the center of a sphere of radius *r* that is subtended by a spherical surface area equal to that of a square with each side of length *r*.
- Since the area of a sphere of radius r is A Æ 4¼ r 2, there are 4¼ sr in a closed sphere.

- Radiation intensity in a given direction is defined as the power radiated from an antenna per unit solid angle.
- The radiation intensity is a far-field parameter.
- It can be obtained by simply multiplying the radiation density by the square of the distance.

$$U = r^2 W rad$$

# Total Radiated Power Using Radiation Intensity The total power is obtained by integrating the radiation intensity over the entire solid angle of $4\pi$ . Thus

$$P_{\rm rad} = \oint_{\Omega} U d\Omega = \int_0^{\pi} \int_0^{2\pi} U \sin\theta d\theta d\phi.$$

where  $d\Omega$  is the element of solid angle =  $\sin\theta d\theta d\phi$ .

#### **RADIATION INTENSITY**

The radiation intensity is total power radiated per unit solid angle and is denoted by U and it is expressed as U= P/4 $\pi$ .



First figure shows radiation intensity of a source and second figure is relative radiation intensity of that source.

### **POINT SOURCE**

• A point source is a radiator that has dimensions of a point in space.

### Non Isotropic but Similar Point Sources



### Principle of PATTERN Multiplication

- The directional property of the antenna is often described in the form of a **power pattern.**
- to be unity at the maximum. The power pattern is simply the effective area normalized



Fig: Power pattern for isotropic source



### Power Synthesis by Pattern Multiplication

