Gain + Effective Aperture

Q: How can we determine the effective aperture of an antenna??

A: If we know the antenna's gain $G(\theta, \phi)$, then we can find its effective aperture $A_e(\theta, \phi)$!!

ICBST (It Can Be Shown That),

$$A_e(\theta, \phi) = \frac{\lambda^2}{4\pi} G(\theta, \phi)$$

Where λ is the wavelength of the e.m. wave (i.e., $\lambda = 2\pi c/\omega$).

Q: What does this mean?

A: It means that the transmit antenna pattern and the

receive antenna pattern are identical, to within a constant ($\lambda^2/4\pi$).

For example, the direction of maximum gain for a given antenna is the same as its direction of maximum effective aperture.

$$A_{em} = \frac{\lambda^2}{4\pi} G_0$$

where A_{em} = the maximum value of $A_e(\theta, \phi)$.