Antenas Abertura

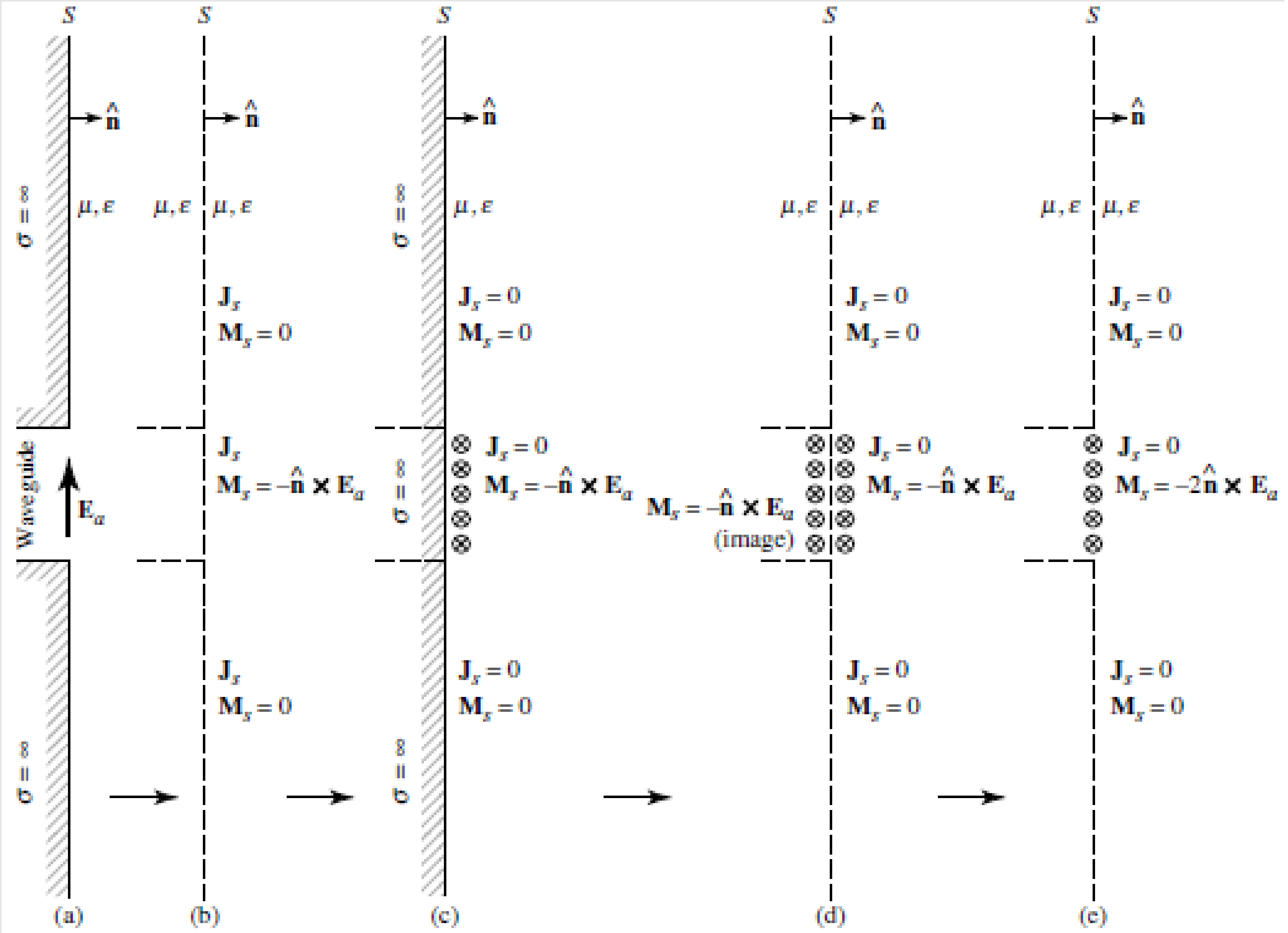
Pyramidal horn antenna

Conical horn antenna

Paraboloidal antenna

Slot antenna


ALFA



S
n̂
σ = ∞
μ, ε
Waveguide
E_a
J_s
M_s = 0
M_s = −n̂ × E_a
J_s = 0
M_s = −n̂ × E_a (image)
M_s = −2n̂ × E_a
(a)
(b)
(c)
(d)
(e)

$$E_r \simeq 0 \quad (12\text{-}10a)$$

$$E_\theta \simeq -\frac{jke^{-jkr}}{4\pi r}(L_\phi + \eta N_\theta) \quad (12\text{-}10b)$$

$$E_\phi \simeq +\frac{jke^{-jkr}}{4\pi r}(L_\theta - \eta N_\phi) \quad (12\text{-}10c)$$

$$H_r \simeq 0 \quad (12\text{-}10d)$$

$$H_\theta \simeq \frac{jke^{-jkr}}{4\pi r}\left(N_\phi - \frac{L_\theta}{\eta}\right) \quad (12\text{-}10e)$$

$$H_\phi \simeq -\frac{jke^{-jkr}}{4\pi r}\left(N_\theta + \frac{L_\phi}{\eta}\right) \quad (12\text{-}10f)$$

$$N_\theta = \iint_S [J_x \cos\theta \cos\phi + J_y \cos\theta \sin\phi - J_z \sin\theta] e^{+jkr'\cos\psi}\, ds' \quad (12\text{-}12a)$$

$$N_\phi = \iint_S [-J_x \sin\phi + J_y \cos\phi] e^{+jkr'\cos\psi}\, ds' \quad (12\text{-}12b)$$

$$L_\theta = \iint_S [M_x \cos\theta \cos\phi + M_y \cos\theta \sin\phi - M_z \sin\theta] e^{+jkr'\cos\psi}\, ds' \quad (12\text{-}12c)$$

$$L_\phi = \iint_S [-M_x \sin\phi + M_y \cos\phi] e^{+jkr'\cos\psi}\, ds' \quad (12\text{-}12d)$$

Conheco J ou M !

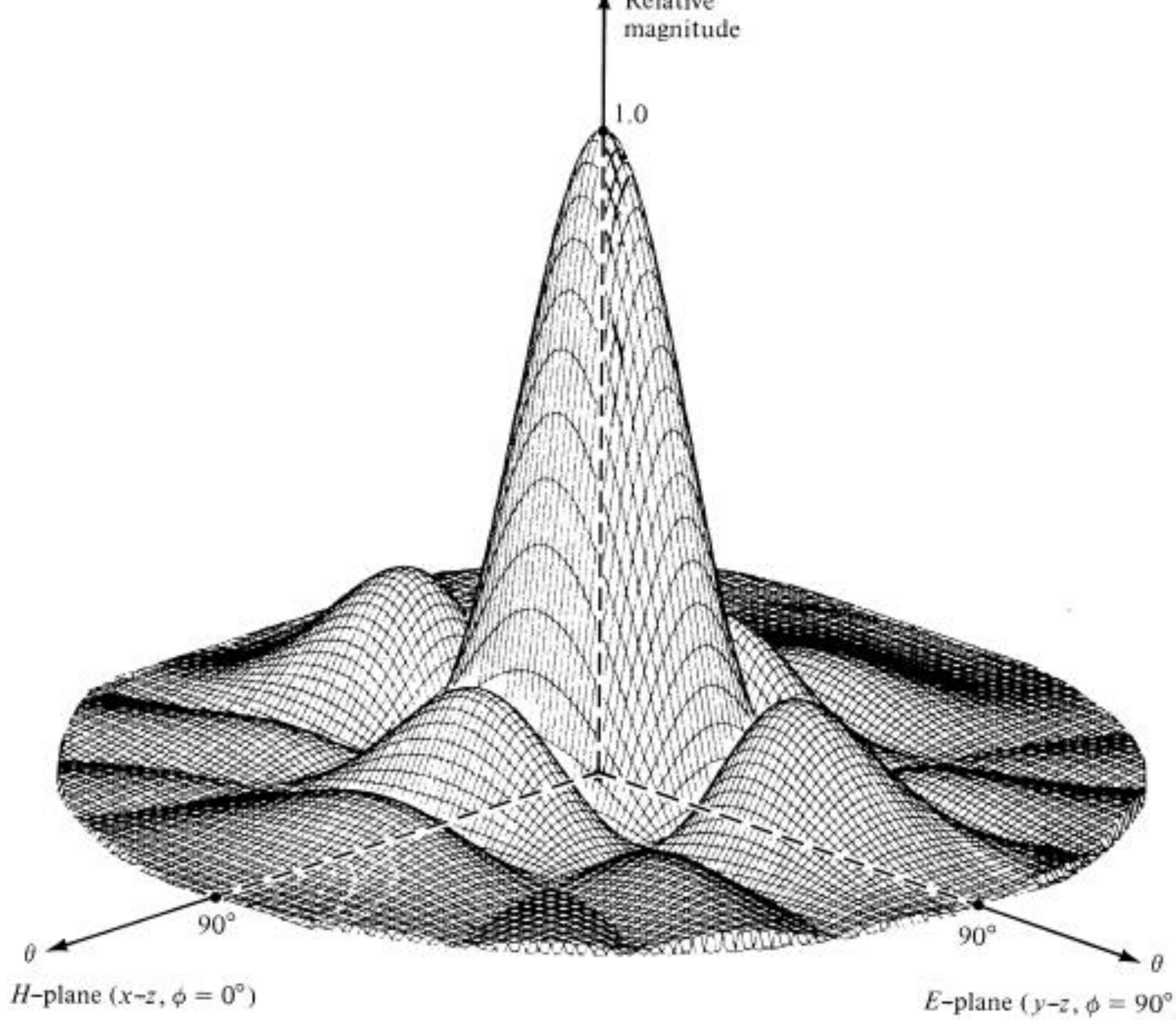
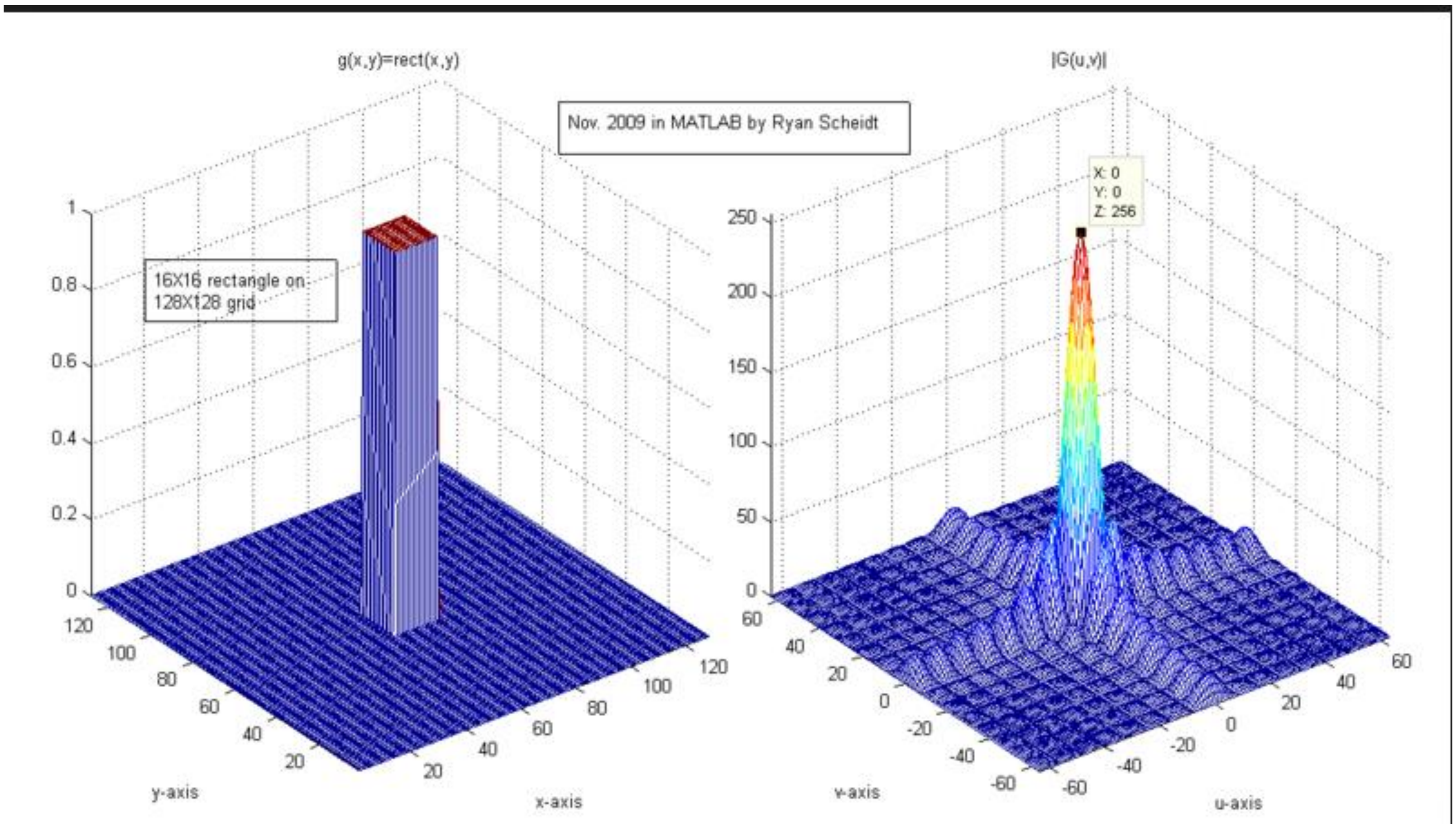


Figure 12.8 Three-dimensional field pattern of a constant field rectangular aperture mounted on an infinite ground plane ($a = 3\lambda$, $b = 2\lambda$).

2D Fourier Transform – rect → sinc

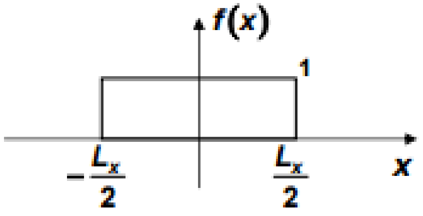


Fourier Transforms and the Rectangular Aperture Far-Field

FT: $F(k_x) = \int_{-\infty}^{\infty} f(x)\, e^{j k_x x}\, dx$

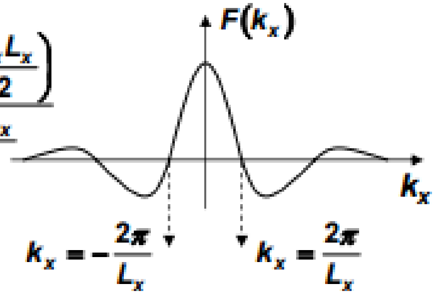
IFT: $f(x) = \int_{-\infty}^{\infty} F(k_x)\, e^{-j k_x x}\, \frac{dk_x}{2\pi}$

Consider the 1D box function



FT of the 1D box function

$$F(k_x) = L_x \frac{\sin\left(\frac{k_x L_x}{2}\right)}{\frac{k_x L_x}{2}}$$



Width of main lobe in k-space = $\frac{4\pi}{L_x}$

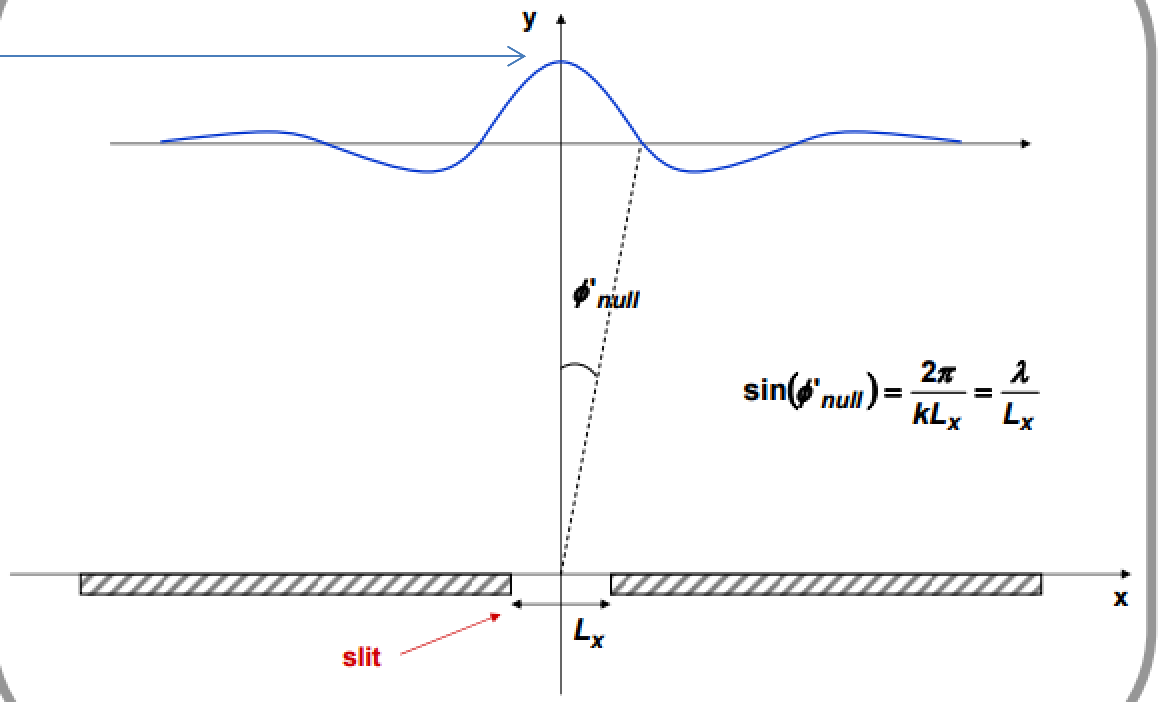
The far-field E-field is proportional to the 2D FT of the aperture shape

$$\vec{E}_{ff}(\vec{r}) = (\hat{\theta}) \frac{j\,k}{2\pi\, r} E_a \sin(\theta) e^{-jkr} \int_{-L_x/2}^{L_x/2} e^{j k_x x'}\, dx' \int_{-L_z/2}^{L_z/2} e^{j k_z z'}\, dz'$$

$$= (\hat{\theta}) \frac{j\,k}{2\pi\, r} E_a \sin(\theta) e^{-jkr} (L_x\, L_z) \frac{\sin(k_x L_x/2)}{k_x L_x/2} \frac{\sin(k_z L_z/2)}{k_z L_z/2}$$

Meio: sempre maximo pois esta tudo em fase!

What Causes the Nulls in the Diffraction Pattern?



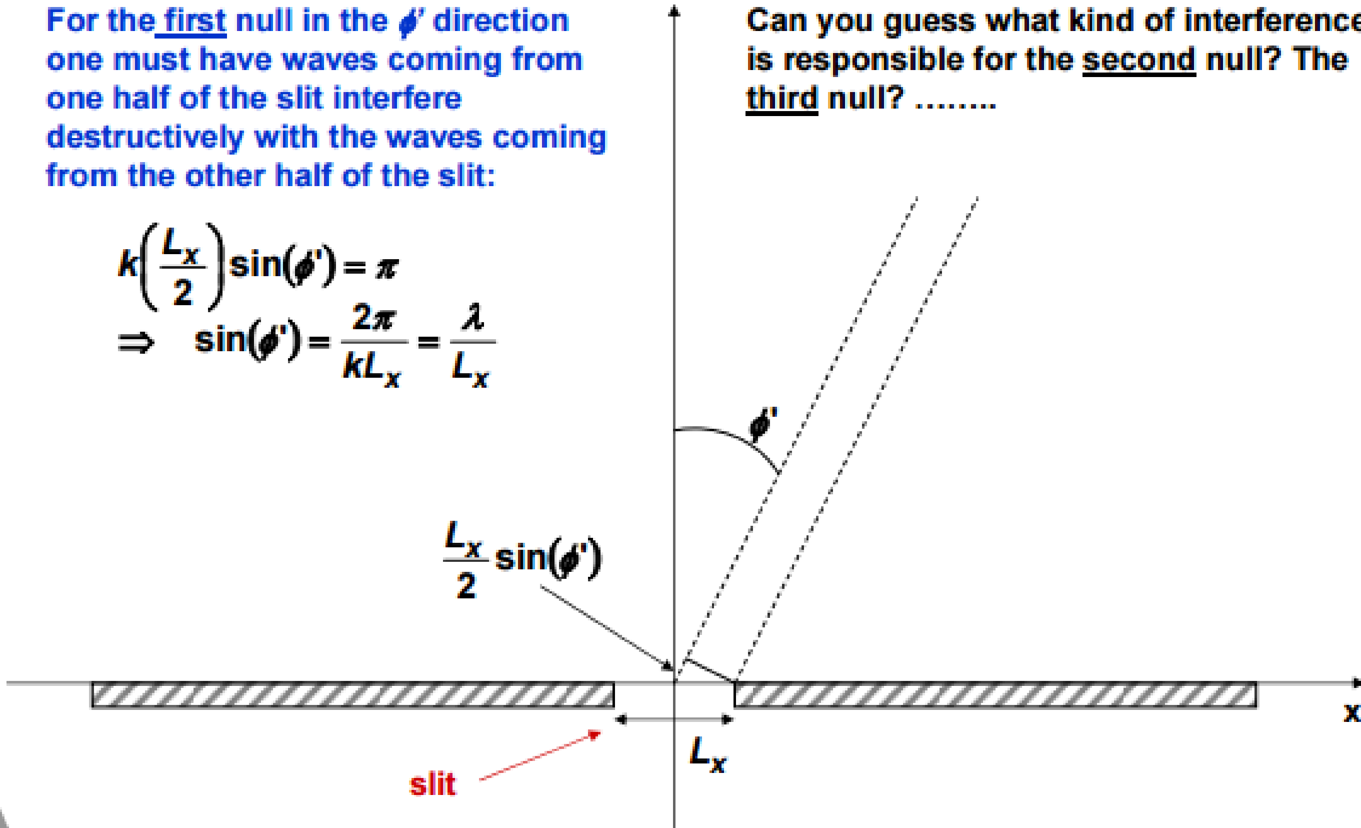
Nulls in the Diffraction Pattern: Interference in Diffraction

For the first null in the ϕ' direction one must have waves coming from one half of the slit interfere destructively with the waves coming from the other half of the slit:

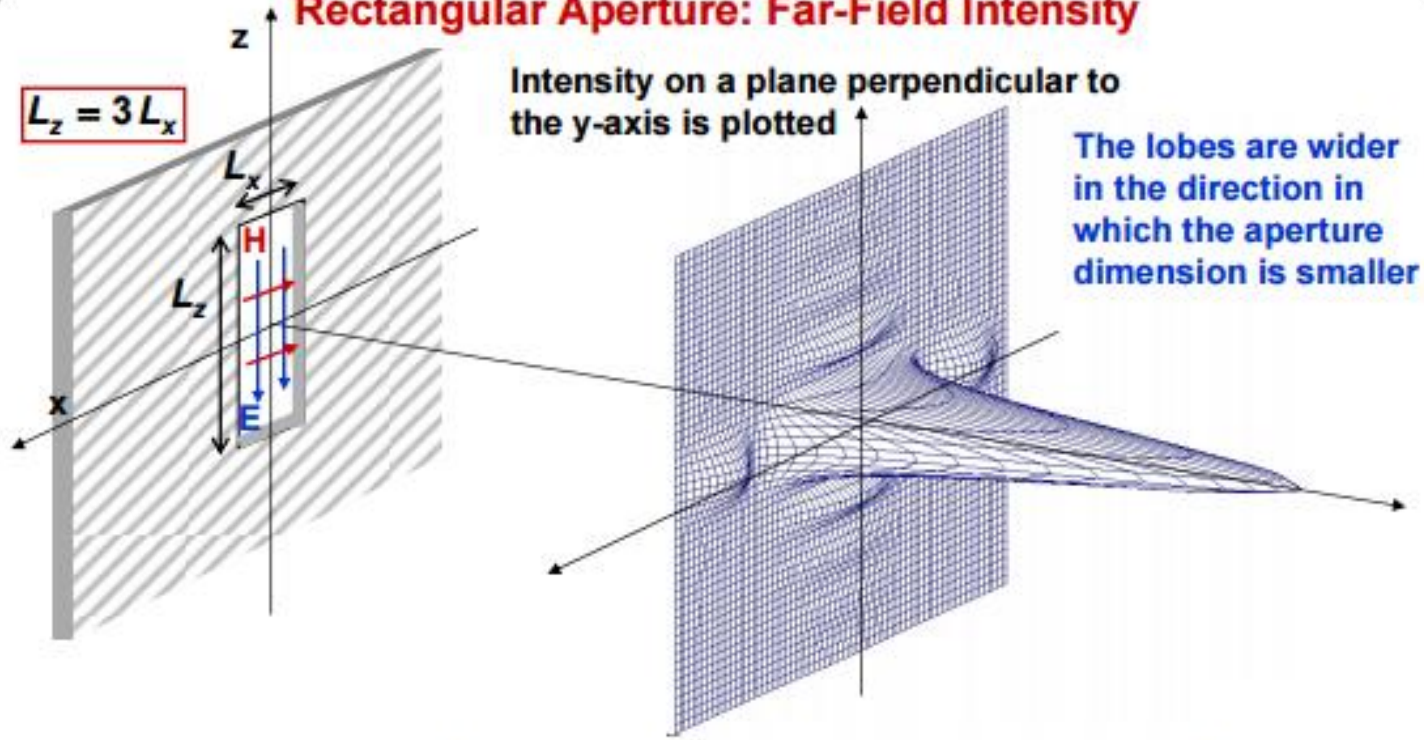
$$k\left(\frac{L_x}{2}\right)\sin(\phi') = \pi$$

$$\Rightarrow \quad \sin(\phi') = \frac{2\pi}{kL_x} = \frac{\lambda}{L_x}$$

Can you guess what kind of interference is responsible for the second null? The third null? ……..



Rectangular Aperture: Far-Field Intensity

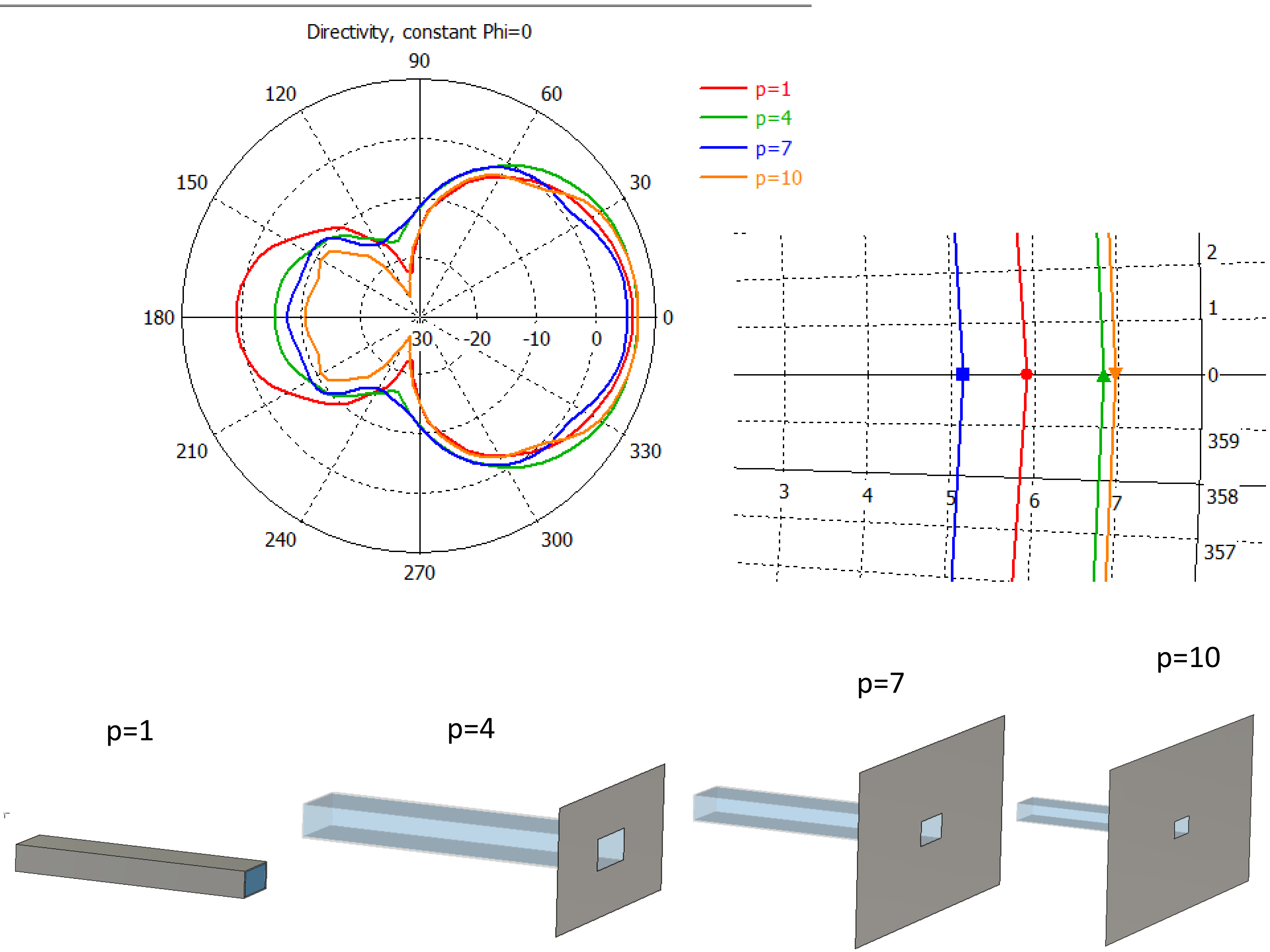


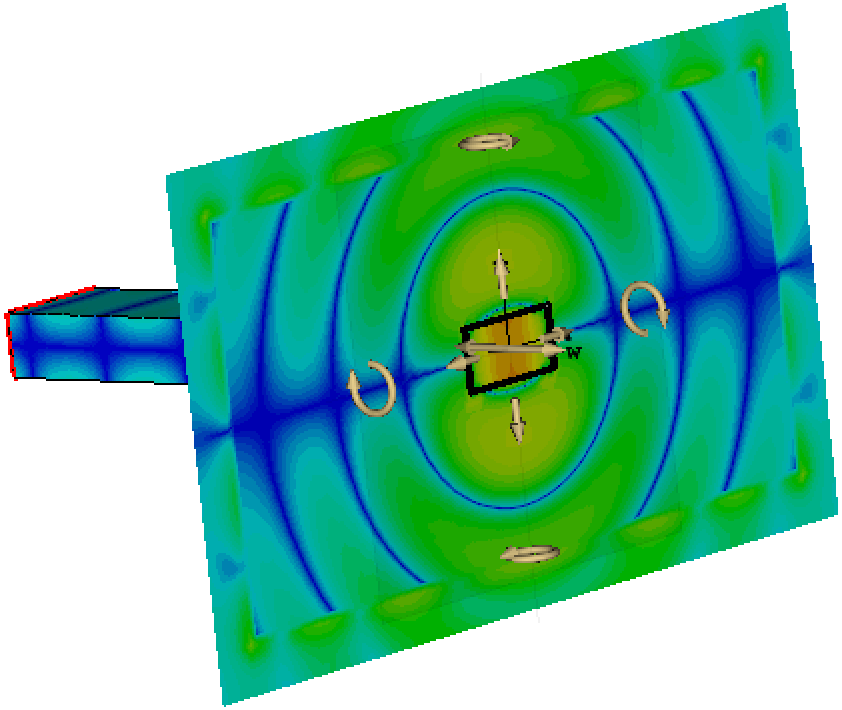
$$\langle \vec{S}_{ff}(\vec{r},t)\rangle = \hat{r}\,\frac{1}{2\eta_o}\left|\frac{k\,E_a}{2\pi r}\right|^2 \sin^2(\theta)\left[(L_x\ L_z)\,\frac{\sin(k_x L_x/2)}{k_x L_x/2}\,\frac{\sin(k_z L_z/2)}{k_z L_z/2}\right]^2$$

$$\Rightarrow \quad \sin(\theta'_{null}) = \pm\frac{2\pi}{kL_z} = \pm\frac{\lambda}{L_z} \qquad \sin(\phi'_{null}) = \pm\frac{2\pi}{kL_x} = \pm\frac{\lambda}{L_x}$$

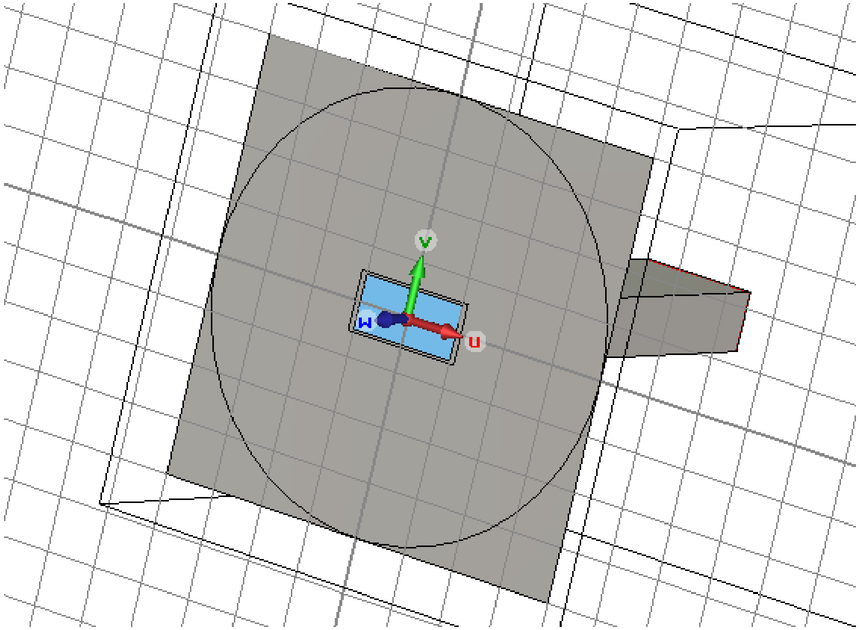
ECE 303 – Fall 2005 – Farhan Rana – Cornell University

Obs: aqui dominio continuo (abertura); vale tambem para redes (Ex. 1:5)

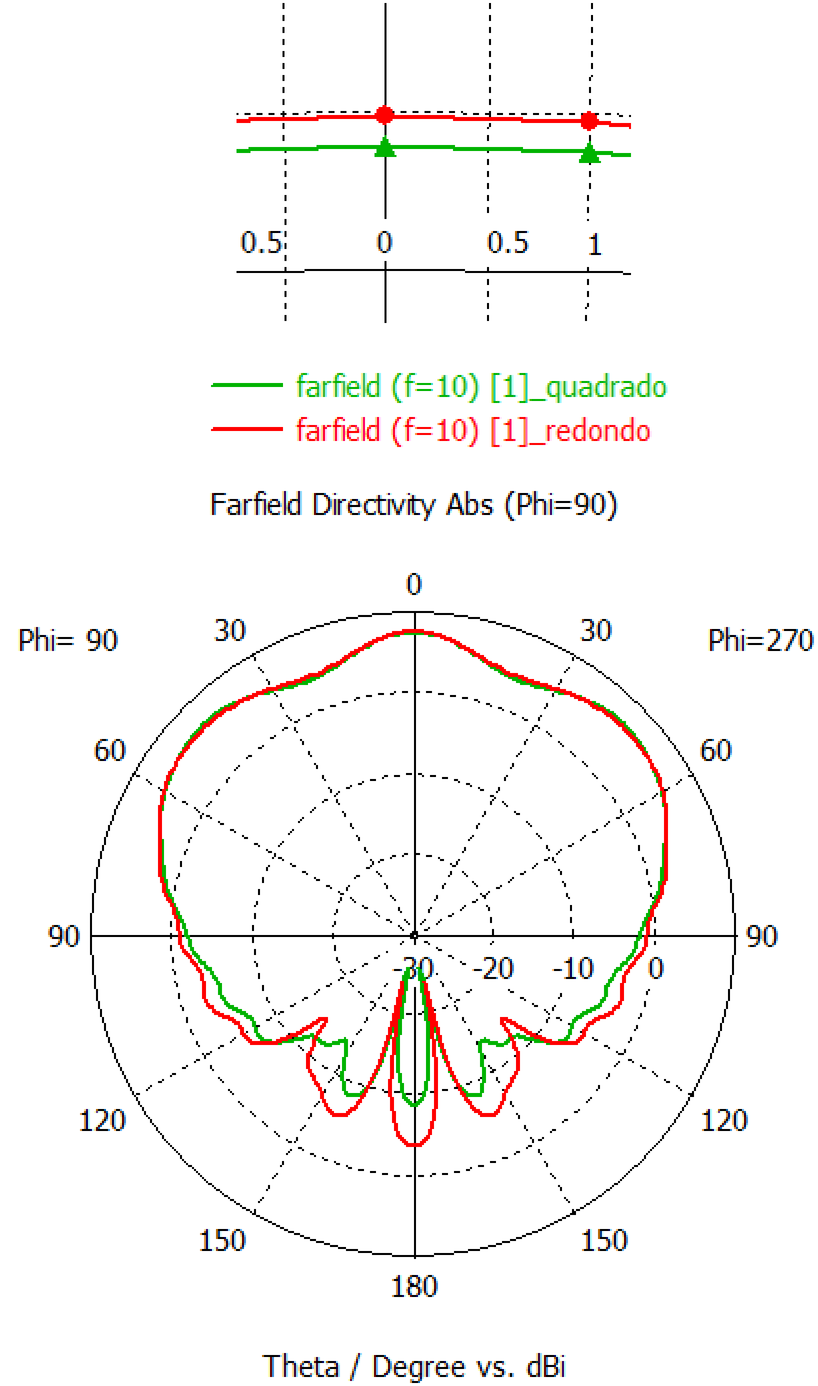

Directivity, constant Phi=0
90
60
30
0
330
300
270
240
210
180
150
120
-30
-20
-10
0
p=1
p=4
p=7
p=10
2
1
0
359
358
357
3
4
5
6
7
p=1
p=4
p=7
p=10



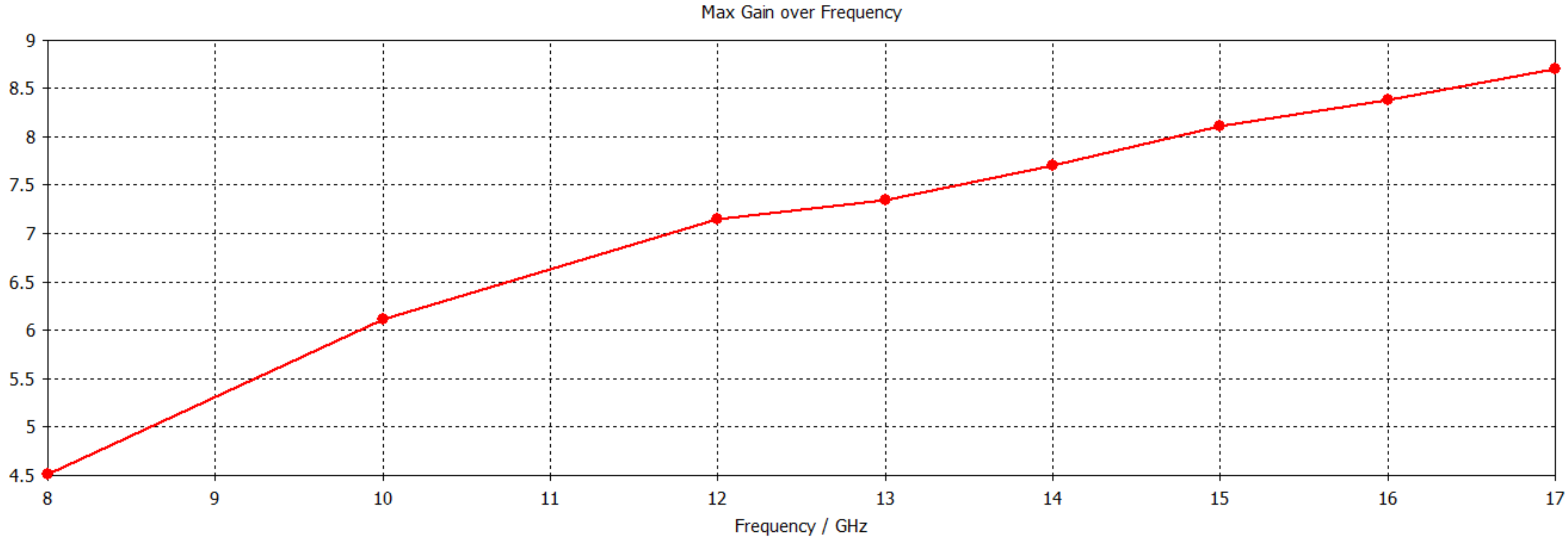
Verifique placa simetria retangular mas campos circular… E se usarmos placa circular?



v
u
w



0.5
0
0.5
1
farfield (f=10) [1]_quadrado
farfield (f=10) [1]_redondo
Farfield Directivity Abs (Phi=90)
0
30
30
Phi= 90
Phi=270
60
60
90
90
-30
-20
-10
0
120
120
150
150
180
Theta / Degree vs. dBi



? Ganho VS. frequencia aumenta linearmente Por que?