
FISICA PARA BIOLOGIA F107 A : AULA 7

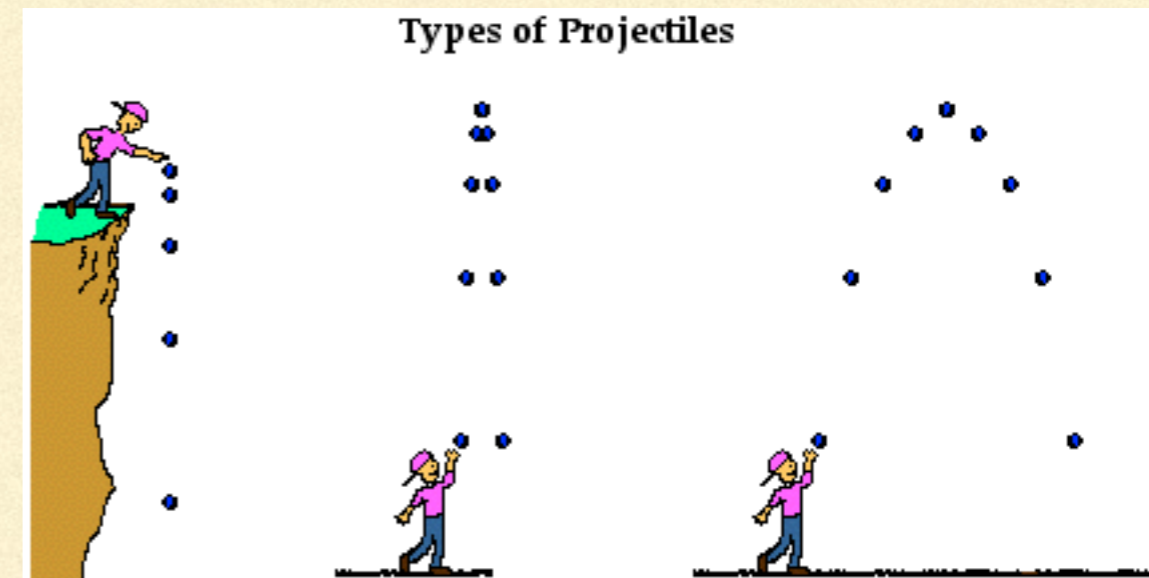
PROFESSOR Orlando Luis Goulart Peres

Pagina do curso: <https://sites.ifi.unicamp.br/orlando/ensino/f-107-fisica-para-biologia/>

Moodle: <https://www.ggte.unicamp.br/ea/>

PARTICULAS E ONDAS

Particular : trajetorias



Colisoes : particulas se chocam

ONDAS MECÂNICAS

Ondas numa lago: meio de transporte

Padrão de repetição: **comprimento de onda**



Amplitudes da onda

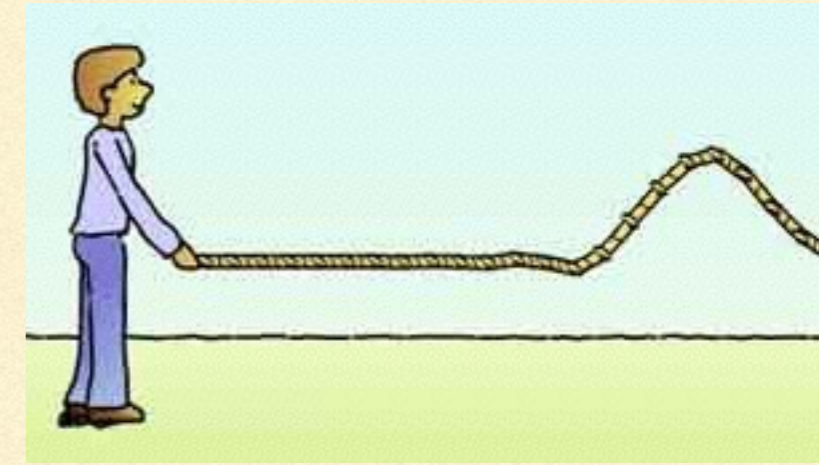


ONDAS MECÂNICAS II

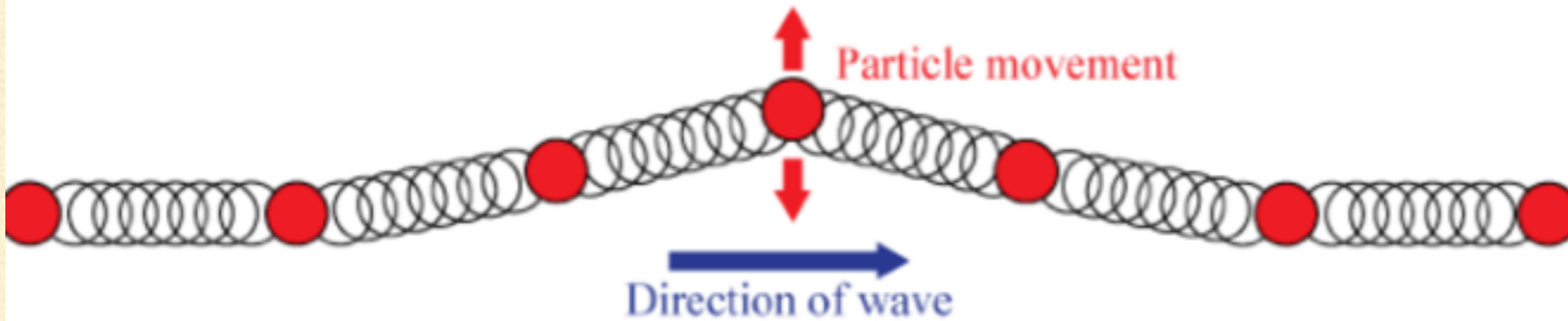
Tipos de ondas:

Transversais

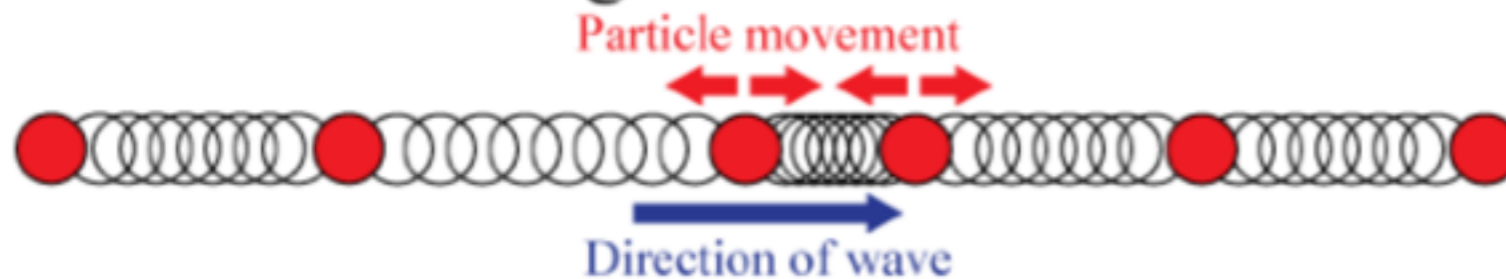
Longitudinais



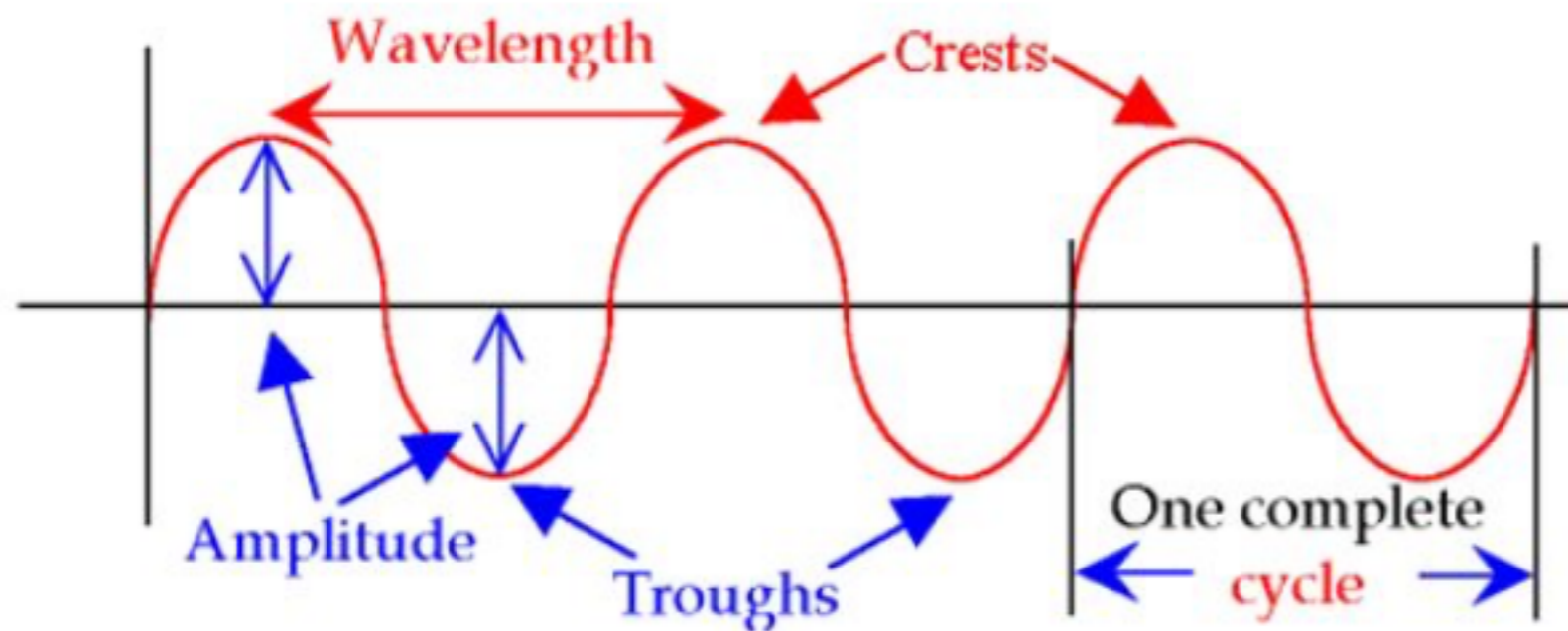
Transverse wave



Longitudinal Wave



ONDAS MECÂNICAS III



Maximos e Minimos: amplitudes

Comprimento de onda: repetições

INTERFERENCIA E DIFRAÇÃO

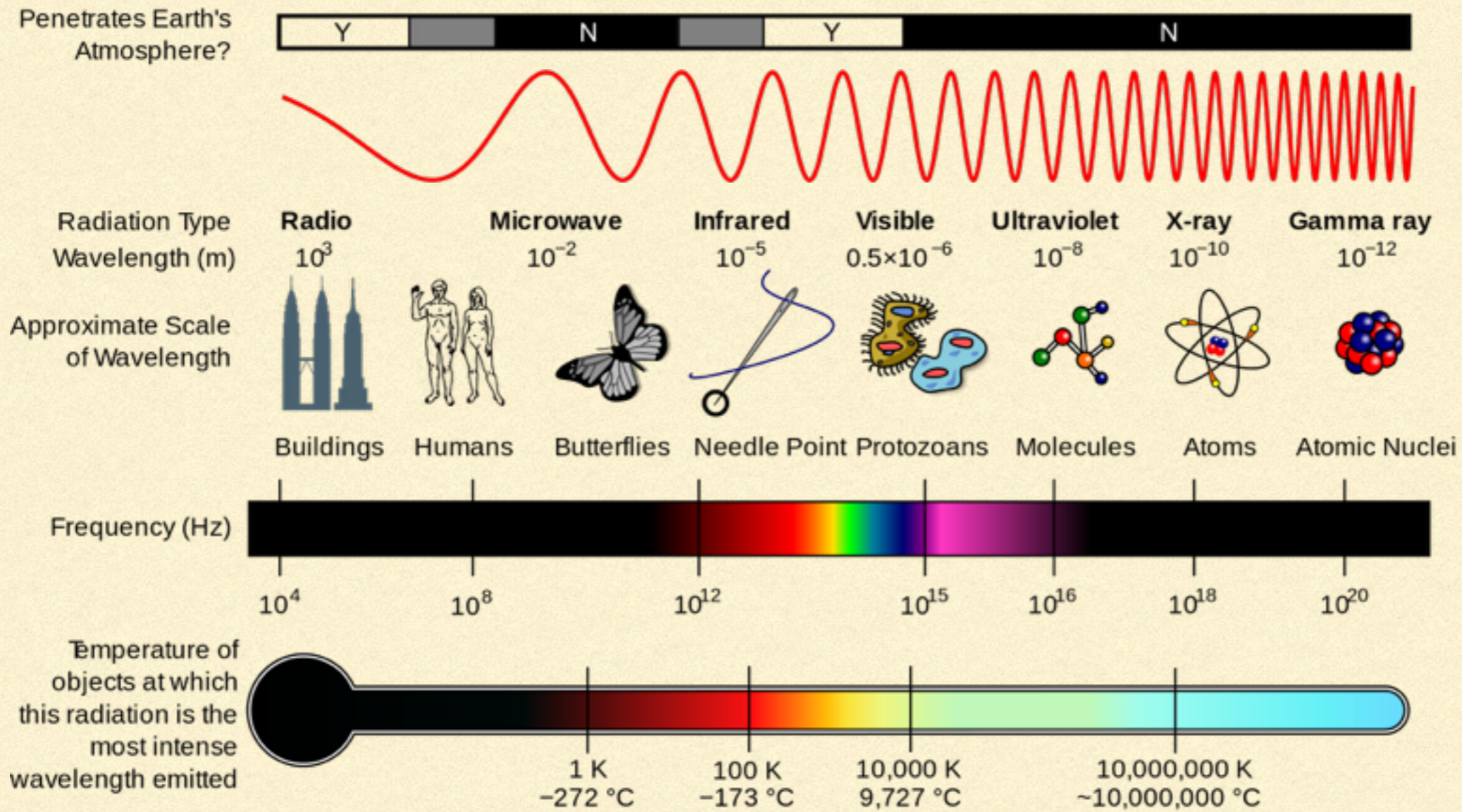
Interferencia: **maximos e minimos**



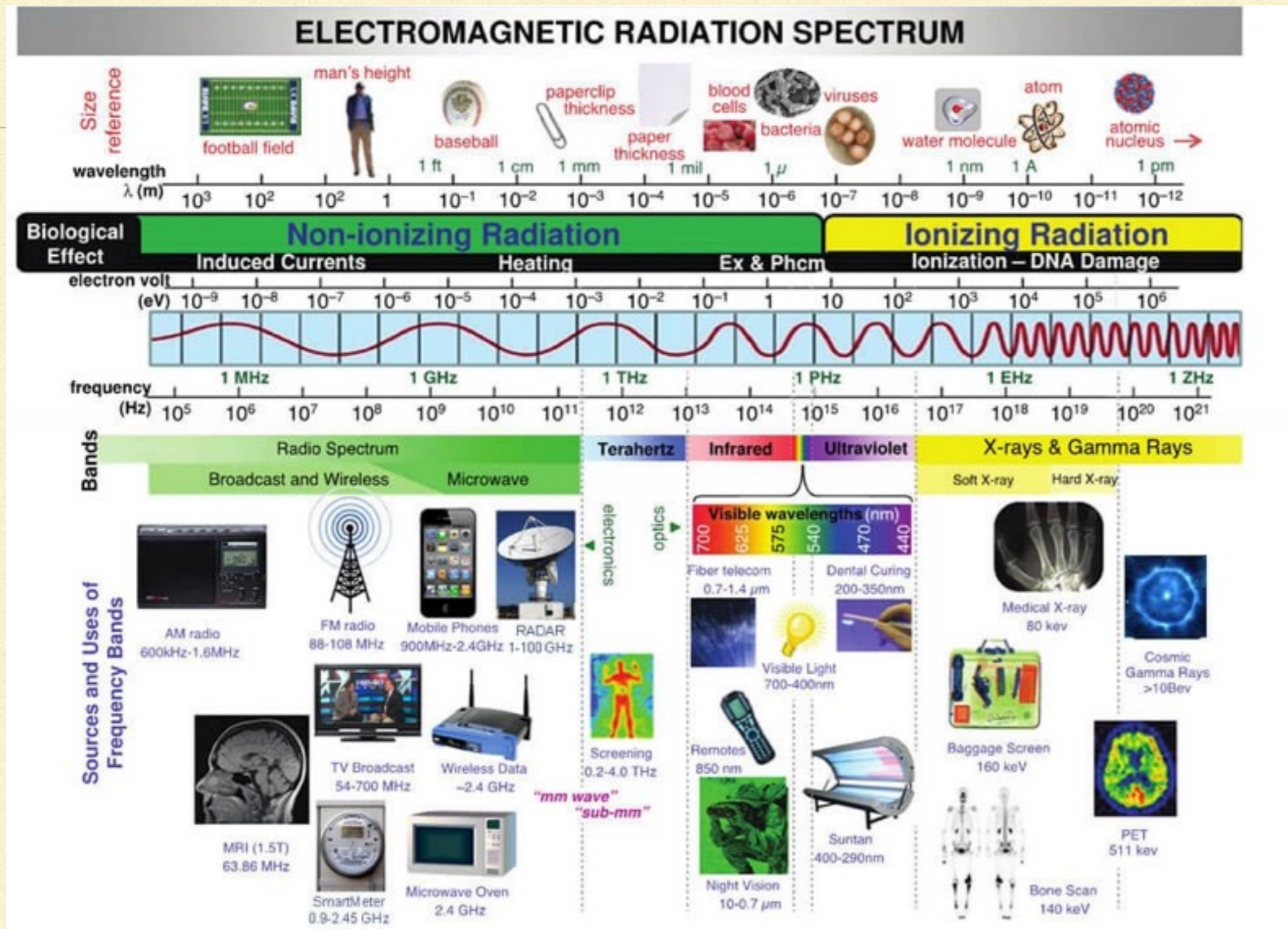
Difração: obstaculo



ONDAS ELETROMAGNETICAS

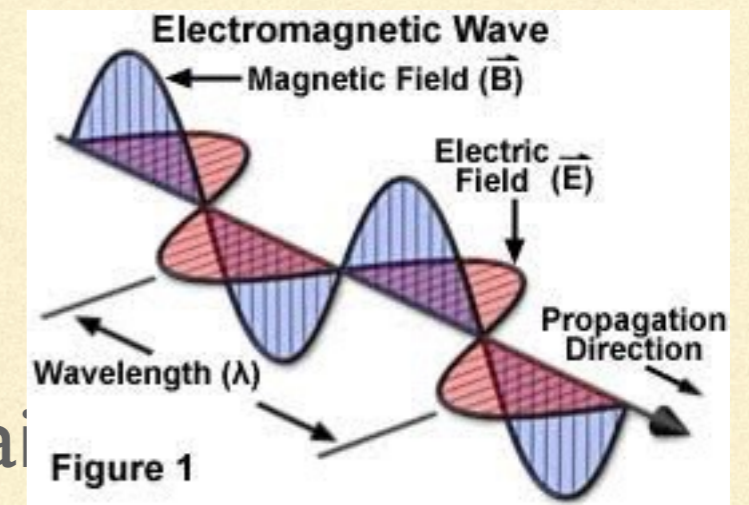


ONDAS ELETROMAGNETICAS II

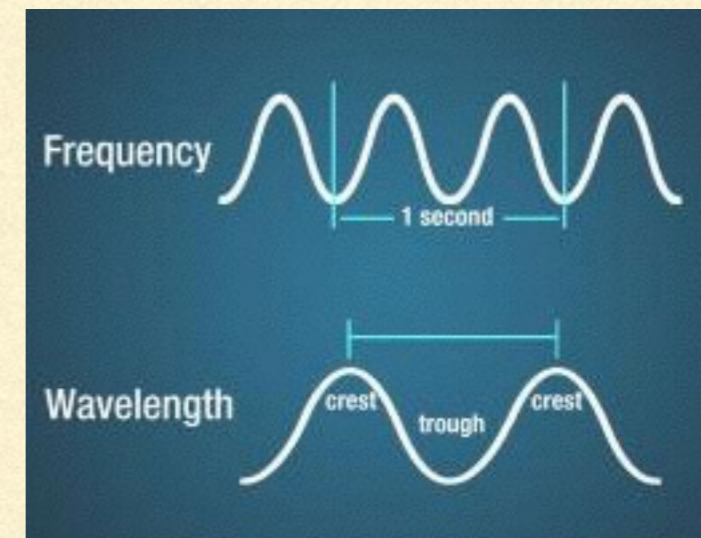
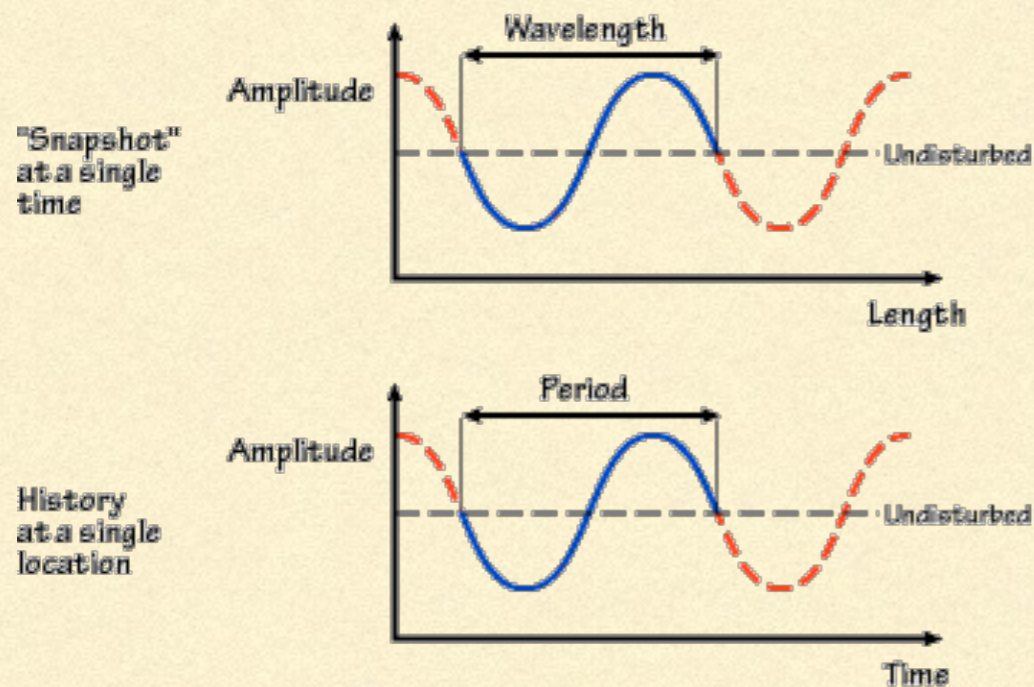


ONDAS ELETROMAGNETICAS III

- Ondas eletromagnéticas são sempre transversais
- Se desloca mesmo no vácuo,
- velocidade de propagação constante, velocidade da luz



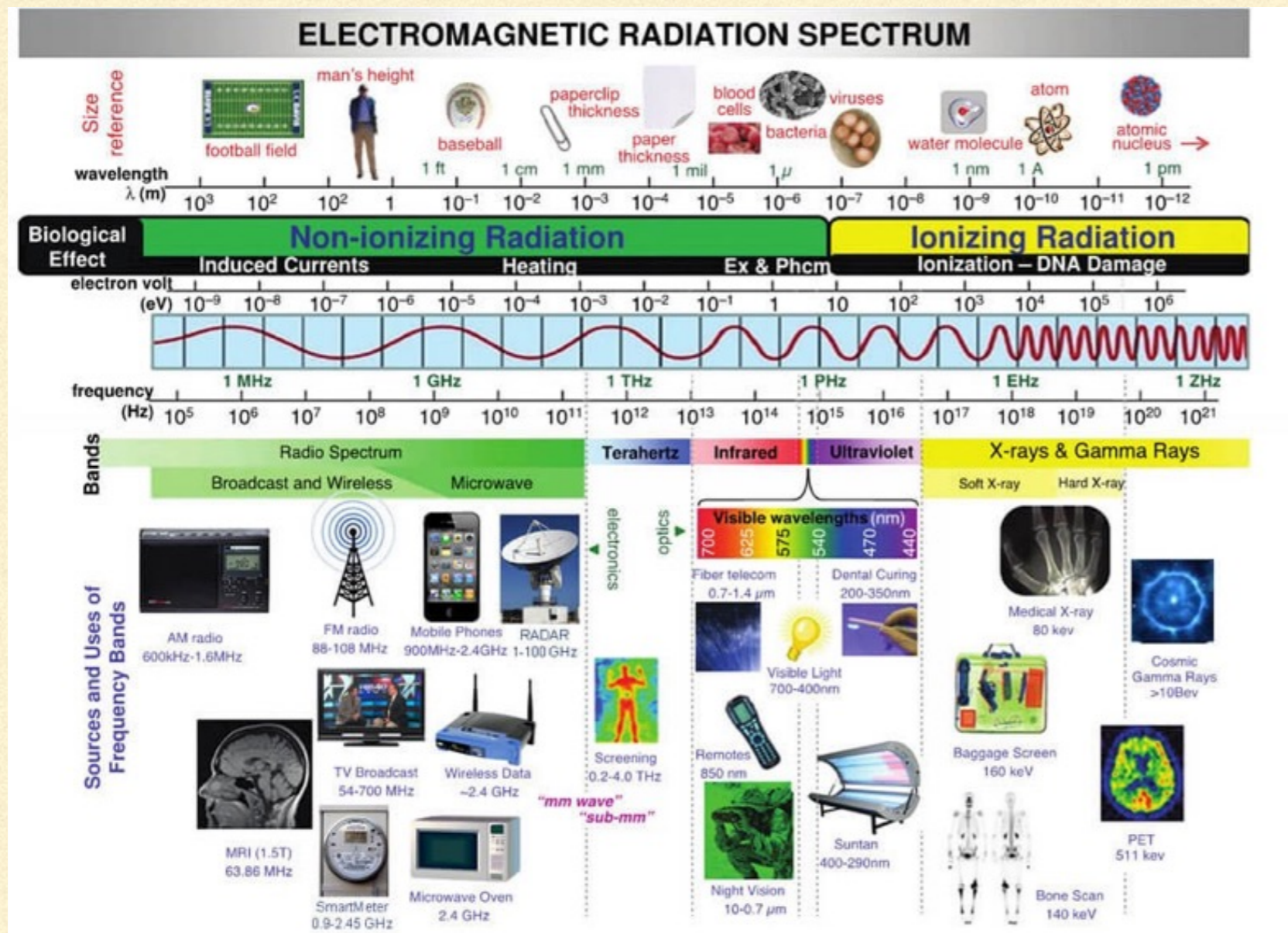
ONDAS ELETROMAGNETICAS IV



- Ondas eletromagnéticas: padrão de repetição nos máximos da amplitude e no tempo, respectivamente **comprimento de onda** e **frequência**.

$$c = f \lambda$$

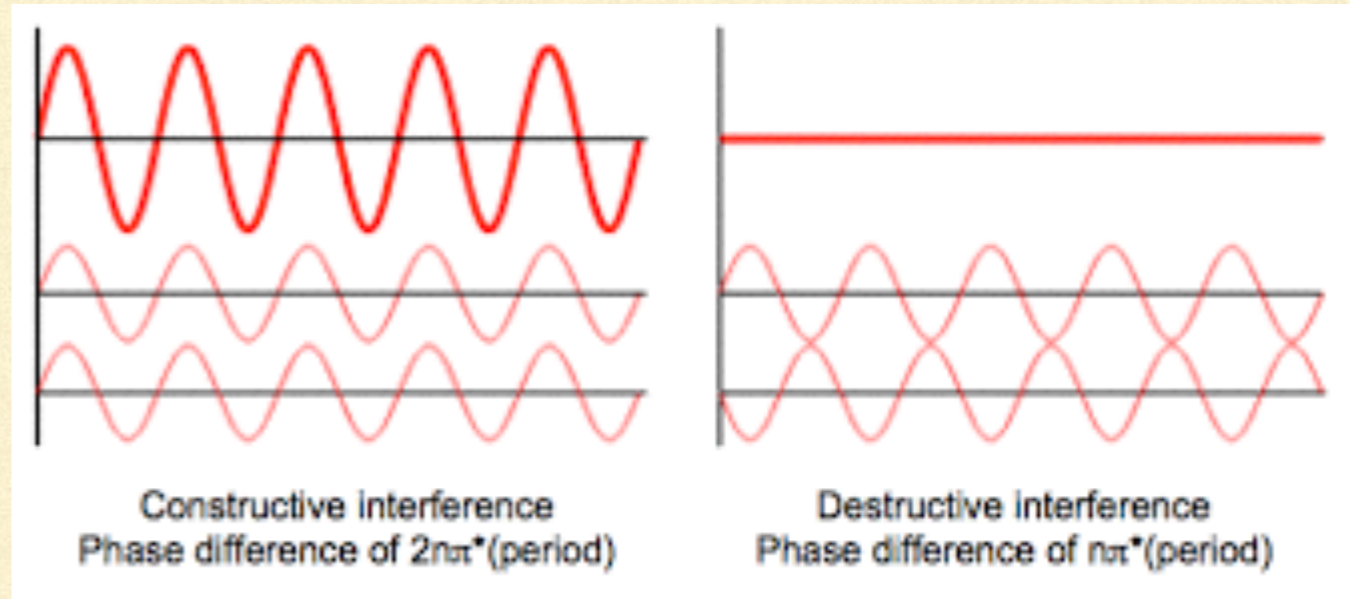
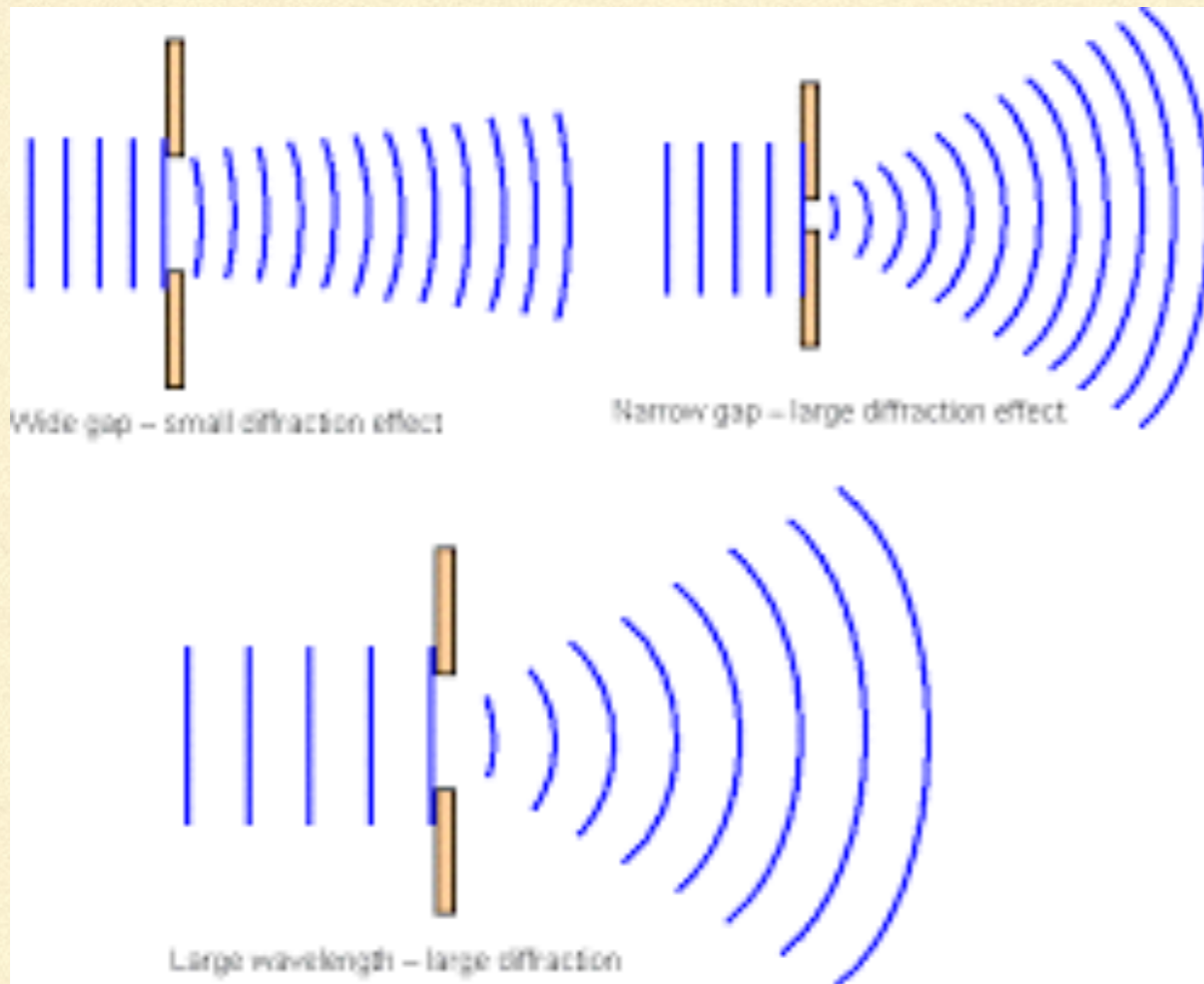
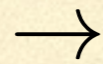
ONDAS ELETROMAGNETICAS V



$$1 \text{ Hz} = 1 \text{ s}^{-1}$$

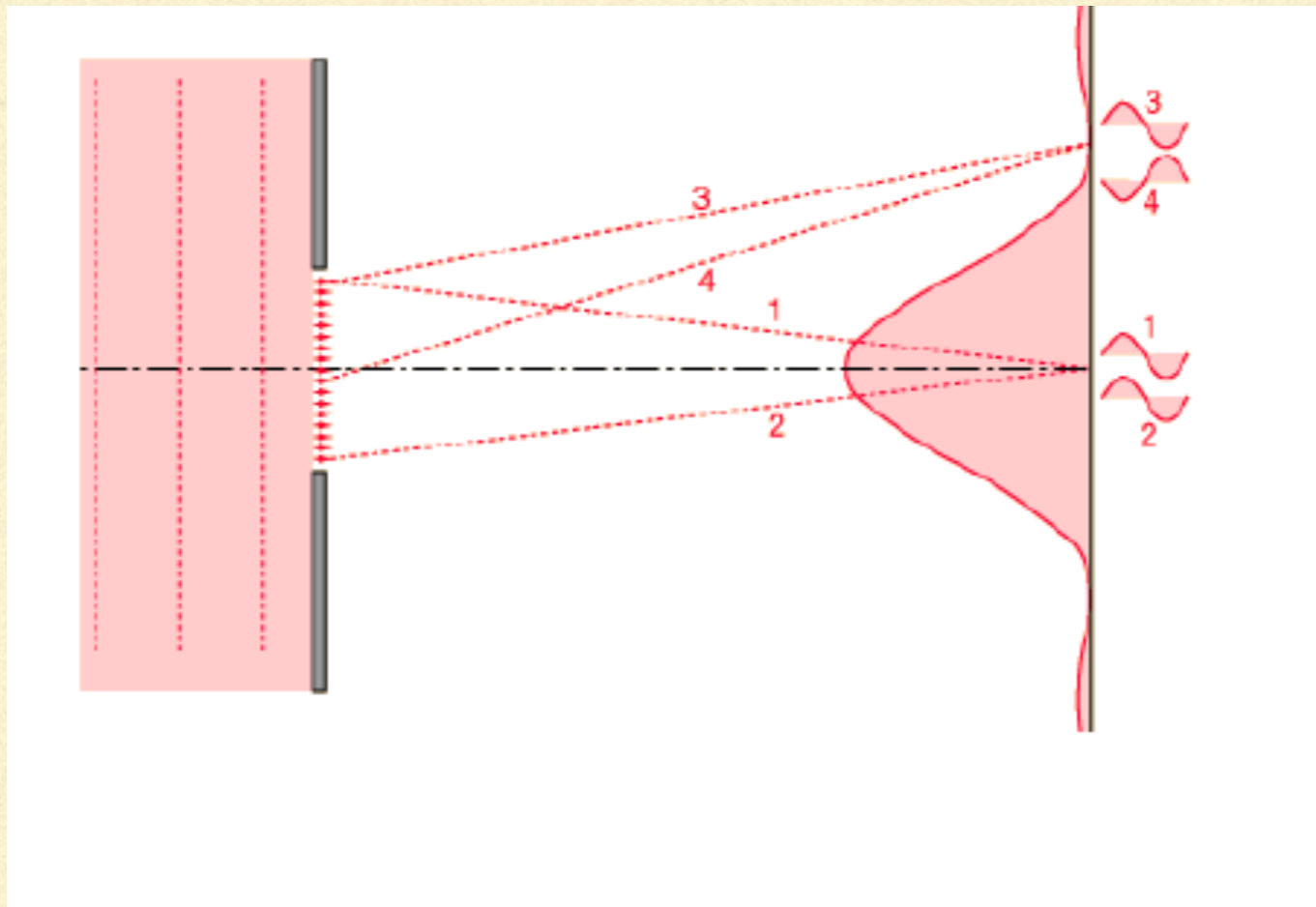
INTERFERÊNCIA E DIFRAÇÃO DE ONDAS ELETROMAGNÉTICAS

Interferencia

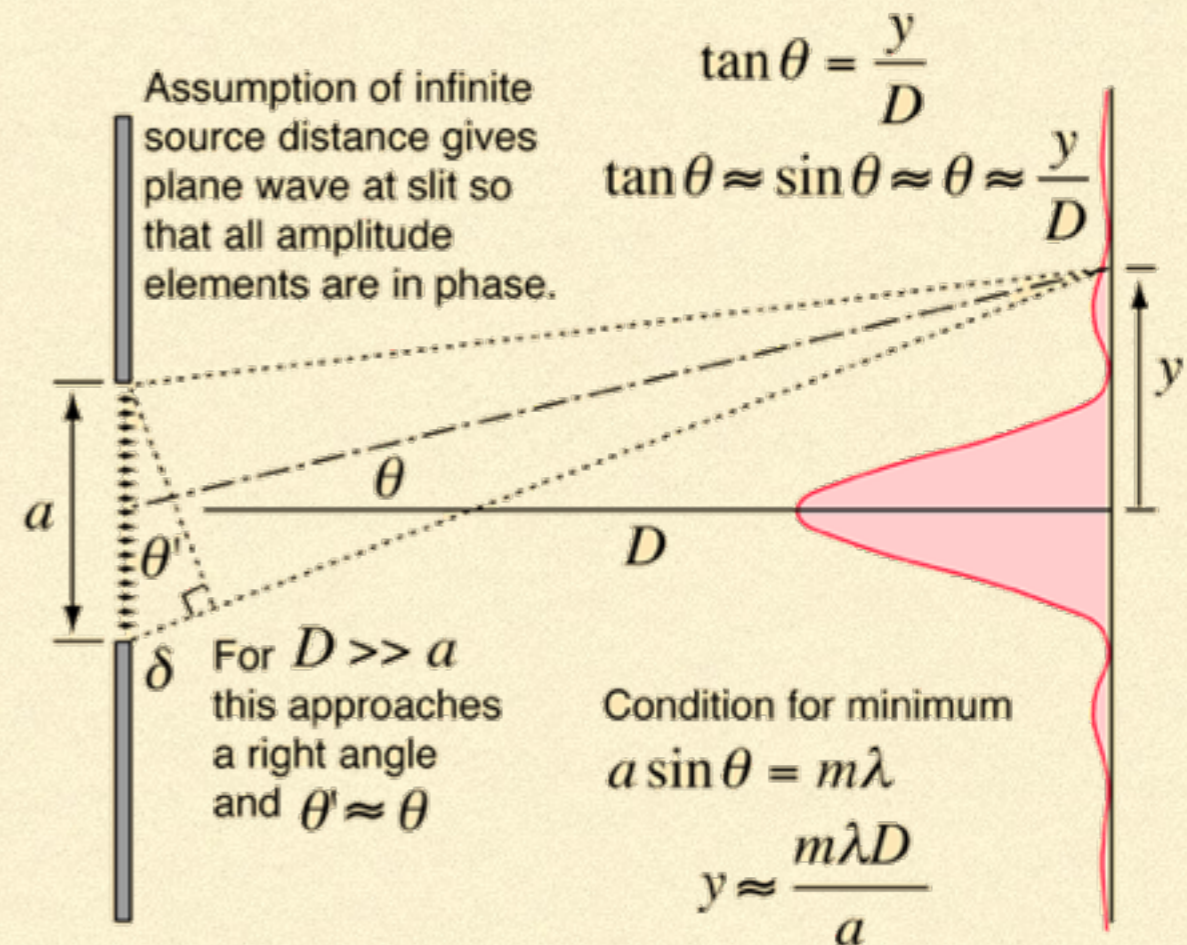


← Difração

DIFRAÇÃO DE ONDAS ELETROMAGNÉTICAS



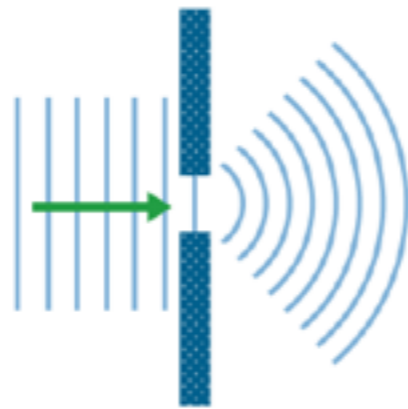
$$a \sin \theta = m\lambda$$



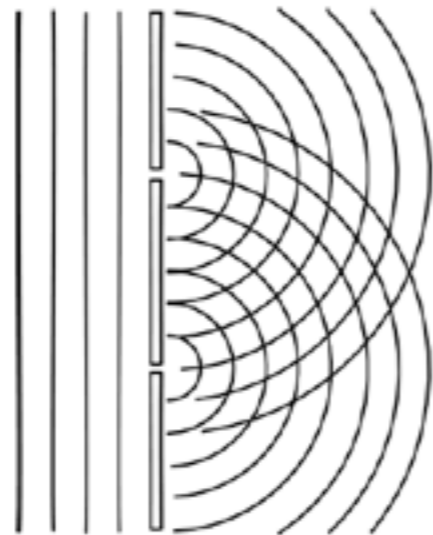
DIFRAÇÃO DE ONDAS ELETROMAGNÉTICAS

Ondas eletromagnéticas com uma fenda:

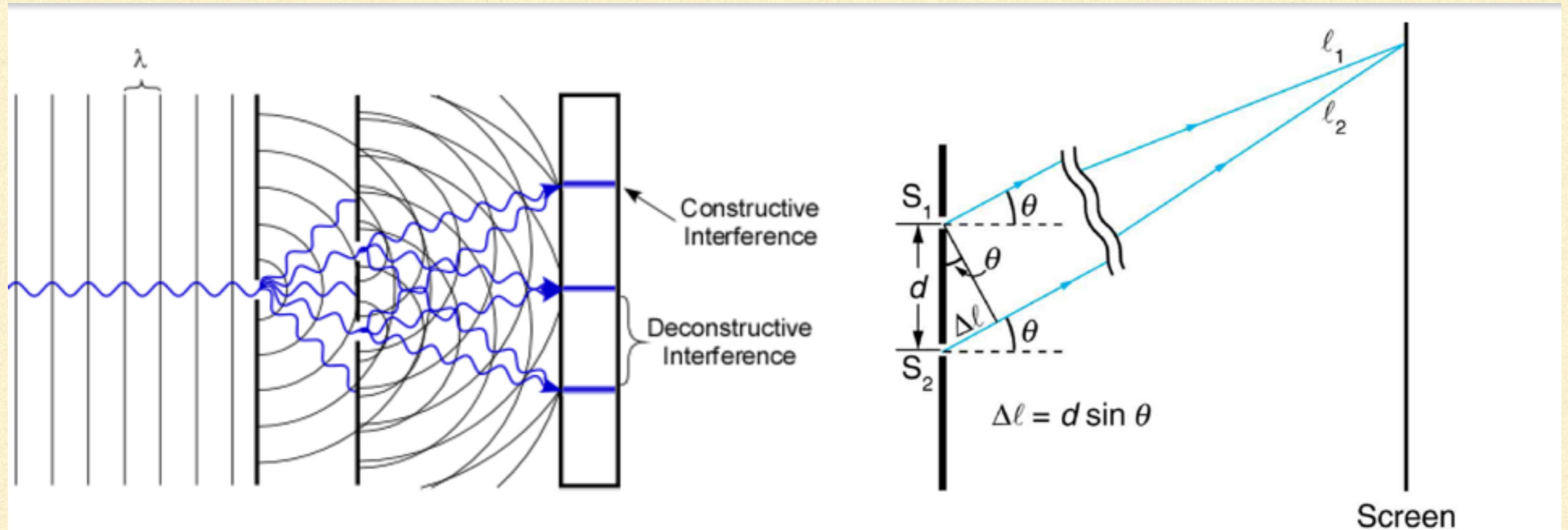
Uma fenda



Duas fendas



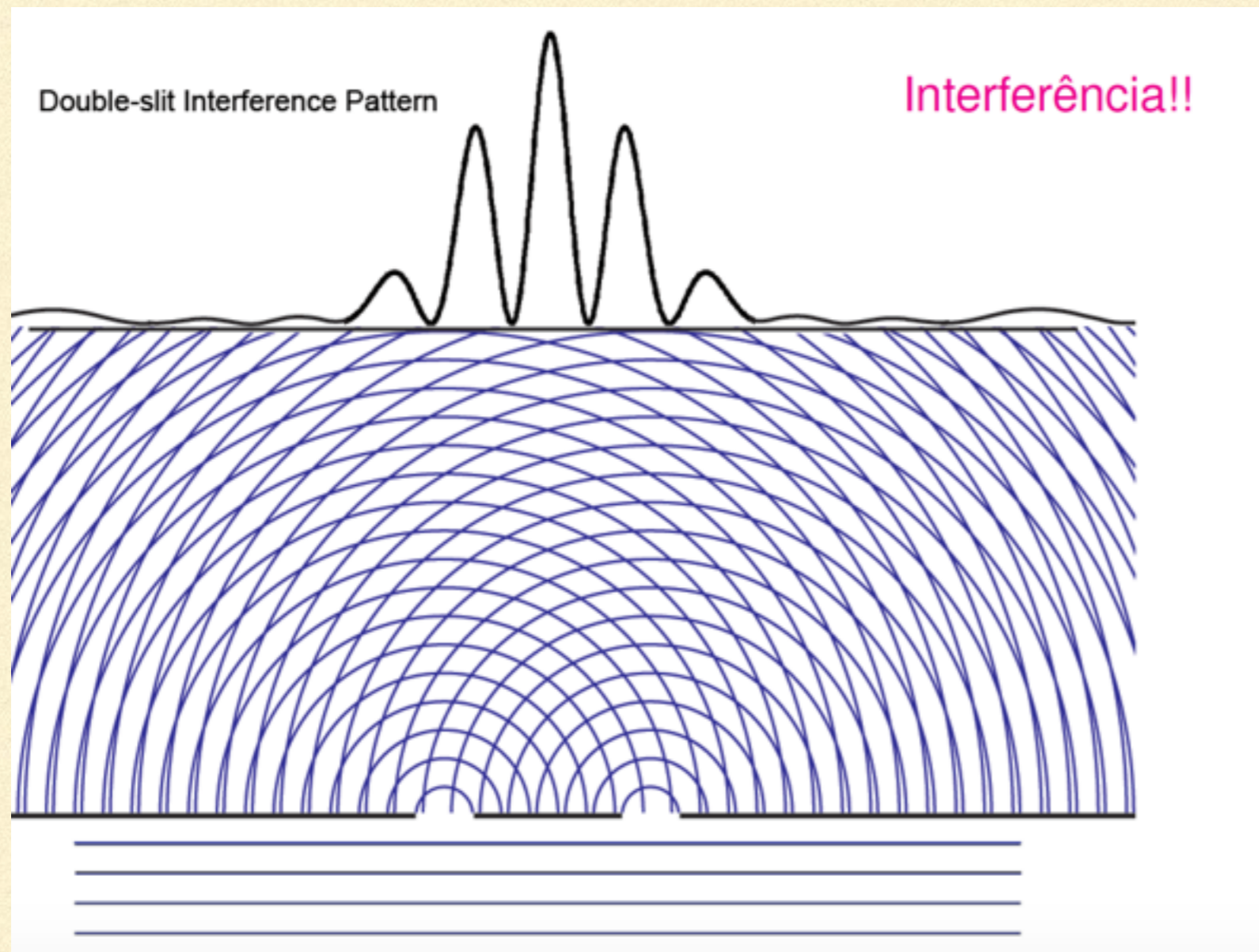
DIFRAÇÃO DE ONDAS ELETROMAGNÉTICAS



Interferência construtiva $\Delta l = n\lambda$

Interferência destrutiva $\Delta l = n\lambda/2$

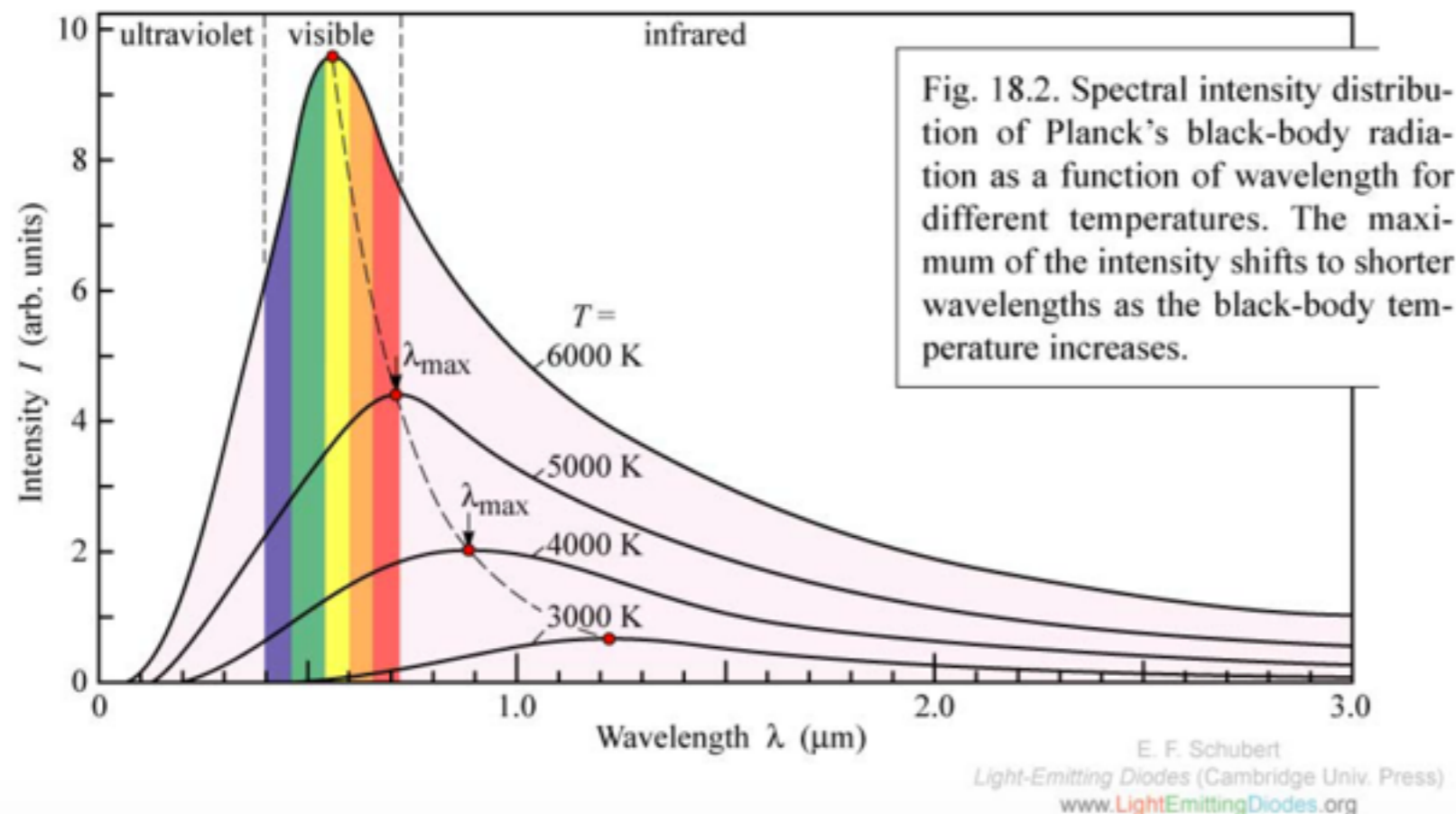
INTERFERENCIA DE ONDAS ELETROMAGNÉTICAS



RADIAÇÃO DE CORPO NEGRO

Corpos quentes emitem radiação

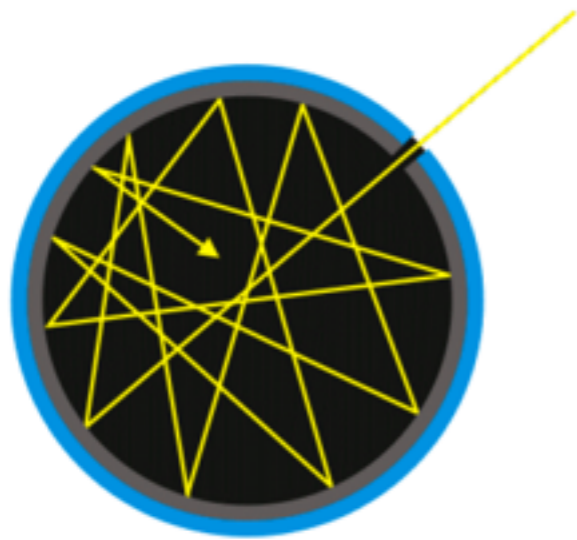
Corpo negro: objeto que absorve toda a radiação



RADIAÇÃO DE CORPO NEGRO II

$$R(T) = \int_0^{\infty} R(T, \lambda) d\lambda$$

Onda eletromagnética estacionária: calculo clássico

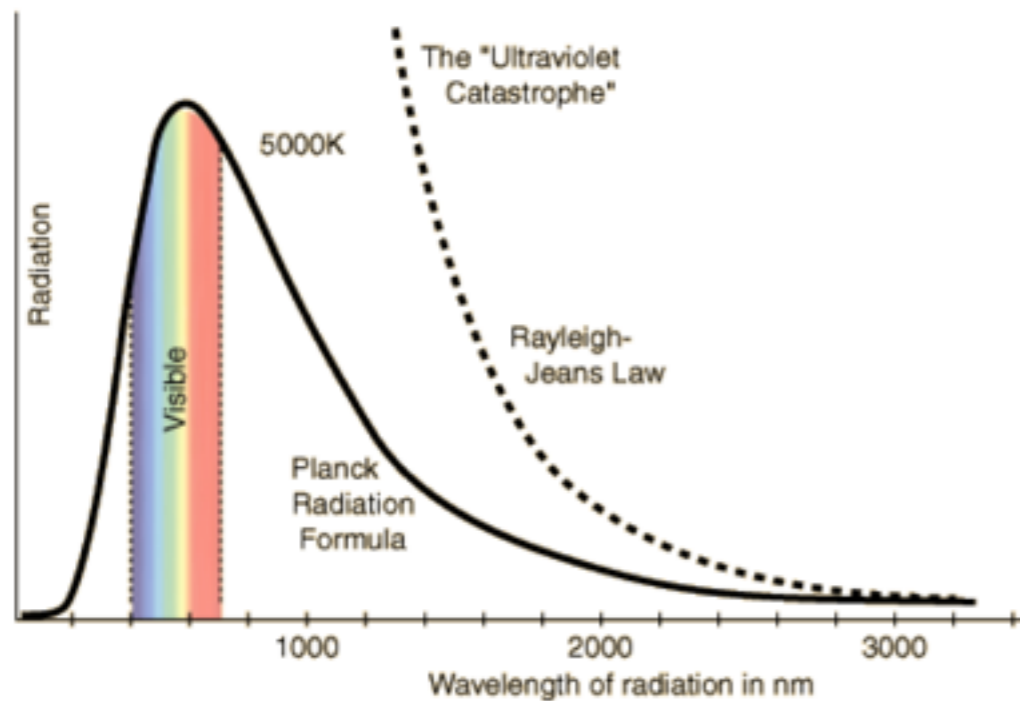


Conceptual Black Body

RADIAÇÃO DE CORPO NEGRO III

$$R(T) = \int_0^{\infty} R(T, \lambda) d\lambda$$

Cálculo de Rayleigh: radiação infinita.



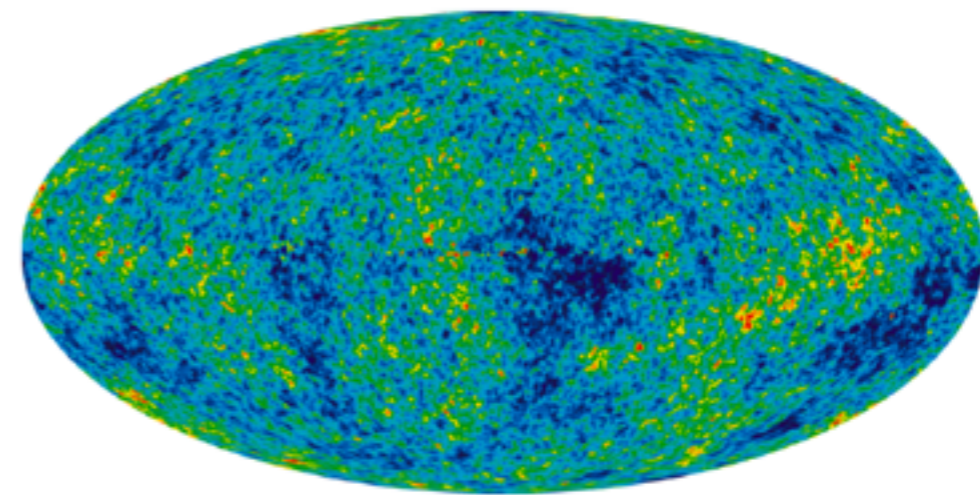
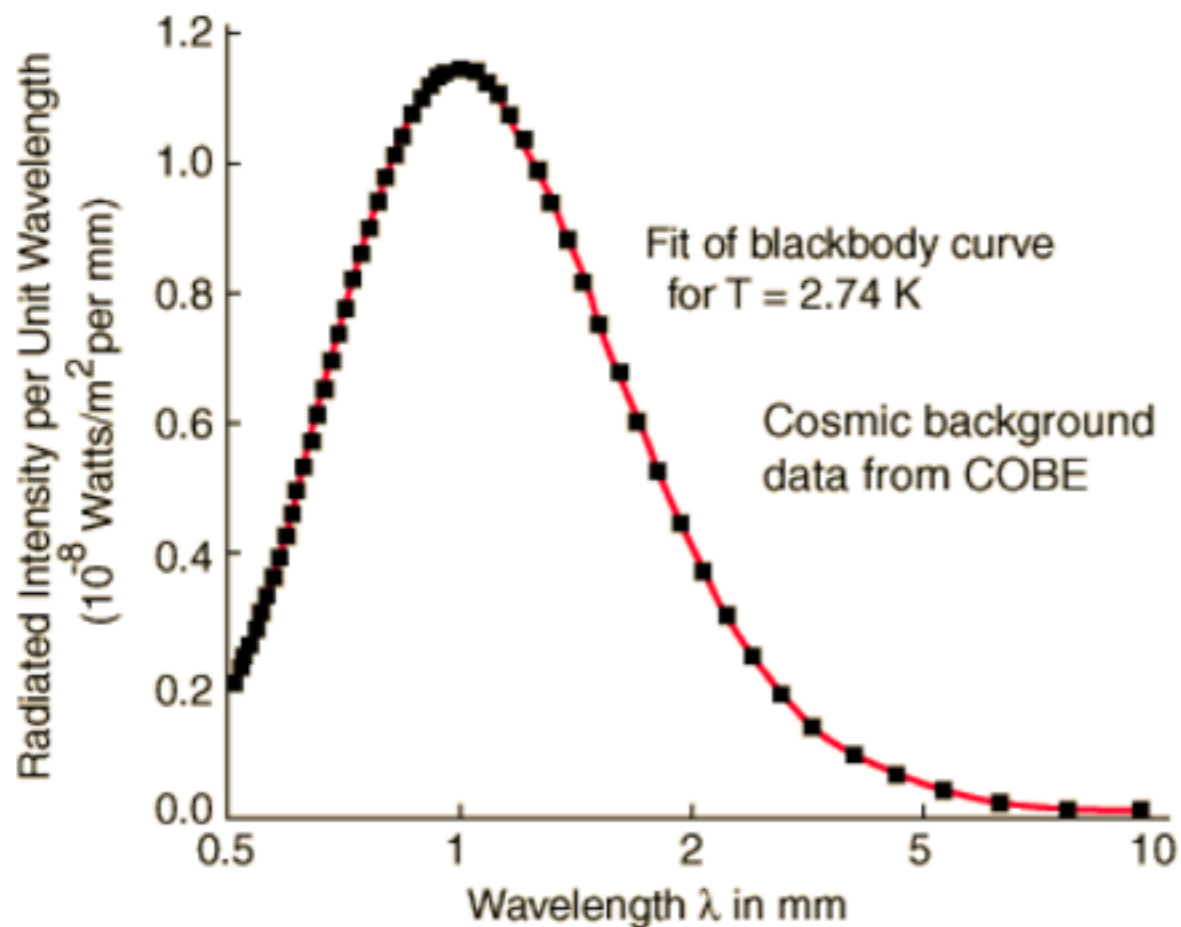
RADIAÇÃO DE CORPO NEGRO IV

Modelo de Planck: energia eletromagnética é quantizada

$$E = h\nu = \frac{hc}{\lambda}: h \text{ constante de Planck}$$

Previsão lei de Wien: $\lambda_{\max} T = \text{constante}$.

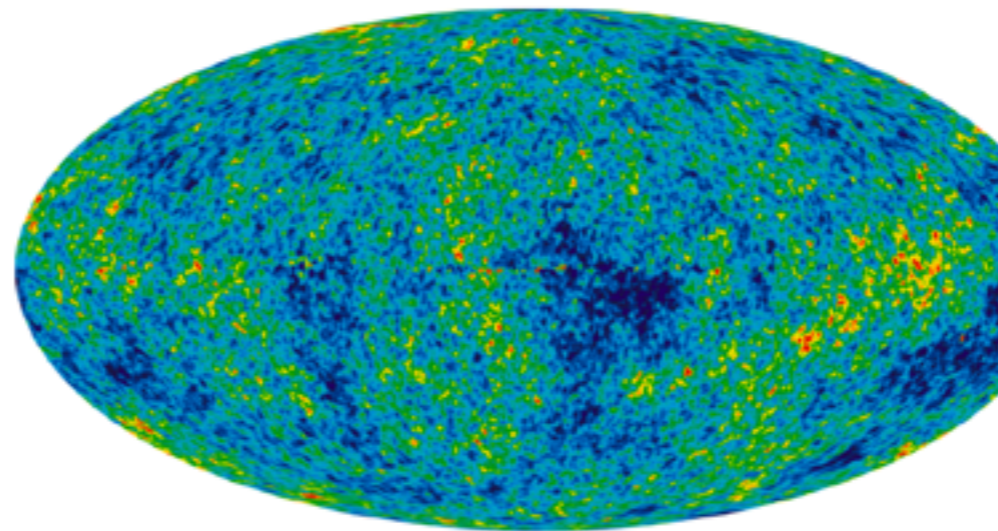
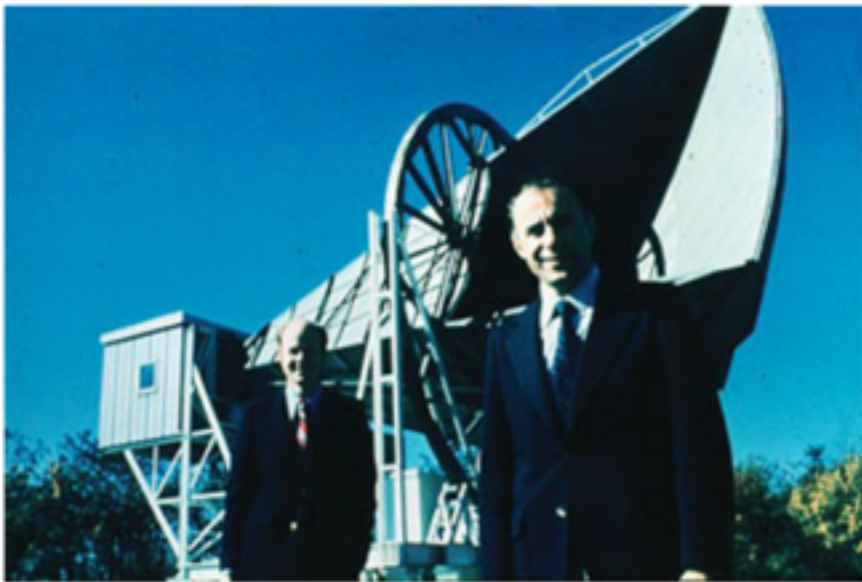
$$T_{\text{CMB}} = 3\text{K}, T_{\text{sol}} = 6000\text{K}$$



RADIACAO DE FUNDO

Penzias e Wilson 1964

$T_{\text{CMB}} = 3\text{K}$: microondas



Radiação cósmica de fundo