Ingeniería Eléctrica
FACULTAD DE CIENCIAS
FÍSICAS Y MATEMÁTICAS
UNIVERSIDAD DE CHILE

EL5206
Laboratorio de Inteligencia Computacional y Robótica

Unidad: Procesamiento Digital de Imágenes

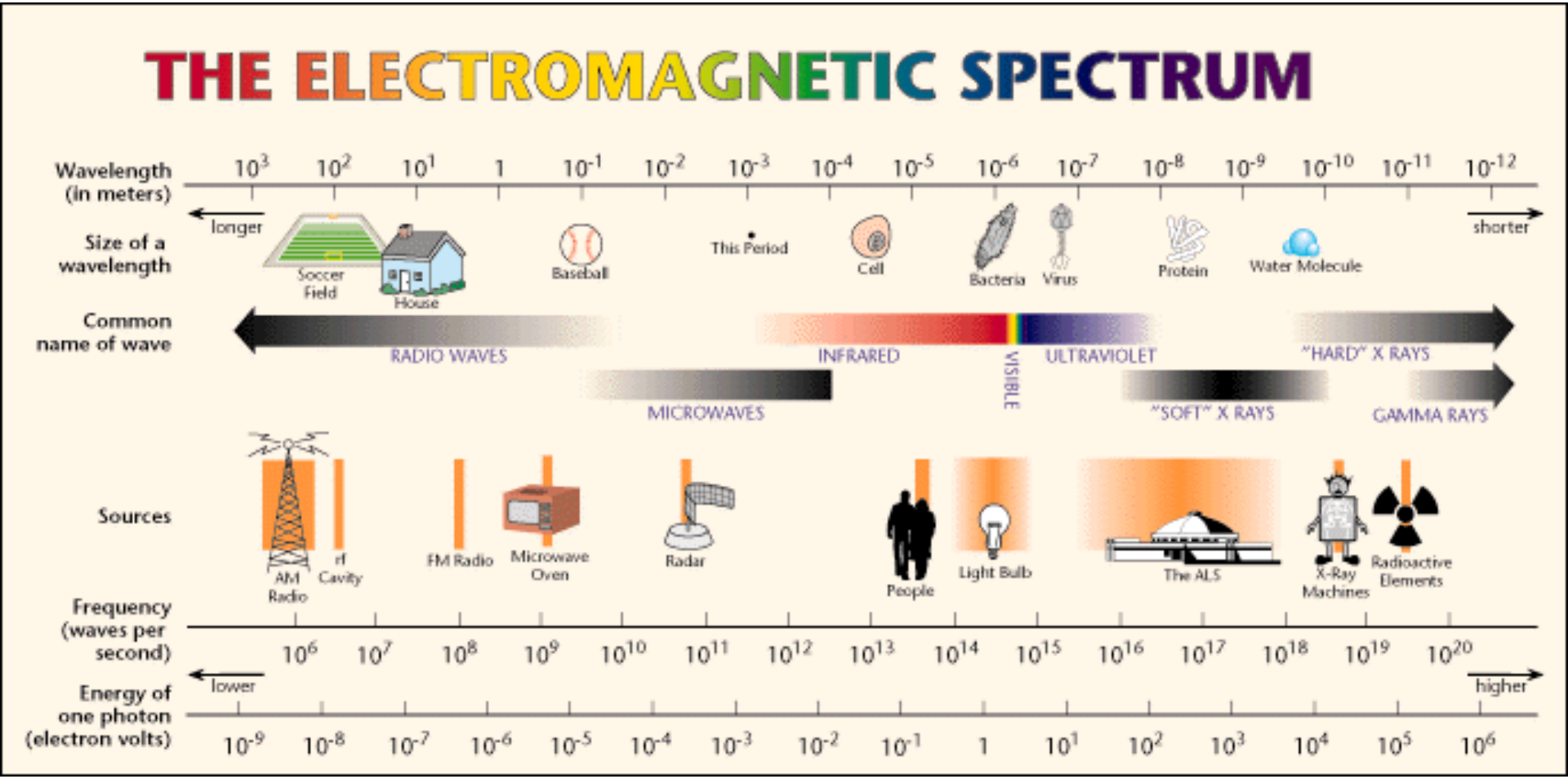
Profesor: Claudio Perez
Auxiliar: Juan Pablo Perez

Conceptos Básicos

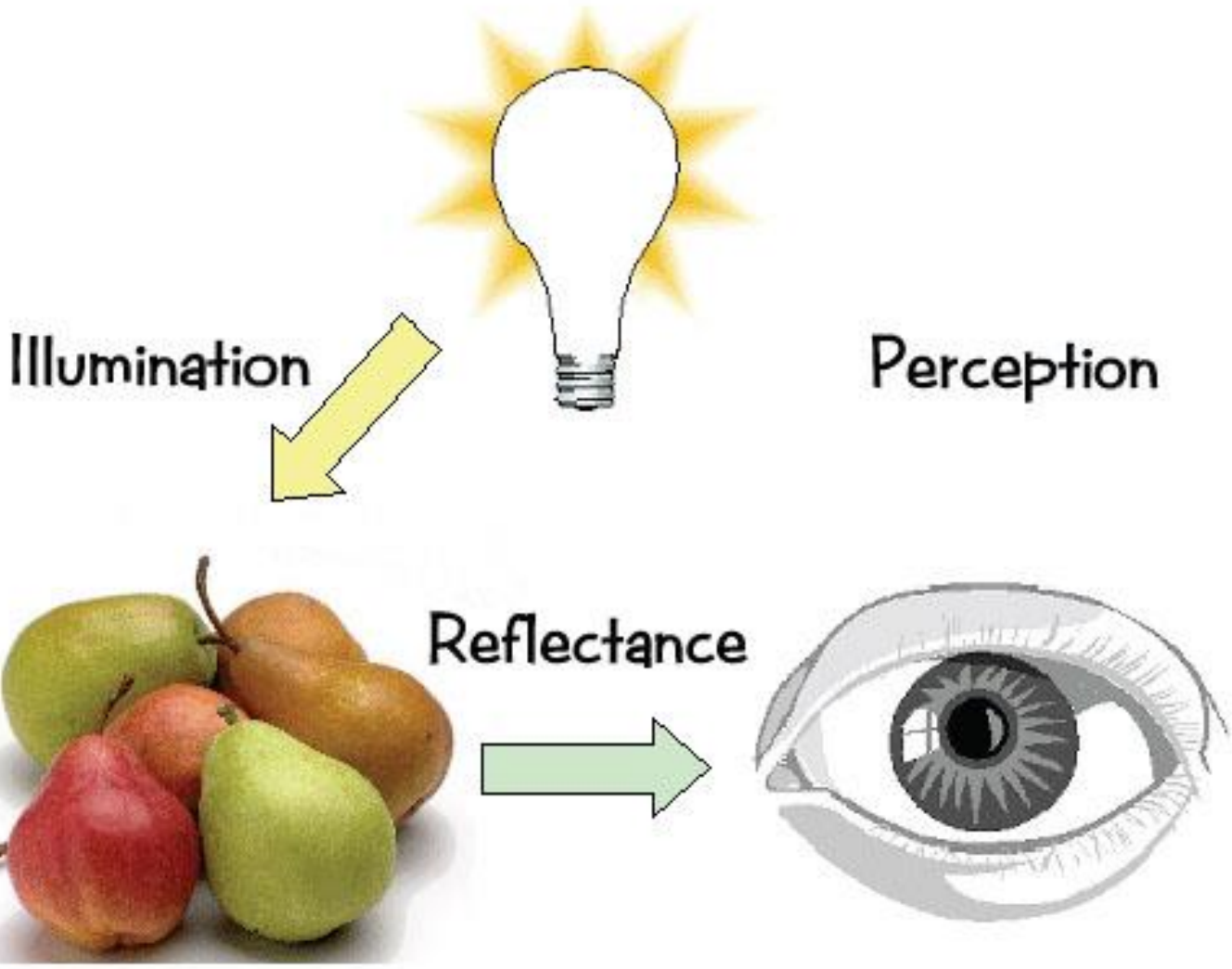
Procesamiento Digital de Imágenes:

Entender Contenidos de una Imagen

Definición

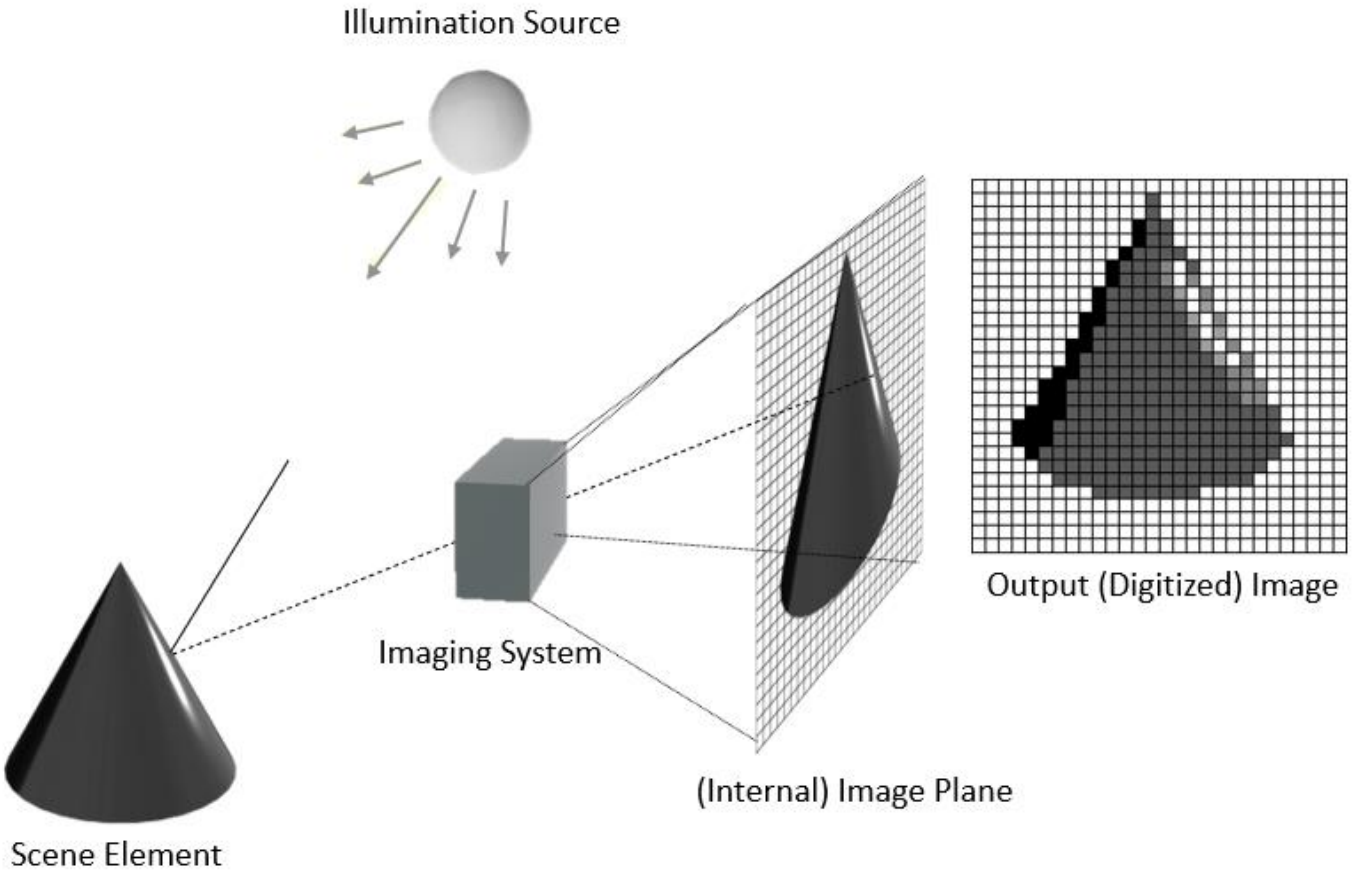

THE ELECTROMAGNETIC SPECTRUM
Wavelength (in meters)
10^{3} 10^{2} 10^{1} 1 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12}
longer
shorter
Size of a wavelength
Soccer Field
House
Baseball
This Period
Cell
Bacteria
Virus
Protein
Water Molecule
Common name of wave
RADIO WAVES
INFRARED
VISIBLE
ULTRAVIOLET
"HARD" X RAYS
MICROWAVES
"SOFT" X RAYS
GAMMA RAYS
Sources
AM Radio
rf Cavity
FM Radio
Microwave Oven
Radar
People
Light Bulb
The ALS
X-Ray Machines
Radioactive Elements
Frequency (waves per second)
10^{6} 10^{7} 10^{8} 10^{9} 10^{10} 10^{11} 10^{12} 10^{13} 10^{14} 10^{15} 10^{16} 10^{17} 10^{18} 10^{19} 10^{20}
lower
higher
Energy of one photon (electron volts)
10^{-9} 10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 1 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6}

Physics of Color



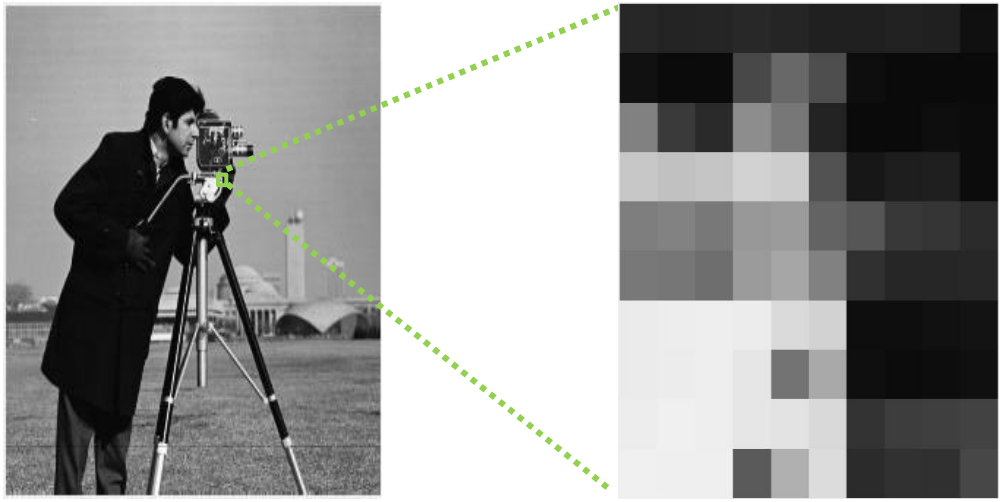

INCIDENT BEAM
REFLECTED
ABSORBED

Imágenes Digitales



Conceptos Básicos

- **Imagen Digital**
- **Pixel**

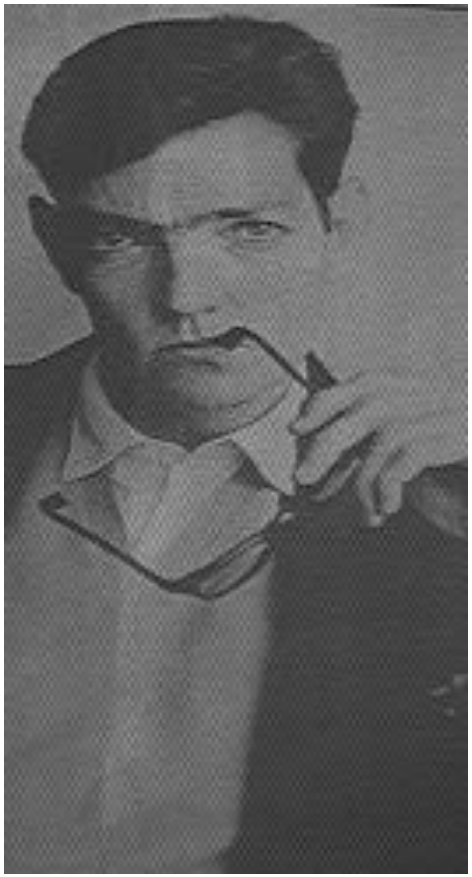


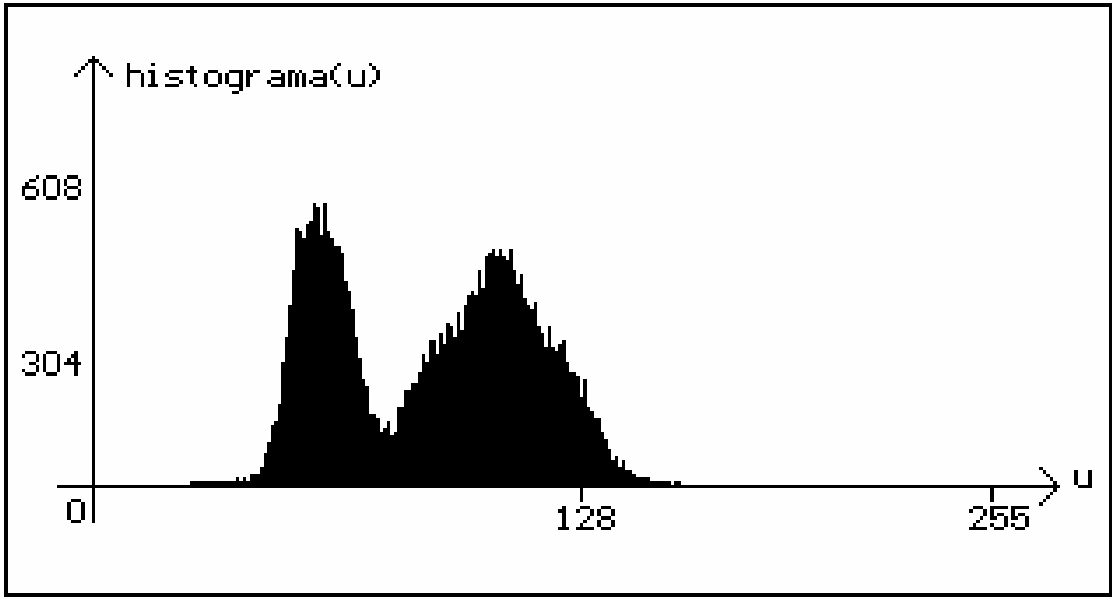
39	36	37	40	37	32	32	34	32	16
17	11	11	72	104	78	14	10	10	10
129	58	42	141	119	35	10	10	14	12
199	193	197	210	205	82	23	30	31	12
126	130	120	152	155	99	86	56	53	43
120	118	110	155	166	129	48	38	38	39
235	237	238	236	218	210	14	14	17	19
235	236	238	230	115	169	15	12	13	16
237	240	238	230	227	217	51	61	63	66
240	239	239	90	176	220	43	49	48	71

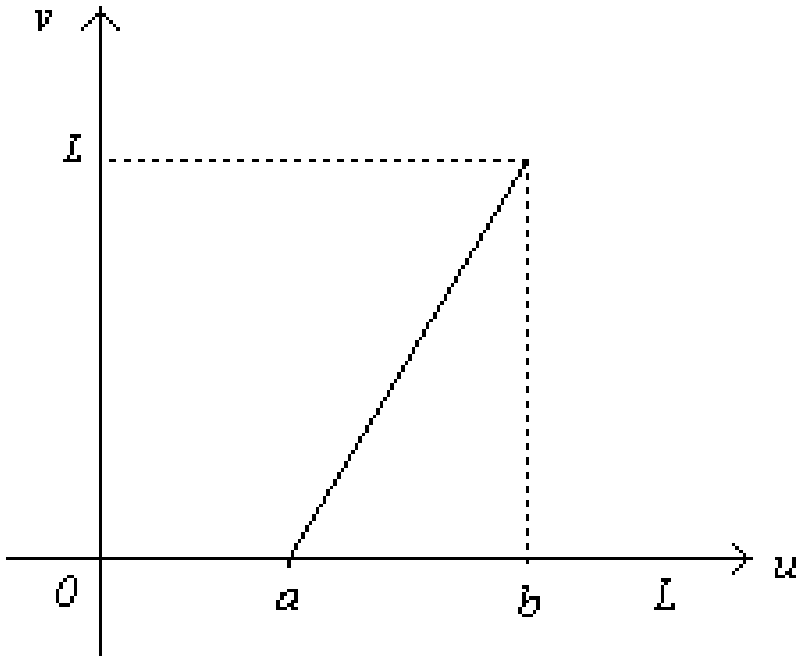
1	1	1					1
0	0	0				0	0

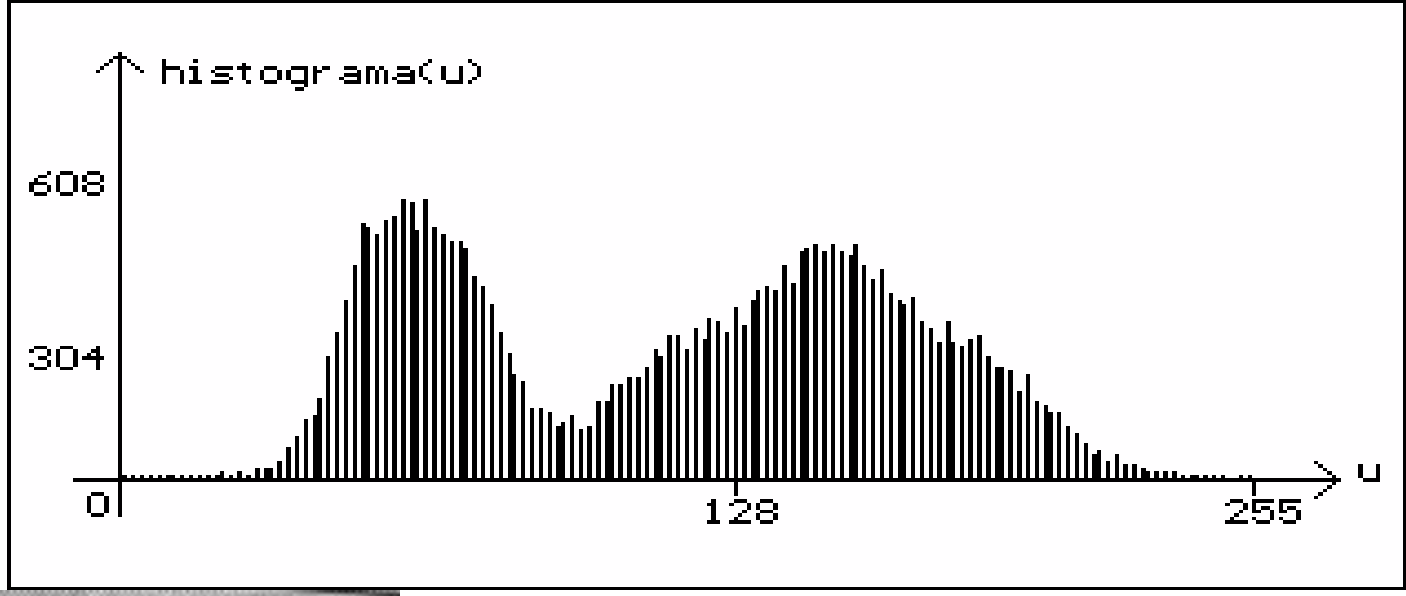
10	5	9				
				100		

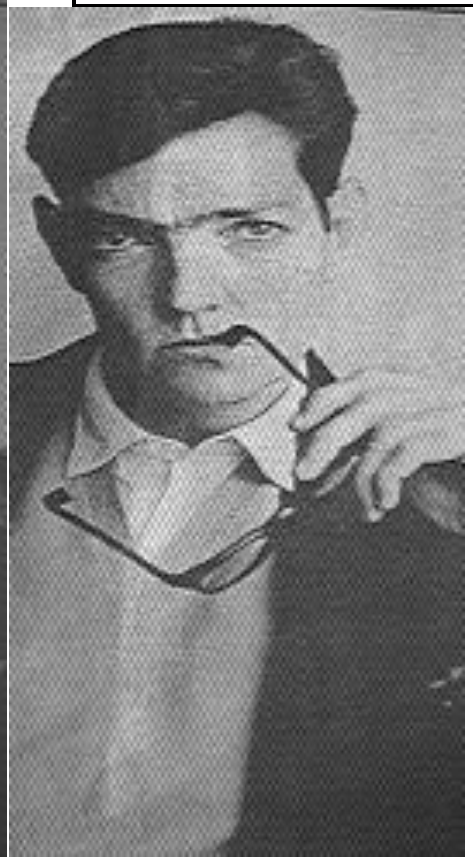
Histograma

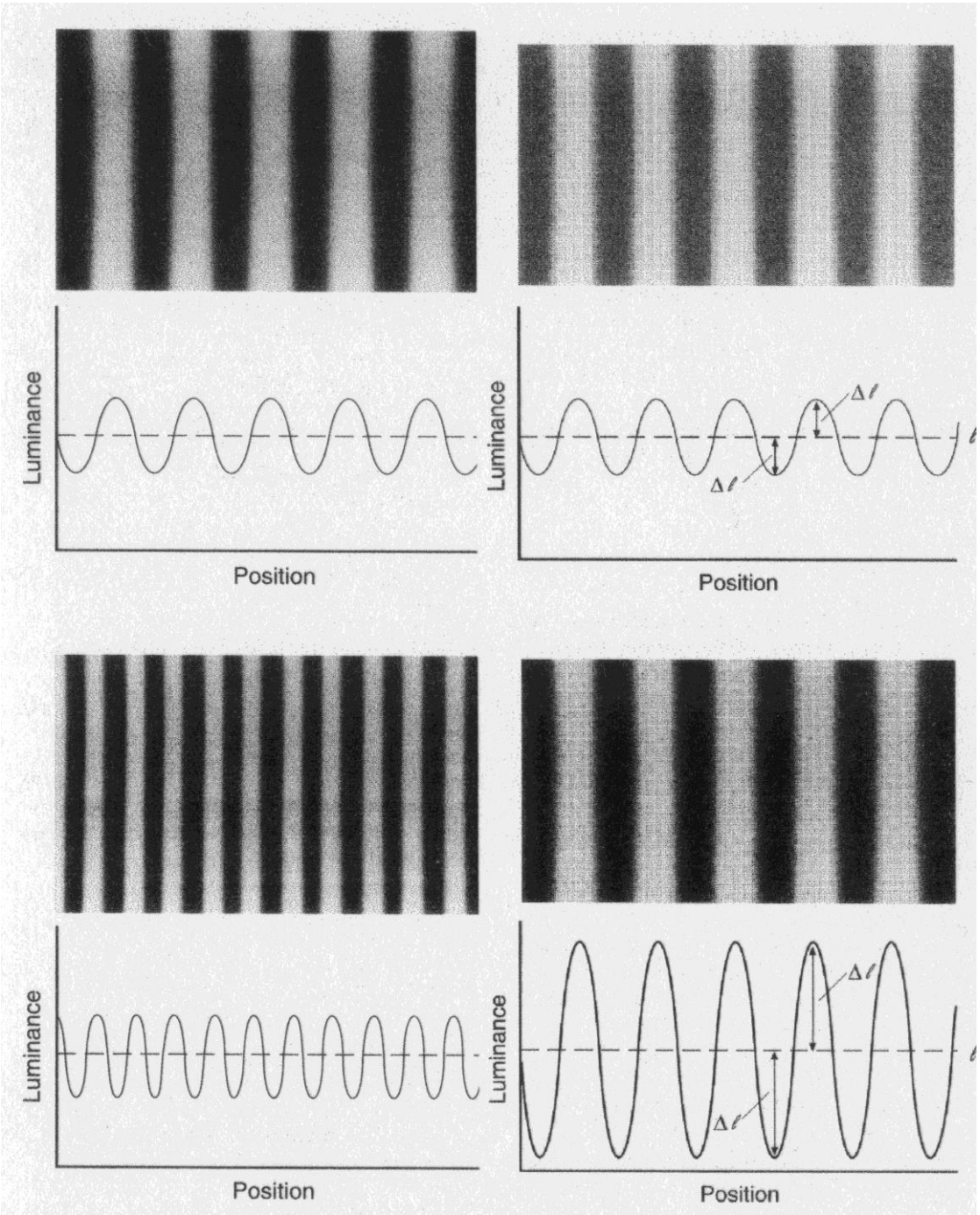







histograma(u)
608
304
0
128
255
u




Luminance
Position
Luminance
Δℓ
Δℓ
Position
Luminance
Position
Luminance
Δℓ
Δℓ
Position

T. De Fourier 2D

- TF

$$F(f(x,y)) = F(u,v) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)e^{-j2\pi(ux+vy)}dxdy$$

- TF inversa

$$F^{-1}(F(u,v)) = f(x,y) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} F(u,v)e^{j2\pi(ux+uy)}dudv$$

DFT - 2D

- Imagen f(x,y) de M x N
- DFT-2D

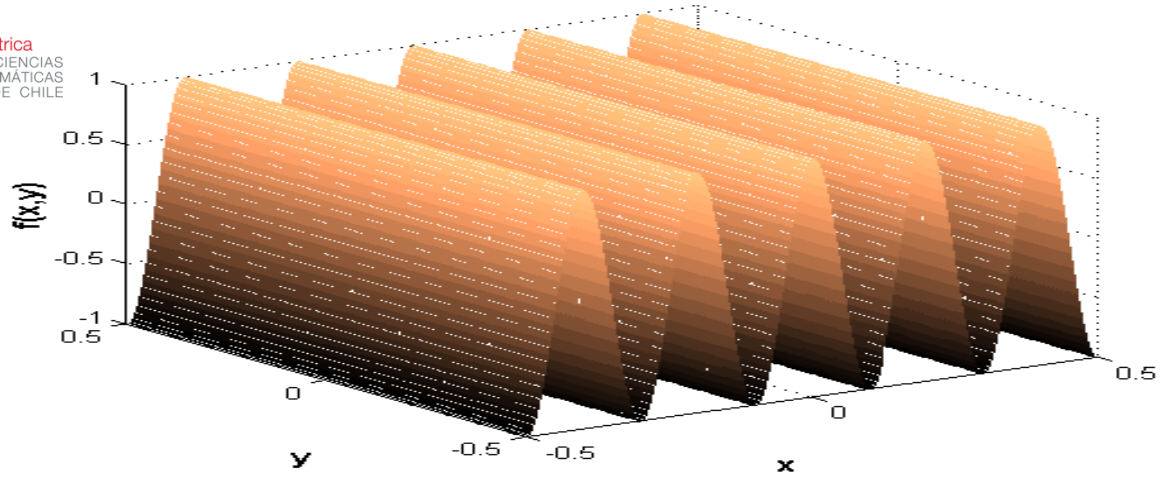
$$F(u,v) = \frac{1}{MN} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} f(x,y) e^{-j2\pi(\frac{ux}{M}+\frac{vy}{N})}$$

$$(u = 0, 1, \ldots, M-1, v = 0, 1, \ldots, N-1)$$

- DFT-2D inversa

$$f(x,y) = \sum_{u=0}^{M-1} \sum_{v=0}^{N-1} F(u,v) e^{j2\pi(\frac{ux}{M}+\frac{vy}{N})}$$

$$(x = 0, 1, \ldots, M-1, y = 0, 1, \ldots, N-1)$$

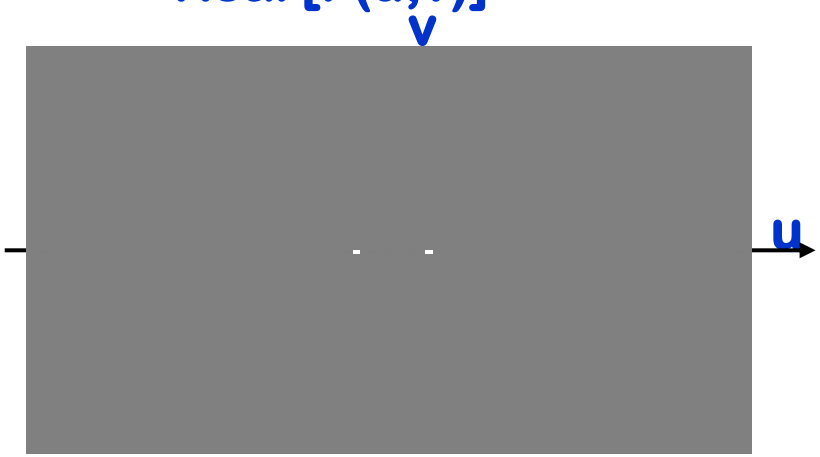


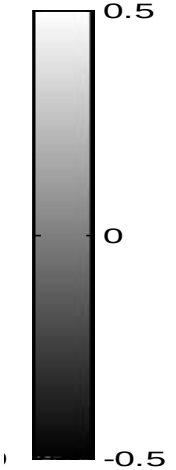
$f(x,y) = \cos(10\pi x)*1$

Fourier Transform

$F(u,v) = 1/2\,[\delta(u+5,0) + \delta(u-5,0)]$

Real [F(u,v)]





Imaginary [F(u,v)]