Physics 421 – Lecture 19

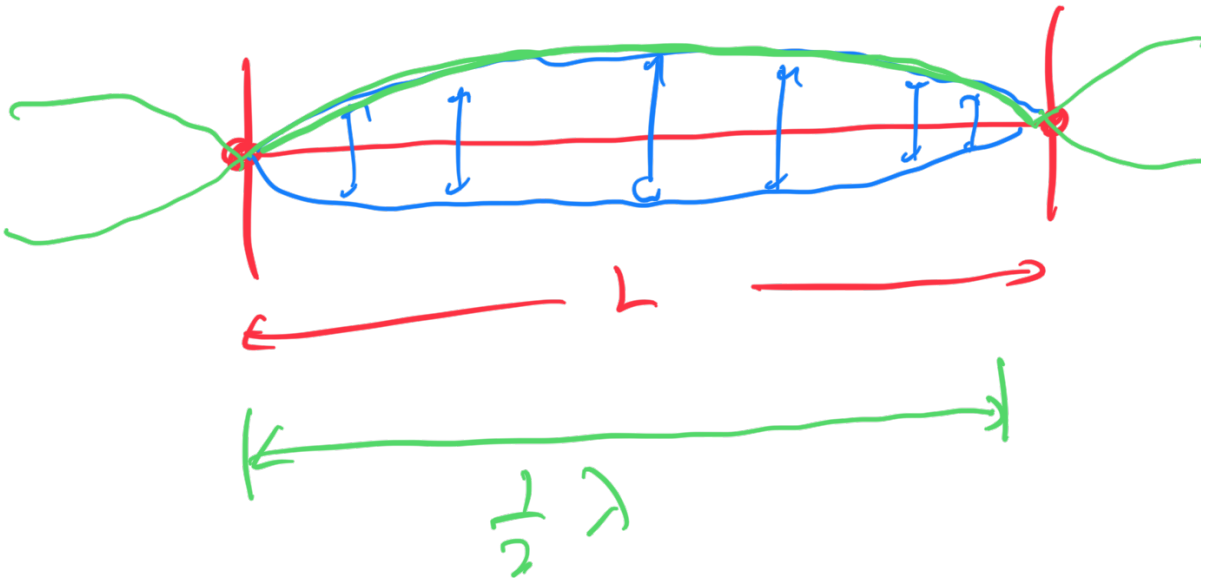
Fourier Analysis of Real Data!

Doing Experiments!

Sound

Waves on a String.

sin/wt



$$\frac{1}{2}\lambda = L$$

$$\boxed{\lambda = 2L}$$

Physics $\Rightarrow$ $v = \sqrt{\frac{T}{\mu}}$

μ ↑ mass/length

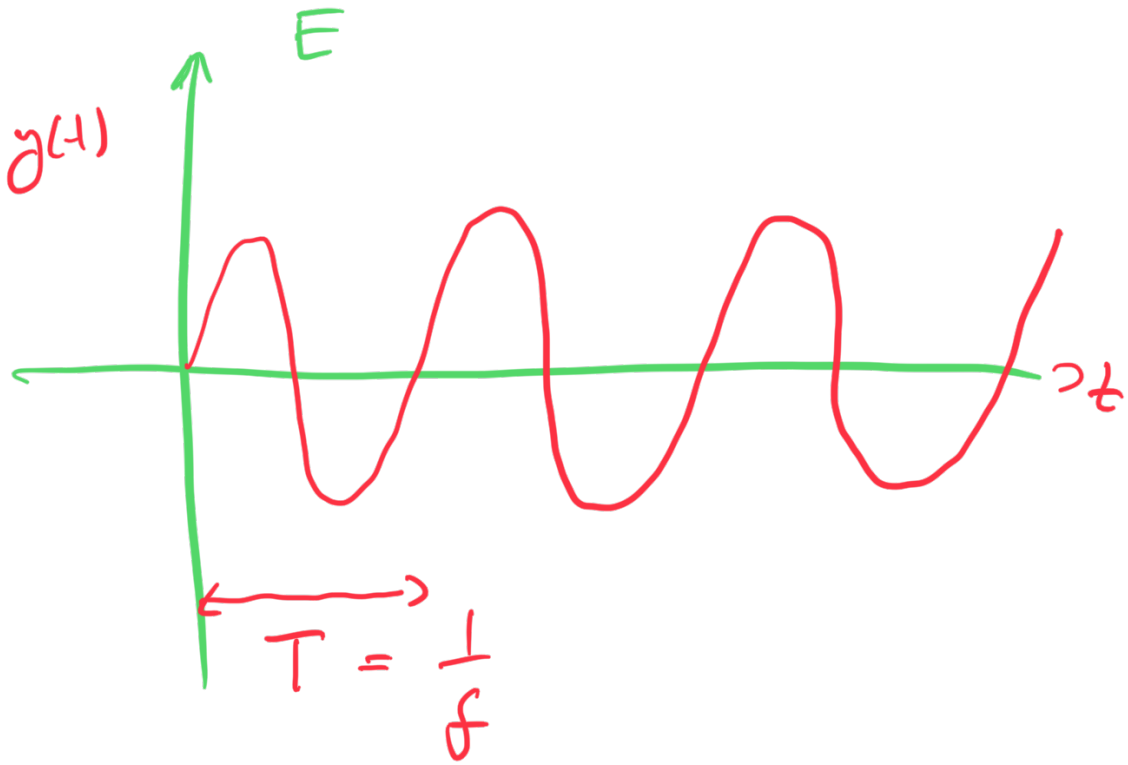
$$= \sqrt{\frac{TL}{m}}$$

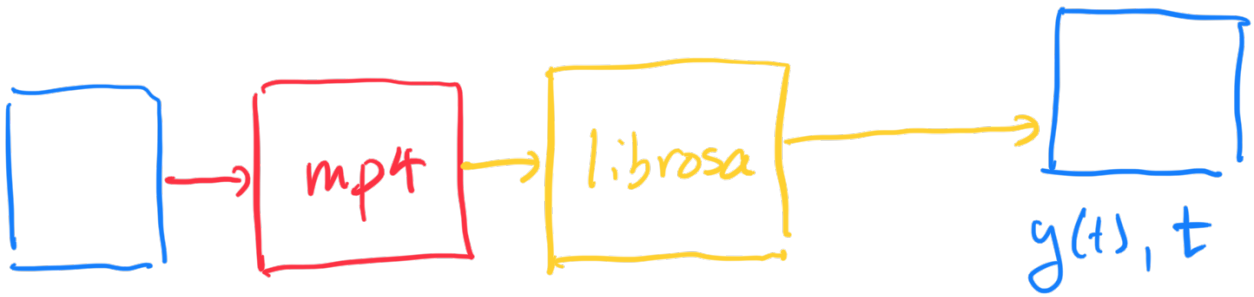
$v = f\lambda$

$$f = \frac{v}{\lambda} = \sqrt{\frac{TL}{m}} \Big/ 2L$$

T

Note → specific frequency.





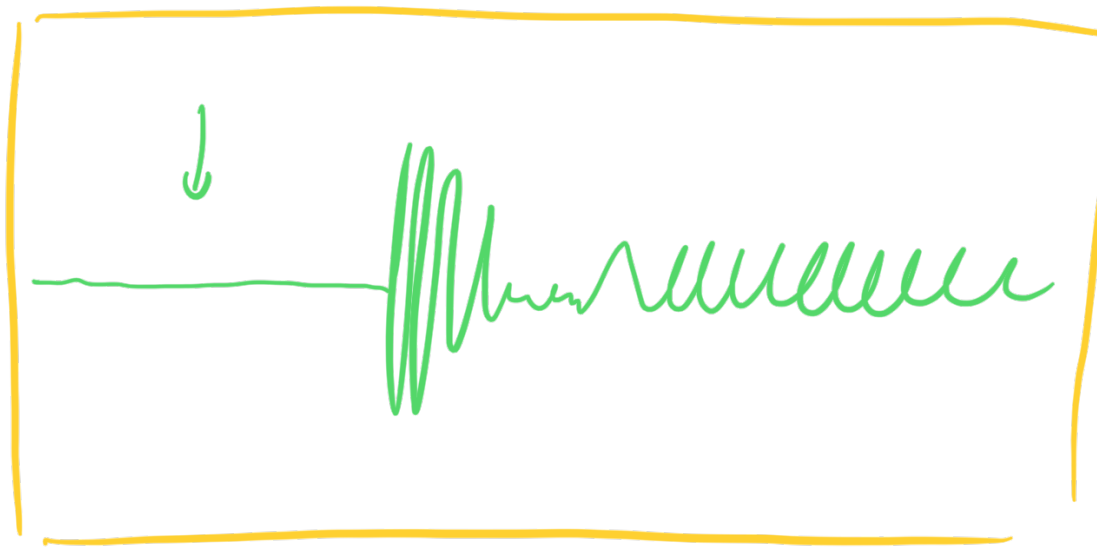
recording.

~ .mov

y(t), t

- two numpy arrays

ffmpeg

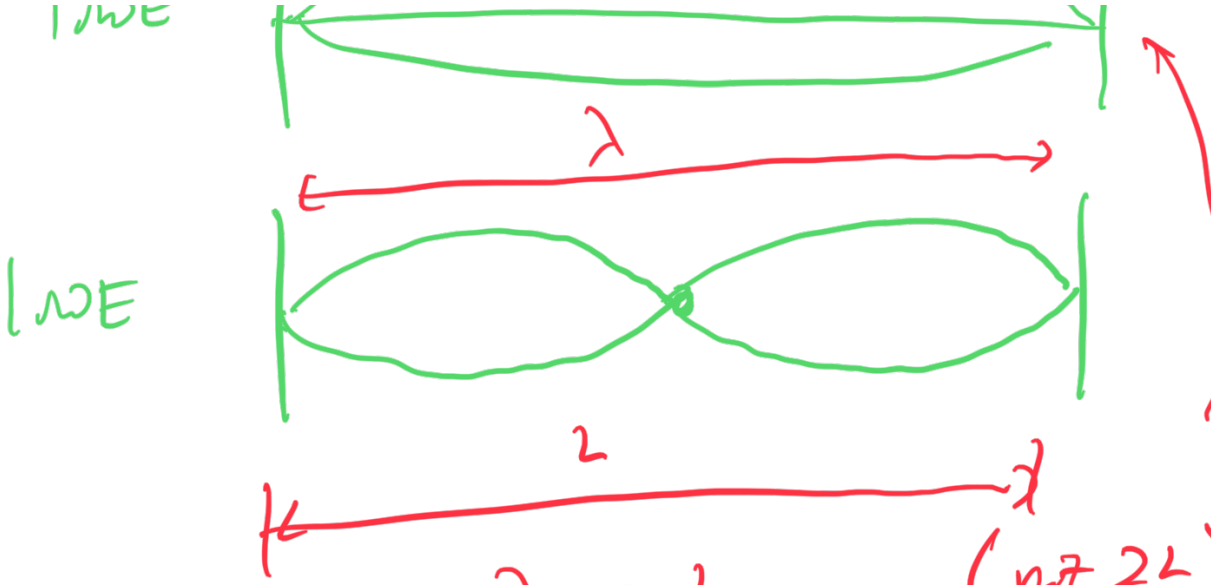


low E → f = 82.407 Hz

mid E → f = 164.814 Hz

high E → f = 329.628 Hz

Octaves



$$f = \frac{v}{\lambda} \quad \lambda \leq \frac{1}{2}$$

mp4

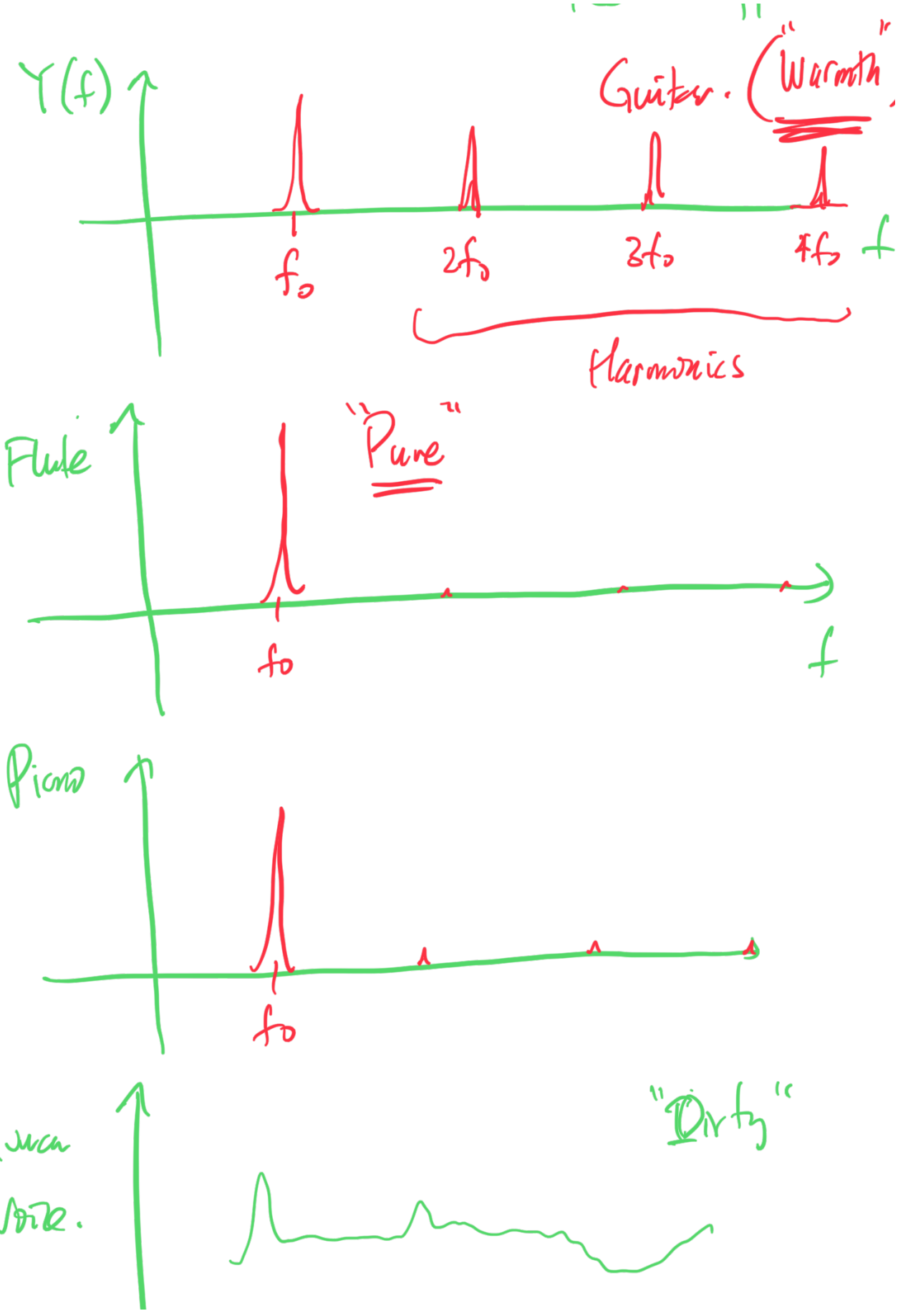
$f_{sampling} \Rightarrow 44.1$ kHz

$f_{output} \Rightarrow 22$ kHz

Humans 20 Hz → 20 kHz

Musicians → Pet Sounds

"Feels different"


Y(f)
Guitar. ("Warmth")
f_0
$2f_0$
$3f_0$
$4f_0$
f
Harmonics
Flute
"Pure"
f_0
f
Piano
f_0
Human Voice.
"Dirty"