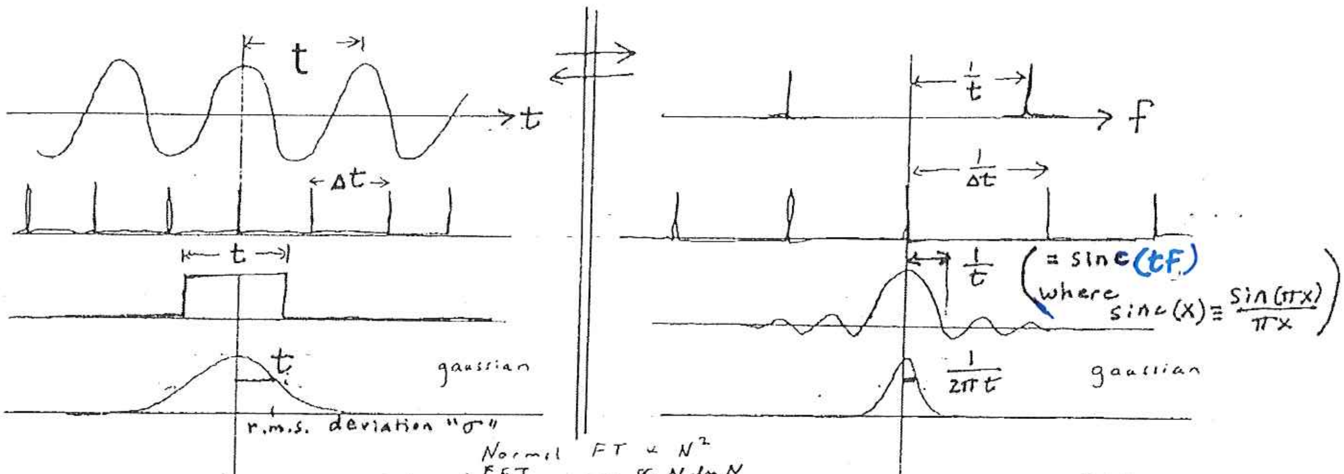
Basic Fourier Transforms



Normal FT ∝ N^2

FFT ∝ $N \ln N$

$$\int_{-\infty}^{\infty} G(f)\, e^{2\pi i f t}\, df = g(t) \rightleftarrows G(f) = \int_{-\infty}^{\infty} g(t)\, e^{-2\pi i f t}\, dt$$

$$h(t) \qquad H(f)$$

Convolution Theorum:

$$g,\ h \rightleftarrows G,\ H$$

(Convolution = N^2 multiply + adds) $\circledast$ ↓ ↓ $\cdot$ (Product : = N multiplies)

$$g \circledast h\,(t) \equiv \int_{-\infty}^{\infty} g(y)\, h(t-y)\, dy$$

$$g \circledast h \rightleftarrows G \cdot H$$

Also:

$$g,\ h \rightleftarrows G,\ H$$

(product) $\cdot$ ↓ ↓ $\circledast$ (convolution)

$$g \cdot h \rightleftarrows G \circledast H$$

Useful Extras:

Similarity : $g(at) \rightleftarrows G\left(\frac{f}{a}\right)$ (If $g(t) \rightleftarrows G(f)$)

Shift : $g(t-a) = G(f)\, e^{i \cdot 2\pi a f}$

g real $\Rightarrow G(-t) = G^*(t)$ ∴ Both real ⇒ Both symmetrical

($*$ ⇒ Change sign of imaginary part)

Parseval : $\int_{-\infty}^{\infty} g^* g\, dt = \int_{-\infty}^{\infty} G^* G\, df$ (conservation of energy)