

Elmhurst College

PHYSICS 414 - Modern Optics

SUMMARY OF HARMONIC WAVE PARAMETERS

SPACE PROPERTY	RELATION	TIME PROPERTY
Wavelength (λ)	$v = \lambda/T$	Period (T)
Spatial Frequency (σ) or Spectroscopic Wavenumber $\sigma \equiv 1/\lambda$	$v = v/\sigma = \lambda v$	Frequency (v or f) $v \equiv 1/T$
Propagation Constant (k) or (Angular) Wavenumber $k \equiv 2\pi\sigma \equiv 2\pi/\lambda$	$v = \omega/k$	Angular Frequency (ω) $\omega \equiv 2\pi v \equiv 2\pi/T$

Here “v” is the phase velocity of the wave.

Some examples of harmonic waveforms are:

$$U = U_0 \cos(kx - \omega t) = U_0 \cos \left[2\pi \left(\frac{x}{\lambda} - \frac{t}{T} \right) \right] = U_0 \cos[2\pi(\sigma x - vt)].$$