wave is:  $|\tilde{\psi}_{tot}(x, y = 0, z, t)| = \sqrt{2}A\sqrt{1 + \cos\Delta\varphi_{21}(x, y = 0, z, t)}$ , and thus when:  $\cos\Delta\varphi_{21}(x, y = 0, z, t) = +1$ , *i.e.* when  $\Delta\varphi_{21}(x, y = 0, z, t) = 0, \pm 2\pi, \pm 4\pi, \pm 6\pi... = \pm n_{even}\pi$ ,  $n_{even} = 0, 2, 4, 6, ...$  the total/resultant plane wave will be maximal (i.e. constructive interference of the two counter-propagating traveling waves):  $|\tilde{\psi}_{tot}(x, y = 0, z, t)| = 2A$ , but when  $\cos\Phi(\vec{r}, t) = -1$ , *i.e.* when  $\Delta\varphi_{21}(x, y = 0, z, t) = \pm 1\pi, \pm 3\pi, \pm 5\pi... = \pm n_{even}\pi$ ,  $n_{odd} = 1, 3, 5, 7, ...$ the total/resultant plane wave will be minimal, (i.e. destructive interference of the two counterpropagating traveling waves):  $|\tilde{\psi}_{tot}(\vec{r}, t)| = 0$ .

## In terms of phasor diagrams:

Maximal/constructive interference occurs when the relative phase  $\Delta \varphi_{21}$  of the two counterpropagating traveling waves is an <u>even</u> integer multiple of  $2\pi$ , *i.e.* 360°, such that the two individual amplitudes add linearly together, because they are precisely in-phase with each other, as shown in the figure below, at time t = 0:

$$\tilde{\psi}_{tot}(x, y = 0, z, t = 0) = 2A$$

$$\tilde{\psi}_1(x, y = 0, z, t = 0) \quad \tilde{\psi}_2(x, y = 0, z, t = 0)$$

$$= A \qquad = A$$

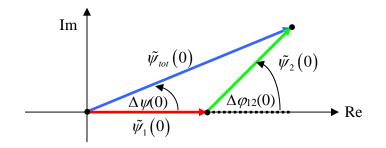
Minimal/destructive interference occurs when the relative phase  $\Delta \varphi_{21}$  of the two counterpropagating traveling waves is an <u>odd</u> integer multiple of  $\pi$ , *i.e.* 180°, such that the two individual amplitudes completely cancel, because they are in precisely out-of-phase with each other, as shown in the figure below, at time t = 0:

$$\tilde{\psi}_{tot}(x, y = 0, z, t = 0) = 0$$

$$\tilde{\psi}_{1}(x, y = 0, z, t = 0) \quad \tilde{\psi}_{2}(x, y = 0, z, t = 0)$$

$$= A \qquad = -A$$

When the relative phase difference  $\Delta \varphi_{21}(x, y = 0, z, t) = \varphi_2(x, y = 0, z, t) - \varphi_1(x, y = 0, z, t)$  is anywhere in between these special points, *i.e.*  $n_{odd}\pi < \Delta \varphi_{21} < n_{even}\pi$ , then only partial/incomplete interference occurs, and the phasor diagram in the complex plane at time t = 0 will in general be something like that shown in the figure below:



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