Time for journey with-and-against the wind

$$\frac{D}{v+u} + \frac{D}{v-u} = \frac{D(v-u)}{(v+u)(v-u)} + \frac{D(v+u)}{(v+u)(v-u)}$$

$$= \frac{D(v-u)}{v^2-u^2} + \frac{D(v+u)}{v^2-u^2}$$

$$= \frac{Dv-Du}{v^2-u^2} + \frac{Dv+Du}{v^2-u^2}$$

$$= \frac{2Dv}{v^2-u^2}$$

Time for journey across the wind

$$\frac{D}{\sqrt{v^2-u^2}} + \frac{D}{\sqrt{v^2-u^2}} = \frac{2D}{\sqrt{v^2-u^2}}$$

$$\text{if } \epsilon \ll 1, \qquad (1+\epsilon)^p \simeq 1 + p\epsilon$$

Time for journey across the wind (again)

$$\frac{2D}{\sqrt{v^2-u^2}} = \frac{2D}{\sqrt{v^2(1-u^2/v^2)}}$$

$$= \frac{2D}{v\sqrt{(1-u^2/v^2)}}$$

$$= \frac{2D}{v}(1-u^2/v^2)^{-1/2}$$

Time for journey with-and-against the wind (again)

$$\frac{2Dv}{v^2-u^2} = \frac{2Dv}{v^2(1-u^2/v^2)}$$

$$= \frac{2D}{v}(1-u^2/v^2)^{-1}$$

$$\Delta t \simeq 3.7 \times 10^{-16} \quad \text{seconds}$$

$$\Delta t \simeq 7.3 \times 10^{-16} \quad \text{seconds}$$

$$\text{wavelength } \lambda \simeq 550 \text{ nm}$$
$$\text{frequency } f \simeq 5.45 \times 10^{14} \text{ Hz}$$