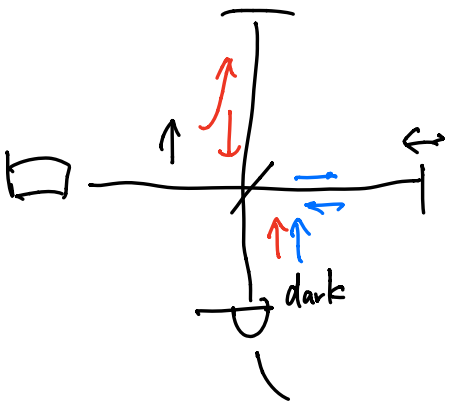
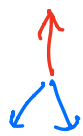
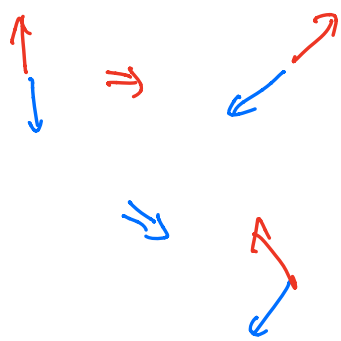
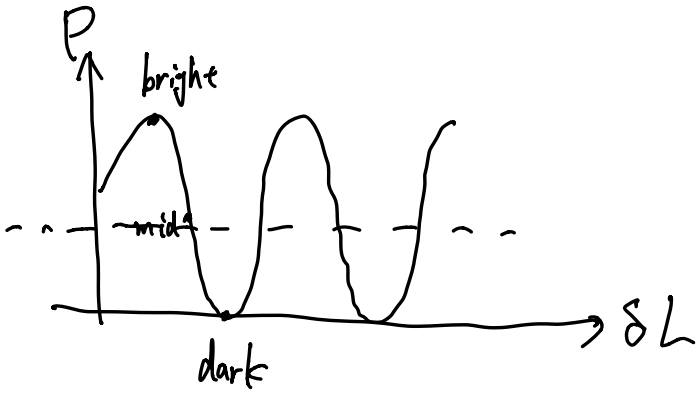
$$E = \underline{E_0 e^{i\omega t}}$$

phaser diagram







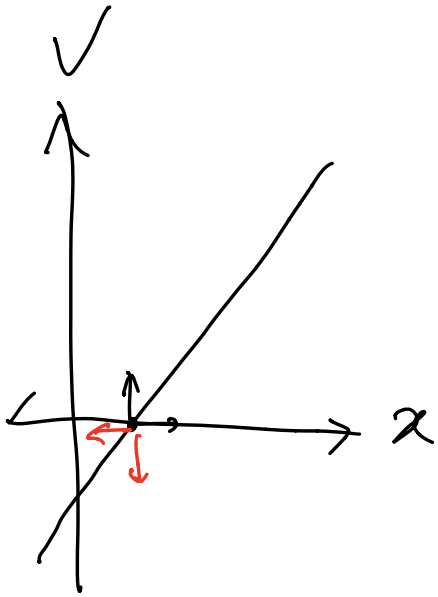


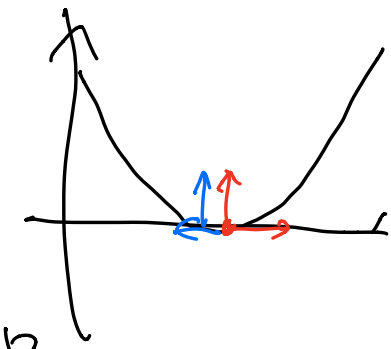
$$n_{shot} \propto \sqrt{P}$$

$$S/N \propto \frac{1}{\sqrt{P}}$$

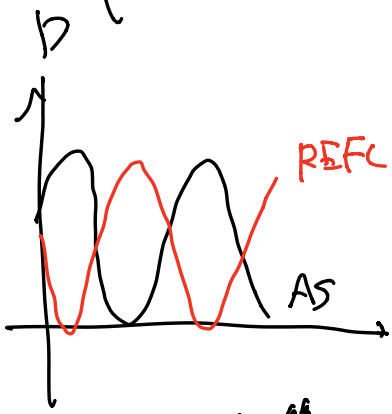
問題.

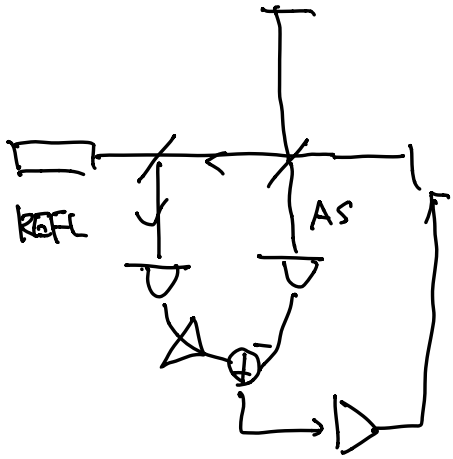
δl に対する
shot noise 計算





☆ mid fringe lock





⇓ 引き算

・Mid-lock は DC Power でできるが、Dark/Bright はできない
なので modulation をかける。

◎ modulation

AM (amplitude-modulation)

PM (FM) (Phase-modulation)

・modulation なし

$$E(t) = E_0 e^{i\omega t}$$

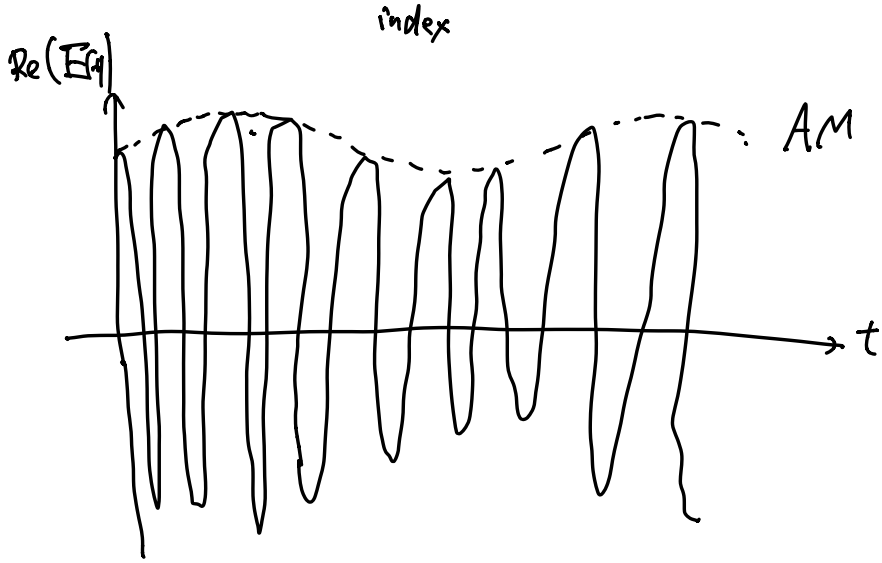
ω_m の sin 波で mod かける。

$$E_{AM}(t) = E_0(t) e^{i\omega t}$$

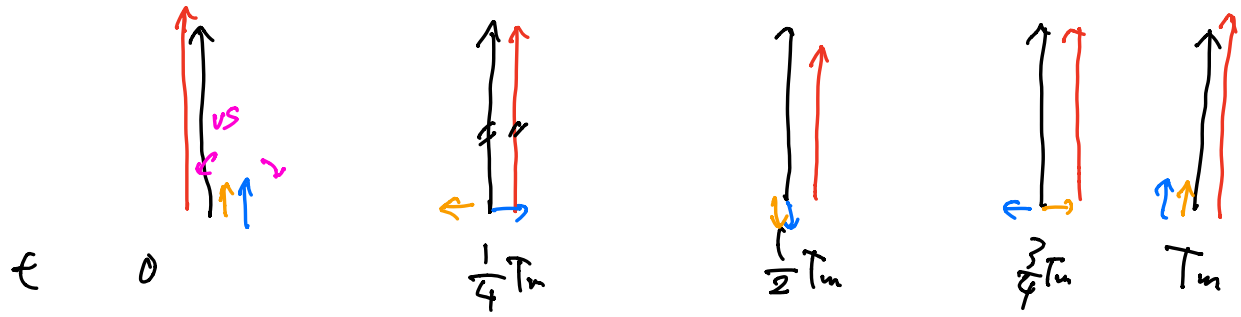
modulation freq

$$= E_0 (1 - m\cos\omega_m t) e^{i\omega t} \qquad \omega \gg \omega_m$$

modulation index



AM (Phasor diagram) $T_m = 1/\omega_m$



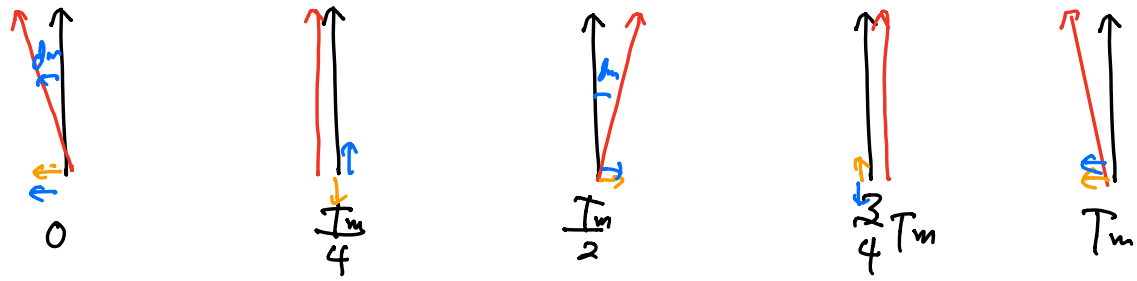
$$E_{AM}(t) = E_0\,(1 - m\cos\omega_m t)\,e^{i\omega t}$$

$$= E_0\left(1 - \frac{m}{2}\left(e^{i\omega_m t} + e^{-i\omega_m t}\right)\right)e^{i\omega t}$$

$$= \underbrace{E_0 e^{i\omega t}}_{\text{carrier}} - \underbrace{\frac{m}{2} e^{i(\omega+\omega_m)t}}_{\text{upper sideband}} - \underbrace{\frac{m}{2} e^{i(\omega-\omega_m)t}}_{\text{lower sideband}}$$

PM $\quad E_{PM}(t) = E_0 e^{i(\omega t + \phi(t))}$

$$= E_0 e^{i(\omega t + d_m \cos \omega_m t))}$$



$$E_{PM}(t) = E_0 e^{i(\omega t + d_m \cos \omega_m t))}$$

$$= E_0 e^{i\omega t} \sum_{n=-\infty}^{\infty} J_n\left(\frac{m}{2}\right) e^{in\omega_m}$$

宿題

◎ ・AM および PM はどっちも sidebandがかける.

・位相が違う.