光について

$$\vec{E}(t) = E_0 \cos(\omega t + kz)$$

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

$z \to ct$

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

E_0 → 強度

$i\omega t$ → 位相

強度，位相は実数、

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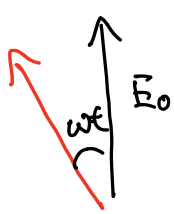
phaser diagram.

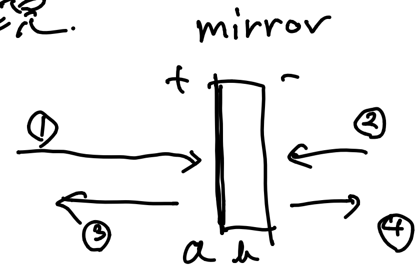
E(t)を複素平面に表す



$$\frac{3\times10^{8}}{1064\times10^{-9}}$$

3×10^{14} Hz

鏡



もし両側 + だったら (R=50%)

① ↑　② ↓　③ ↑ + ↓ = 0　④ ↑ + ↑ = 0

E_{in} のエネルギーと E_{REFL} のエネルギーが保存するため.

① E_{in}^{1}　② E_{in}^{2}　③ E_{REFL}^{1}　④ E_{REFL}^{2}

反射率を a を r_a　b面を r_b

透過率を t_a　t_b

$$E_{REFL}^{1} = r_a E_{in}^{2} + t_b E_{in}^{2}$$

$$E_{REFL}^{2} = t_a E_{in}^{1} + r_b E_{in}^{2}$$

$$|r_a| = |r_b| \;,\; |t_a| = |t_b|$$

宿題

$$r_a = -r_b$$

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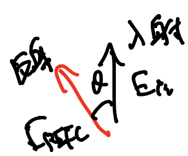
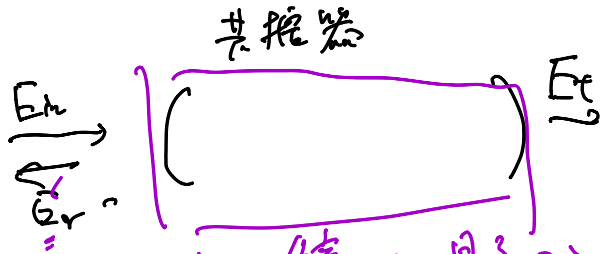
rは複素反射率.



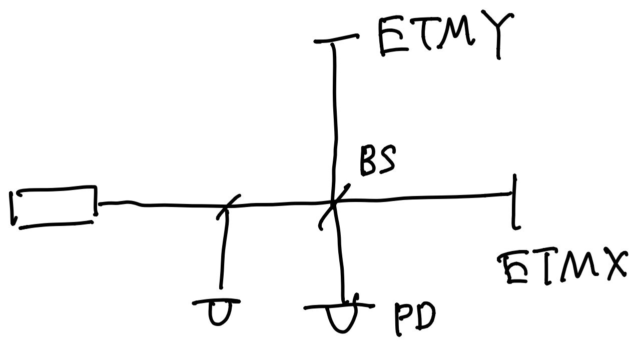
$$E_{REF} = r E_{in} = r' e^{i\theta} E_{in}$$



1つの鏡として見ることができる。

共振器に対しても反射率，透過率を定義できる。

· Michelson干渉計



BS : beam spliter

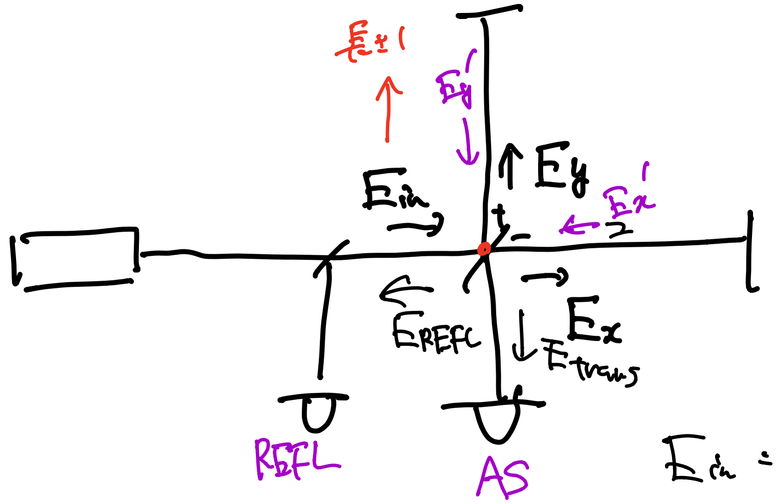
ETM : end test mass.

PD : photo detector

MICH : Michelson 自由度.

AS : anti-symmetric

REFL : refraction



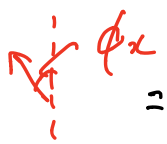
$$E_{in} = e^{i\omega t}$$

BS の反射を $\frac{1}{\sqrt{2}}$

$$E_y = \frac{1}{\sqrt{2}} E_{in} \qquad E_x = \frac{1}{\sqrt{2}} E_{in}$$

$\uparrow \frac{1}{\sqrt{2}}$ $\qquad$ $\uparrow \frac{1}{\sqrt{2}}$

$$E_x' = E_x\left(t - \frac{2L_x}{c}\right)$$



$$= e^{i\omega\left(t - \frac{2L_x}{c}\right)} = e^{i(\omega t - \phi_x)}$$

$$\phi_x = \frac{2\omega L_x}{c}$$

$$E_y' = e^{i(\omega t - \phi_y)}$$

$$E_{REFL} = \frac{1}{\sqrt{2}} E_x' + \frac{1}{\sqrt{2}} E_y'$$

$$E_{trans} = -\frac{1}{\sqrt{2}} E_x' + \frac{1}{\sqrt{2}} E_y'$$

(1) Bright fringe from AS

$$E_{REFL} = \frac{1}{\sqrt{2}} E_x' + \frac{1}{\sqrt{2}} E_y'$$

$$E_{trans} = -\frac{1}{\sqrt{2}} E_x' + \frac{1}{\sqrt{2}} E_y'$$

宿題：E_{REFL}, E_{trans} を計算して
L_x, L_y に対する応答を考える
phaser diagram と共に。