ERROR SPEED of LIGHT

$$C = \frac{8\pi A D^2}{D+B}\frac{(f_1+f_2)}{(S_1-S_2)}$$

remember $Q = f(a,b,c)$

$$\sigma_{mQ}^2 = \left(\frac{\partial Q}{\partial a}\right)^2 \sigma_{ma}^2 + \left(\frac{\partial Q}{\partial b}\right)^2 \sigma_{mb}^2$$

or

$$\left(\frac{\sigma_{mQ}}{Q}\right)^2 = \left(\frac{1}{Q}\frac{\partial Q}{\partial a}\right)^2 \sigma_{ma}^2 +$$

Nice is $Q = a^n b^m c \ldots$

then $$\left(\frac{\sigma_Q}{Q}\right)^2 = n^2\left(\frac{\sigma_a}{a}\right)^2 + m^2\left(\frac{\sigma_b}{b}\right)^2$$

But C above is not like this

Why? $D+B$ \& f_1+f_2 \& S_1-S_2

We can always define new "simplifying" VARIABLES
CHAIN RULE for ERROR
eg $F = f_1+f_2$, $S = S_1-S_2$ $E = D+B$
and look at

$\frac{\sigma_F}{F}$ etc.

$$F = f_1 + f_2$$

$$\sigma_F^2 = \left(\cancel{\frac{\partial F}{\partial f_1}}\right)^2 \sigma_{f_1}^2 + \left(\cancel{\frac{\partial F}{\partial f_2}}\right)^2 \sigma_{f_2}^2$$

$$\left(\frac{\sigma_F}{F}\right)^2 = 2\underbrace{\left(\frac{\sigma_f}{f}\right)^2}_{\text{big}}$$

$$S = S_1 - S_2$$

$$\sigma_S^2 = \left(\frac{\partial S}{\partial S_1}\right)^2 \sigma_{S_1}^2 + \left(\frac{\partial S}{\partial S_2}\right)^2 \sigma_{S_2}^2$$

$$\left.\left(\frac{\sigma_S}{S}\right)^2 = 2\left(\frac{\sigma_S}{\underbrace{S}_{\text{SMALL}}}\right)^2\right\} \text{BIG CONTRIBUTION}$$

$$E = D + B$$

NOTE HOW E is not independent of D or B

Could proceed with

$$\left(\frac{\sigma_E}{E}\right)^2 = \left(\frac{\sigma_D}{D}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2$$

So that, contribution of $\frac{D^2}{D+B}$ on $\left(\frac{\sigma_C}{C}\right)^2$

D^2

m $$\underbrace{4\left(\frac{\sigma_D}{D}\right)^2}_{D^2} + \underbrace{\left(\frac{\sigma_D}{D}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2}_{D+B}$$

$$= 5\left(\frac{\sigma_D}{D}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2$$

But better use $G = \frac{D^2}{D+B}$

$$\frac{\partial G}{\partial D} = 2D\left(\frac{1}{D+B}\right) - \frac{D^2}{(D+B)^2} = \frac{\overset{1D^2}{\cancel{2D^2}} + 2DB - \cancel{D^2}}{(D+B)^2}$$

$$= \frac{D^2 + 2DB}{(D+B)^2}$$

$$\frac{\partial G}{\partial B} = -\frac{D^2}{(D+B)^2}$$

$$\left(\frac{\sigma_G}{G}\right)^2 = \frac{(D^2 + 2DB)^2}{(D+B)^4}\,\sigma_D^2 + \frac{D^4}{(D+B)^4}\,\sigma_B^2$$