Exercice n°21 : Frange achromatique

① Déjà fait : $\delta(x) = \dfrac{ax}{\delta'_2} + (1-m)\, e$

② $P = 0 \Rightarrow \dfrac{ax_{P=0}}{\lambda \delta'_2} = \dfrac{(m-1)\,e}{\lambda} \Rightarrow \boxed{x_{P=0} = \dfrac{(m-1)\,e\,\delta'_2}{a}}$

③
$\begin{cases}
m = m_0 + \dfrac{A}{\lambda^2} & m_0 = 1{,}5 \ \text{et} \ A = 0{,}00605 \ \mu m^2 \\[2mm]
T_1 T_2 = 3\,mm \\
\delta'_2 = 1\,m \\
e = 10\,\mu m
\end{cases}$

$P = \dfrac{\delta(\lambda)}{\lambda} = \dfrac{ax}{\lambda \delta'_2} + (1-m)\dfrac{e}{\lambda}$

$\Rightarrow \boxed{x = \left[P\lambda + (m-1)\,e \right]\dfrac{\delta'_2}{a}} \Rightarrow \boxed{x = \left[P\lambda + \left(m_0 + \dfrac{A}{\lambda^2} - 1\right)e \right]\dfrac{\delta'_2}{a}}$

④ $\dfrac{dx}{d\lambda} = 0 \Rightarrow \dfrac{d}{d\lambda}\left[P\lambda + (m-1)\,e \right] = 0$

$\Rightarrow P + e\dfrac{dm}{d\lambda} = 0 \Rightarrow P + e\,2\left(\dfrac{-A}{\lambda^3}\right) = 0 \Rightarrow \boxed{P = \dfrac{2eA}{\lambda^3}}$

A.N. $\begin{cases} P_{rouge} = 0{,}23 \\[1mm] P_{violet} = 1{,}89 \end{cases} \Rightarrow$ seul ordre possible : ordre 1
ordre de la frange quasi-stat.

NB : achromatique car ttes les franges quasi superposées (x indépendant de λ).

$\lambda_{P=1} = \left(\dfrac{2eA}{P}\right)^{1/3} = 0{,}494 \ \mu m$

$x_0 = \left[\lambda_{P=1} + \left(m_0 + \dfrac{A}{\lambda_{P=1}} - 1\right)e \right]\dfrac{\delta'_2}{a}$

A.N. $\boxed{x_0 = 1{,}83\ mm}$

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