

# K-K関係を満たしているか？

$$\chi''(\omega) = A \frac{\gamma}{(\omega - \omega_0)^2 + \gamma^2}$$

↓ 代入

$$\chi'(\omega) = \frac{1}{\pi} \text{P.V.} \int_{-\infty}^{\infty} \frac{\chi''(\omega')}{\omega' - \omega} d\omega'$$

↓ 計算結果

$$\chi'(\omega) = -A \frac{\omega - \omega_0}{(\omega - \omega_0)^2 + \gamma^2}$$

実際に確認してみよう！  
(レポート問題)

$$\chi(\omega) = -\frac{ne^2}{\varepsilon_0 m} \cdot \frac{1}{\omega^2 + 2i\gamma\omega - \omega_0^2}$$

$\omega \ll \omega_0, \omega \gg \omega_0$  (非共鳴(吸収なし))のときは

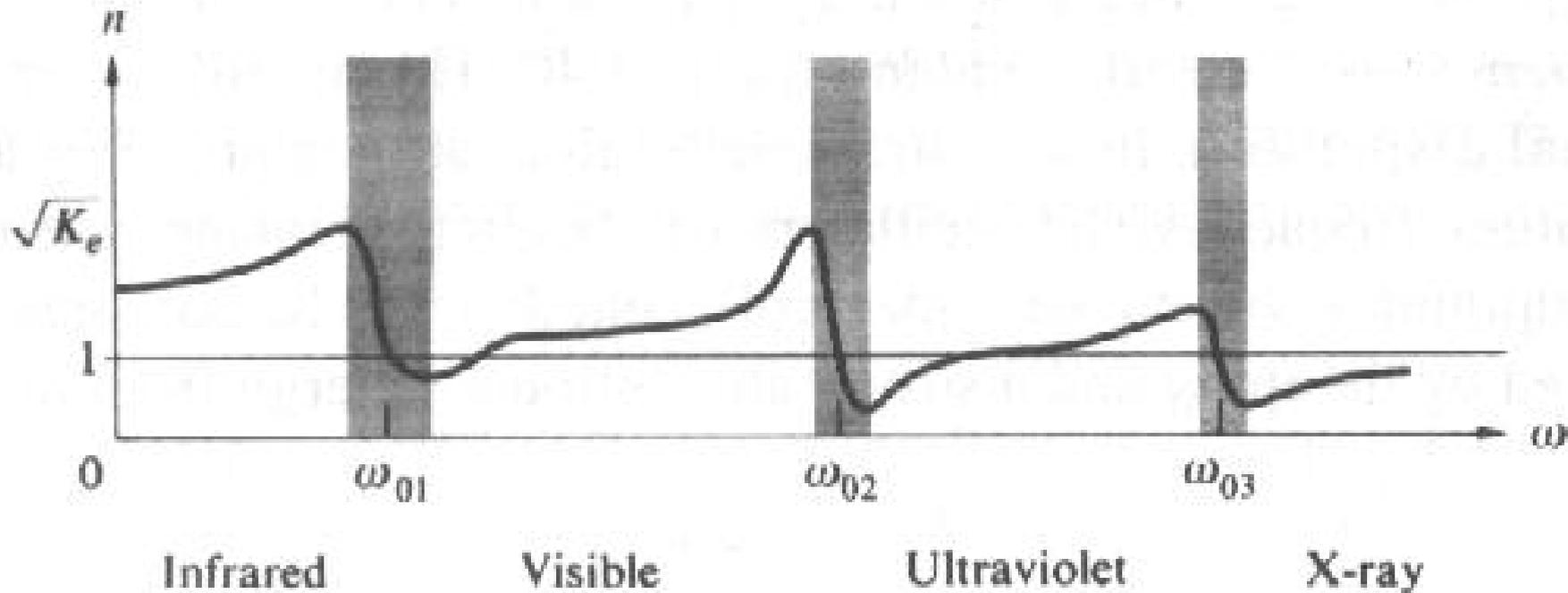
$$\chi(\omega) = -\frac{ne^2}{m\varepsilon_0} \cdot \frac{1}{\omega^2 - \omega_0^2} \propto \frac{1}{\omega_0^2 - \omega^2}$$

実部のみ(吸収なし)

$$n(\omega) = \frac{c_0}{c(\omega)} = \sqrt{\frac{\varepsilon(\omega)}{\varepsilon_0}} = \sqrt{1 + \chi(\omega)} \quad \text{より}$$

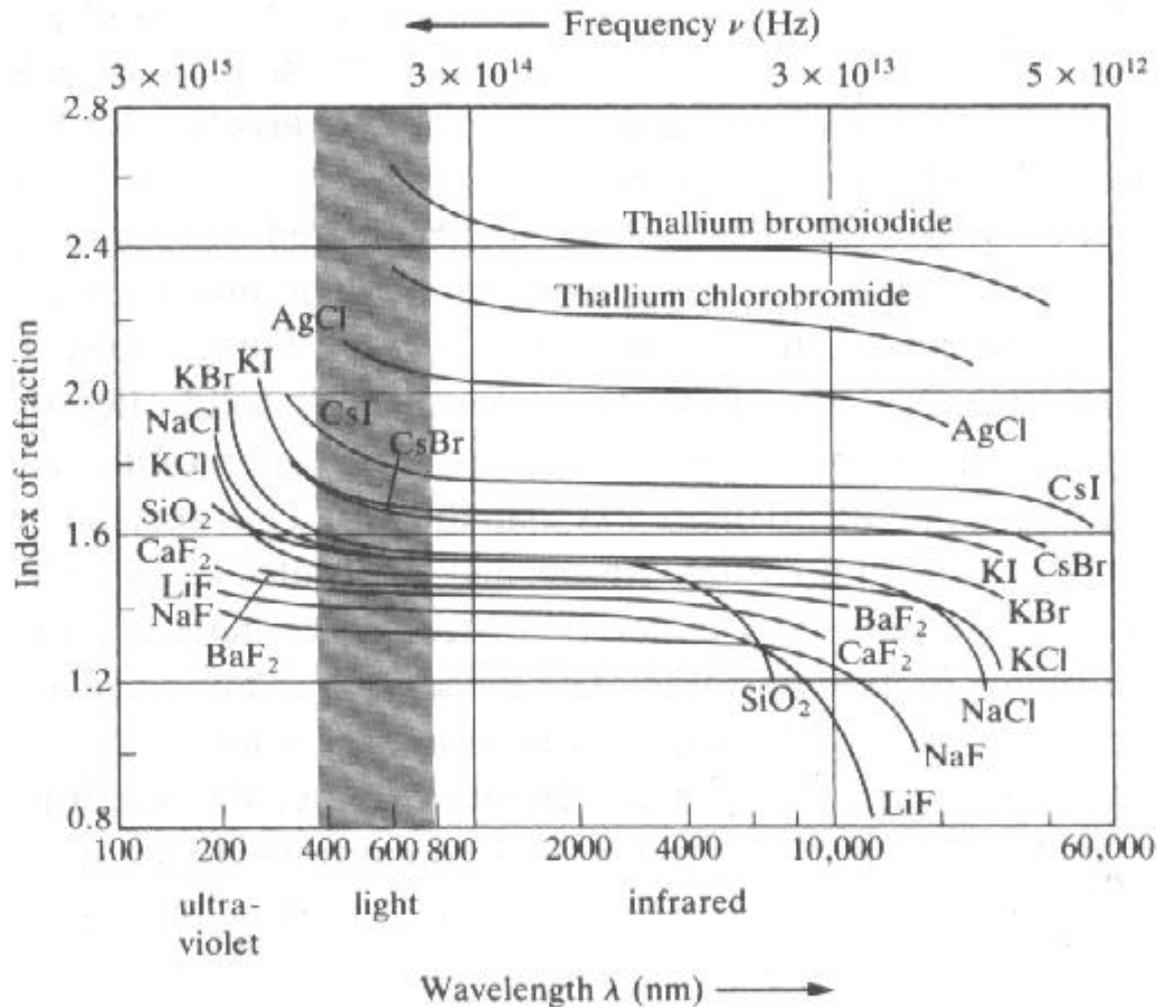
$$\left(n^2(\omega) - 1\right)^{-1} = C\left(\omega_0^2 - \omega^2\right) = C\left(\lambda_0^{-2} - \lambda^{-2}\right)$$

# 典型的なガラスの分散特性

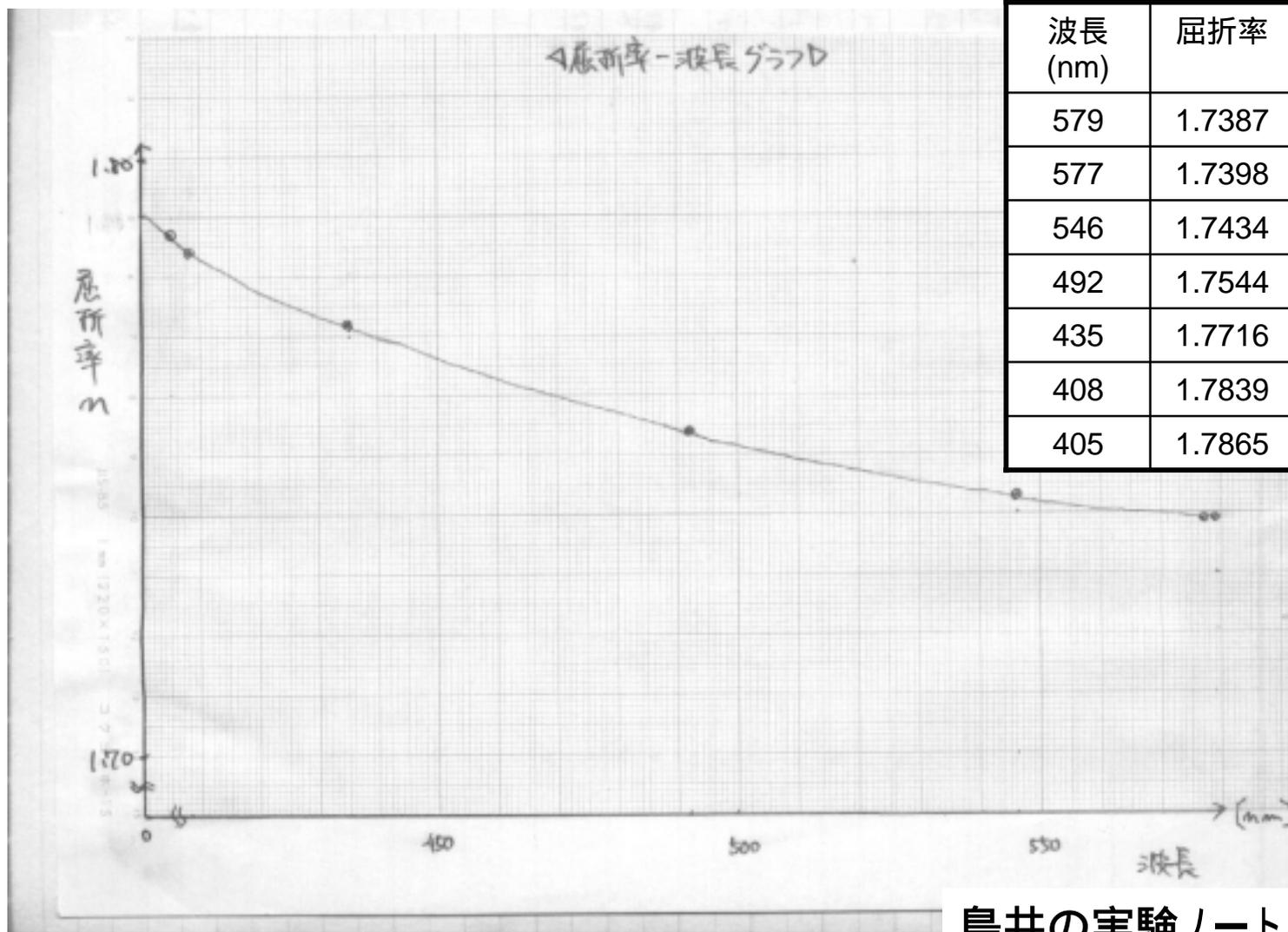


**Figure 3.41** Refractive index versus frequency.

# 色々なガラスの屈折率の波長依存性

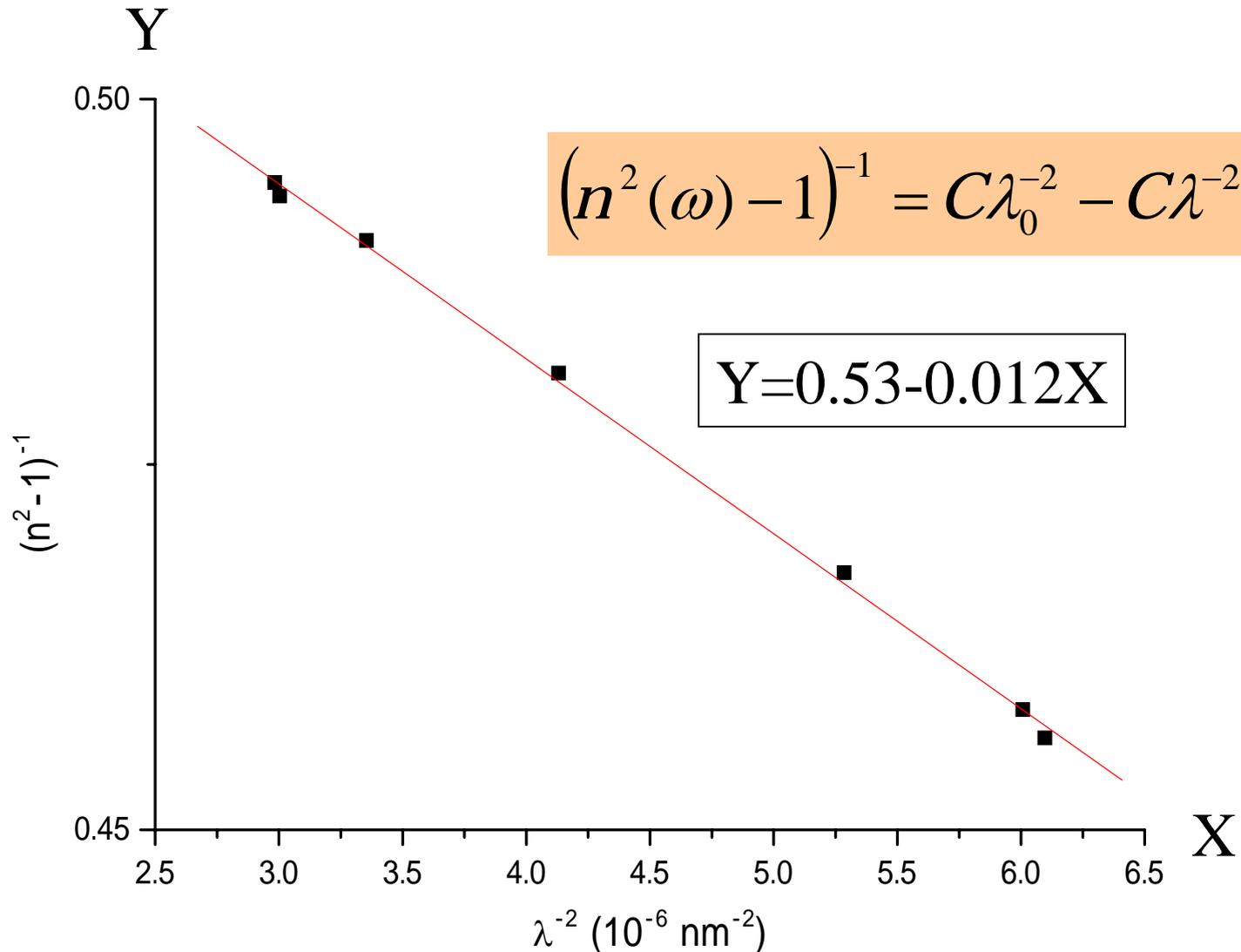


# 基礎実験 (ガラスの屈折率)



鳥井の実験ノートより転載

# 共鳴周波数を求める



# 比誘電率と屈折率の関係

**TABLE 3.2 Maxwell's Relation**

Gases at 0°C and 1 atm

Substance	$\sqrt{K_E}$	$n$
Air	1.000294	1.000293
Helium	1.000034	1.000036
Hydrogen	1.000131	1.000132
Carbon dioxide	1.00049	1.00045

Liquids at 20°C

Substance	$\sqrt{K_E}$	$n$
Benzene	1.51	1.501
Water	8.96	1.333
Ethyl alcohol (ethanol)	5.08	1.361
Carbon tetrachloride	4.63	1.461
Carbon disulfide	5.04	1.628

Solids at room temperature

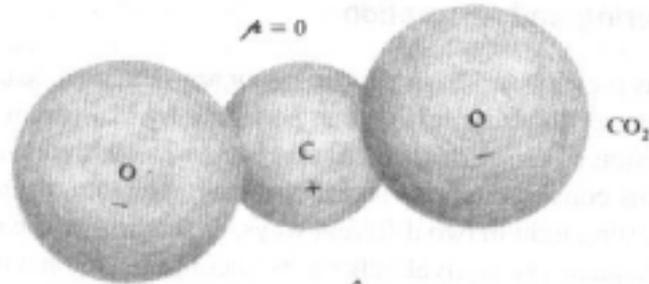
Substance	$\sqrt{K_E}$	$n$
Diamond	4.06	2.419
Amber	1.6	1.55
Fused silica	1.94	1.458
Sodium chloride	2.37	1.50

Values of  $K_E$  correspond to the lowest possible frequencies, in some cases as low as 60 Hz, whereas  $n$  is measured at about  $0.5 \times 10^{15}$  Hz. Sodium D light was used ( $\lambda = 589.29$  nm).

$$K_E \equiv \frac{\epsilon(\omega \approx 0)}{\epsilon_0}$$

$$n(\omega) = \sqrt{\frac{\epsilon(\omega)}{\epsilon_0}}$$

# 種々の分子の永久双極子モーメント



$A = 6.2 \times 10^{-30} \text{C}\cdot\text{m}$

