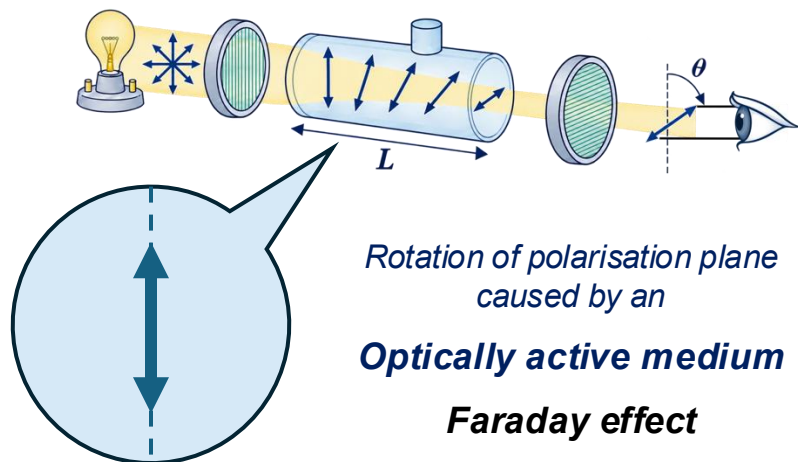


Microscopic Theory of Temperature-Dependent Optical Rotation in Chiral Solutions

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Optical rotation



Organic solutions with
chiral molecules



**What is its underlying
microscopic mechanism?**



F. Arago, J. Biot, M. Faraday, E. Verdet

$$\theta = VBL \quad \text{and} \quad \theta = \alpha cL$$



P. Drude

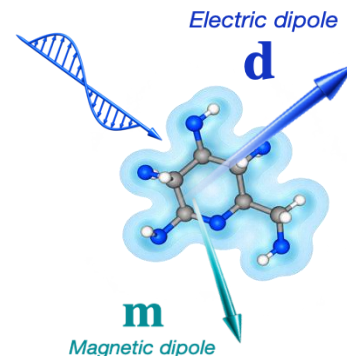
$$\frac{\theta(\lambda)}{L} = \frac{A}{\lambda^2 - \lambda_0^2}$$



L. Rosenfeld

$$R_{mn} = \text{Im}(\mathbf{d}_{nm} \cdot \mathbf{m}_{mn})$$

In this work...



Electromagnetism

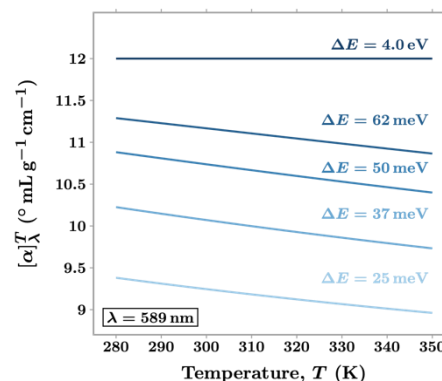
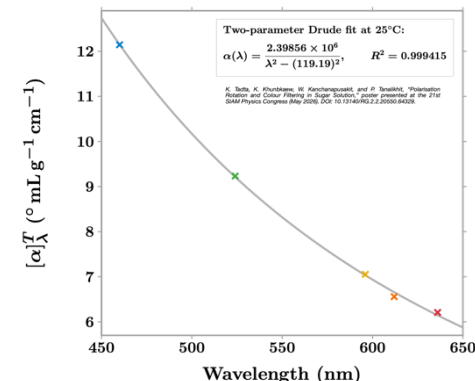
$$\frac{\theta}{L} = \frac{\omega}{2c_0} \text{Re}(n_+ - n_-) = \frac{N\omega^2}{\epsilon_0 c_0^2} \text{Re}(\beta)$$

Kubo response theory

$$\chi_{ij,\text{chiral}}^{dm}(\omega) = i\omega\delta_{ij} \cdot \frac{2}{3\hbar} \sum_{n,m} \frac{p_n R_{mn}}{\omega_{mn}^2 - (\omega + i\gamma_{mn})^2} \equiv \beta(\omega, T)$$

Final result

$$\frac{\theta}{L} = \frac{2N\omega^2}{3\epsilon_0\hbar c_0^2} \text{Re} \sum_{E_n > E_n} \frac{[p_n(T) - p_m(T)]R_{mn}}{\omega_{mn}^2 - (\omega + i\gamma_{mn})^2}$$



$$\frac{\theta(\lambda)}{L} = \frac{A}{\lambda^2 - \lambda_0^2} \quad \text{with} \quad A = \frac{2NR_{10}\lambda_0^2}{3\epsilon_0\hbar c_0^2}$$

R₁₀ was estimated and found to be in agreement (same order) with values reported in the relevant literature.

