Light induced magnetization using chiral molecules

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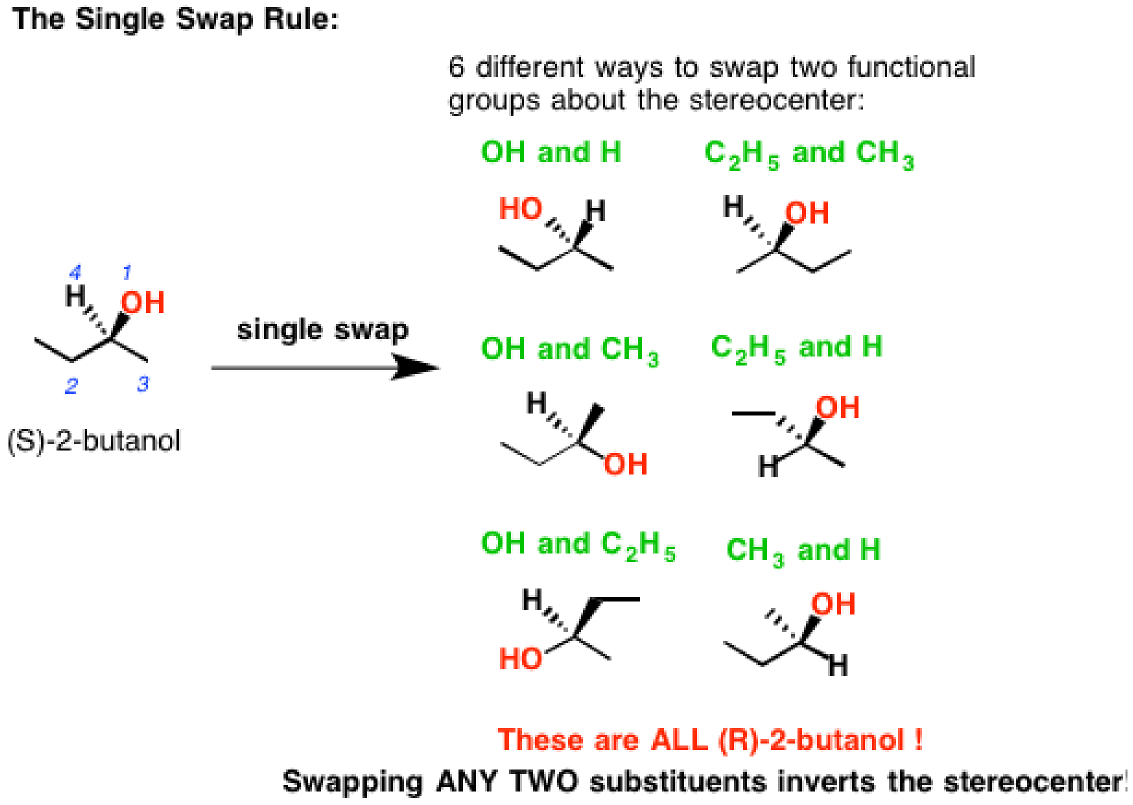
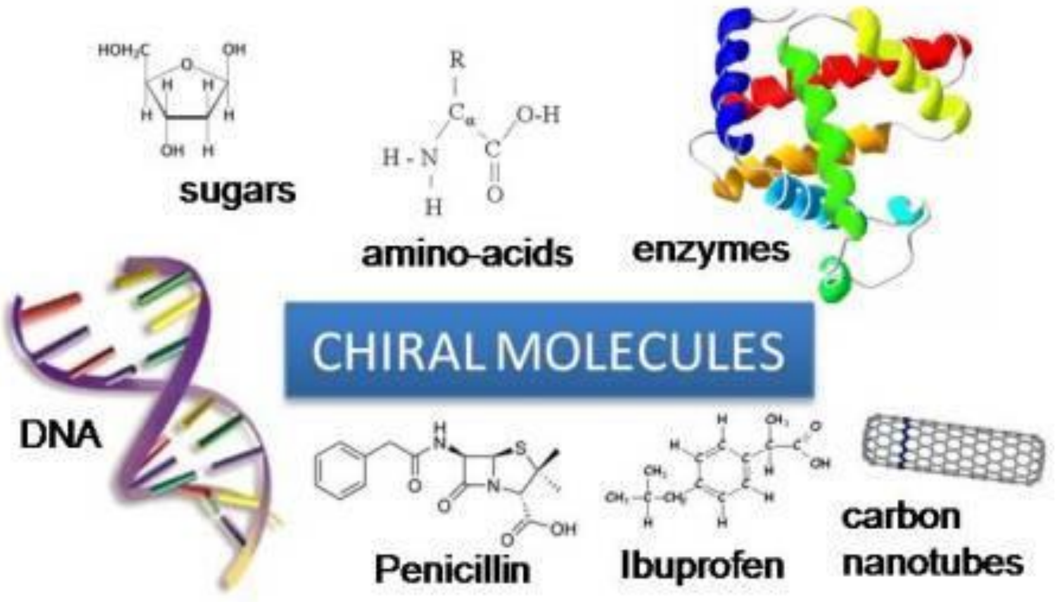
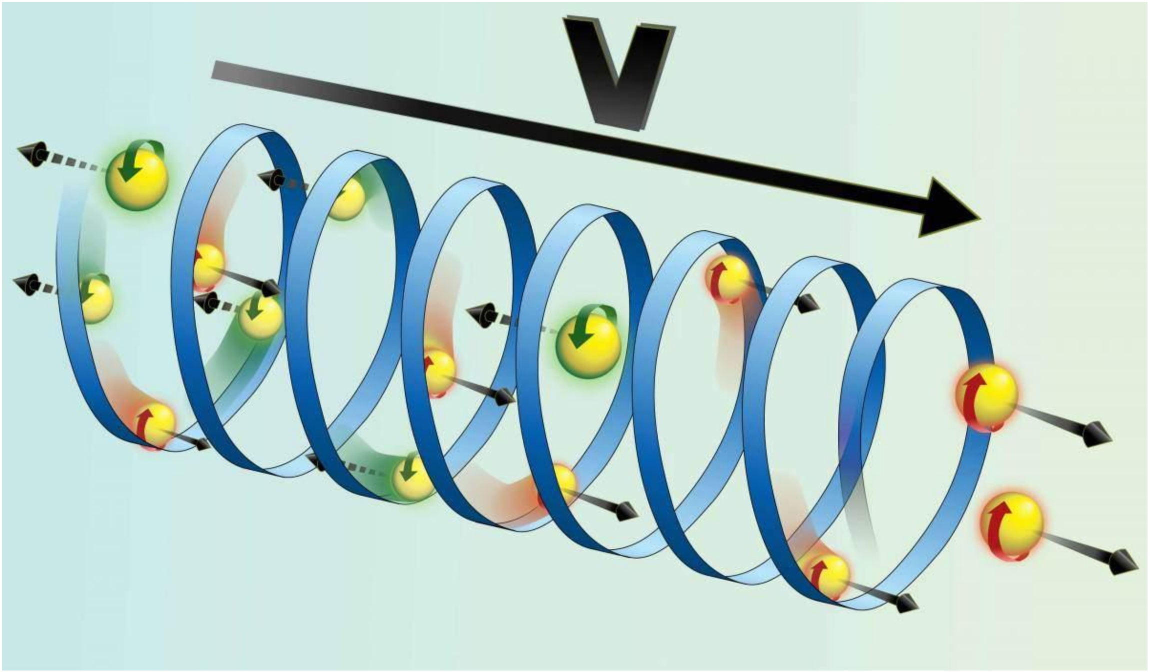
Chiral molecules

chiral molecules commonly comprise a carbon atom attached to four different substituents. Only two geometry is allowed by swapping components.



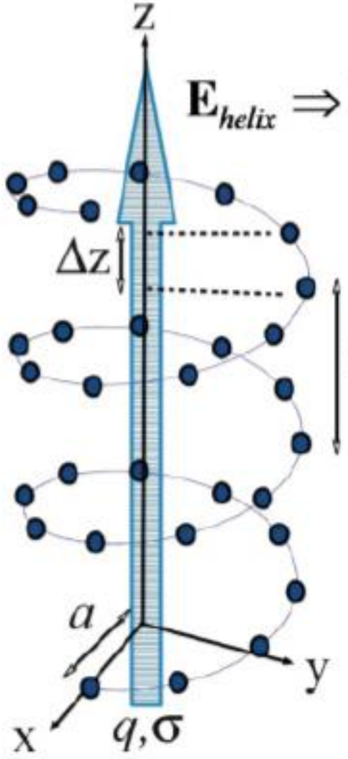




Spin selection in Chiral molecules

R. Gutierrez, etc., Phys. Rev. B 85, 081404(R), 2012

$$\mathbf{E}_{helix} \Rightarrow \mathbf{B} = \frac{\mathbf{v}}{c^2} \times \mathbf{E}_{helix}$$



medium. The potential for a single point charge located at $\mathbf{x}' = (a, \phi', z')$ in a uniform dielectric medium is just

$$\Phi(\mathbf{x}) = \frac{q}{\epsilon} \frac{1}{|\mathbf{x} - \mathbf{x}'|} = \frac{q}{\epsilon} \frac{1}{(\rho^2 + a^2 - 2a\rho\cos(\phi - \phi') + (z - z')^2)^{1/2}}. \tag{25}$$

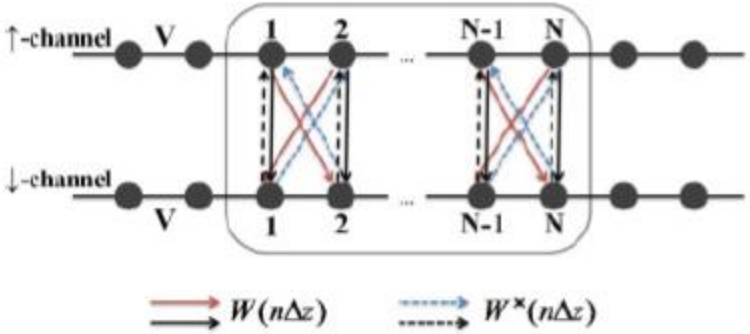
A textbook calculation yields the electric field on the central axis:

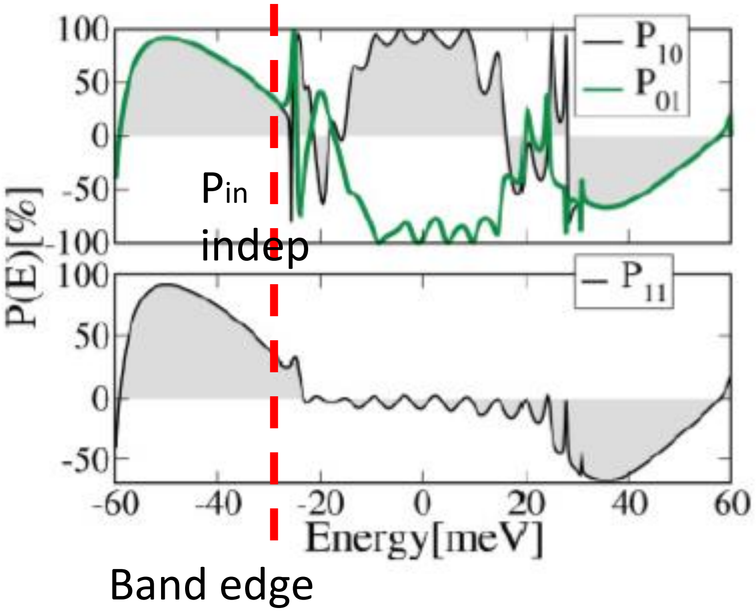
$$E_\rho(0,\phi,z) = -\frac{q}{\epsilon}\sum_{n,s} \frac{a\cos\left(\phi - \frac{2\pi s \Delta z}{P}\right)}{(a^2 + (z - nP - s\Delta z)^2)^{3/2}},$$

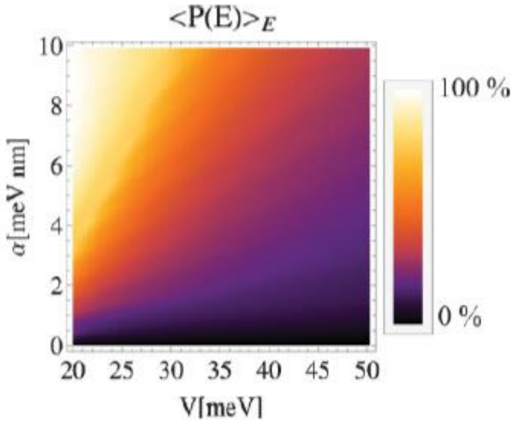
$$E_\phi(0,\phi,z) = \frac{q}{\epsilon}\sum_{n,s} \frac{a\sin\left(\phi - \frac{2\pi s \Delta z}{P}\right)}{(a^2 + (z - nP - s\Delta z)^2)^{3/2}}, \tag{26}$$

$$E_z(0,\phi,z) = \frac{q}{\epsilon}\sum_{n,s} \frac{(z - nP - s\Delta z)}{(a^2 + (z - nP - s\Delta z)^2)^{3/2}}.$$

D. Hochberg, G. Edwards, and Th. W. Kephart, Phys. Rev. E 55, 3765 (1997).





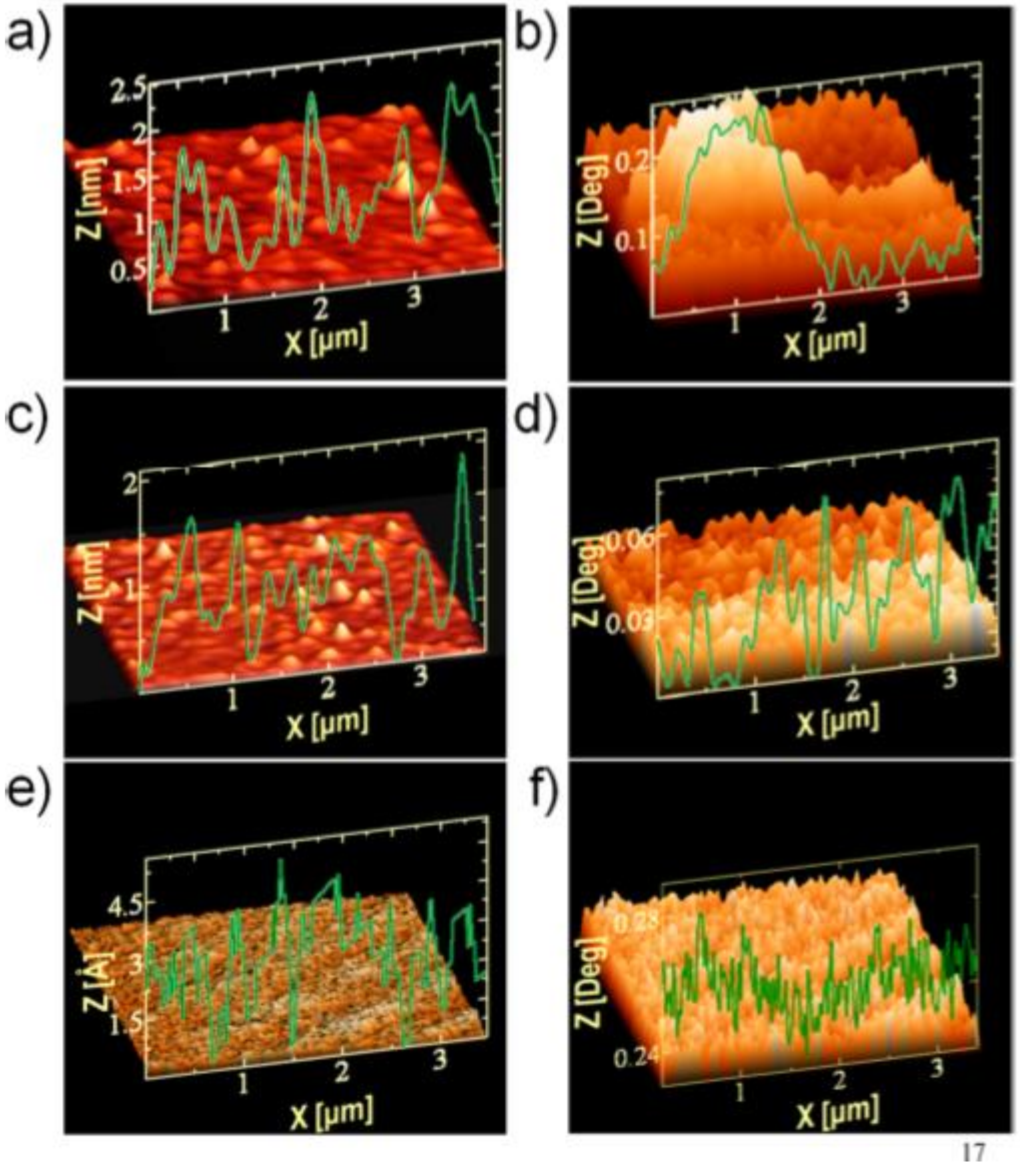


$$H = \sum_{\sigma=\uparrow,\downarrow}\sum_{n=1}^{N} U_n c^\dagger_{n,\sigma} c_{n,\sigma} + V \sum_{\sigma=\uparrow,\downarrow}\sum_{n=1}^{N-1} (c^\dagger_{n,\sigma} c_{n+1,\sigma} + \text{H.c.}) + \sum_{n,m=1}^{N} (c^\dagger_{n,\uparrow} W_{n,m} c_{m,\downarrow} + c^\dagger_{m,\downarrow} W^\times_{m,n} c_{n,\uparrow}) + H_{\text{leads}}. \tag{2}$$

Light induced magnetization

O. Dor, etc.,
Nano let. 2014, 14, 6042-6049

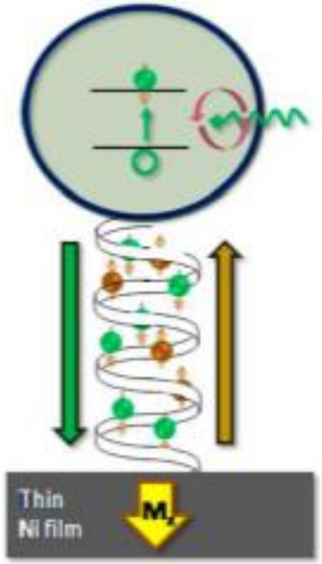
AFM MFM

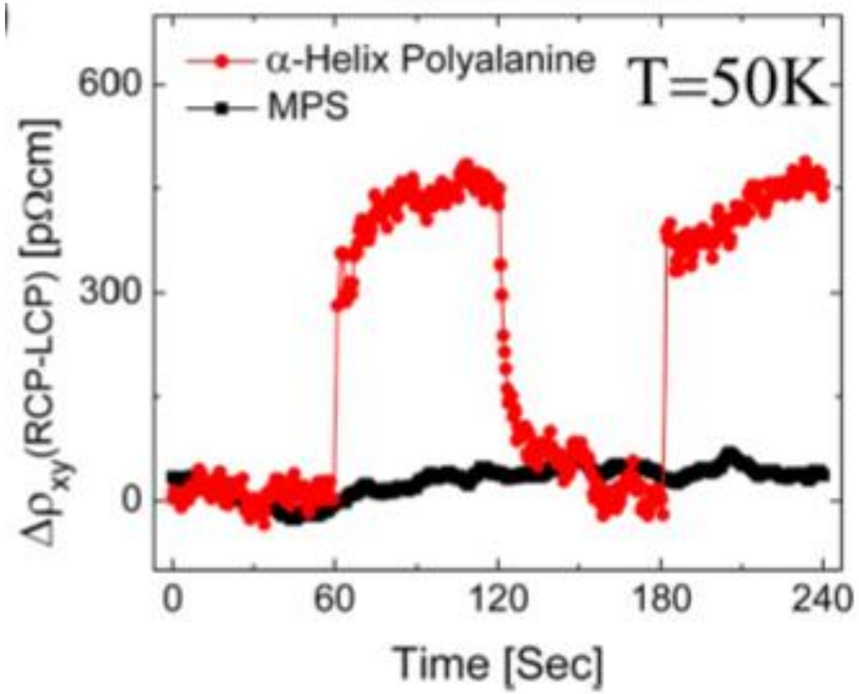


with light

no light

Without chiral molecule





AHE under circular light with and without chiral molecule