Polarization Review

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Physics 158

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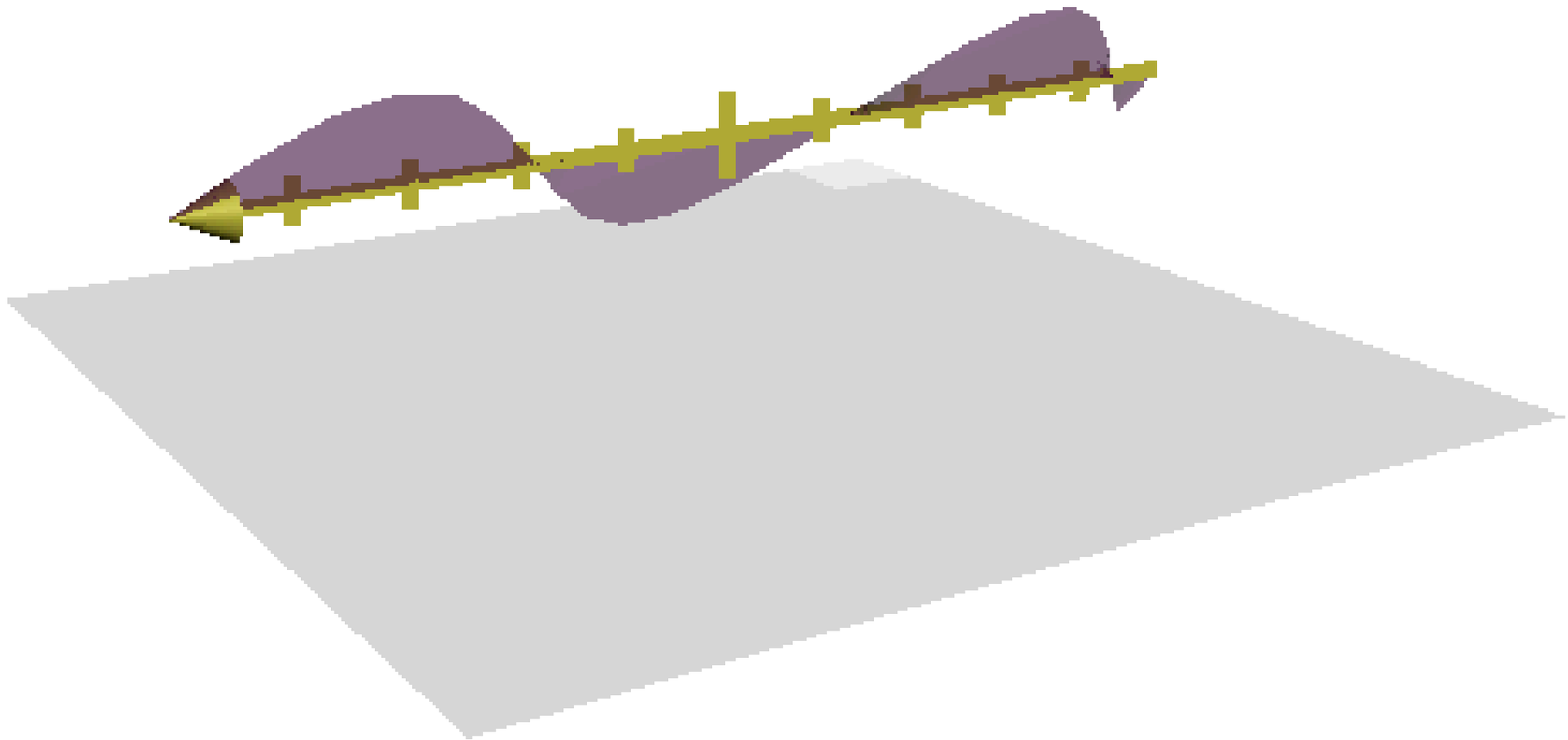
Describe these polarization states



Jones Vectors

Expressing polarization in terms of two orthogonal states with complex amplitude (i.e. amplitude and phase) of each component expressed in vector form

vertical	$\begin{bmatrix} 0 \\ 1 \end{bmatrix}$
horizontal	$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$
linear at +45°	$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 \\ 1 \end{bmatrix}$
linear at θ	$\begin{bmatrix} \cos\theta \\ \sin\theta \end{bmatrix}$
right circular	$\frac{1}{\sqrt{2}}\begin{bmatrix} i \\ 1 \end{bmatrix}$
left circular	$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 \\ i \end{bmatrix}$

Jones Calculus

- Find the Jones matrix for a thickness of optically active corn syrup that rotates the polarization by +90°
- Find the Jones matrix for reflection from an air-glass interface, if the light is incident at oriented at an angle θ relative to the normal

Corn Syrup Demonstration

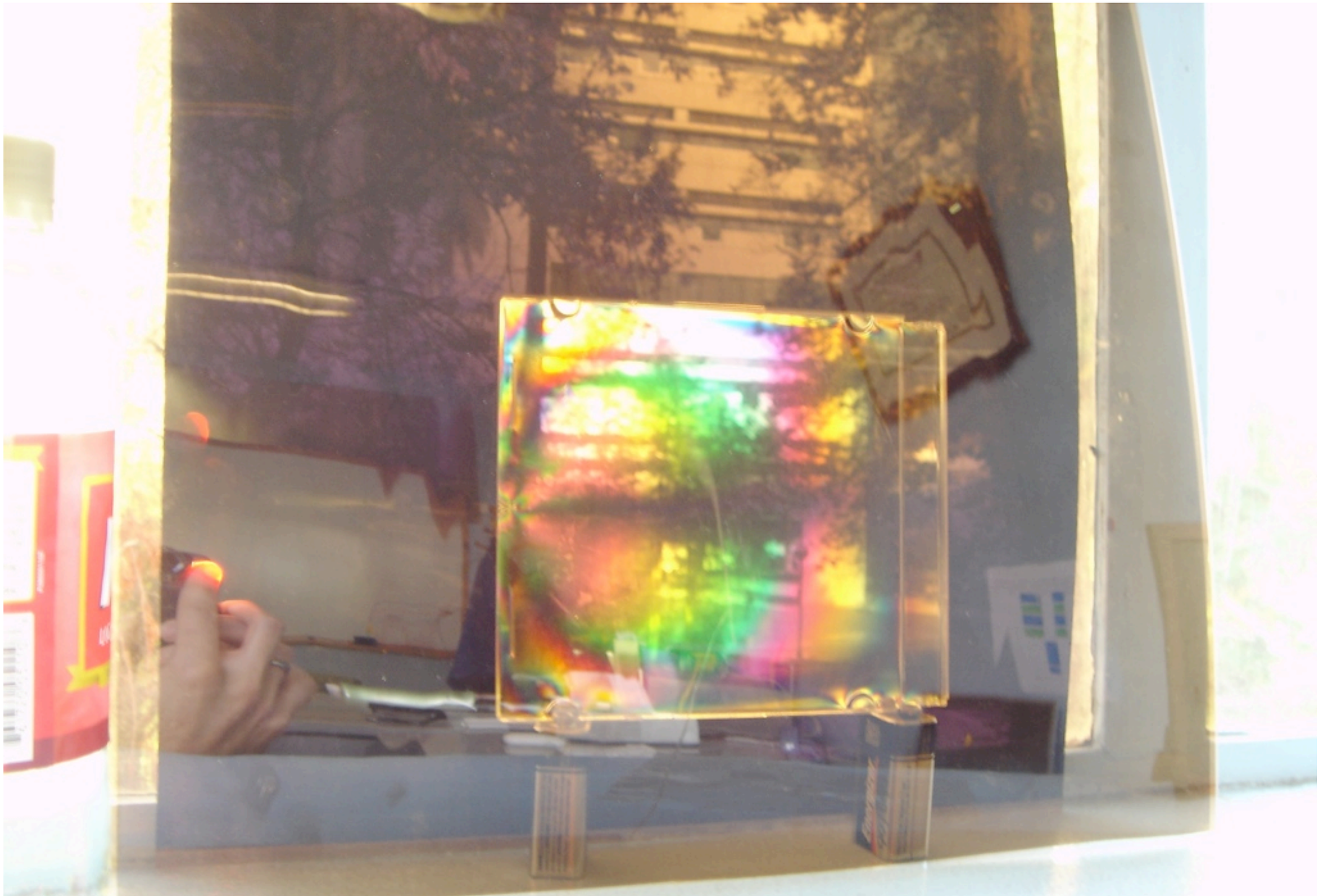
Circular Polarization Basis

- Describe the following in terms of L and R states (left and right handed circular polarization respectively)
  - cos(kz-ωt)$\hat{x}$ + cos(kz-wt)$\hat{y}$
  - cos(kz-ωt)$\hat{x}$ + sin(kz-wt)$\hat{y}$
  - cos(kz-ωt+π/3)$\hat{x}$ + cos(kz-wt)$\hat{y}$
  - cos(kz-ωt)$\hat{x}$ - 2 cos(kz-wt)$\hat{y}$

Retarders

Use Jones calculus to find the intensity of light transmitting through a pair of crossed polarizers with a retarder between them. The retarder has a retardance of $2\pi\Lambda/\lambda$ and has its fast axis oriented at an angle θ with respect to the transmission axis of the first polarizer.

Stress Induced Birefringence



Stress Induced Birefringence

Optical Activity and Birefringence

Describe how you could differentiate between an optically active material between two crossed polarizers that rotates the polarization by 10° and a half-waveplate between crossed polarizers that rotates the polarization by 10°

Polarizers

Draw the polariation state for unpolarized light that propagates through a linear polarizer followed by a half wave plate oriented with its fast axis at 45° with respect tot he polarizer transmission angle. Repeat for unpolarized light going in the opposite direction.

Polarizers

Draw the polariation state for unpolarized light that propagates through a linear polarizer followed by a quarter wave plate oriented with its fast axis at 45° with respect to the polarizer transmission angle. Repeat for unpolarized light going in the opposite direction.