Ray tracing and generation of entangled light

Part A. Light propagation in isotropic dielectric media

A.1 $(0.4\ \mathrm{pt})$
$v_p =$

A.2 $(0.2\ \mathrm{pt})$
$n =$

A.3 $(0.4\ \mathrm{pt})$

$\hat{S} =$

$v_r =$

Part B. Light propagation in uniaxial dielectric media

B.1 $(1.5\ \mathrm{pt})$
Allowed refractive indices and corresponding $\hat{B}$ and $\hat{D}$ for a given θ:
Set 1

$n =$

$\hat{B} =$

$\hat{D} =$

Set 2

$n =$

$\hat{B} =$

$\hat{D} =$

The angle with only one value of refractive index is permitted
$\theta =$

B.2 (0.8 pt)

Set 1
Polarization $\hat{E} =$

Which wave (ordinary or extraordinary):

$\tan\alpha =$

Set 2
Polarization $\hat{E} =$

Which wave (ordinary or extraordinary):

$\tan\alpha =$

B.3 (0.6 pt)
Set 1
Refractive index $n =$

Polarization $\hat{E} =$

Which wave (ordinary or extraordinary):

Set 2
Refractive index $n =$

Polarization $\hat{E} =$

Which wave (ordinary or extraordinary):

B.4 (0.8 pt)

Set 1

tan $\alpha_r =$

$v_r =$

$\hat{S} =$

Set 2

tan $\alpha_r =$

$v_r =$

$\hat{S} =$

$n_s =$ (in terms of $\hat{S}$, $\hat{x}$, $\hat{z}$, n_o, and n_e)

B.5 (1.1 pt)

$\bar{A} =$

$\bar{B} =$

$\bar{C} =$

$\tan\theta_2 =$ $(\phi = 0)$

$\tan\theta_2 =$ $(\phi = \frac{\pi}{2})$

Part C. Entanglement of light

C.1 (0.8 pt)

All possible relations between ω, ω_1, ω_2 and $\vec{k}$, $\vec{k}_1$, $\vec{k}_2$

Relation 1:

which conservation laws:

Relation 2:

Which conservation laws:

Equations for splitting ω and $\vec{k}$ into ω_1, ω_2 and $\vec{k}_1$,$\vec{k}_2$:

C.2 (0.8 pt)

Impossible ways of splitting:

C.3 (1.3 pt)

$M =$

$N =$

$L =$

Angle between the axis of the cone and z' axis:

Angle of the cone:

C.4 (0.8 pt)

$P(\alpha, \beta) =$

$P(\alpha, \beta_\perp) =$

$P(\alpha_\perp, \beta) =$

$P(\alpha_\perp, \beta_\perp) =$

C.5 (0.5 pt)

Expression of $S =$

Values of $S =$

Consistency with classical theories: