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Courses » Introduction to Non-linear Optics and its Applications

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Unit 9 - Week 7

Course outline

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Pre-requisite Assignment

Week 1

Week 2

Week 3

Week 1

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Week 7

- Lecture 31 : Realistic calculation of SHG 3 wave interaction
- Lecture 32 : 3 wave interaction, Equation for pump, signal and idler wave Non-collinear phase matching
- Lecture 33 : Manley-Rowe Relation (3 wave mixing), Parametric down conversion
- Lecture 34 : Parametric down conversion (cont), Optical Parametric Amplification (OPA)
- Lecture 35 : Optical Parametric Amplification (OPA). Difference frequency generation under OPA
- Quiz: Week 7 Assignment 7

Feedback for Week 7

Week 8

Week 9 Mook 10 Week 7 Assignment 7

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2018-09-19, 23:59 IST.

Consider different frequency interaction $(\omega_1 - \omega_2 = \omega_3)$, where the corresponding to ω_1 is treated as constant throughout the crystal (Undep pump approximation). The coupled amplitude equations for $\Delta k = 0$ are (w.

$$\kappa_i = \frac{\omega_i d_{eff}}{n_i c})$$

$$\frac{dA_1}{dz} = i\kappa_1 A_2 A_3$$

$$dz = i\kappa_1 A_2 A_3$$
(b)
$$\frac{dA_2}{dz} = i\kappa_2 A_1 A_3^*$$

$$\frac{dA_1}{dz} = i\kappa_1 A_2 A_3$$

(a)
$$\frac{dA_2}{dz} = i\kappa_2 A_1 A_3$$
$$\frac{dA_3}{dz} = i\kappa_3 A_1 A_2^*$$

(b)
$$\frac{dA_2}{dz} = i\kappa_2 A_1 A_3$$

 $\frac{dA_3}{dz} = i\kappa_3 A_1 A_2$

$$\begin{array}{ll} \frac{dA_{1}}{dz}=i\kappa_{1}A_{2}A_{3} & \frac{dA_{1}}{dz}=i\kappa_{1}A_{2}A_{3}^{*} & \frac{dA_{1}}{dz}=i\kappa_{1}A_{2}A_{3} \\ \text{(a)} \frac{dA_{2}}{dz}=i\kappa_{2}A_{1}A_{3}^{*} & \text{(b)} \frac{dA_{2}}{dz}=i\kappa_{2}A_{1}A_{3}^{*} & \text{(c)} \frac{dA_{2}}{dz}=i\kappa_{2}A_{1}A_{3} \\ \frac{dA_{3}}{dz}=i\kappa_{3}A_{1}A_{2}^{*} & \frac{dA_{3}}{dz}=i\kappa_{3}A_{1}A_{2} & \frac{dA_{3}}{dz}=i\kappa_{3}A_{1}A_{2} \end{array}$$

- (a)
- (b) (c)

No, the answer is incorrect. Score: 0

Accepted Answers:

(a)

For Q1 the governing equation for the field $A_2(z)$ is (where $\alpha = \sqrt{\kappa_2 \kappa_3 |A_1|^2}$ (a) $\frac{d^2 A_2}{dz^2} + \alpha^2 A_2 = 0$ (b) $\frac{d^2 A_2}{dz^2} = 0$ (c) $\frac{d^2 A_2}{dz^2} - \alpha A_2 = 0$ (d) $\frac{d^2 A_2}{dz^2} - \alpha^2 A_2 = 0$

- (a)
- (b)
- (c)
- (d) No, the answer is incorrect.

Score: 0

Accepted Answers:

(d)

For Q1 if the initial conditions are $A_1(0) = A_{10}$, $A_2(0) = A_{20}$ and $A_3(0) = 0$

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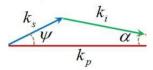
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Assignment Solution

(b) (c)	
No, the answer is incorrect. Score: 0	
Accepted Answers: (c)	
4)	2 point

For a sum frequency generation process $(\omega_i = \omega_p + \omega_s)$ if the angle between wave vector k_p and k_s is ψ , then the angle between k_p and k_i is



(a)
$$\tan^{-1} \frac{(k_p/k_s)\sin\psi}{1+(k_s/k_p)\cos\psi}$$

(b)
$$\tan^{-1} \frac{(k_s/k_p) \sin \psi}{1 - (k_s/k_p) \cos \psi}$$

(c)
$$\tan^{-1} \frac{(k_s/k_p)\sin\psi}{1-(k_p/k_s)\cos\psi}$$

(d)
$$\tan^{-1} \frac{(k_s/k_p)\sin\psi}{1+(k_p/k_s)\cos\psi}$$

(a)

(b)

(d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(b)

2 points

For achieving noncollinear phase matching in a sum frequency gener process ($\omega_i = \omega_p + \omega_s$) the angle between the wave vectors k_p and k_s is

(a)
$$\cos^{-1} \frac{k_p^2 + k_s^2 - k_i^2}{2k_p k_i}$$
 (b) $\cos^{-1} \frac{k_p^2 + k_s^2 - k_i^2}{2k_i k_s}$ (c) $\cos^{-1} \frac{k_p^2 + k_s^2 - k_i^2}{2k_p k_s}$

(a) (b)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(c)

2 points

A phase-matching configuration is possible in beta-barium borate (BBO) in v two separate non-collinear beams at 1.064 μm generate a second harmonic k at 0.532 μm . Assuming the refractive indices are same for both the waveleng the angle between the two fundamental beams is

(a) 180°

(b) 40.06°

(c) 30.1°

(d) 90°

(a)

(b)

(c)

No, the answer is incorrect.

Score: 0 Accepted Answers: (a)				
A phase-matching on non-collinear beam If the effective refrarespectively, the an (a) 180°	ıs at 1.064 μm g active indices at	generate a second t the two waveler	l harmonic beam ngths are 1.5940	at 0.532
(a) (b) (c) (d) No, the answer is incorrect. Score: 0 Accepted Answers: (b)				
8) In optical parametr (a) from lower fre the lower frequency	quency to the l	nigher frequency	(b) from higher	^{2 points} r frequen
(a) (b) (c) No, the answer is incorrect. Score: 0 Accepted Answers:				
9) Degenerate parame (a) SHG (b) D		on process is exac ectro optic effect	tly opposite to (d) none of	2 points these
(a) (b) (c) (d) No, the answer is incorrect. Score: 0 Accepted Answers: (a)				
For type-I phase material $e \rightarrow o + o$	_	of the following is $(c) o \rightarrow o$	•	•
(a) (b) (c) (d)				
No, the answer is incorrect. Score: 0 Accepted Answers: (d)				

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