
IPT5110 Nonlinear Optics

國立清華大學 光電光程研究所/電機工程學系

Prof. 黃衍介

class schedule: M3M4F5

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Class location: EECS 107

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一、課程說明

The scope of this course covers most nonlinear optical phenomena associated with the 2nd and 3rd order optical nonlinearity. If time allows, high harmonic generation and plasma nonlinearity in the relativistic regime will be introduced. To assist learning, this course begins with some review on the linear electromagnetic theory and then gradually moves into the nonlinear regime. Seeing is believing. In-class laboratory demonstration will be arranged whenever possible.

二 指定用書

1. Class handouts (available at 水木書苑 or <http://www.hope.nthu.edu.tw>)

三、參考書籍

0. David K. Cheng, Field and Wave Electromagnetics 2nd Ed., Addison Wesley, 1989. 近代實驗光學，東華書局，黃衍介 著。
1. Nonlinear Optics by E.G. Sauter, John Wiley & Sons, 1996.
2. Fundamental of Photonics by Saleh & Teich, John Wiley & Sons, Inc.
3. Nonlinear Optics by R.W. Boyd, Academic Press.
4. Optical Waves in Crystals by Yariv and Yeh, John Wiley & Sons, Inc.
5. Quantum Electronics, by Yariv, John Wiley and Sons, Inc.

四、教學方式

in-class lectures + experimental demo+weekly quiz + homework assignment + exams

五、教學進度

1. Electromagnetic waves in the linear regime (D. K. Cheng, Huang)
2. Electromagnetic Wave in Anisotropic Media (Ch. 2 by Sauter, Ch. 6 by S&T, Ch. 4 by Y&Y)
3. Nonlinear Susceptibility (Ch. 1 by Boyd, Ch. 1 by Sauter)

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4. Electro-optics (Ch. 3 by Sauter, Ch. 18 by S&T, Ch. 7 by Y&Y, Ch. 10 by Boyd)
 5. Acousto-optics (Ch. 20 by S&T, Ch. 9 by Y&Y, Ch. 7 by Boyd)
 6. Second harmonic generation (Ch. 2, 4 by Sauter, Ch. 19 by S&T)
 7. Other Frequency Conversions using 2nd-order Nonlinearity (Ch. 4&5 by Sauter, Ch. 2 by Boyd, Ch. 19 by S&T, Ch. 12 by Y&Y)
 8. Quasi-phase-matching nonlinear optics (handout)
 9. Third-order Nonlinear Processes: third-harmonic generation, conjugate waves, Brillouin scattering, and Raman Scattering (Ch. 6 by Sauter, Ch. 18 by Yariv, Ch. 19 by S&T)
 10. DC and AC Kerr Effect (Ch. 7 by Sauter, Ch. 19 by S&T)
 11. High harmonic generation and plasma nonlinear optics (tentative)

六、成績考核

Homework	20%
1 st midterm exam (Oct. 20)	20%
2 nd midterm exam	20%
final exam	20%

weekly quiz 20% (weighting factor for extra credits, if grade adjustment is necessary in the end of the semester)

七、講義位址 chapter files available at <http://www.hope.nthu.edu.tw> and bonded copy available at 水木書苑