Catalog Entry for PHYS 522: NONLINEAR OPTICS

PHYS 522 (3) Nonlinear Optics (3)

Classical Phenomenology and Maxwell's equations in media; Maxwell-Bloch equations. Theory of nonlinear wave interactions and propagation. Properties of optical fibers and nonlinear materials. Theory of nonlinear propagation, solitons, inverse scattering transforms, optical chaos. Applications to lasers, optical violability, self-induced transparency, and stimulated light scattering. Prerequisite: PHYS 421, PHYS 481

Syllabus for PHYS 522: NONLINEAR OPTICS
1 . Introduction
(a) Definition of optics
(b) Classical phenomenology and Maxwell's equations in media
(c) The role of quantum theory

2. Linear and Nonlinear Responses of Matter

3. Nonlinear optical properties of materials
      Categories of materials
      Bulk materials
      Time characteristics
      Space and time translation invariance
      Nonlinear optical units
      Properties of nonlinear susceptibilities 1
      Local field corrections; cascading

4. Nonlinear wave interactions

5. Theory of nonlinear propagation equations; slowly-varying envelope approximation

6. Theory of light propagation in linear and weakly nonlinear (Kerr Media) dielectrics

7. Optical fibers and nonlinear materials

8. Maxwell-Bloch equations

9. Applications:

       lasers, optical violability, self-induced transparency, stimulated scattering,

       solitons and inverse scattering transforms, and chaos In optical systems