

Macroscopic Electrodynamics II

Physics 5331 Syllabus

7. Time Varying Fields II

- 7.1 Conservation of energy; energy flux
- 7.2 Conservation of momentum; Maxwell stress tensor
- 7.3 Conservation of angular momentum; shear tensor
- 7.4 Viewpoint on effective conservation laws for macroscopic media
- 7.5 Maxwell stress tensor example
- 7.6 Lienard-Wiechart potentials
- 7.7 Green function for half-infinite geometry
- 7.8 Discrete transformation properties of electromagnetic quantities
- 7.9 Connections between classical electromagnetism and quantum field theory

Problems

8. Plane Electromagnetic Waves and Propagation in Matter

- 8.1 Plane waves in dielectric media
- 8.2 Reflection and refraction of plane waves from dielectric interfaces I: $\mathbf{E}_\perp$ polarization
- 8.3 Reflection and refraction of plane waves from dielectric interfaces II: $\mathbf{B}_\perp$ polarization
- 8.4 Brewster's angle and total internal reflection
- 8.5 Simple model for constitutive relations
- 8.6 Model applications to plasmas, metals and dielectrics
- 8.7 Kramers-Kronig relations
- 8.8 Dispersion in one-dimension: theory and example

Problems

9. Wave Guides and Resonant Cavities

- 9.1 Boundary conditions near an imperfect conductor
- 9.2 General considerations for wave guides of arbitrary cross section
- 9.3 Example: rectangular waveguide modes
- 9.4 Power loss in waveguides: power method
- 9.5 Power loss in waveguides: perturbation of boundary conditions
- 9.6 Rectangular resonant cavity
- 9.7 Eigenmode expansion for spherical resonant cavity
- 9.8 Energy loss and frequency shift in resonators
- 9.9 Orthogonality properties for wave guide eigenfunctions
- 9.10 Reflection and impedance properties of thin diaphragms in waveguides

9.11 Variational examples: thin diaphragms in rectangular waveguides

Problems

10. Radiation of Systems and Point Particles; Scattering

- 10.1 EM radiation of systems: harmonic formalism
- 10.2 EM radiation of systems: real source formalism
- 10.3 Frequency distribution of radiated power
- 10.4 Physical interpretation of multipole expansion approximation
- 10.5 Dipole and quadrupole contributions to radiated power
- 10.6 Point particle radiations: Larmor and Lienard results
- 10.7 Synchrotron radiation from periodic trajectories: general considerations
- 10.8 Synchrotron radiation from circular periodic motion
- 10.9 Definition of polarized scattering cross sections
- 10.10 Kirchhoff identity for scattering
- 10.11 Conducting sphere: short wavelength scattering
- 10.12 Optical theorem
- 10.13 Conducting sphere: partial wave techniques

Problems

11. Relativistic Formulations of Electrodynamics

- 11.1 The exact relativistic transformation and covariant notation
- 11.2 Relativistic form of Maxwell's equations
- 11.3 The "light cone"
- 11.4 Invariance properties of Lorentz transformations
- 11.5 Energy/momentum aspects of Lorentz transformations
- 11.6 Relativistic kinematics in the context of linear and circular particle accelerators
- 11.7 Relativistic Lagrangian for electrodynamics
- 11.8 Covariant form of the energy-momentum tensor

Problems

12. Feynman Wheeler Theory of Radiation Resistance

- 12.1 Background
- 12.2 Feynmann propagator
- 12.3 Radiation reaction calculation
- 12.4 Comments
- 12.5 Adios!
- 12.6 References for Ch.12

Problems