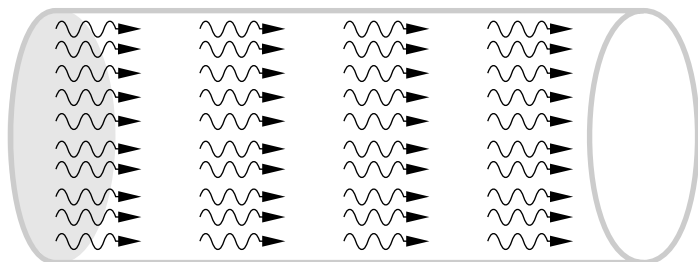


OPTICAL PUMPING



OPTICAL PUMPING
by
Frank Zerilli
Michigan State University

1. Program of Study 1
Acknowledgments.....1

Title: **Optical Pumping**

Author: Frank Zerilli, Michigan State University

Version: 2/1/2000

Evaluation: Stage B0

Length: 1 hr; 8 pages

Input Skills:

1. Calculate the wavelength and frequency of a photon emitted or absorbed when an atom makes a transition from one given state to another (MISN-0-216).
2. Describe the distribution of energies of a collection of atoms in thermal equilibrium (MISN-0-159).

Output Skills (Knowledge):

- K1. Define spontaneous emission.
- K2. Define stimulated emission.
- K3. Define population inversion.
- K4. Explain the basic principle of laser operation (optical pumping).

External Resources (Required):

1. Weidner and Sells, *Elementary Modern Physics*, 3rd ed., Allyn and Bacon (1980). For access, see this module's *Local Guide*.

Post-Options:

1. "Laser Devices" (MISN-0-258), learner originated.
2. "Optical Circuits" (MISN-0-259); learner originated, introduce the latest high technology applications of the principle of optical pumping.

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New authors, reviewers and field testers are welcome.

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Views expressed in a module are those of the module author(s) and are not necessarily those of other project participants.

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1. Program of Study

In WSM¹ study section 9-4. Note that the coherence of the emitted photons is related to the high intensity of the emitted light. Looking at the wave aspect of the emitted photons, coherence means that the waves corresponding to the photons are in phase. If we add the amplitudes of N waves which are in phase, the intensity of the resultant wave is N^2 times the intensity of a single wave. If the waves had random phase relationships, the intensity of the resultant would be only N times that of a single wave. For large N , N^2 is much greater than N .

Acknowledgments

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LOCAL GUIDE

The readings for this unit are on reserve for you in the Physics-Astronomy Library, Room 230 in the Physics-Astronomy Building. Ask for them as “The readings for CBI Unit 257.” Do **not** ask for them by book title.

¹R.T. Weidner and R.L. Sells, *Elementary Modern Physics*, 3rd ed. (Allyn and Bacon, Boston: 1980). For access, see this module’s *Local Guide*.

