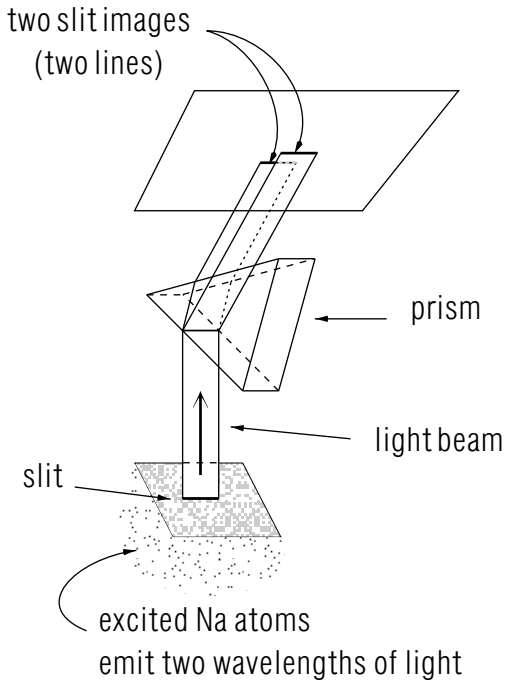
PHYSNET

MISN-0-216

TRANSITIONS AND SPECTRAL ANALYSIS



Project PHYSNET Physics Bldg. Michigan State University East Lansing, MI

TRANSITIONS AND SPECTRAL ANALYSIS

by

William C. Lane

Title: **Transitions and Spectral Analysis**

Author: William C. Lane, Michigan State University

Version: 2/1/2000 Evaluation: Stage B0

Length: 1 hr; 8 pages

Input Skills:

1. Vocabulary: atomic spectra, energy level, excited state, ground state (MISN-0-215).
2. Name the seven major regions of the electromagnetic spectrum (MISN-0-212).

Output Skills (Knowledge):

K1. Vocabulary: band spectra, continuous and line spectra, fluorescence, phosphorescence, resolving power, dispersion, spectroscope.

K2. State the three general types of information spectroscopy yields and cite an area of application for each type.

K3. Compare and contrast emission spectroscopy with absorption spectroscopy, including the types of light sources used.

K4. Briefly outline a procedure for spectral analysis, including: (a) the mechanism for exciting the sample atoms or molecules; (b) how the various wavelengths are separated; (c) why the spectra usually appear as lines; (d) how the wavelengths of the spectral lines are measured; and (e) how the sample atoms or molecules are then identified.

K5. Describe the three mechanisms by which the atoms and molecules make transitions between energy levels.

External Resources (Required):

1. M. Alonso and E. J. Finn, *Physics*, Addison-Wesley (1970). For access, see this module's *Local Guide*.
2. I. M. Freeman, *Physics, Principles and Insights*, McGraw-Hill (1968). For access, see this module's *Local Guide*.
3. G. R. Harrison, R. C. Lord, and J. R. Loofbourow, *Practical Spectroscopy*, Prentice-Hall (1948). For access, see this module's *Local Guide*.
4. R. A. Sawyer, *Experimental Spectroscopy*, Prentice-Hall (1946). For access, see this module's *Local Guide*.

THIS IS A DEVELOPMENTAL-STAGE PUBLICATION
OF PROJECT PHYSNET

The goal of our project is to assist a network of educators and scientists in transferring physics from one person to another. We support manuscript processing and distribution, along with communication and information systems. We also work with employers to identify basic scientific skills as well as physics topics that are needed in science and technology. A number of our publications are aimed at assisting users in acquiring such skills.

Our publications are designed: (i) to be updated quickly in response to field tests and new scientific developments; (ii) to be used in both classroom and professional settings; (iii) to show the prerequisite dependencies existing among the various chunks of physics knowledge and skill, as a guide both to mental organization and to use of the materials; and (iv) to be adapted quickly to specific user needs ranging from single-skill instruction to complete custom textbooks.

New authors, reviewers and field testers are welcome.

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Eugene Kales	Graphics
Peter Signell	Project Director

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D. Alan Bromley	Yale University
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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. Introduction

Excited atoms and molecules drop down to their ground states, emitting photons characteristic of their source. Such photons constitute "fingerprints" of the atoms or molecules which emit them. Spectroscopy is the science of excitation of the atoms and molecules, detection of the photons subsequently emitted, and interpretation of the sources of the photons. Spectroscopy also includes detection of the absorption of photons in passing through a material. This unit examines how the photons are produced in atomic transitions, and how this process is put to practical use in spectroscopy.

2. Study Suggestions

Read:

M. Alonso and E. J. Finn, *Physics*, Addison-Wesley (1970). For access, see this module's *Local Guide*. Read Sections 25.1-25.4 and 27.7. Examine Figure 27.28.

Then read:

1. I. M. Freeman, *Physics, Principles and Insights*, McGraw-Hill (1973), pp. 532-535 (Sec. 21.2-21.3). For access, see this module's *Local Guide*.

2. Harrison, Lord, and Loofbourow, *Practical Spectroscopy*, Prentice-Hall (1948), pp. 1-25 (skim sec. 1.14-1.20), pp. 27-29 (Sec. 2.1-2.2), and pp. 166-167. For access, see this module's *Local Guide*.

3. Sawyer, *Experimental Spectroscopy*, Prentice-Hall (1946), pp. 18-21, (Sec. 10 and 11), pp. 28-30 (Sec. 16 and first paragraph of Sec. 17). For access, see this module's *Local Guide*.

Acknowledgments

Preparation of this module was supported in part by the National Science Foundation, Division of Science Education Development and Research, through Grant #SED 74-20088 to Michigan State University.