

# PHYSICS 780.04

## ATOMIC AND MOLECULAR PHYSICS

WINTER QUARTER 2009

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<http://www.physics.ohio-state.edu/~eric/teach.html>

*Required text:*  
*Spectra of Atoms and Molecules*, P. Bernath (New York:  
Oxford University Press, 2<sup>nd</sup> edition 2005)

*Grading:* There will be one midterm examination, weekly to bi-weekly graded homework sets, and a comprehensive final examination. The grading will be apportioned as follows:

Graded homeworks	30%
Midterm ...	30%
Final...	40%

The final will be a take-home examination.

### SYLLABUS

#### I. Absorption and Emission of Radiation (*B Chapter 1*)

1/06	T	NO CLASS
1/08	Th	Transition rates; Einstein coefficients
1/13	T	Absorption, Emission, Line widths, intensity

#### II. Atomic Spectra (*B Chapter 5*)

1/15	Th	One-electron atoms
1/20	T	Multi-electron atoms
1/22	Th	Coupling Schemes; Hund's rules
1/27	T	(Hyper)fine structure and external fields

#### III. Diatomic Molecules (*B pp 97-99, 321-326*)

1/29	Th	The Born-Oppenheimer Approximation; electronic states
2/03	T	Molecular orbitals

IV. Diatomic Molecular Spectroscopy (*B pp 161-177, 208-224, 326-332, 293-305*)

2/05	Th	The rigid rotor, branches
2/10	T	The vibrating rotor
2/12	Th	Electronic & Raman spectra

V. Rotations of Polyatomic Molecules (*B pp 185-198*)

2/17	T	Linear molecules and symmetric tops
2/19	Th	EXAMINATION (2 HOURS)
2/24	T	Asymmetric Tops
2/26	Th	Astronomical Spectroscopy

VI. Introduction to Group Theory (*B Chapters 2,3, pp 99-105*)

3/03	T	Point groups, character tables, representations
3/05	Th	Spectroscopic and quantum mechanical uses

VII. Vibrations of Polyatomic Molecules (*B pp 226-253*)

3/10	T	Classical motion
3/12	Th	Normal coordinates & symmetries