

# PHYSICS 452 – – FALL 2016

## ATOMIC PHYSICS AND LASERS

Lecture: T $\theta$  – 11:30 - 12:50

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Text: Milonni & Eberly, 2<sup>nd</sup> Edition

TA: TBA

Text: Notes distributed in class

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as of July 22, 2016, subject to change

Week # Monday date	Tuesday	Thursday	Reading & Homework
<b>Background in Atomic Physics and Quantum Mechanics.</b>			
I 8/29	Historical Background Classical models	Schrödinger Equation(s) Multiple solutions	Notes: Ch. 1, 2.1, 2.2 Problem set #1
II 9/5	<b>NO CLASS HOLIDAY</b>	Rabi and Bloch view for two-level atom	Notes: Ch. 2.; M&E, 9.1-9.3 Prob. set #2
III 9/12	More on Bloch sphere Dressed atom picture	Separate S.E. for H atom Fine structure (intro)	Notes: Ch. 7 Problem set #3
IV 9/19	Fine structure and Hyperfine structure Zeeman, Stark & dipole	Experimental class working in groups on Quantum defects	Handout on Fine Structure Problem set #4
V 9/26	Quantum Transitions, $\Omega_R$ Other Atoms Again Selection Rules	Stimulated Emission A and B Coefficients	Notes: Ch. 3 & 5 Griffiths - maybe?
VI 10/3	<b>First Hour Exam In Class</b>	Introduction to Lasers	M & E, Ch. 1
<b>Laser Operation and Types of Lasers.</b>			
VII 10/10	How Lasers Work Gain - Rate Eq's Three and Four levels	Fabry Perot Longitudinal Modes	M & E, Ch. 1, Sec 3.6 - 3.12, 4.1 - 4.12 M & E, prob's. 3.10, 3.14, 4.1, 4.4, 4.7
VIII 10/17	Single Mode - Lamb dip Gas Lasers: HeNe, CO <sub>2</sub> , Ar <sup>+</sup> Liquid Lasers - Dye Lasers	Ring Laser Cavities Saturation Spectroscopy	M&E, Sec 5.8 - 5.11; 11.3 - 11.11 M & E, prob's. 5.6, 5.8, 11.4, 11.7, 11.9
IX 10/24	Solid State Lasers & Locking Schemes (Figueroa lecture)	Ti:Sapphire & Semiconductor Lasers	M&E, 11.12 - 11.15
X 10/31	Gaussian Beams and Fabry-Perot Resonators	Resolution Limits	M&E, 7.1-7.9, espec. 7.5 & Table 7.1 7.1, 7.3a, 7.4; prove Eq. 7.5.6
XI 11/7	Fiber Optics & Lasers Limits to Telecom	<b>Second Hour Exam In Class</b>	
<b>Applications of Lasers - Nobel Prizes.</b>			
XII 11/14	Laser Cooling Temperature Limit	Breaking the Limit Evaporative Cooling	M&E 14.4 - 14.6
XIII 11/21	Optical Lattices	<b>Thanksgiving NO CLASS</b>	M&E All of ch. 14; prob's 14.6, 14.8a, 14.6, 14.8a, 14.9a,b, 14.11, 14.14, 14.21
XIV 11/28	Bose-Einstein Condensation	Frequency Combs	See assignment above
XV 12/5	Adaptive Optics	Fiber Lasers Coherence - Ducks video	

(Required Statement)

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