PHYSICS 452/562 – – FALL 2019

ATOMIC PHYSICS AND LASERS

Lecture: Tθ – 11:30 - 12:50 | as of July 17, 2019 | Harold Metcalf - S225 - 632-8185 or 8036
Room: Physics PP - 124 | subject to change | harold.metcalf@stonybrook.edu
Text: van der Straten & Metcalf (Cambridge) | find it at https://doi.org/10.1017/CBO9781316106242
Text: Milonni & Eberly, 2nd Edition (Wiley)

Week # Monday date	Tuesday	Thursday	Reading & Homework
Background in Atomic Physics and Quantum Mechanics.			
I 8/26	Historical Background Classical models	Schrödinger Equation(s) Multiple solutions	vdS & M: Ch. 1, 2.1, 2.2 Problem set #1
II 9/2	Rabi and Bloch view for two-level atom	More on Bloch sphere Dressed atom picture	vdS & M: Ch. 2,; M&E: 9.1-9.3 Prob. set #2
III 9/9	Atomic Clocks Ramsey method	Separate S.E. for H atom Fine structure (intro)	vdS & M: Ch. 7 Problem set # 3
Everything below here is just a space holder. Subject to change.			
IV 9/16	Quantum defects (TBA)	Fine structure Relativity and spin-orbit	vdS & M: Ch. 8.1 - 8.5, 8.A, 8.B vdS & M: 10.1 - 10.3 Problem set # 4
V 9/23	Hyperfine structure Zeeman, Stark & dipole Selection Rules	Quantum Transitions, Ω_R Other Atoms Again	vdS & M: Ch. 9.1 - 9.3, 11 Problem set #5
VI 9/30	A and B Coefficients Stimulated Emission	Non-Linear Optics Harmonic Generation	vdS & M: Ch. 5 *and* M & E: Sec. 3.7 M & E - Ch. 10, prob 10.10
VII 10/7	**First Hour Exam In Class**	Introduction to Lasers Three and Four levels Gain - Rate Eq's	
Laser Operation and Types of Lasers.			
VIII 10/14	**NO CLASSES HOLIDAY**	Fabry Perot Longitudinal Modes, Single Mode - Lamb dip	M & E, Ch. 1 M & E, Ch. 4, Sec's. 1-12 M & E, prob's. 3.10, 3.14, 4.1, 4.4, 4.7
IX 10/21	Gas Lasers: HeNe, CO_2, Ar^+ Begin Tunable & Dye Lasers	More About Tunable Lasers Ring Laser Cavities	M&E, Sec's. 5.8 - 5.11; 11.3 - 11.11 M & E, prob's. 5.6, 5.8, 11.4, 11.7, 11.9
X 10/28	Solid State Lasers Ti:Sapphire, DPSS, and Semiconductor Lasers	Saturated Absorption Spect. Modulation and Managing Optical Freq's.	M & E, 11.12 - 11.15
XI 11/4	Gaussian Beams and Fabry-Perot Resonators	Resolution Limits Mode Locked Lasers Pulsed & Freq. Comb	M&E, 7.1-7.9, espec. 7.5 & Table 7.1 7.1, 7.3a, 7.4; prove Eq. 7.5.6
XII 11/11	Fiber Optics & Lasers - Limits to Telecom – Nanofibers	**Second Hour Exam In Class**	
Applications of Lasers - Nobel Prizes.			
XIII 11/18	Laser Cooling & Temp. Limit Breaking the Limit	Trapping and Confinement Optical Tweezers	M&E 14.4 - 14.6
XIV 11/25	Optical Lattices & Magnetic Traps For Neutral Atoms	**Thanksgiving NO CLASS**	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
XV 12/2	Adaptive Optics Coherence - Ducks video	TBA	

(Required Statement)

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/