

January 15, 2019

<b>Physics 513 (Tentative) Syllabus</b>			
Lect.	Week	Dates	Topic
1	1	15-Jan	Introduction, admin., single photons, photoelectric effect, interference, delayed choice experiments
2	1	17-Jan	Interference calculations, interference of massive particles, Glauber theory of photodetection
3	2	???	HW1 discussion, $g(2)$ measurements, coherent states, quantum-dot based single-photon sources
4	2	???	Single-photon detectors, Hanbury-Brown Twiss with photons and atoms
5	3	29-Jan	photon bunching and anti-bunching; intro to squeezing, Amplitude and phase
6	3	31-Jan	Squeezing data, effect of loss, photon number squeezing, Wigner tomography, Laser pointer, LIGO
7	4	5-Feb	Pfleegor-Mandel-expt., BEC-interf.; SPDC intro
8	4	7-Feb	2-photon interference, Hong-Ou-Mandel tests (w tunneling), Mandel experiments
9	5	12-Feb	FWM, polarization, Beth expt, OAM states, Qubits, Bloch/Poincare sphere, NMR basics
10	5	14-Feb	Light-atom interactions, RWA, unitary transformations, $\pi$ - and $\pi/2$ -pulses
11	6	19-Feb	Quantum Zeno effect (ions), quantum interrogation
12	6	21-Feb	quantum anti-zeno effect, lifetime enhancement/reduction, cavity QED a la Haroche
13	7	26-Feb	Cavity QED; (vacuum) Rabi oscillations, (de)coherence, Rabi vs. Ramsey fringes
14	7	28-Feb	Photon QND, S. cat states, Complementarity, Railcross Q. Eraser, Bell's inequalities, basic theory
15	8	???	BI experiments; loopholes, BI versus relativity; other tests of nonlocality, GHZ and Hardy tests
16	8	???	Entanglement in other systems, entanglement-enhanced clocks, super-phase resolution, quantum metrology, quantum lithography
17	9	???	Quantum dense coding, quantum teleportation
18	9	???	No quantum-bit-commitment; basic quantum cryptography, security, single- and entangled photon;
19	10	???	Phase and polarization; records and optimal attacks; decoy-state protocol; quantum networks
20	10	???	Quantum measurements, projective and 'weak', POVMs
21	11	???	Quantum states and density matrices, tomography, entanglement measures, distillation, "bound" entanglement
22	11	???	Quantum information, single-qubit gates, CNOT gate, Hadamard gate, circuit model, Deutsch-Jozsa algorithm
23	12	???	Fault-tolerant threshold; quantum error correction; decoherence-free subspaces
24	12	???	Shor's algorithm, Grover's search algorithm and variations
25	13	???	<i>Ion-trap quantum computing</i>
26	13	???	<i>Neutral atoms (Rydberg + optical lattices), q. simulation</i>
27	14	???	<i>Superconducting qubits</i>
28	14	???	<i>Semiconductor-based quantum processing</i>
29	15	2-May	<i>Quantum repeaters</i>