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Quantum Optics II, Physics 7223

Instructor

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Place and Times

Mondays, Wednesdays and Fridays, 10:05-10:55am
Room S104, Howey Physics Building

Course Description

Basic Methods:
Quantum Systems weakly coupled to the environment: Master Equations, Quantum Langevin Equations and Quantum Trajectories.
Special techniques:
Coherent states and phase space methods (Glauber-Sudarshan P), Husimi-Q, Generalized P, Fokker-Planck
Equations and stochastic differential equations.
Photoelectric detection of light fields:
Basic results; measurement of correlations functions; non-classical fields.
Applications: Chosen from among the following
Cavity QED (microwave and optical); Trapped ions (entanglement, spin squeezing); Quantum Optical approaches to
Quantum Information Processing (atomic ensembles); Bose Einstein Condensate-light interactions.

Textbook

The course will not be based on any individual text. At times lectures will be based on original papers and generally on the
instructor's notes. Students should make their own notes in class, these will be augmented by occasional handouts. However
all of the following are texts with which any research student should become familiar:

- Quantum Optics:
  - L. Mandel and E.M. Wolf, *Optical coherence and Quantum Optics*.
  - H. J. Carmichael, *An open systems approach to Quantum Optics*
  - M.O. Scully and M.S. Zubairy, *Quantum Optics*
  - D.F. Walls and G.J. Milburn, *Quantum Optics*
  - M. Orszag, *Quantum Optics*
  - C. Cohen-Tannoudji, J. Dupont-Roc and G. Grynberg, *Atom-photon interactions*
  - R. Loudon, *The Quantum Theory of Light*
- Quantum Statistical Methods:

W.H. Louisell, *Quantum statistical properties of radiation*.
- C.W. Gardiner and P.Zoller, *Quantum Noise*

- QED:
  - C. Cohen-Tannoudji, J. Dupont-Roc and G. Grynberg, *Photons and atoms: Introduction to Quantum Electrodynamics*

- Atomic Physics, Laser Cooling and Trapping
  - B.H. Bransden and C.Joachain, *Physics of atoms and molecules*
  - H.J. Metcalf and P. van der Straten, *Laser Cooling and Trapping*

Homework and Grades

You are expected to comply with the academic honor code. Grades will based on the results of an assignment (50 %), and a final project (50 %).