

Quantum Optics, Phys 250, homework 1

Instructor **Prof. D. Bouwmeester**
Room: 4123 Broida Hall,
email: bouwmeester@physics.ucsb.edu

Homework is due on Wednesday 7 October 6pm in the BOX

Study Handout: Chapter 3 Quantum field Theory, by L.H. Ryder

Try to follow all the derivations in detail and make sure you understand all the notations that are used.

- 1) Starting from (3.10) reproduce the derivation of the Euler-Lagrange equation (3.19).
- 2) Starting from (3.24) prove Noether's theorem (3.28).
- 3) Prove that Θ_{ν}^{μ} as given in (3.20) is the energy momentum tensor by investigating the conserved quantities associated to the invariance of an action (and therefore the Lagrangian) under translations in space and time (translations in x^{μ}).
- 4) Give an explicit expression for the conserved quantities corresponding to invariance of the Lagrangian under Lorentz boosts.
- 5) In half a page summarize the line of arguments followed in section 3.3 resulting in the Lagrangian (3.83).

If you want you can hand in the homework in groups of 2 or 3.