

# Physics 113 Quantum Theory Seminar

## Assignment 1 January 17,18, 2011

This week we start to learn the *mathematical language of quantum mechanics*. We continue learning the mathematical language in the second seminar also. Much of this work should be review of mathematics you learned in linear algebra. *Learning the language of quantum mechanics BEFORE studying quantum mechanics is important.* The only way to do this is *LOTS of problems*.

### Part 1: Readings

**Zettili:** Chapter 2

Sections: 2.1-2.4.4; 2.4.6-2.4.8; 2.5-2.5.3 + relevant solved problems

**Boccio** - Chapter 4 (Pages 241-277 Sections 4.1-4.16 ) ; Chapter 5(Pages 327-338 Sections 5.1-5.2 ).

You must do the readings BEFORE attempting the problems in order to get a good grasp of the overall content of the week's material to be understood. A problem should then make you look more carefully at specific parts of the readings that are necessary for the solution of that particular problem!

Prior to discussing any problems, we will deal with any questions and/or discussion of the readings.

### Part 2: Everyone Problems

Everyone must understand these solutions.

Will be discussed second in seminar.

Random choice of presenter.

Quality/correctness of presentation = 20% Seminar grade.

1. Zettili 2.1 - Dirac Algebra
2. Zettili 2.39 - Unitary and/or Hermitian?
3. Boccio 4.22.3 - Orthogonal Basis Vectors
4. Boccio 4.22.6 - Projection Operator Representation
5. Boccio 4.22.7 - Operator Algebra
6. Boccio 4.22.8 - Functions of Operators

7. Boccio 4.22.12 - More Gram-Schmidt
8. Boccio 5.6.1(a, b, c, d, e, g, i, m, n) - Simple Probability Concepts

### Admonition #1

Doing homework assignments by yourself. Copying off some "smart friend" cheats the other students in the class, and it cheats you and your friend. Identical-looking assignments will be referred to me by the grader. You may discuss general physics principles behind the questions with other students -and I encourage you to participate in study groups.

### Admonition #2

Participating in class. Sitting there like a vege while other students think hard and bother to answer questions is parasitic, intellectually. Contribute.

### Part 3: Extra Problems

Solve as many as you can.

Attempting zero is NOT an option!

Will be discussed third in seminar.

Volunteer presenter. Never volunteering is NOT an option!

Quality/correctness of presentation = 30% Seminar grade.

If a problem is not solved by anyone, then will be done in seminar.

1. Zettili 2.6 - Properties of a Ket Vector
2. Zettili 2.29 - Common Eigenvectors
3. Boccio 4.22.5 - Matrix Representation and Expectation Value
4. Boccio 4.22.9 - A Symmetric Matrix
5. Boccio 4.22.11 - Function of a Matrix
6. Boccio 4.22.13 - Infinite Dimensions
7. Boccio 5.6.1(f, h, j, k, l) - Simple Probability Concepts

**Midterm/Final Examinations** will be comprised of selected extra problem solutions handed in at the beginning of seminar. Each exam = 25% Seminar grade.