AMATH 473/673, PHYS 454
Non-relativistic quantum mechanics
Fall 2014

Description:

Applications of quantum mechanics are ubiquitous in modern technology, for example in semi-conductors and super-conductors, in solar panels and lasers. Further practical applications of quantum mechanics are being developed, from quantum chemistry and nanotechnology to quantum computing and quantum cryptography. Also on the level of pure discovery, significant progress is currently being made, for example, in the field of quantum cosmology. The aim of AMATH 473/673, PHYS 454 is to provide a solid basis from which interested students can proceed to both applied and pure research topics in quantum theory.

Outline of topics: We will discuss the mathematical structures underlying quantum mechanics (e.g., Hilbert spaces, self-adjoint operators, operator-valued measures, one-parameter-groups). Subsequently, the axiomatic formulation of quantum mechanics and the canonical quantization procedure will be reviewed. The relation between the Schrödinger, Heisenberg and interaction pictures will be discussed, along with some applications. The role of symmetries in quantum mechanics will be examined with a special focus on rotational invariance. Basic perturbative methods will be treated. Time permitting, some additional topics include many-particle physics and entanglement theory/Bell inequalities, as well as decoherence.

Recommended Textbooks:

There are numerous textbooks on quantum mechanics. This course will not follow any particular text. Some notes will be distributed in class or made available otherwise later. Please refer to the course website for additional references.

Instructor:	Robert Koenig, QNC 3123, ext. 31850, rkoenig@uwaterloo.ca
Prerequisite:	AMATH 373 or PHYS 334; level at least 4A in Math or Science, or instructor consent.

Lecture times:	11:30 - 12:20 p.m. on Monday, Wednesday and Friday in MC 4042.
First Lecture:	Monday, September 8, 2014