QUANTUM MECHANICS II (PHYS 501) Jan-April 2009 Lecturer: PCE Stamp (room 311A)

What follows is a rough guide to what will be in this course. There is no set book for the course – there are of course many books at roughly the level of this course, and a list of some good ones is given below. However the course notes, supplemented by selected reading, should suffice as background material. The course will include many examples from different fields of physics. The level of the course will depend to some extent on the audience.

(1) BASICS

Classical Physics: Hamiltonians & Lagrangians, & Symmetries Wave-functions and density matrices; Schrodinger eqtn. Quantum Measurements & Entanglement Basic Theory of Path integrals - derivation of Schrodinger eqtn

(2) FERMIONS & BOSONS

Statistics – fermions, bosons, & anyons 2^{nd} quantization; coherent states

(3) PERTURBATION THEORY

Time-independent theory: expansion in small parameter; diagrammatic representation Level repulsion

Scattering theory: Born approximation, S-matrix & T-matrix; Resonant scattering, bound states Time-dependent perturbation theory: Adiabatic & sudden limits; Fermi Golden rule Landau-Zener formula, Berry phase; asymptotic results

(4) SEMICLASSICAL APPROXIMATIONS

Classical & Quantum orbits; trace formulae; quantum chaos WKB and Tunneling, and other non-perturbative effects; topological phase

(5) SPIN & ANGULAR MOMENTUM

Spin & Angular momentum algebra Scattering off central fields; applications in atomic, nuclear, & condensed matter physics Einstein-Podolsky-Rosen effects; separability; quantum teleportation Coherent states & path integrals for spin. Spin tunneling & topological spin phase

SOME USEFUL BOOKS

AB Migdal	"Qualitative Meth	ods in Quantum Theory"
LD Landau EM I	Lifshitz "Quantur	n Mechanics"
K Gottfried	"Quantur	n Mechanics"
RP Feynman AF	۲ Hibbs "Quantur	n Mechanics & Path Integrals"
JJ Sakurai	"Advance	ed Quantum Mechanics"
LS Schulman	n "Techniques & Applications of Path Integrals"	
LI Schiff	"Quantum Mechanics"	
RP Feynman, RE	3 Leighton, M Sands	"Feynman lectures on Physics, vol III"