

M1 – Course description **MU4PYA01**

Course: Advanced Quantum Mechanics / Mécanique quantique avancée	Code Apogée UE : MU4PYA01	
	Nombre d'ECTS : 6	
Course coordinators:	Sorbonne Université Name : Mouhanna Dominique Adress : LPTMC Phone : 01 44 27 76 59 Email : mouhanna@lptmc.jussieu.fr	Université de Paris Name : van Wijland Frédéric Adress : MSC, bâtiment Condorvet Phone : 01 57 27 62 54 Email : fvw@univ-paris-diderot.fr
Number of hours:	60	
Semester :	S1	
Lecture localization:	Campus Jussieu (Sorbonne Université) – Université de Paris	
Laboratories:	no	
Objectives:	Acquire the basics of advanced mechanics (symmetries, group theory applied to quantum mechanics, angular momentum, spin, systems of identical particles, perturbation theory, scattering) with a twist towards modern topics such as quantum computation, or alternative approaches, such as path integrals.	
Prerequisites:	At least an introductory BSc level course in Quantum Mechanics covering the postulates, the basics of Hilbert spaces algebra, Schrödinger's equation for simple systems, and in particular in simple potential and in the harmonic oscillator.	
Topics/program:	I. Introduction II. Recap and general formulation 1. Basic and operational principles 2. Conceptual problems 3. Abstract formalism III. Symmetries and conservation laws 1. Introduction 2. Symmetries and conservation laws in classical physics 3. Symmetries and conservation laws in quantum mechanics 4. Discrete symmetries IV. Theory of the angular momentum V. Central potential VI. The spin VII. Identical particles VIII. Approximation methods IX. Time dependent perturbation theory X. Introduction to scattering theory	

Competences expected after the course:	Students should be able to follow fundamental physics curricula with Master 2 level courses on magnetism, spintronics, quantum devices, condensed matter, relativistic particles and quantum field theory.
Bibliography:	<p>C. Cohen-Tannoudji, B. Diu and F. Laloë, Quantum Mechanics, Wiley</p> <p>D. J. Griffith, Introduction to Quantum Mechanics, Prentice Hall, Inc.</p> <p>M. Le Bellac, Quantum Physics, Cambridge University Press</p> <p>R. Shankar, Principles of Quantum Mechanics, Plenum Press, New-York</p> <p>J.L. Basdevant, Lectures on Quantum Mechanics, Springer</p> <p>J.J. Sakurai, Modern Quantum Mechanics, Cambridge University Press</p> <p>S. Weinberg, Lectures on Quantum Mechanics, Cambridge University Press</p>
Evaluation :	Two written exams (one mid-term, one final)
Barèmes (Apogée) :	Ecrit : 100 /100