Imperial College London

Module Specification (Curriculum Review)

Basic details

UID		Cohorts covered	Earliest cohort: 2024-25; Latest cohort:
Long title	Quantum Systems 1: Cold Atomic Systems		
New code	PHYS70057	New short title	
Brief description of module *(approx. 600 chars.)*	The module covers atomic physics, angular momentum in atoms and molecules, laser cooling atoms, cold molecules, and trapped ions. (129 characters)		
Available as a standalone module/ short course?	N		

Statutory details

	ECTS	CATS	Non-credit	HECOS codes
Credit value	5	10	N	
FHEQ level	Level 7			

Allocation of study hours

	Hours	
Lectures	26	
Group teaching	5	*Incl. seminars, tutorials, problem classes.*
Lab/ practical		
Other scheduled		*Incl. project supervision, fieldwork, external visits.*
Independent study	94	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement		*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed?	No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 1	Other	

Ownership

Primary department	Physics
Additional teaching departments	
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N
External institution	N/A

External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Module Leader		Ben	Sauer
Topic Leader		Mike	Tarbutt
Topic Leader		Stefan	Truppe

Learning and teaching

Module description

Learning outcomes	At the end of this module students will be able to: - evaluate the quantum structure of one and two electron atoms and be able to apply standard techniques to the coupling of angular momentum in atomic systems and processes. - describe and evaluate Doppler, sub-Doppler and evaporative cooling processes in atomic, molecular and ionic systems. - describe the energy level structure of atoms and molecules and evaluate the allowed transitions between these levels. - explain the principles of electric decelerators and traps, optical traps and magnetic traps, evaluate trap properties and analyse the motion of trapped particles. - explain the processes by which molecules can be formed at low temperature by the association of cold atoms. - explain the techniques by which ions are trapped and used for measurement and quantum optics and quantum information processing.
Module content	The module covers atomic physics, including basic structure and atom-light interactions, angular momentum in atoms and molecules, laser cooling atoms, the physics of ion trapping, cold molecules and cold ions.
Learning and Teaching Approach	The course will be delivered by lectures. There are four main themes which build sequentially: atomic physics, cold atoms, molecules, then ions. Each theme will have a problem sheet to consolidate learning. Model solutions and peer review will be used to further consolidate understanding of the material.
Assessment Strategy	The assessment will be by problem sheets (20%) and a two hour written examination (80%). Each of the problem sheets will follow the lectures that make up the particular theme it is associated with. The problems will be assessed using a mixture of peer assessment and expert review. The written examination will have one question based on each theme. The problem sheets and examination questions will contain some material that cuts across the themes to ensure the students have a holistic view of the subject matter.
Feedback	Summative feedback will be provided by marked problem sheets that are returned to students as the module progresses. The peer assessment, detailed marking and solution sheets will provide formative feedback. There will be opportunities for formative feedback during weekly office hours. These office hours will also be an opportunity to answer questions from students and for clarification of any areas that are found to be difficult.
Reading list	Fitch, Truppe and Tarbutt, Quantum Systems I Lecture Notes; Cohen Tannoudji, Quantum Mechanics; Griffiths, Introduction to Quantum Mechanics; Foot, Atomic Physics; Edmonds, Angular Momentum in Quantum Mechanics;

Quality assurance

Office use only

Date of first approval		QA Lead	
Date of last revision	August 2023	Department staff	
Date of this approval		Date of collection	
		Date exported	
Module leader	Ben Sauer	Date imported	

Notes/ comments

Template version 16/06/2017