

Basic details

UID	<input type="text"/>	Cohorts covered	Earliest cohort <input type="text" value="2022-23"/>	Latest cohort <input type="text"/>
Long title	<input type="text" value="Quantum Optics"/>			
New code	<input type="text" value="PHYS70010"/>	New short title	<input type="text"/>	
Brief description of module <i>(approx. 600 chars.)</i>	<input type="text" value="This module covers the interaction of quantum mechanical objects with light, including at the single-photon level. A description of the quantised electromagnetic field will be introduced, and the physics of atoms' and mechanical oscillators' interaction with the electromagnetic field will be discussed."/>			
				303 characters
Available as a standalone module/ short course?	<input type="text" value="N"/>			

Statutory details

Credit value	ECTS <input type="text" value="7.5"/>	CATS <input type="text" value="15"/>	Non-credit <input type="text" value="N"/>	HECOS codes	<input type="text"/>
FHEQ level	<input type="text" value="Level 7"/>				<input type="text"/>
					<input type="text"/>
					<input type="text"/>

Allocation of study hours

	Hours	
Lectures	<input type="text" value="26"/>	
Group teaching	<input type="text" value="10"/>	<i>Incl. seminars, tutorials, problem classes.</i>
Lab/ practical	<input type="text"/>	
Other scheduled	<input type="text" value="10"/>	<i>Incl. project supervision, fieldwork, external visits.</i>
Independent study	<input type="text" value="141.5"/>	<i>Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.</i>
Placement	<input type="text"/>	<i>Incl. work-based learning and study that occurs overseas.</i>
Total hours	<input type="text" value="187.5"/>	
ECTS ratio	<input type="text" value="25.00"/>	

Project/placement activity

Is placement activity allowed?

Module delivery

Delivery mode	<input type="text" value="Taught/ Campus"/>	Other	<input type="text"/>
Delivery term	<input type="text"/>	Other	<input type="text" value="Term 1, exam in term 3"/>

Ownership

Primary department	<input type="text" value="Physics"/>
Additional teaching departments	<input type="text" value="None"/>
	<input type="text"/>
	<input type="text"/>

Delivery campus

## Collaborative delivery

Collaborative delivery?

External institution   
External department   
External campus

## Associated staff

Role	CID	Given name	Surname
Module Leader		Florian	Mintert
Lecturer		Michael	Vanner

## Learning and teaching

### Module description

Learning outcomes	On completing the Quantum Optics module, students will have a detailed understanding of the quantisation of the electromagnetic field, correlation functions and photon statistics. Students will be familiar with the interaction of light with quantum-mechanical objects and the Jaynes-Cummings model.
Module content	<ul style="list-style-type: none"><li>•Semi-classical atom-field interaction (optical Bloch equations, Ramsey interferometry)</li><li>•Field quantisation (Fock states, coherent states)</li><li>•Fluctuations and correlations (Mach-Zahnder interferometry, Hanbury-Brown-Twiss experiment, Hong-Ou-Mandel effect)</li><li>•Quasi-Probabilities (Wigner function, Husimi function)</li><li>•Atom-field interaction (dipole interaction, Jaynes-Cumming model)</li></ul>
Learning and Teaching Approach	Students will be taught during one term in a combination of lectures and exercises on theoretical work.
Assessment Strategy	100% summative assessment based on final exam: written exam of 2 hours.
Feedback	Problem sheets are provided weekly. Solution will be discussed in rapid-feedback sessions. Students are not required to, but may, hand in their solutions.
Reading list	Lecture notes will be available, but additional textbooks are also recommended: <ul style="list-style-type: none"><li>•R. Loudon, The Quantum Theory of Light (Oxford),</li><li>•D. F. Walls and G. J. Milburn, Quantum Optics (Springer),</li><li>•M. O. Scully and M.S. Zubairy, Quantum Optics (Cambridge),</li><li>•G. Grynberg, A. Aspect and C. Fabre, Introduction to Quantum Optics (Cambridge)</li></ul>

## Quality assurance

## Office use only

Date of first approval

QA Lead

Date of last revision   
Date of this approval

Department staff   
Date of collection

Module leader

Date exported   
Date imported

Notes/ comments



