

## Quantum Mechanics 2 (C002245)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

<b>Course size</b>	<i>(nominal values; actual values may depend on programme)</i>		
<b>Credits</b> 6.0	<b>Study time</b> 180 h	<b>Contact hrs</b>	52.5 h

### Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	online lecture	0.0 h
			lecture	30.0 h
			seminar: coached exercises	22.5 h
			online seminar: coached exercises	0.0 h

### Lecturers in academic year 2020-2021

Verschelde, Henri	WE05	lecturer-in-charge
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### Offered in the following programmes in 2020-2021

	crdts	offering
<a href="#">Bachelor of Science in Physics and Astronomy</a>	6	A
<a href="#">Bachelor of Science in Mathematics</a>	6	A

### Teaching languages

Dutch

### Keywords

Quantum mechanics Theoretical Physics

### Position of the course

To familiarize the students with the concepts, laws and ways of thinking of chemical thermodynamics and with the applications to phase transitions and chemical reactions. To provide insight into the molecular background of thermodynamic concepts. To discuss the various aspects of the problem of reaction rate. To demonstrate how rate equations are deduced from experimental data and how rate equations and reaction mechanisms are related. To explain and evaluate the theories on reaction rates which are currently used.

### Contents

Spherical harmonics and the hydrogen atom.  
 Axiomatic approach to quantum mechanics using electron spin.  
 The measurement problem and entanglement.  
 Quantum computing.  
 Symmetry in quantum mechanics: translation and rotation symmetry.  
 The three dimensional Schrödinger equation: central potential and particle in an electromagnetic field.  
 Scattering theory and partial wave analysis of potential scattering.  
 Approximation methods in quantum mechanics: time independent and time dependent perturbation theory ( interaction picture), and variational methods.  
 Introduction to relativistic quantum mechanics: Klein Gordon - and Dirac equations, Lorentz invariance, spinors.  
 Free relativistic particle.  
 Hawking radiation of black holes.

### Initial competences

Basic knowledge of mathematical analysis and linear algebra is sufficient.

## Final competences

- 1 The student can apply advanced mathematical methods to other areas, in particular to quantum mechanical problems.
- 2 The student has a thorough understanding of the mathematical and physical principles of quantum mechanics.
- 3 The student can communicate this insight in a structured way and has a critical and scientific attitude towards the insights he/she has gained.
- 4 The student can apply his insight and knowledge when analysing and solving problems.

## Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

## Conditions for exam contract

This course unit cannot be taken via an exam contract

## Teaching methods

Lecture, seminar: coached exercises, online lecture, online seminar: coached exercises

## Extra information on the teaching methods

ICT: we plan a site where info on theory and exercises can be found

## Learning materials and price

syllabus (in Dutch) available via Ufora.

## References

- J. J. Sakura: *Modern Quantum Mechanics*
- B. H. Bransden & C. J. Joachain: *Quantum Mechanics*
- J. Björken & S. Drell : *Relativistic Quantum Mechanics*, McGraw-Hill (1964)
- L. Landau & E. Lifschitz : *Quantum Mechanics*, Pergamon (1965)
- A. Messiah : *Mécanique Quantique*, Dunod (1960)

## Course content-related study coaching

There is possibility for consulting the teacher and assisting personnel. Electronic means of consultation are being planned for the future but personal contact will remain the main form of study coaching

## Evaluation methods

end-of-term evaluation

## Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, oral examination

## Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, oral examination

## Examination methods in case of permanent evaluation

## Possibilities of retake in case of permanent evaluation

not applicable

## Extra information on the examination methods

Theory : oral with written preparation, closed book  
Exercises : written, open book

## Calculation of the examination mark

$1/2(\text{theory})+1/4(\text{oral})+1/4(\text{exercises})$