Class Description:
Prerequisites: Foundations of Science 1-6 or Instructor's consent

Brief Course Description
Quantum mechanics is both a fundamental departure from the classical understanding of the Universe and one of the foundational theories on which modern physics is based. Designed to provide a rigorous mathematical introduction to quantum mechanics, this course covers the Schrödinger and Heisenberg description of quantum systems, application to basic atomic structure and simple boundary condition problems, quantum statistics, perturbation theory.

Instructor Details:
Name: Enrico Iacopini, email: iacopini@unifi.it
NYUGlobal Home Email Address:
Office Hours:
Villa Ulivi Office Location:
Villa Ulivi Phone Number: +39 055 5007 300

Desired Outcomes:
On completion of this course, students should be able to
- understand the experiments that led to the development of and those that confirm quantum mechanics;
- understand, explain, and utilize the concepts of quantization, wave-particle duality, and fundamental uncertainty in measurement
- solve the time-independent Schrödinger equation with various potential functions;
- understand the differences between Fermions and Bosons;
- solve problems involving angular momentum and addition of angular momenta;
- Apply time-independent perturbation theory.
Assessment Components

- Attendance and Participation: 20%
- Written Assignments (two 3 page reaction papers): 20%
- Midterm Exam: 20%
- Oral Presentation of 10 minute length: 15%
- Final Exam: 25%
- Failure to submit or fulfill any required course component results in failure of the class.

Assessment Expectations:

- **Grade A**: The student’s work demonstrates an understanding of the subject that goes beyond assigned course readings. The student writes essays/exam questions that are an original synthesis of source materials, demonstrating the ability to evaluate source material critically. Written arguments are clear, well-organized and well-presented; oral presentations are concise, incisive and supplemented by appropriate visual materials. The student has distinguished himself/herself throughout the course of the semester for his/her contributions to class discussion.

- **Grade B**: The student’s work shows a clear understanding of assigned readings and materials covered in class. The student writes clear, well-organized and well-presented essays/exam questions; oral presentations are concise, incisive and supplemented by appropriate visual materials. The student is prepared in class and asks relevant questions.

- **Grade C**: The student’s work shows a basic understanding of the subject treated in assigned readings and covered in class. However, written and/or oral work is deficient in one or more of the following areas: clarity, organization or content. The student’s work is generally in need of improvement.

- **Grade D**: The student’s work shows occasional understanding of the subject treated in assigned readings and covered in class. Written and/or oral work is deficient in one of more of the follow areas: clarity, organization or content. The student does not participate in class discussion and has not frequented the instructor’s office hours.

- **Grade F**: The student’s work does not demonstrate understanding of the subject treated in assigned readings and covered in class. Written and/or oral work are either insufficient or are not submitted. The student appears unprepared in class and has not frequented the instructor’s office hours.

Grading Guidelines

- A=94-100
- A-=90-93
- B+=87-89
- B=84-86
- B-=80-83
- C+=77-79
Grading Policy:
Please refer to Assessment Expectations and the policy on late submission of work

Academic Accommodations:
Academic accommodations are available for students with documented disabilities. Please contact the Moses Center for Students with Disabilities at 212-998-4980 or see the Moses Center for further information.

Students with disabilities who believe that they may need accommodations in a class are encouraged to contact the Moses Center for Students with Disabilities at (212) 998-4980 as soon as possible to better ensure that such accommodations are implemented in a timely fashion. For more information, see Study Away and Disability.

Attendance Policy:
Study abroad at Global Academic Centers is an academically intensive and immersive experience, in which students from a wide range of backgrounds exchange ideas in discussion-based seminars. Learning in such an environment depends on the active participation of all students. And since classes typically meet once or twice a week, even a single absence can cause a student to miss a significant portion of a course. To ensure the integrity of this academic experience, class attendance at the centers is mandatory, and unexcused absences will be penalized with a two percent deduction from the student's final course grade. Students are responsible for making up any work missed due to absence. Repeated absences in a course may result in failure.

For courses that meet once a week, one unexcused absence will be penalized by a two percent deduction from the student’s final course grade. For courses that meet two or more times a week, the same penalty will apply to the number of class times over a single week.

Excused Absences:
In case of absence, regardless of the reason, the student is responsible for completing missed assignments, getting notes and making up missed work in a timely manner based upon a schedule that is mutually agreed upon between the faculty member and the student. The only excused absences are those approved by the Office of Academic Support; they are as follows:

Absence Due to Illness
- If you are sick, please see a doctor. Contact the Office of Student Life for assistance.
- For absences that last for two or more consecutive days, a doctor’s certificate, “certificato medico” is required. The doctor will indicate in writing the number of days of bed rest
required. Please note these certificates can only be obtained on the day you see the doctor and cannot be written for you afterwards.

- Absences can ONLY be excused if they are reported WITHIN 48 HRS of your return to class via the online NYU Florence Absence Form [insert new hyperlink]
- OAS will not accept a student email or telephone call regarding an absence due to illness
- OAS will only notify faculty of absences REPORTED on the ABSENCE FORM
- The Office of Student Life, when assisting you in cases of severe or extended illness, will coordinate with the Office of Academic Support to properly record your absences

**Due to Religious Observance**

- Students observing a religious holiday during regularly scheduled class time are entitled to miss class without any penalty to their grade. This is for the holiday only and does not include the days of travel that may come before and/or after the holiday
- Information regarding absences due to religious observance must be provided at least SEVEN DAYS PRIOR to the date(s) in question using the online NYU Florence Absence Form [insert new hyperlink]
- Please note that no excused absences for reasons other than illness can be applied retroactively.

**Due to a class conflict with a program sponsored lecture, event, or activity**

- All students are entitled to miss one class period without any penalty to their grade in order to attend a lecture, event or activity that is sponsored by La Pietra Dialogues, Acton Miscellany or the Graduate Lecture series.
- Information regarding absences due to a class conflict must be provided at least SEVEN DAYS PRIOR to the date(s) in question using the online NYU Florence Absence Form [insert new hyperlink]
- Please note that no excused absences for reasons other than illness can be applied retroactively.

Students with questions or needing clarification about this policy are instructed to contact a member of the Office of Academic Support located in Villa Ulivi or to email florence.academicsupport@nyu.edu

**Late Submission of Work**

- All course work must be submitted on time, in class on the date specified on the syllabus.
- To request an extension on a deadline for an assignment, students must speak to the professor one week prior to the due date
- To receive an incomplete for a course at the end of the semester, two weeks before final exams, both the student and the faculty member must meet with the Assistant Director of Academic Affairs to review the request and if granted, they must both sign an Incomplete Contract detailing the terms for completing missing coursework.
Plagiarism Policy

PLAGIARISM WILL NOT BE TOLERATED IN ANY FORM:
The presentation of another person’s words, ideas, judgment, images or data as though they were your own, whether intentionally or unintentionally, constitutes an act of plagiarism.

In the event of suspected or confirmed cases of plagiarism, The faculty member will consult first with the Assistant Director for Academic Affairs as definitions and procedures vary from school to school. Please consult the “Academic Guidelines for Success” distributed on your USB key at Check-in and on the NYU Florence Global Wiki.

For a detailed description of some possible forms of plagiarism and cheating please consult the Community Compact that you signed at Orientation, a copy of which is on the above mentioned Wiki and USB key.

Writing Center:
The Writing Center, located in Aula Belvedere in Villa Ulivi, offers you feedback on any type of writing, at any stage in planning or drafting. Sign up for a consultation at the Writing Center’s website and submit your working draft or ideas a day in advance to NYU Florence Writing Center. Drop in for a consultation M-Th, but remember that appointments are given priority. Be assured that very rough drafts are welcome. Please note that we do not correct or “fix” your writing; instead we prompt you to think and work. Our aim is to create stronger writers in the long term, not necessarily perfect papers in the short term.

Required Text:
Introduction to Quantum Mechanics: David J. Griffiths, ISBN 13 978 0131911758
Copies of each textbook are available for consultation and short term loans in the Villa Ulivi Library. Extra copies of some textbooks are also available for semester long loans. For more information on Books and Course Materials go here.

Supplemental Texts:
None

Internet Research Guidelines:
The careful use of internet resources is encouraged and a list of recommended websites will be given. Failure to cite internet and other non-traditional media sources in your written work constitutes plagiarism.

Additional Required Equipment:
N/A
Class Assignments and Topics:

Session 1 - [September 3rd and 4th]
Introduction. The Schrodinger equation. The statistical interpretation D. Griffiths: 1.1 and 1.2
Wave function normalization. Momentum. D. Griffiths: 1.4 and 1.5

Session 2 - [September 10th and 11th]
The Uncertainty Principle. Stationary states D. Griffiths: 1.6 and 2.1
The infinite square well D. Griffiths: 2.2

Session 3 - [September 17th and 18th]
The quantum harmonic oscillator D. Griffiths: 2.3
The free particle D. Griffiths: 2.4

Session 4 - [September 24th and 25th]
The finite square well D. Griffiths: 2.6
Hilbert space. Observables D. Griffiths: 3.1 and 3.2

Session 5 - [October 1st and 2nd]
Eigenvalues and Eigenvectors D. Griffiths: 3.3
The Uncertainty principle revisited D. Griffiths: 3.5

Session 6 - [October 8th and 9th]
Dirac notation D. Griffiths: 3.6
Quantum Mechanics in 3D D. Griffiths: 4.1

Session 7 - [October 15th and 16th]
The hydrogen atom D. Griffiths: 4.2
Angular momentum D. Griffiths: 4.3

Session 8 - [October 22nd and 23rd]
Midterm
Spin D. Griffiths: 4.4.1

Session 9 - [November 5th and 6th]
Two particle systems D. Griffiths: 5.1
Atoms D. Griffiths: 5.2

Session 10 - [November 12th and 13th]
Solids D. Griffiths: 5.3
Quantum statistical mechanics D. Griffiths: 5.4

Session 11 - [November 19th and 20st]
Quantum statistical mechanics D. Griffiths: 5.4
Time independent perturbation theory D. Griffiths: 6.1
Session 12 - [November 26th and 27th]
Degenerate perturbation theory  
The fine structure of hydrogen

D. Griffiths: 6.2
D. Griffiths: 6.3

Session 13 - [December 3rd and 4th]
The Zeeman effect
The variational Principle

D. Griffiths: 6.4
D. Griffiths: 7.1

Session 14 - [December 10th and 11th]
Final exam
Final exam results

Classroom Etiquette
- Eating is not permitted in the classrooms. Bottled water is permitted.
- Cell phones should be turned off during class time.
- The use of personal laptops and other electronic handheld devices are prohibited in the classroom unless otherwise specified by the professor.
- We recycle! So keep it green! Please dispose of trash in the clearly marked recycle bins located throughout the on campus buildings.

Required Co-curricular Activities
[Field trip and site visit dates may be consolidated here as well as listed under the appropriate class session above. These must be requested in advance via the Office of Academic Support and pre-approved before appearing on the syllabus]

Suggested Co-curricular Activities
[Here you can refer students to the NYU Calendar of events or simply state the following]
Suggested optional co-curricular activities will be announced in class and/or via email by the professor throughout the semester.

Your Instructor
Enrico Iacopini (now in pension) was full Professor of Physics from 2001 and member of the Department of Physics and Astronomy of the Florence University. His research in high energy physics took place mainly at CERN (European Centre for Nuclear Research). He has been Director of the INFN (Istituto Nazionale di Fisica Nucleare) Florence Division from 2002 to 2008 and Director of the Department of Physics and Astronomy from 2010 to 2016. He has been member of the EGO (European Gravitational Observatory) Council from 2005 up to 2017. From October 2011 up to October 2015 he has been Chairman of the TCS (Technical and Scientific Council) of the INFN.
He is author of more than 135 publications present in ISI web of science; his H-index is 38 and the sum of Times Cited is higher than 4350.
Concerning didactics, from 1992 to 1994 he was teaching Experimental Physics to the students of the Physics Department; from 1994 to 2000 he was teaching Physics II (Electromagnetism) to the students of the Geology Department and from 2001 up to 2018 he was teaching “Subnuclear Physics” and “Complements of Subnuclear Physics” to the students of the Physics Department (last two years before the final degree).