

# Physics 670/671

## Quantum Mechanics I/II

**Instructor:** Jason Kumar  
WAT 436  
[jkumar@hawaii.edu](mailto:jkumar@hawaii.edu)  
(808)956-2972

**Class meets:**  
T Th 9:00-10:15am in WAT 114  
Office hours by arrangement

**Required Textbook:**  
*Principles of Quantum Mechanics* 2<sup>nd</sup> Edition  
R. Shankar

**Optional Textbook:**  
*Modern Quantum Mechanics*  
J. J. Sakurai

### Communication:

Lecture notes and assignment solutions will be available via google drive.

### Topics to be covered:

- Mathematical background, including linear algebra
- Fundamentals of quantum mechanics
- Problems in 1 dimension, including
  - Particle in a box
  - Tunneling
  - Quantum harmonic oscillator
- Problems in 2 and 3 dimensions
- Symmetry transformations and their generators
- Angular momentum and spin
- Time-independent perturbation theory
- Time-dependent perturbation theory
- Scattering
- Interactions with electromagnetic fields
- Other advanced and miscellaneous topics

### Grading:

The course grade will be based on homework, quizzes, and exams

- 10% -- homework
- 50% -- quizzes (timed, open textbook and notes, in-person, proctored)
- 20% -- midterm (timed, open textbook and notes, in-person, proctored)
- 20% -- final (timed, open textbook and notes, in-person, proctored)

Late homework: homework scores will be multiplied by  $(0.9)^n$ , where  $n$  is the number of days late. No credit for late quizzes, midterm, or final, unless excused in advance for a valid reason. For quizzes and exams, no resources may be used aside from the textbooks and notes. No AI resources may be used on any assignments.

### Student Learning Objectives:

- 1) An understanding of results in linear algebra which are relevant to quantum mechanics,
- 2) An understanding of the connection to classical mechanics,
- 3) An ability to solve simple problems in 1d, 2d, and 3d, including the quantum harmonic oscillator,
- 4) An understanding of symmetry and symmetry generators,
- 5) An understanding of time-independent and time-dependent perturbation theory,
- 6) And understanding angular momentum and spin,
- 7) An ability to solve the hydrogen atom,
- 8) An understanding of scattering theory,
- 9) An understanding of advanced applications of quantum mechanics.

### University Policies and Procedures:

The University of Hawai'i is an equal opportunity/affirmative action institution. It is committed to a policy of nondiscrimination on the basis of race, sex, victims of domestic or sexual violence, gender identity and expression, age, religion, color, national origin, ancestry, citizenship, disability, genetic information, marital status, breastfeeding, income assignment for child support, arrest and court record (except as permissible under State law), sexual orientation, national guard absence, or status as a covered veteran. For additional details, visit the [UH Systemwide Policies and Procedures Information System \(PPIS\)](#) site.

### Student Conduct:

Review the [UH Systemwide Student Conduct Code](#) for more information. Review the [Online Netiquette and Privacy Tips](#) to prepare yourself when interacting online.

### Academic Honesty:

Acts of dishonesty, including but not limited to the following:

- Cheating, plagiarism, or other forms of academic dishonesty.

Cheating is an act of academic dishonesty and includes, but is not limited to:

1. use of any unauthorized assistance in taking quizzes, tests, or examinations;
2. use of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments;
3. the acquisition, without permission, of tests or other academic material belonging to a member of the UH faculty, staff or student body; and
4. engaging in any behavior specifically prohibited by a faculty member in the course syllabus or class discussion.

Plagiarism is also an act of academic dishonesty and includes, but is not limited to:

- the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement.
- It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.
- Furnishing false information to any UH official, faculty member, or office.
- Forgery, alteration, or misuse of any UH document, record, or form of identification.

### UH Title IX

- The University of Hawai‘i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking ([UH Title IX](#)). If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you.
- If you would like to report incidents of sex discrimination or gender based violence, contact your campus [Title IX Coordinator](#) or submit the online [reporting form](#).
- If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, contact your campus’ [confidential resource](#).

### Accommodation Statement

The University of Hawai‘i is committed to a barrier-free campus and provides accommodations to ensure students with disabilities equal access to education. We agree to make academic adjustments to ensure non-discrimination of students with disabilities. This commitment is in accordance with applicable state and federal laws, including the Americans with Disabilities Act, and Sections 504 and 508 of the Rehabilitation Act.

Under the Americans with Disabilities Act (Title II) and the Rehabilitation act of 1973-section 504 and 508, individuals with disabilities have protections against discrimination and are assured access to programs, services and activities. For more information see “Americans with Disabilities Act” and “Rehabilitation Act of 1973 – Section 504 or Section 508”.

Students must self-identify to the appropriate Disability Services Office and complete the intake process before receiving reasonable accommodations. To ensure the prompt and effective provision of accommodations, students should contact the Disability Services Office as early as possible. Find your disability services office contact for your home campus.

- **UH Mānoa**

Visit the [KOKUA](#) website. KOKUA can be reached at (808) 956-7511 or (808) 956-7612, email: [kokua@hawaii.edu](mailto:kokua@hawaii.edu).

### Financial Aid Statement:

If students do not begin attendance in a course or stop participating in a course, Title IV funds must be returned according to Federal Return of Title IV funds regulations (34 CFR 668.21(a)). This means you may be required to return some (or all) of the financial aid you have received. It is very important to remember that colleges are required to take steps necessary to ensure that students are academically engaged in order to justify the disbursement of Federal Title IV student aid funds. If at any time your plans change and you no longer plan to participate in the courses in which you enrolled, you must contact the financial aid office to minimize any possible negative financial impact.

For more information on financial assistance for your education, please contact your [home campus financial aid office](#). Financial assistance may include grants, scholarships, and other resources to help you pay for the cost of college. A financial aid adviser will be able to help you navigate this process to determine your eligibility for these funds.