



PHYSICS 4301 101  
Intro Quantum Mechanics  
2024 Fall Semester

## Instructor Information

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Aleksandr Chernatynskiy

**Email:** aleksandrc@mst.edu

**Office:** Phys 117

### Office Hours

2-4 pm Tuesday, PHYS 202, but TBD

**Preferred Method of Contact:** email

## Course Information

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**Meeting Location:** Physics 00127

**Meeting Days:** MoWeFr

**Meeting Time:** 11:00AM - 11:50AM

**Modality:** In-Person

## Course Description

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Description from JoeSS - Course Catalog:

## Course Goals

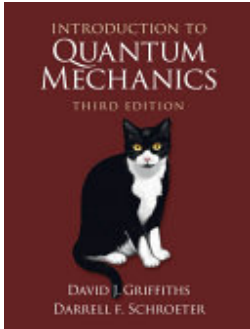
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At the end of this course students will:

- learn about the fundamentals of the quantum mechanics and its basic applications.

## Course Materials

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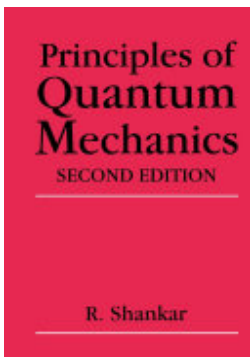
### **Introduction to Quantum Mechanics**

**ISBN:** 9781108103145

**Authors:** David J. Griffiths, Darrell F. Schroeter

**Publisher:** Cambridge University Press

**Publication Date:** 2019-11-20



### **Principles of Quantum Mechanics**

**ISBN:** 9781475705768

**Authors:** R. Shankar

**Publisher:** Springer Science & Business Media

**Publication Date:** 2012-12-06

Optional

## Generative AI (GAI) is allowed in this course

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**GAI tools may be used to augment your learning process,  
not replace it.**

When GAI is allowed you must verify and cite all claims and information appropriately. GAI are known to hallucinate. Do not blindly trust the information an AI generates. You must also not adopt generated content without reflection and revision to make it your work.

GAI usage is allowed in this course.

*When GAI is allowed you must verify and cite all claims and information appropriately. GAI are known to hallucinate and may include bias. Do not blindly trust the information an AI generates.*

*You must also not adopt generated content without reflection and revision to make it your work.*

Please check your instructor's GAI course policies for more information.

## **Course Policies**

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This class follows the standard lecture/discussion approach during the class sessions. **My** lectures notes will be made available for download through Canvas, but those are **my** notes. They do not guarantee to contain nether all the material discussed in the class, nor the full details. Approximately half of the lecture will be devoted to the delivery of the material omitting some math details, while the other half will be devoted to filling those gaps by the students under the instructor guidance, example problems, and homework. Canvas pages also contain recommended reading from the suggested textbooks.

## **Contingency Information**

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Instructor Illness or Unavailability: Either substitute or zoom, dependning on the circumstances.

Student Illness:

Students should contact Student Health Services ([mstshs@mst.edu](mailto:mstshs@mst.edu)), 573-341-4284, if they become ill or are unable to attend class or take tests on campus.

If a student is isolating, the student will receive an absence note from Student Health and not Student Support and Community Standards (Care Management). The student will be responsible of forwarding the absence note to their instructors.

## **Departmental Contact**

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First point of contact for questions, issues, and concerns is the instructor of your course. If you have a situation that you cannot resolve through discussion with the instructor, you may contact the department chair.

**Name:** Dr Thomas Vojta

**Title:** Chairman and Curators' Professor

**Email:** vojtat@mst.edu

## Course Schedule

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Intro to Quantum Fall 2024 (Phys 4301)		
Date	Topics/Reading material	Homework
	<b>Foundations:</b> Superposition & uncertainty principles, Postulates of quantum mechanics, Spectral representation, 1D problems: Harmonic Oscillator, Potential well, Potential barrier.	# 1
		# 2
		#3
		#4
09/23	Midterm Exam 1	
	<b>Time-independent Schrödinger equation in 3D and it's applications:</b> Spherical coordinates, Theory of angular momentum, Identical particles, Spin, Electronic structure of atoms.	#5
		#6
		#7
		#8

Intro to Quantum Fall 2024 (Phys 4301)		
10/21	Midterm Exam 2	
	<b>Approximate methods:</b> Perturbation theory and Variational methods and their applications. Multielectron atoms and molecules. Time-dependent perturbation.	#9
		#10
		#11
11/22	Midterm Exam 3	
	<b>Current developments and interesting discussions:</b> Measurement problem, quantum-classical boundary, Bells inequalities (no-hidden variables), philosophical issues.	
12/12	Final Exam @ 7.30 am	

## Grading Policies

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The grade for the class consists of three elements: quizzes, homework and exams.

- 15%: quizzes, the grade is the average grade of all your scores. Quizzes are **not** “pop-up” quizzes, I will announce in advance that there will be a quiz. The purpose is a periodic review of the material covered, and how it fits into the “big picture” of the quantum-mechanical description of the nature. Some number of quizzes scores (~20%) will be dropped.
- 15%: Assigned homework is to be submitted via CANVAS every week on the due date, late homework **will not** be accepted. For an honest attempt to solve the homework **full credit will be given**; Instructor will return the homework with the feedback. Attempting and turning in the homework is a must, if “A” is desired. Solutions will also be discussed during the class sessions.

- 70%: The hour exams will be given in class at the following anticipated dates: **1: 09/23, 2: 10/21 and 3: 11/22**. The lowest grade on one of these exams will be dropped. The final will be comprehensive and "undroppable" (if this is a word).
- Every problem in the exam will be graded on the 10 point scale and the overall score adjusted to make up the percentage indicated in the table. Note, that **incorrect units** of the answer will result in an automatic **1 point deduction**.
- After the first exam, I will have an individual meeting with everyone who would get "C" or lower on it in order to find a way for improvement.

## Grading Scale Information

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Course grading scale

Letter Grade	Points
A	90 -100 points
B	80 - 89 points
C	70 - 79 points
D	60 - 69 points
F	59 and below

Assignment breakdown of grade calculation

Assignment	Percentage of Grade
Quizzes	15
Homework	15
Midterm exams (3)	40
Final exam	30
	Total: 100%

**STUDENT ASSISTANCE, RESOURCES & UNIVERSITY**

## **POLICIES**

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This section of the syllabus contains information and links to important information regarding:

- Academic Dishonesty & Integrity Policies
- Student Resources
  - Educational & Tutoring
  - Health and Well-Being
  - Other Support Services
- Missouri S&T and UM System Policies

Use the syllabus navigation menu to migrate easily through the information.

## **Academic Integrity & Generative AI Policy**

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### **Student Honor Code and Academic Integrity**

As a student at Missouri S&T you are responsible for maintaining your own academic integrity. Familiarize yourself with this information.

- All students are expected to follow the [Honor Code](#).
- Your instructor is a mandated reporter in cases of Academic Integrity and Dishonesty
- [Student Academic Regulations](#) describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism, sabotage, and unauthorized use of artificially generated content, any of which will be reported to the Dean of Students.

- Other resources for students regarding academic integrity can be found [online](#).







## Generative Artificial Intelligence (GAI)

Your instructor should provide information that explains what their policy is on use of Generative AI (GAI).

Your instructor may use one of these indicators to define their policy. If your instructor has tagged your course as conditional that means that GAI may be allowed on one assignment, but not another. If in doubt, check with your instructor.

It is your responsibility to know the GAI policy for your courses.

Indicators that may be used in your course:

<p><b>Allowed</b></p>	 <p><b>GAI tools may be used to augment your learning process, not replace it.</b></p> <p><small>When GAI is allowed you must verify and cite all claims and information appropriately. GAI are known to hallucinate. Do not blindly trust the information an AI generates. You must also not adopt generated content without reflection and revision to make it your work.</small></p>	
<p><b>May be allowed</b> (check each assignment)</p>	 <p><b>GAI tools may only be used under the guidance of the instructor for specific assignments and in a particular manner.</b></p> <p><small>When GAI is allowed you must verify and cite all claims and information appropriately. GAI are known to hallucinate. Do not blindly trust the information an AI generates. You must also not adopt generated content without reflection and revision to make it your work.</small></p>	
<p><b>Not allowed</b></p>	 <p><b>No use of GAI is acceptable for use on any graded class activity. Use of GAI may result in a zero for the assignment.</b></p>	

For more information about the GAI policy, visit <https://teaching.missouri.edu/blog/teaching-time-ai>

**S&T Tutoring & Campus Educational Support Resources**

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## **One Canvas** (<https://umsystem.instructure.com/>)

Course content may be used by your instructor to post syllabi, policies, schedule(s), and grades.

## **S&T Connect**

S&T Connect enables students to request appointments with their instructors and advisors via the S&T Connect calendar, which syncs with the Outlook Exchange calendar. S&T Connect tracks each student's performance across all courses. S&T Connect Early Alert enables students to be provided with services as needs arise.

## **Student Success Center**

The Student Success Center (SSC) offers peer tutoring and success coaching to help students succeed in their academic goals. Additionally, we work as a resource hub and can connect you to the campus resources necessary to help you dig deeper and finish the semester strong. Visit the SSC in Room 117 Innovation Lab and contact us at [ssc@mst.edu](mailto:ssc@mst.edu) or 573-341-7590. To learn more about the SSC, visit <https://ssc.mst.edu/>.

## **Writing and Communication Center**

The Writing and Communication Center's mission is to assist all students in their efforts to become better writers, communicators, and critical thinkers. The Center's peer consultants and coaches provide free individualized one-on-one and small-group conversations to offer meaningful feedback and guidance to students across all disciplines. More information can be found on our website, through email: [writing@mst.edu](mailto:writing@mst.edu) or stop by Curtis Laws Wilson Library 314–315.

## **University Libraries**

The Curtis Laws Wilson Library is the place to gather on campus, offering group meeting spaces, quiet study carrels and reservable conference

rooms. The library provides students and faculty with physical and electronic books, journals, articles and databases as well as recreational reading, games and DVDs. We also have technology to check out, from laptops to charges to calculators and everything in-between. Librarians create library and course guides to help navigate searching for resources. Talk to us one-on-one via chat, email, phone or in person for any assistance regarding library services or finding peer-reviewed, credible research materials for study and research needs. Find out more information and connect with the library here: [library.mst.edu](http://library.mst.edu).

### **S&T Tutoring Opportunities**

The [Student Success Center \(SSC\)](#) helps you with your studies in three ways:

- **LEAD Drop-in:** Our LEAD Drop-in service provides convenient access to experienced peer learning assistants for a multitude of courses across campus. No appointments necessary. Simply check our tutoring schedule to discover when support for your specific course is available: <https://ssc.mst.edu/leaddrop-in/>
- **LEAD Group Sessions:** Our LEAD Group sessions offer after-hours group tutoring, facilitated by our dedicated peer learning assistants in partnership with faculty members. Explore the LEAD Group schedule to see if your course is featured and join us at the next session: <https://ssc.mst.edu/leadgroup/>
- **Knack Tutoring:** If your schedule clashes with our LEAD offerings, or if your course isn't covered, Knack is your solution. Request a tutor for either a virtual meeting or an in-person session on campus, ensuring you get the help you need, when you need it. To sign up for your FREE Knack account, visit: <https://ssc.mst.edu/knacktutoring/>

### **[Student Veterans Resource Center](#)**

The Student Veterans Resource Center (SVRC) is the nexus of resources

and support for student veterans at S&T. The SVRC provides student veterans with a “safe space” and a familiar atmosphere. The center’s Veteran Consuls provide one-on-one consultations to guide students to various resources on campus, while its advisor provides students with VA health and benefits resources. Visit the SVRC at Harris Hall, Suite G10, and contact us at [svrc@mst.edu](mailto:svrc@mst.edu).

### **Student Emergency Fund (SEF)**

The SEF is administered by the Division of Student Success to help ensure Missouri S&T students have access to the support and resources they need to successfully recover from an unforeseeable financial emergency. The goal of this fund is to prevent one small emergency or unexpected expense from derailing a student’s progress toward degree completion.

## **Respiratory & Other Illness Policy Updates**

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In March 2024, the Centers for Disease Control and Prevention (CDC) updated recommendations on how people can protect themselves and their communities from respiratory viruses, including COVID-19.

The new simplified recommendations follow similar guidelines for other respiratory infections.

For any respiratory illness, COVID-19 and influenza in particular, the new recommendations suggest returning to normal activities when:

- Symptoms have been improving overall for at least 24 hour, and
- If fever is present, no fever for 24 hours without the use of fever-reducing medication.

Students who are ill are advised to be seen at Student Health Services. Students can schedule appointments by calling (573) 341-4284 or online through their patient portal.

If you are ill, protect others around you by:

- Practicing good hygiene: cover your coughs and sneezes, wash or sanitize hands often, and clean frequently touched surfaces.
- Stay away from others until you are feeling better, particularly if they are immune-compromised.

**Notify your instructor of any illnesses that prevent you from attending class.**

## **Health & Well-Being Support Resources**

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### **Student Mental Health and Well-Being**

Your well-being is important, and it contributes to your success in this course. At S&T, we provide resources to support your mental, physical, and social well-being. Any of us can experience challenges that make learning difficult. If you are struggling, take advantage of the following resources offered by the university:

### **Student Well-Being (<https://wellbeing.mst.edu/>)**

Student Well-Being provides counseling services, health promotion initiatives, and prevention programs to empower the S&T community to thrive and enhance personal, academic, and professional success. Department office hours are Monday-Friday, 8 a.m. – 5:00 p.m. On the website, you can find information related to confidential individual and group counseling, wellness consultations and trainings, case management services, resources for many health and wellness topics, and help for mental health crisis situations. For the 988 Suicide and Crisis Lifeline, call or text 988, or visit [missouri988.org](https://missouri988.org) For the National Suicide Prevention Lifeline, call or text 988, or visit [missouri988.org](https://missouri988.org).

### **Health and Well-Being Canvas Course**

(<https://umsystem.instructure.com/enroll/G3LY3G>)

The Health and Well-Being Canvas Course features trainings, presentations, and other health and well-being resources for students. The course is free for all students, is non-credit, and students can enroll at any point in the semester.

### **UCARE**

UCARE, housed within the Division of Student Success, is the central point of contact to connect a student who may be experiencing a personal, academic, financial, well-being, and/or other concern to support and resources. An instructor, staff member, or other student may share concerns about a student with UCARE. UCARE helps connect a student with solution-focused assistance to support their holistic well-being, success, and academic progress. A referral can be submitted at <https://go.mst.edu/ucare-refer> or by emailing [ucare@mst.edu](mailto:ucare@mst.edu). For urgent matters, check out the after-hour and urgent resources.

### **Miner Oasis**

The Miner Oasis is simply a place to relax.

We have coloring books, customizable essential oils, coffee and tea, healthy snacks, yoga mats, and a massage chair to help you de-stress and be your best self!

The Miner Oasis is open Monday - Friday, 8am - 5pm, in 201 Norwood Hall

Other free resources available for students are the Zen Den (similar to the oasis but private and for only one student at a time), light therapy, a Buddha board, and a biofeedback/HeartMath program. Stop by the front desk in 204 Norwood Hall to learn more about these resources.

### **Morning Cup of Joe**

Using pop culture to explore mental health topics relevant to the students at S&T and the S&T community at large. Find us at: <https://wellbeing.mst.edu/>  
<https://www.instagram.com/sandtwellbeing>  
<https://www.facebook.com/sandtwellbeing>

## **Other Student Support Services & Resources**

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### **[Student Emergency Fund \(SEF\)](#)**

The SEF is administered by the Division of Student Success to help ensure Missouri S&T students have access to the support and resources they need to successfully recover from an unforeseeable financial emergency. The goal of this fund is to prevent one small emergency or unexpected expense from derailing a student's progress toward degree completion.

### **[Missouri S&T Fitness Center](#)**

Access to the Fitness Center and swimming pool is provided to actively enrolled students who pay an activity fee. Students who have not registered for classes will not be granted access. A valid Miner ID card must be presented for entry. For information on hours and equipment availability visit <https://studentrec.mst.edu/fitness-center/>

### **[Commuter's Commodities \(Food Pantry\)](#)**

Hunger is a real problem for far too many of today's students. The pantry is to help alleviate the financial burden of obtaining good quality food and supplies.

Today's college students face serious financial challenges. Many students find it difficult to support themselves while also paying for college. Hunger is a real problem for far too many of today's students. One issue they are faced with is food insecurity - not having reliable access to sufficient, nutritious food.

Commuter's Commodities is a food and supply pantry to help alleviate the

financial burden of obtaining good quality food, small household goods, cleaning supplies and hygiene products. Our hope is that this will help our commuter students and students who may be in need.

We are a partner agency with The Food Bank for Central & Northeast Missouri.

### [Closets Are For Clothes Exchange & Boutique](#)

The purpose of this service is to alleviate the often heavy financial burden of transitioning or coming out. All S&T students who have a need may use it accordingly.

A clothing exchange is a type of swap wherein participants exchange their valued but no longer used clothing for clothing they need and will use. Don't have anything to swap? No problem! This service is available to all S&T students who have a need.

### [LGBTQ+ Resource Center](#)

Here you will find a wide variety of resources, information about the LGBT community at Missouri S&T, and ways to get involved as students, staff, faculty, or alumni. The LGBT Resource Center is the central hub of LGBTQ life at Missouri S&T.

### [Resource Library](#)

SDI has many books and resources in our library that are available to check-out.

### [MinerLink](#)

MinerLink is your connection to most student organizations on campus. MinerLink allows you to:

- Browse registered student organizations
- Contact and join a student organization
- View daily and upcoming events
- RSVP to events
- Check into university events using the event pass ... and more!

For more information visit

<https://involvement.mst.edu/involvement/minerlink/>

## **Missouri S&T Campus & UM System Policies**

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### **Statement about Copyright, FERPA, and Use of Video**

It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions, whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided [online](#).

### **Accessibility and Accommodations**

It is the university's goal that learning experiences be as accessible as possible. Student Accessibility and Testing provides services and accommodations that facilitate full participation in Missouri S&T's learning experience for students with disabilities. If you anticipate or experience physical, academic, and/or digital barriers due to a disability, please contact Student Accessibility and Testing at (573) 341-6655, email [dss@mst.edu](mailto:dss@mst.edu), or visit <https://saat.mst.edu/> for information.

### **Nondiscrimination, Equity, and Title IX**



Missouri S&T is committed to the safety and well-being of our campus community, and to creating an environment free from discrimination and harassment.

The University prohibits discrimination and harassment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law. As used in this policy, the word “sex” is also inclusive of the term “gender.”

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Sexual harassment violations of this law include quid pro quo, hostile environment, sexual assault, dating/domestic violence, and stalking. The U.S. Department of Education has stated the prohibition on discrimination on the basis of sex includes sexual orientation and gender identity.

Students who are experiencing pregnancy or pregnancy-related conditions, including the birthing parent and non-birthing parent, have rights protected under Title IX. Students should contact Student Accessibility and Testing or the Office of Equity and Title IX to learn more about their rights and pregnancy-related assistance/accommodations provided by the University to ensure equitable access to University educational programs and activities.

In accordance with the University of Missouri’s Collected Rules and Regulations, all faculty and staff are required to report any information concerning discrimination disclosed through communication including, but not limited to, direct conversation, email, social media, classroom papers and homework exercises to the Equity Officer/Title IX Coordinator.

For more information regarding support for those that have been impacted or to report an incident of discrimination or harassment as defined by [Chapter 600](#) of the University's Collected Rules and Regulations, visit the Office of Equity and Title IX or visit their website at [equity.mst.edu](http://equity.mst.edu).

### **Office of Equity and Title IX**

Equity Officer and Title IX Coordinator: Dr. Paul Hirtz

Phone: (573) 341-7734

Location: 900 Innovation Drive, Suite 500

E-mail: [equity@mst.edu](mailto:equity@mst.edu)

## **Emergency Info & Classroom Egress Maps**

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### **[Campus Police Emergency Quick Reference](#)**

### **Classroom Egress Maps**

In case of emergency both instructors and students should know where to go that is safe. These maps show where the classroom emergency exits are located. <http://designconstruction.mst.edu/floorplan/>.