DEPARTMENT OF ASTRONOMY
UNIVERSITY OF TORONTO MISSISSAUGA

AST201H5S LEC0101
Exploring the Universe
Course Outline - Summer 2024

Class Location & Time	Tue, 09:00 AM - 11:00 AM Thu, 09:00 AM - 11:00 AM Fri, 11:00 AM - 01:00 PM
Instructor	Peter Luca
Office Location	
Office Hours	Thursdays 11:00 - 12:00
E-mail Address	peter.luca@utoronto.ca
Course Web Site	https://q.utoronto.ca

Course Description

The Universe extends from the Sun to the most distant regions we can observe. This course explores our Sun, the other stars, the Milky Way galaxy in which our Sun lives, other galaxies that are far outside our Milky Way, and the most distant objects we can observe. In addition, the course presents evidence that everything we observe is just a small fraction of what exists in the Universe. The course content considers how the Universe began and evolved over time and the possibility of life beyond Earth.

Exclusion: AST121H1 or AST201H1 or AST210H1 or AST221H1 or AST222H1 or ASTA02H3 or ASTB23H3 (SCI)
Distribution Requirement: SCI

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Describe how physical laws, such as gravitation, nuclear fusion, radiation, convection, etc., help us model the structure of stars.
2. Describe the key observational properties and the classification of stars.
3. Interpret astronomical data and measurements, such as stellar spectra and Hertzsprung-Russell diagrams.
4. Explain the life cycle of stars, from their birth in nebulae to their eventual death as white dwarfs, neutron stars, or black holes.
5. Understand how general relativity explains the curved spacetime near black holes.
6. Describe the properties and characteristics of galaxies, including their classification, structure, and formation.
7. Understand the scale of the universe and the cosmological distance ladder.
8. Explain the expansion of the universe and the evidence supporting the Big Bang theory.
9. Understand the unsolved problems in dark matter, dark energy, and the evolution of the universe.

Textbooks and Other Materials

Required textbook:

- Openstax Astronomy - Digital ISBN-10: 1-947172-24-7 (Freely available at https://openstax.org/details/books/astronomy)

Alternative Textbook:

- *Explorations: An Introduction to Astronomy*(9th Edition), Arny and Schneider, McGraw Hill, ISBN 978-1-260-56589-84
- *The Cosmic Perspective* (9th Edition), Bennett, Donahue, Schneider, and Void, Pearson, ISBN: 9780135729458

Assessment and Grading

Type	Description	Due Date	Weight
Assignment	Mini-Project 1 - Doppler Effect Spectroscopy	2024-07-11	10%
Assignment	Mini-Project 2 - Using Parallax to Measure Distance	2024-07-25	10%
Assignment	Mini-Project 3 - Research Report: Astronomical Technology	2024-08-06	10%

Class Participation	Q&A Discussion Post 1		5%
Class Participation	Q&A Discussion Post 2		5%
Term Test	Term Test 1	2024-07-16	15%
Term Test	Term Test 2	2024-07-30	15%
Final Exam	Final Exam	TBA	30%
		Total	100%

Midterm Tests

The term tests will be **50 minutes** in length and will take place online during regularly scheduled lecture periods, starting at precisely **9:10 am**. Detailed instructions on how to access and complete online term tests*via* the course Quercus site will be given.

Procedures and Rules

Missed Term Work and Tests, Late Penalties, Absence Declarations, and Petitions for Special Consideration

Penalties for all term work missed or otherwise submitted late is as described in the text that follows unless valid and documented reasons exist for special consideration. Students may submit a petition for special consideration **within one week** of the due date of the missed item of term work or date of the missed test.

The ACORN absence declaration system may be used once per term, to declare an absence of up to seven consecutive calendar days (including days both before and after the date of submission), without requiring medical or other documentation. Provide the Course Instructor with a confirmation of this declaration (e.g. a screenshot) in your petition for special consideration, which contains your name, student number, absence dates, and confirmation number. For more information on the ACORN absence declaration process, and to access the form, see here.

In all cases, petitions for special consideration should be based on illness or other extenuating circumstances, which are beyond one's reasonable control. Note that reasons such as vacations, family events, wedding attendance, lack of preparation, technology failure, extra-curricular commitments, and academic work in other courses are not considered to constitute extenuating circumstances beyond a student's reasonable control. If not for reasons of illness, in addition to your ACORN absence declaration, your petition for special consideration must contain supporting documentation, which can include a U of T Verification of Extenuating Circumstances form, automobile collision or police reports, a death certificate, and supporting documentation from employers, lawyers and other professional persons. Supporting documents can be submitted electronically as an attachment in your e-mail to the Course Instructor. These attachments can include screenshots, photographs, and/or scans of physical documents. Please ensure the electronic documents are legible and also ensure that you retain the original copies of all documents submitted in case you are asked to present them later. The supporting documentation included in your petition must specify the exact period that you were unable to complete your term work or term test for it to be considered. The Course Instructor will inform the student by e-mail (as per the Communications Policy herein) whether special consideration is granted following due diligence on the documentation provided. Note that false statements and/or documentation will be treated as academic offences and handled accordingly.

If a student misses a term test, a mark of **zero (0%)** will be assigned unless a petition for special consideration is made and granted by the Course Instructor. In the case that special consideration is granted, the mark value of the missed test will be re-assigned to a make-up test that will be scheduled at the earliest mutually convenient time for the Course Instructor and student.

The penalty for late submission of term work (*e.g.* projects, assignments, *etc.*) is a **20% deduction in the final mark per day** that the work is late. A late penalty may be waived provided that a petition for special consideration is made and granted as described above.

Re-evaluation Requests

Requests for re-evaluation of an article of term work (e.g. test, assignment, project, etc.) must be made in writing **within two weeks** of the return of the article of term work and include a brief explanation as to why the request is being made. Term work submissions can be written in pencil; however, re-marking of term work written in pencil is not permitted. Similarly, articles of term work on which correction media has been used will be **exempt** from re-evaluation. Re-evaluation requests must be made to the same person that did the initial grading of the article of term work (normally, this is a Teaching Assistant). Note that the final mark assigned to a re-evaluated article of term-work may go up or down based on the outcomes of re-evaluation (in whole or in part, at the discretion of the marker). Disputes in grading subsequent to re-evaluation by the original marker may be brought forward to the Course Instructor for final adjudication. You, as a UTM student, have the right to appeal a mark beyond the Course Instructor only if the term work in question is worth at least 20% of the course mark.

Missed Final Exam

Students who cannot complete their final examination due to illness or other serious causes must file an online petition **within 72 hours of the missed examination**. Late petitions will **NOT** be considered. Upon approval of a deferred exam request, a non-refundable fee is required for each examination approved. See the Office of the Registrar Administrative Fees for Services page for more information.

Laboratory Safety Training

N/A

Laboratory Conduct: Expectations, Roles, and Responsibilities.

N/A

Communications Policy

Students are welcome and encouraged to meet with the Course Instructor during the posted office hour(s). Office hours will be held online; details for connecting to office hours via Zoom will be posted on the course Quercus site. Note that virtual office hour visits will not be recorded. Correspondence by e-mail is also acceptable. In all e-mail correspondence regarding this course, please note the following:

1. Please send e-mail only from your @utoronto.ca or @mail.utoronto.ca account.
2. In the Subject line of your message, please include the course code and a brief description of the topic, e.g. "[Course code] - Request for an appointment regarding Stellar Evolution".
3. Please include your full name and student number in all correspondence.
4. Please consult the course syllabus and course website before sending questions by e-mail

I will endeavour to respond to e-mail within 24 hours. Students are responsible for all information posted to the course Quercus site and e-mails sent by the Course Instructor and Teaching Assistants.

Student Technology Requirements and Connection Tools

This course is fully online; Zoom will be used for remote course delivery (*i.e.* lectures, tutorials, and practicals) and office hours. Students are therefore expected to review and be in compliance with the University of Toronto's requirements for online learning and to register for a UTM Zoom account prior to the first course meeting. Students are also strongly encouraged to familiarize themselves with the resources available on the UTM Library's Learn Anywhere website.

Privacy and Use of Course Materials

All course materials belong to the Course Instructor, the University, and/or other sources (depending on the specific facts of each situation) and are protected by copyright. In this course, you are permitted to download materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the Course Instructor. In the event of a mandated switch to remote course delivery, this course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

Information Security Risks

If you are a citizen of another country, and/or accessing your courses at the University of Toronto from a jurisdiction outside of Canada, please note that you may be subject to the laws of the country in which you are residing, or any country of which you have citizenship. The University of Toronto has a long-established commitment to freedom of expression, with this right enabled by an environment valuing respect, diversity, and inclusion. In your classes, you may be assigned readings, or discuss topics that are against the law in other jurisdictions. I encourage you to become familiar with any local laws that may apply to you and any potential impact on you if course content and information could be considered illegal, controversial, or politically sensitive. If you have any concerns about these issues, please contact your instructor directly to discuss with them

Academic Integrity

UTM wishes to remind students that they are expected to adhere to the Code of Behaviour on Academic Matters regardless of the course delivery method (*i.e.* in-person or online). Potential academic offences include, but are not limited to:

- Using or possessing an unauthorized aid or aids or to obtain unauthorized assistance in any academic examination or term test or in connection with any other form of academic work. Use of unauthorized aid(s) and unauthorized assistance includes working collaboratively, in-person or online, with others on assessments that are expected to be completed

individually, in addition to accessing unauthorized resources (search engines, chat rooms, Reddit, *etc.*) for assessments completed online.
- Representing as one's own, any idea or expression of an idea or work of another in any academic examination or term test or in connection with any other form of academic work, *i.e.* to commit plagiarism.
- Submitting, without the knowledge and approval of the instructor to whom it is submitted, any academic work for which credit has previously been obtained or is being sought in another course or program of study in the University or elsewhere;
- Submitting any academic work containing a purported statement of fact or reference to a source which has been concocted.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources.

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Students are permitted opt-out of using the University's plagiarism detection tool and notice of this decision must be delivered to the Course Instructor no later than the end of day on which the first class meeting occurs. This notice should be provided *via* email, as per the communication policy specified herein. In such a case, you may be asked to submit all of your rough work for an assignment and you may be required to have a short meeting with the Course Instructor to discuss your research methodology.

Academic Rights

You, as a student at UTM, have the right to:

- Receive a syllabus by the first day of class.
- Rely upon a syllabus once a course is started. An instructor may only change marks' assignments by following the University Assessment and Grading Practices Policy provision 1.3.
- Refuse to use the University's plagiarism detection tool (you must be offered an alternative form of submission).
- Have access to your Instructor for consultation during a course or follow up with the Department Chair if the Instructor is unavailable.
- Receive at least one significant mark (15% for H courses, 25% for Y courses) before the last day you can drop a course for H courses, and the last day of classes in the first week of January for Y courses taught in the Fall/Winter terms.
- Submit handwritten essays so long as they are neatly written.
- Have no assignment worth 100% of your final grade.
- Not have a term test worth 25% or more in the last two weeks of class.
- Retain intellectual property rights to your research.
- Receive all your assignments once graded.
- View your final exams. To see a final exam, you must submit an online Exam Reproduction Request within 6 months of the exam. There is a small non-refundable fee.
- Privacy of your final grades.
- Arrange for representation from Downtown Legal Services (DLS), a representative from the UTM Students' Union (UTMSU), and/or other forms of support if you are charged with an academic offence.

Inclusivity Statement

You belong here. The University of Toronto commits to all students, faculty, and staff that you can learn, work, and create in a welcoming, respectful, and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach here.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. The Department of Chemical and Physical Sciences (CPS) denounces discrimination, harassment and unwelcoming behaviour in all its forms. You have rights under the Ontario Human Rights Code. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti- Semitism, homophobia, transphobia, ableism and ageism, please tell someone so that we can intervene. CPS takes these reports extremely seriously. You can talk to anyone you feel comfortable approaching, including your professor, teaching assistant, technician, an academic advisor, our Chairs, members of our Equity, Diversity and Inclusivity Committee, or any staff member at our Equity, Diversity & Inclusion Office.

You are not alone. Working together, we can all achieve our full potential.

Course Code of Conduct and Expectations

Each member of this course is expected to maintain:

- A professional and respectful attitude during all course activities, including lectures, labs, and online activity.
- A personal calendar/schedule/organizer to ensure that all course activities are completed and due dates are met.
- Backup copies of all work. Electronic backups should be maintained (ideally in real time) to circumvent technology failures that would otherwise prevent completion of assignments on time. Note that all UofT students are provided with 1 TB of cloud-based storage on the Office365 OneDrive platform (hosted by Microsoft Canada). All students are encouraged to maintain a live backup copy of their work using this secure, cloud-based platform.
- A collection of class notes recorded independently based on concepts covered in lectures and labs (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation).
- Familiarity with the University's policy on Academic Integrity (see: the section entitled Academic Integrity, above, and the Code of Behaviour on Academic Matters).
- Familiarity with the University policy on Conflict of Interest and Close Personal Relationships. Note that a conflict of interest arises when your personal interests conflict with your responsibilities as a student of the University. For example, if you have, or have had, a familial, sexual, or otherwise close relationship with a member of the teaching staff, you will almost inevitably be in a conflict-of-interest situation, which may affect your academic performance. Please disclose any potential conflicts-of-interest to the Course Instructor and/or Department Chair as soon as possible.
- Familiarity with the University policy on Sexual Violence and Sexual Harassment Note that sexual violence is any sexual act or act targeting a person's sexuality, gender identity or gender expression, whether the act is physical or psychological in nature, that is committed, threatened or attempted against a person without the person's consent. All members of the University community should have the ability to study, work, and live in an environment free from sexual violence and sexual harassment.

Equity Statement

The University of Toronto is committed to equity and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions, comments, or concerns, you may contact the UTM Equity and Diversity officer at edo.utm@utoronto.ca or the University of Toronto Mississauga Students' Union Vice President Equity at vpequity@utmsu.ca.

Accommodations for Learning Needs

The University of Toronto Mississauga supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation, we recommend that students register as soon as possible with Accessibility Services.
Phone: 905-569-4699
Email: access.utm@utoronto.ca

Accommodations for Religious Observances

Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, lab session, or lecture. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

Mental Health

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto (St. George and Mississauga campuses) offer a wide range of free and confidential services that could assist you during these times.

As a UTM student, you have an Academic Advisor who can support you by advising on personal matters that impact your academics. Other resources include:

- Accessibility Services

- Health & Wellness (St. George)
- Health & Counselling Centre (UTM)
- My Student Support Program (MySSP)
- Good2Talk Student Helpline
- Navi

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at My Student Support Program (MySSP) or visiting the Feeling Distressed webpage.

Acknowledgement of Traditional Lands

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

Final Exam Information

Duration: 2 hours

Other Information

Projected Course Schedule:

Day #	Topic	Textbook Chapter
1	Introduction Interstellar Distances Course Policies	Ch. 1
2	Introduction to the Wave Nature of Light Electromagnetic Spectrum Blackbody Radiation	Ch. 5
3	Spectroscopy Structure of the Atom Spectral Lines Doppler Effect	Ch. 5, 17
4	Proporties the Stars Stellar Parallax Brightness and Luminosity (Magnitude Scale)	Ch. 19, 17
5	Introduction to Star Formation Nuclear Fusion (from Atoms to Stars)	Ch. 16, 21
6	HR Diagram Main Sequence Stars	Ch. 18
7	**Term Test 1 (Tues. July 16)**	
	The Sun and Solar Structure	Ch. 15,16

8	Stellar Evolution of Low Mass Stars	Ch. 22
9	Red Giants White Dwarfs	 Ch. 22, 18
10	Type 1a Supernovae Stellar Evolution of High Mass Stars	 Ch. 23
11	Type II Supernovae Neutron Stars and Pulsars	 Ch. 23
12	Black Holes Curved Spacetime General Relativity Gravitational Waves	 Ch. 24
13	The Cosmic Distance Ladder Cephids and RR Lyrae Variables	 Ch. 26, 19
14	**Term Test 2 (Tues. July 30)**	
	The Milky Way Galaxy	Ch. 25
15	Galaxies: Discovery and Characterization Active Galaxies and Quasars	 Ch. 26, 27
16	Dark Matter Cosmology Hubble's Law	 Ch. 28
17	Big Bang Theory Inflation	 Ch. 29
18	Life in the Universe	Ch. 30

Last Date to drop course from Academic Record and GPA is July 29, 2024.