

Department of Physics and Astronomy

ASTRONOM 2022A

Origin of the Universe

COURSE OUTLINE · FALL 2026

1. Course Information

Academic term: Fall 2026.

Delivery mode

Lectures: in person each Thursday, 4:30 to 6:30 PM, in room MC 110. The first class is on Thursday September 10, the first Thursday of the term.

Structure of each session

Each session opens with a warm up of about thirty minutes, from 4:30 to 5:00, led by the teaching assistants. The warm up reviews the main points of the previous week, works through questions arising from the reading, and gives students a chance to ask about anything that is unclear. In the weeks marked in the schedule in Section 3, the quiz is written during this period.

The lecture follows, from about 5:00 to 6:30. Students who arrive late still have the lecture, but the warm up is where most questions are answered, and the quizzes cannot be written afterwards.

There are no prerequisites for this course. It is designed for students who are not enrolled in a programme in the Faculty of Science, as an introduction to current ideas about the Universe. The content is presented in a learned but accessible manner, and no mathematics beyond arithmetic is required.

The following are antirequisites for this course: Astronomy 4602A/B and Earth Sciences 1086A/B. This course may not be counted toward any Physics and Astronomy module other than the Minor in Conceptual Astronomy.

Classes start	Reading week	Classes end	Study day	Examination period
Sept 9	Oct 10 to 18	Dec 9	Dec 10	Dec 11 to 22

OWL Brightspace website

- Students should check the OWL site for this course regularly. It is the primary way information reaches the class.
- Weekly updates, lecture material and quiz results are posted there.
- Email is monitored on business days, and students should expect a reply within 48 hours, not counting weekends and holidays.
- Questions of general interest should be posted on the discussion forum so that everyone can see the answer. The forum is monitored by the instructor and the teaching assistants.
- For help with Brightspace, see the OWL Brightspace Help page, or call the Western Technology Services Helpdesk at 519 661 3800, extension 83800.

2. Instructor Information

Instructor and teaching assistants	Email	Office	Office hours
Prof. Shahram Abbassi (course coordinator)	sabbassi@uwo.ca	PAB 270	Monday 2–4 PM, or by appointment
Teaching assistants	TBD	TBD	TBD

The course has two teaching assistants. Their names, contact details and office hours will be announced on OWL in the first week of term. They lead the warm up at the start of each session, run the quizzes, and mark the quizzes and the writing assignment.

Office hours are held in person at the times above, and by appointment when those times are not convenient. Please write from your Western email address and put ASTR 2022 in the subject line.

3. Course Syllabus, Schedule and Delivery

This course is an introduction to cosmology: how our picture of the Universe developed, how we measure its scale and contents, and how modern physics leads us from Newtonian ideas to an expanding relativistic Universe. We begin with the historical emergence of scientific astronomy and the basic scales of space and time. We then move from stars and galaxies to the large-scale Universe, before developing the ideas of Newtonian and relativistic cosmology. The second half of the course focuses on the evidence for dark matter, dark energy and cosmic acceleration, the hot Big Bang, the composition of the Universe, and inflation.

The emphasis throughout is on the connection between observation and physical interpretation. Students will see how astronomical measurements, together with gravity and relativity, allow us to reconstruct the history and evolution of the Universe without requiring advanced mathematics.

Learning outcomes

- Describe how ideas about the Universe developed from early cosmological thought to modern scientific cosmology.
- Identify the characteristic scales of astronomical systems and explain how astronomers measure distance, time, motion and large-scale structure.
- Describe the hierarchy from stars and galaxies to groups, clusters and the cosmic web.
- Explain the basic Newtonian picture of gravity and cosmology, and why general relativity is required for a modern description of the Universe.
- Explain the principal observational evidence for dark matter, dark energy and the accelerated expansion of the Universe.
- Describe the hot Big Bang model, the cosmic microwave background, primordial nucleosynthesis and the observational evidence for an early hot dense phase.
- Identify the main components of the cosmic energy budget and discuss the role of inflation in modern cosmology.
- Distinguish well-established observational results from open questions in contemporary cosmology.

Discovery Credits

Students in second year or higher may declare this course as a Discovery Credit, so that it appears on the transcript as pass or fail. It cannot be used to meet modular or essay requirements. Instructors are not told which students have made this declaration, and all students receive the same assessments, evaluated to the same standards.

Audit

Audit students are welcome and need not consult the instructor beforehand.

Online component

Lecture material, links and weekly updates are posted on the OWL site for this course. Any change to the schedule is posted there and announced in class. Google Chrome and Mozilla Firefox are the preferred browsers for OWL, and students should keep them up to date.

Schedule

The schedule below is tentative. Any changes will be announced in class and posted on OWL. Each session begins with the thirty minute warm up led by the teaching assistants, and the quizzes are written during it in the weeks marked.

Week and date	Topic	Assessment
1. Sep 10	Introduction: our place in the Universe and the questions of cosmology	
2. Sep 17	Early ideas about the Universe and the birth of scientific astronomy	
3. Sep 24	The Universe in space and time: astronomical scales, distances and cosmic timescales	Quiz 1
4. Oct 1	From stars and galaxies to the large-scale structure of the Universe	Quiz 2
5. Oct 8	Newtonian cosmology: gravity, motion and the classical picture of the Universe	Quiz 3
Oct 10 to 18	Fall reading week. No class on Thursday October 15.	
6. Oct 22	Midterm test. No regular class.	Midterm test
7. Oct 29	Relativistic cosmology: spacetime, gravity and an expanding Universe	Quiz 4
8. Nov 5	The dark side of the Universe: evidence for dark matter and dark energy	Quiz 5
9. Nov 12	Dark energy and the discovery of cosmic acceleration	Quiz 6
10. Nov 19	Did the Universe have a beginning? The hot Big Bang and the cosmic microwave background	Quiz 7
11. Nov 26	What is the Universe made of? Baryons, radiation, dark matter and dark energy	Essay due Nov 27
12. Dec 3	The early Universe and inflation	Quiz 8
Dec 10	No class. Fall classes end December 9, and December 10 is the Study Day.	

4. Course Materials

OWL Brightspace website

Lessons and additional instructional material are made available on the OWL site for this course. Students need access to a desktop or laptop computer with an internet connection. After signing in, select this course from the course list.

Reading, all of it optional

There is no required textbook for this course, and there is nothing you must buy. Everything you are examined on is covered in the lectures and in the material posted on OWL. The references below are offered for students who would like to read around the subject, and they are entirely optional. Nothing in them is examined except where it also appears in a lecture.

- Andrew Fraknoi, David Morrison and Sidney Wolff, *Astronomy*, second edition, OpenStax. Free to read online at openstax.org. A broad, accessible astronomy text with useful chapters on the history of astronomy, gravity, galaxies, relativity and cosmology. A printed copy may be ordered from OpenStax for a fee.
- Simon Singh, *Big Bang: The Origin of the Universe*. A narrative history of how the Big Bang model was developed and of the people and observations that shaped it. Particularly useful for the historical and conceptual parts of the course.
- Peter Coles, *Cosmology: A Very Short Introduction*, Oxford University Press. A brief and readable account of modern cosmology, useful for the second half of the term.

Copies of the two commercial titles may be requested through Western Libraries. Neither is needed to pass or to do well in this course.

Further material posted weekly

Each weekly page on OWL carries the lecture slides together with suggestions for going further: short articles, videos from NASA and ESA, and selected public lectures or podcasts. None of this is mandatory, and none of it is examined, but it is a good way to explore each topic in greater depth.

Students are responsible for checking the course OWL site regularly for news and updates, since it is the primary method by which information is passed to the class.

5. Methods of Evaluation

Quizzes, 15%. Eight short quizzes are given during the term, beginning in week 3 and running on the dates shown in the schedule. Each is written during the warm up at the start of class, takes about ten minutes, and covers material from recent classes. Nothing is asked that has not been covered in a lecture. The teaching assistants run and mark them. Your best five count toward your grade, so the three lowest are dropped automatically. Because quizzes are written at the start of the session, a student who arrives after the quiz has finished cannot write it, and that quiz counts as one of the three dropped.

Writing assignment, 15%. One piece of writing of about 1200 words on a topic from a list posted on OWL, due Friday November 27 at 11:59 PM. The automatic 48-hour no-late-penalty period and the firm cutoff are described below under Flexible completion and missed assessments. The rubric is posted with the topics. Students must write in their own words and reference any source they draw on.

Midterm test, 25%. Written in class on Thursday October 22, from 4:30 to 5:30, covering the material of weeks 1 to 5. There is no regular lecture that day. Missed-work and automatic reweighting rules are described below under Flexible completion and missed assessments.

Final examination, 45%. The final examination is cumulative and covers the whole course, with emphasis on the material after the midterm. The date and time are set by the Office of the Registrar and will be posted on OWL.

Generative AI and assessments. Generative AI tools are not permitted for the quizzes, writing assignment, midterm test, or final examination unless the instructor explicitly permits their use for a specific assessment. Any permitted use and its conditions will be stated in the assessment instructions. Unauthorized use will be treated as a scholastic offence.

Component	Weight	Date
Quizzes, best 5 of 8	15%	In class, on the dates in the schedule
Writing assignment	15%	Due Friday Nov 27, 11:59 PM
Midterm test	25%	Thursday Oct 22, in class
Final examination	45%	Scheduled by the Office of the Registrar
Total	100%	

Marks are posted to the OWL gradebook. Any apparent error in a posted mark should be reported to the instructor within two weeks of the mark first appearing. Formal Requests for Relief from Academic Decisions follow the University procedures listed in Section 7. Please note that the final examination mark is posted only after the examination period ends, that the official final grade comes from the Office of the Registrar, and that in rare cases final grades may be adjusted to conform to Department of Physics and Astronomy policy.

Flexible completion and missed assessments

Academic Consideration requests are not required or accepted for in-term assessments in this course. Missed quizzes, the midterm test, and the writing assignment are handled automatically through the flexible-completion rules below. The only absence that requires an Academic Consideration request and submission through the Student Absence Portal is the final examination.

Quizzes. Eight quizzes are offered and the best five count. The three lowest or missed quizzes are dropped automatically, so there is no makeup quiz and no Academic Consideration request is needed. If more than three quizzes are missed, the 3% weight of each additional missed quiz shifts automatically to the final examination.

Midterm test. If the midterm is missed, no Academic Consideration request is required or accepted; its 25% weight shifts automatically to the final examination. In addition, if the final examination percentage is higher than the midterm percentage, the midterm weight shifts automatically to the final examination. For a conflict with another scheduled class, lab, or tutorial, a university-sanctioned varsity or institutional event, or a religious accommodation, an alternative sitting will be arranged.

Writing assignment. The stated deadline is Friday November 27 at 11:59 PM. An automatic 48-hour no-late-penalty period applies, making the firm cutoff Sunday November 29 at 11:59 PM. No submission is accepted after the cutoff. If the assignment is not submitted by then, its 15% weight shifts automatically to the final examination; no Academic Consideration request is required or accepted.

Final examination. Academic Consideration is required for a missed final examination and must be submitted through the Student Absence Portal with the required documentation. If Academic Consideration is granted, the student writes the Special Examination. See the Academic Calendar under Special Examinations for details. Academic Consideration policy: https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

Special Examination. A student who misses the Special Examination with documentation will normally receive a withdrawal (WDN). In cases of prolonged illness, a student may submit a Request for Relief to the Dean to seek permission to write the final examination the next time the course is offered.

6. Recommendations

Students in this class should understand the degree of independence the course expects.

- Put every deadline in a planner at the start of term, and set aside time each week to get organised.
- Come to class. Since there is no required textbook, the lectures are where the material is, and the quizzes follow them closely.
- Arrive for the warm up. It is the half hour of the week set aside for your questions, and on quiz weeks it is the only time the quiz can be written.
- Take notes as you go. Writing while you read or listen is more effective than reading or listening alone.
- Form a study group. Explaining an idea to someone else is the fastest way to find out whether you understand it.
- Ask questions. Use the discussion forum, office hours, or a word after class. Asking early is far easier than recovering late.

7. Additional Statements

Religious accommodation

Students seeking religious accommodation should submit the request through the Student Absence Portal (SAP) as early as possible and no later than two weeks before an examination, or one week before a midterm test or quiz. In the Faculty of Science, religious accommodations are treated as scheduling conflicts; for tests worth 16% or more, including the 25% midterm in this course, an alternative sitting will be provided.

Policy: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

EDI Diversity Calendar: <https://www.edi.uwo.ca>

Accommodation policies

Students with disabilities are encouraged to contact Accessible Education, which recommends accommodations on the basis of medical documentation or psychological and cognitive testing. Please contact the instructor if you require lecture or printed material in an alternate format, or if any other arrangement would make this course more accessible to you.

University policy: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/AcademicAccommodation_disabilities.pdf

http://academicsupport.uwo.ca/accessible_education/index.html

Academic policies

The website for Registrar Services is registrar.uwo.ca. In accordance with University policy, the centrally administered email account provided to students is considered the official university email address, and it is the responsibility of the account holder to attend to messages sent there in a timely manner.

Requests for Relief from Academic Decisions.

University policy:

https://uwo.ca/univsec/pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Undergraduate procedures:

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

Electronic devices during tests and examinations. In Faculty of Science courses, possessing an unauthorized electronic device during an in person assessment is a scholastic offence. This includes phones, smart watches, smart glasses, hidden cameras and wireless earbuds. The device need not be switched on or in use, and having it at your desk, on your person or within reach is enough. As of September 2026 the usual penalty is a failing grade in the course together with a prohibition of twelve months on retaking it. Only devices the instructor has expressly permitted may be brought in.

Generative artificial intelligence. Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is not permitted in the completion of any course assessment, including the writing assignment, quizzes, midterm test, and final examination. Using such tools for content generation, code writing, problem solving, translation, or summarization when not explicitly allowed will be treated as a scholastic offence. If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is the student's responsibility to seek clarification before using any AI tools in academic work.

Scholastic offences. Scholastic offences are taken seriously. Students should review the following University documents.

Policy: https://uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_offences.pdf

Undergraduate procedures:

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Written work and plagiarism

Students must write their assignments in their own words. Any idea or passage taken from another author must be acknowledged, with quotation marks where appropriate and with proper referencing. Assignments should not include lengthy quotations, even where these are properly referenced. Plagiarism or excessive quotation may result in a mark of zero on the assignment. A description of what counts as plagiarism is available at plagiarism.org.

Submitting work written by you but already submitted for credit in another university course may also constitute plagiarism. Please speak to the instructor if you think this may apply to you. All required papers may be submitted for textual similarity review to the commercial plagiarism detection software licensed by the University, currently Turnitin, and submitted papers are added to that reference database for the purpose of detecting future plagiarism.

Guidelines for the writing assignment: about 1200 words, single spacing is acceptable, 12 point type, with your name, student number, course number and assignment number on the first page. A cover page is not required. References should follow APA format, and extra words used for a bibliography do not count toward the limit.

Advice for successful performance

Lectures draw on current cosmological observations from facilities and missions such as JWST and Planck as well as on the standard theoretical framework. They are the primary source for everything you are examined on. Lecture notes are posted on OWL, but they do not necessarily contain every explanation given in class, and those explanations are examinable. Attending, taking your own notes, and using the warm up to clear up anything unclear will matter more in this course than any reading you do.

Support services

Please visit the Science and Basic Medical Sciences Academic Advising webpage for information on adding and dropping courses, academic consideration for absences, Requests for Relief from Academic Decisions, examination conflicts and other academic matters, at <https://www.uwo.ca/sci/advising/>.

Students who are in emotional or mental distress should refer to Mental Health at Western, at uwo.ca/health, for a complete list of options for obtaining help.

Western is committed to reducing incidents of gender based and sexual violence and to providing compassionate support to anyone who has experienced it. Information about support services for survivors, including emergency contacts, is at uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager, please write to support@uwo.ca.