

Astronomy 3302A: Astrophysics of Interstellar Space

Course Outline

1. Course Information

Course Information

Astronomy 3302A: Astrophysics of Interstellar Space

List of Prerequisites

Physics 2101A/B, 2102A/B

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Els Peeters	epeeters@uwo.ca	206	80973	Thu 11:30am-12:00pm or by appointment
Charmi Bhatt	cbhatt7@uwo.ca	312	-	-

Students must use their Western (@uwo.ca) email addresses when contacting their instructors. We will try to respond to your email inquiry within two working days of reception.

Format office hours: in-person or zoom. In the event of a COVID-19 resurgence during the course, only via zoom.

3. Course Syllabus, Schedule, Delivery Mode

Calendar description:

The physics of interstellar space --the gas, dust, electromagnetic radiation, cosmic rays, and magnetic fields-- present between the stars in a galaxy and between galaxies. Star formation, the interaction of light and matter, and the physical processes that determine the properties, dynamics, and behavior of the interstellar medium.

Course Philosophy:

The interstellar medium (ISM) is the "stuff between the stars" and includes cold and molecular gas as well as hot and ionized gas, dust grains, magnetic fields, radiation, and cosmic rays. The goal of this course is to understand how the interesting physics at play (including atomic, molecular, gas-phase, and gravitational physics) determines the energetics, composition, and structure of the ISM.

Course Learning Outcomes:

By the end of this course, students should have a basic understanding of the theory and observations that underpin current research of the Interstellar Medium. More specifically, students should be able to:

- Quantitatively describe the components that make up the interstellar medium and explain how these components are studied.
- Quantitatively describe, explain, and apply the interaction of radiation and matter.
- Quantitatively describe and apply the microscopic processes occurring in the interstellar medium and explain how they determine the macroscopic properties of (components of) the interstellar medium.
- Explain and illustrate how the interesting physics at play (including atomic, molecular, gas-phase, and gravitational physics) determines the energetics, composition, and structure of the ISM.

Outline of topics to be covered:

1. Introduction to ISM
2. Interaction of Light and Matter
3. Microscopic processes in the ISM
4. Interstellar dust
5. HII Regions

Course content may vary.

Gradescope:

Assignments will be submitted to Gradescope, accessible from the course OWL site. Gradescope accepts pdfs, scans or photos of handwritten assignment pages. Marks and feedback on these assignments will be returned to the student via Gradescope.

Contingency plan:

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

4. Course Materials

Supplementary reading on reserve in the Taylor Library or referenced on the course website:

- on reserve in the Taylor Library:

- 'An Introduction to Modern Astrophysics' by B.W. Carroll & D.A. Ostlie, 2nd ed., 2007.
- 'The Physics and Chemistry of the Interstellar Medium' by A. G. G. M. Tielens, 2005.
- available on-line via the Taylor Library:
 - 'The Physics of the interstellar medium' by Dyson & Williams, 2020 (see course website: Links)

A basic scientific calculator (e.g. the Sharp EL-510RB calculator used for first year physics courses) is allowed during the midterm and the final exam but programmable calculators, smartphones, and smartwatches are not permissible for quizzes and exams.

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

All course material will be posted to OWL: <http://owl.uwo.ca>.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements:

In the event that online learning is required, a stable internet connection with working microphone and webcam and a device that meets the system requirements for Zoom will be required.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assignments (#4)	40%
Midterm Test	25%
Final Exam	35%

In order to pass this course, students must obtain (1) a grade of at least 50% for the course grade (based on the weight distribution given) AND (2) a grade of at least 50% on the weighted average of the midterm and the final exam to ensure that students demonstrate sufficient mastery of the learning outcomes. If students fail to obtain a grade of 50% on either one, the lower value of the following two grades – their course grade (based on the weight distribution given) or a course grade of 45 – will be adopted as their final course grade.

Please note: The Department of Physics and Astronomy may, in exceptional cases, adjust the final course marks in order to conform to Departmental policy. Final grades will be rounded to

the nearest integer, and grades ending in 9 (eg. 69) are not automatically “bumped up” by 1 mark.

Assignments are due: Oct 3, Oct 24, Nov 23, Dec 5

Midterm test: [*]

6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth 10% or more of the overall course grade

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University’s medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Assignments: Assignments are due by 11:59pm on October 3, October 24, November 23, and December 5. A student may miss a due date of an assignment *once* during the semester and submit the late assignment by 11:59pm on October 5, October 26, November 25, and December 7 respectively without incurring any penalty. No submissions will be accepted after the late submission deadline.

If you received permission for absence of assignment 1 and/or 2, the weight of the assignment(s) will be added to the weight of the midterm exam. If you received permission for absence of assignment 3 and/or 4, the weight of the assignment will be added to the weight of the final exam.

Make-up Midterm: If you received permission for absence to the midterm, the missed midterm must be made up on [*]. If you received permission for absence for both the midterm and the make-up of the midterm, the weight of the midterm will be added to the weight of the final exam.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

Note: missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

6. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

7. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

A basic scientific calculator (e.g. the Sharp EL-510RB calculator used for first year physics courses) is allowed during the midterm and the final exam but programmable calculators, smartphones, and smartwatches are not permissible for quizzes and exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

In the event of health lock-down, tests and examinations in this course will be conducted using zoom. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remoteproctoring.uwo.ca>.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

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

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.