

ASTRONOMY 3302A: Astrophysics of Interstellar Space

2019-2020: fall term

General Information

- **Lectures:**
Tuesdays 9:30am–10:30am and Thursdays 9:30am–11.30am; Rm PAB 106
- **Instructor:**
Prof. Els Peeters
Rm 206 PAB
phone: 661-2111 ext. 80973
epeeters [at] uwo.ca
- **Office hours:**
Thursdays 11:30am–12:00pm. I can also be reached during the week through e-mail for simple inquiries or to make an appointment. I will try to reply to e-mails within two working days of reception.
- **Teaching assistant:**
Collin Knight
cknigh24 [at] uwo.ca
- **Course website:**
Sakai OWL: <http://owl.uwo.ca>
- **Texts, readings, materials:**
Supplementary reading on reserve in the Taylor Library or referenced on the course website:
 - on reserve in the Taylor Library:
 - “The physics of the interstellar medium” by Dyson & Williams, 2nd ed.
 - “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 Interstellar Medium” by J. Lequeux, 2005 (see course website: Links).

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 Description

- **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.
Prerequisites: Physics 2101A/B, 2102A/B

Unless you have either the prerequisites for this course or written special permission from your Dean 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.

- **Outline of topics covered:**

- Introduction to the ISM
- The Interaction of Light and Matter
- Microscopic Processes in the ISM
- Interstellar dust
- HII regions
- (Gas dynamics)
- (Star formation)

Course content may vary.

- **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.

- **Mark distribution:**

- Three assignments: 25%
- Midterm: 35%
- Final exam: 40%

In order to pass this course, you must obtain (1) a grade of at least 50% over all course components AND (2) a grade of at least 50% based solely on the weighted-average of the midterm and final exam. If you fail to obtain a grade of 50% on the weighted average of the midterm and final exam, this failing grade will be adopted as your final course grade.

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

The Department of Physics and Astronomy may, in rare cases, adjust the final course marks in order to conform to Departmental policy.

Any errors, or appeals to your scores, must be reported to your instructor within two weeks of their initial posting.

- **Description of examinations:**

- One 2-hour midterm (short answers, essays and problems; closed book)
- One 3-hour final (short answers, essays and problems; cumulative; closed book)

Course Calendar/Schedule

- Assignments are due on Oct. 1, Oct. 17, and Nov. 26.
- Midterm: Thursday Oct. 31 in class.
- Final exam: during the December exam period. Details to be announced.
- Make-Up Final exam: January 11, 9am, WSC55
- Last day to drop this course: November 12

Course policies & friendly reminders from UWO:

- Students must use their Western (@uwo.ca) email addresses when contacting the instructor.
- Students are expected to come to class prepared, to bring a calculator and to work through exercises (alone or in groups).
- The course website will be the only medium where course materials are distributed, announcements are made and where you can access your marks for various components of this course. It is your responsibility to check this website frequently.
- Assignments
 - Students will be allowed to discuss the material among them, but each student will have to turn in her/his own copy of the assignment.
 - Assignments must be turned in at the requested due date electronically.
 - A student may miss a due date once during the semester and submit the late assignment **before** the start of the following class without incurring any penalty. No submissions will be accepted after the late submission deadline.
 - Remember that clarity is essential for getting partial or full credit for problems. Please show all steps leading to your final answer. Finally, remember to include the appropriate units for any numerical answer and take care of the significant digits.
- A basic scientific calculator (e.g. the Sharp EL-510RB calculator used for first year physics courses) is allowed during the quizzes and exams but programmable calculators, smartphones, and smartwatches are **not** permissible for quizzes and exams.
- This course may use Gradescope, an online collaborative grading and analytic platform. For information on their privacy policy, please visit their website <https://www.gradescope.com/privacy>.
- Accommodation

If you are unable to meet a course requirement (assignment, midterm, or final exam) due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at scibmsac@uwo.ca. For further information, please consult the university's policy on academic consideration for student absences:

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

If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (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 (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

If you miss the midterm and receive approval for the absence, a make-up midterm will be organized.

If you miss an assignment (i.e. missing the late submission deadline) and receive approval for the absence, your assignments will be re-weighted accordingly.

Students needing to make travel arrangements are advised to book a travel date after the end of the examination period. No make up exams will be given to accommodate travel.

- **Accessibility:** Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at 661-2147 for any specific question regarding an accommodation.
- **Accommodation for students with disabilities:** for the University's policy on accommodation, see www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf.
- **Emotional/mental health distress:** Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.uwo.ca/uwocom/mentalhealth/>) for a complete list of options about how to obtain help.
- **Academic misconduct:** 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 website:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.
- **Religious holidays:** for the University's policy on accommodation for religious holidays, see www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf.
- **Registrarial Services:** <http://www.registrar.uwo.ca>
- **Services provided by the University Students' Council:** <http://westernusc.ca/services/>

Advice for successful performance:

This is a challenging class that will require you to apply many different types of physics in novel ways. You are advised to keep up with the course, participate in class, and work through the assignments to succeed in this course. If you encounter difficulties in doing the homework assignments, ask your fellow students, the TA or me for help.

Estimation of student workload: Expect to spend 10-15 hours (including class time) per week on this course alone.