

**Faculty of Science Course Syllabus**  
**Department of Physics and Atmospheric Science**  
**PHYC 2452: Stellar and Galactic Astrophysics – Winter 2023**

**Instructor:** Philip Bennett [Philip.Bennett@dal.ca](mailto:Philip.Bennett@dal.ca) Office: DUNN 226

**Lectures:** T,Th 5:35 pm – 6:55 pm in Dunn 101.

**Laboratories:** There will be a planetarium show presented during the tutorial period. Since the planetarium theatre capacity is 35 people, two identical shows will be scheduled for consecutive Tuesday tutorial periods.

**Tutorials:** T 7:05 pm – 7:55 pm in Dunn 101.

**Teaching Assistants:** Abby Yashayaeva & Ben Hansson

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### Course Description

This companion course to **PHYC 2451** provides a general introduction to the astrophysics of stars and galaxies for science students. The basic properties of stars, star formation, stellar evolution, stellar populations, star clusters, and the late stages of stellar evolution will be discussed. The course will examine the interstellar medium, galactic structure and evolution, & compact objects (neutron stars, black holes, quasars) at an introductory level. The role of dark matter & dark energy in the formation of the universe, and in establishing the present-day large-scale structure of the universe will be reviewed.

### Course Prerequisites/Restrictions

A first-year science course.

### Course Objectives/Learning Outcomes

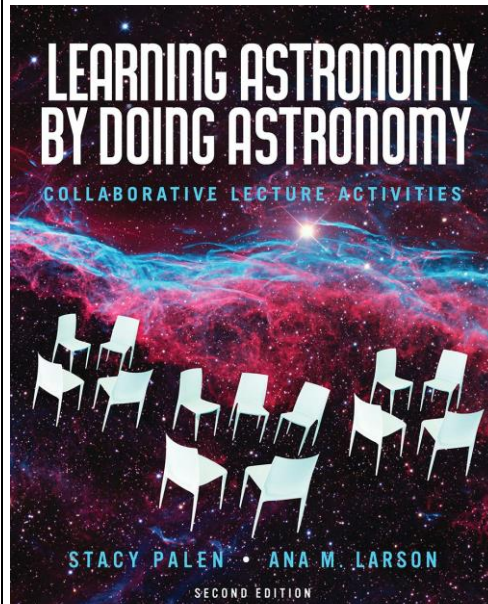
- The night sky and the apparent motions of the stars
- Stellar catalogues – an historical perspective
- Stellar spectroscopy and the Hertzsprung-Russell diagram
- Star Formation
- The Main Sequence Life of Stars
- The Sun in detail
- Late Stages of Stellar Evolution & Stellar Death
- Our Galaxy – the Milky Way
- Normal & Active Galaxies
- The Local Group of Galaxies
- The Large-Scale Structure of the Universe
- The Big Bang and Cosmological Models
- Dark Matter & Dark Energy

Course Textbooks: *Learning Astronomy by Doing Astronomy*, 2<sup>nd</sup> ed, (Smartwork 5 version) is **\*\*required\*\***, as this text will be used for lab exercises. The other two textbooks are optional, but recommended.

**1. Required- Learning Astronomy by Doing Astronomy, 2<sup>nd</sup> ed. (Smartwork 5 version)**

**Authors:** Stacy Palen & Ana M. Larson  
**Publisher:** W.W. Norton & Company  
**ISBN:** 978-0-393-41984-9 (pbk)  
 978-0-393-89293-2 (e-book)

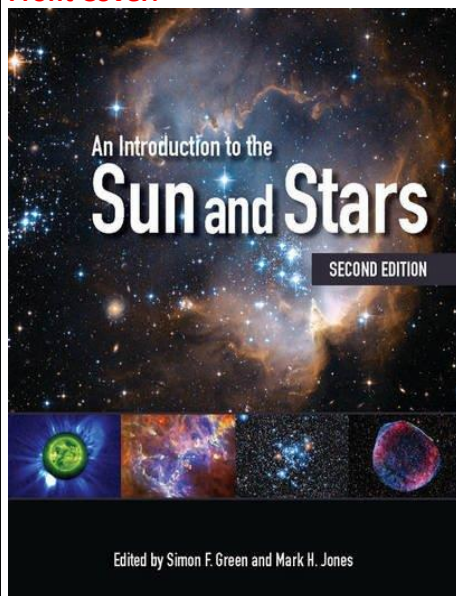
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**2. An Introduction to the Sun & Stars, 2<sup>nd</sup> ed. (optional)**

**Editors:** Simon F. Green, Mark H. Jones  
**Publisher:** Cambridge University Press  
**ISBN:** 978-1-107-49263-9 (pbk)

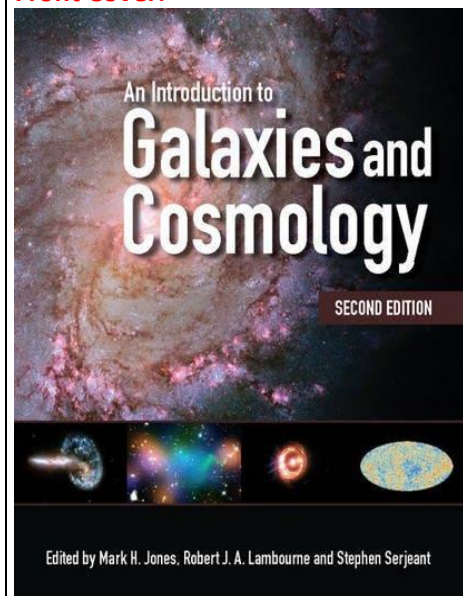
**Front Cover:**



**3. An Introduction to Galaxies and Cosmology, 2<sup>nd</sup> ed. (optional)**

**Editors:** Mark H. Jones, Robert J.A. Lambourne, & Stephen Serjeant  
**Publisher:** Cambridge University Press  
**ISBN:** 978-1-107-49261-5 (pbk)

**Front Cover:**



**Materials:** Lectures will be available as PDF slides on **Brightspace**.

**Course Assessment**

Component	Weight (% of final grade)	Date
<i>Midterm Exam 1</i>	<b>15%</b>	<b>Tues, 14 Feb 2023, 5:35—8:00 pm, Dunn 101</b>
<i>Midterm Exam 2</i>	<b>15%</b>	<b>Tues, 14 Mar 2023, 5:35—8:00 pm, Dunn 101</b>
<i>Final exam</i>	<b>15%</b>	<b>Tues, 4 Apr 2023, 5:35—8:00 pm, Dunn 101</b>
<i>Multiple-Choice Assignments</i>	<b>20%</b>	<b>4 Brightspace quizzes</b>
<i>Smartwork activities</i>	<b>10%</b>	<b>5 pre- and post-activities (10 activities in total)</b>
<i>Lab Assignments</i>	<b>20%</b>	<b>2 laboratory reports</b>
<i>Participation</i>	<b>5%</b>	<b>observing &amp; planetarium sessions</b>

Assignment grade will be based on: (1) 4-5 multiple choice assignments submitted as quizzes on Brightspace, (2) 5 pre- and post-chapter *Smartwork* activities using the *Learning Astronomy* text, and (3) 2 lab assignments.

**Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale**

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

## Course Policies

- Be sure to plan your term to include the dates and times of the tests and the examination. You are expected to write exams on the date scheduled. If you must miss an exam due to COVID or other illness or other some justified reason, **advance notice MUST be given, in writing (e-mail is OK)**. If an exam is missed without prior notice, **there is no guarantee that you will be able to write a rescheduled exam**. If sick, please complete and submit the [Student Declaration of Absence](#) form.
- Assignments will be posted to Brightspace, and will generally be due 2 weeks later.
- **Multiple choice assignments should be answered online via Brightspace**. Other assignments, requiring a written response, **should be scanned and uploaded to Brightspace**.
- Late assignments will receive an **automatic 20% penalty per lecture after the deadline** for assignments, unless justified to the instructor prior to the deadline. For example, assignments handed in one lecture late will be graded out of 80% of the full mark; assignments handed in two lectures late will be graded out of 60% of the full mark.
- **Assignments will NOT be accepted** (without prior permission of the instructor) more than 1-2 weeks after the deadline, because we will discuss the assignments after that time, and answers will be given.
- All examinations will be **open book**, and various resources may be brought into the exam room including course textbooks, course notes, other written materials, and calculators. **The average of the top 2 grades for the 3 exams (2 midterms & 1 final) will be used to calculate the overall exam grade**.
- Calculators will generally be **required** and should be brought to exams.
- Laptop computers, tablets, cell phones or other devices will be allowed in exams for the sole purpose of viewing of local files such as electronic copies of the course textbook or notes, or Brightspace course pages. **No internet access outside of Dalhousie is allowed during exams**.
- Students are **strongly encouraged to work together on assignments** since the purpose of assignments is not to evaluate students' knowledge (exams serve that purpose), but to help students learn the course material and analysis methods. However, the work that you submit **must be your own**. All the drawings, observations, and calculations that you submit **must be your own**, and any written work submitted **must be written in your own words**.
- It is an **academic offence** to copy another student's solution, or to copy solutions obtained from solutions manuals, or by any other means other than your own work. Please note that instructors are obligated to report any academic offences to the Senate Disciplinary Committee. See the Academic Calendar for more details about intellectual honesty.
- Students are **strongly encouraged to attend tutorials** and participate in group problem-solving activities. You may ask anything you wish at the tutorials: help with the problem sets, solutions to the previous problem sets, but also about being a science major, and expectations in your current and upper year classes. We will use some tutorials to observe the night sky with departmental telescopes, weather permitting, and hold planetarium sessions on some cloudy nights.
- **All students are required to comply with health and safety requirements on campus**, and should be considerate of others' health concerns. Non-compliance may be reported under the Code of Student Conduct.
- I have not set office hours, but will generally be available in my office (Dunn 226) most weekday afternoons until 5:00 pm, or by e-mail appointment request to [Philip.Bennett@dal.ca](mailto:Philip.Bennett@dal.ca). I try and respond promptly to all e-mails.

**Faculty of Science Course Syllabus (Section B) (revised June-2021)****University Policies and Statements**

**This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate**

**Academic Integrity**

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

**Accessibility**

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

**Student Code of Conduct**

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

**Diversity and Inclusion – Culture of Respect**

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

**Statement:** <http://www.dal.ca/cultureofrespect.html>

**Recognition of Mi'kmaq Territory**

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Important Dates in the Academic Year (including add/drop dates)**

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

**University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Faculty of Science Course Syllabus (Section C) (revised June-2021)****Student Resources and Support****Advising**

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

**Academic supports**

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

**Other supports and services**

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

**Safety**

**Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>