

Division of Natural Science  
<http://natsci.info.yorku.ca/>  
Course Outline

NATS 1585A, Astronomy: Exploring the Universe

Fall 2017  
MFW, 1:30pm, Lassonde C

Course Instructor(s) and Contact Information

**Instructor:** Professor Adam Muzzin

**Email:** [NATS1585@yorku.ca](mailto:NATS1585@yorku.ca)

- This email should be your first contact for all course-related matters.
- Emails will be responded to as quickly as possible, but note that a reply can take up to 24 - 48 hours. Please do not expect an immediate response.
- **Office hours:** MW @ 2:30 - 3:30 pm (i.e., right after class), Petrie building, room 338
- If you cannot attend those office hours, meetings can be set up at other times by email.

**Term dates:** September 7 - December 4

**Fall reading days:** October 26 - 29

**Drop date:** November 10

**Withdrawal date:** November 11

**Email Policies and Etiquette**

- It is a challenge to keep emails for a large class organized. Please compose emails with a subject line which will allow for better organization and faster response.
- Email aliases are not always obvious (e.g., [superjim@something.com](mailto:superjim@something.com)). Please compose emails with your name and/or student number in the subject or main body.
- Politeness within emails is appreciated, as well as use of full sentences and non-texting slang.
- Many basic questions are already answered on the syllabus or Moodle page. Please read these before sending an email. To reduce email volume, emails with questions that are clearly answered either in the syllabus or on the Moodle page will not be answered.

Expanded Course Description

Welcome to NATS 1585A, "Astronomy: Exploring the Universe". This course explores the universe beyond our solar system. We begin by studying how gravity triggers fusion reactions in stars that create heat, light, and every element in our bodies except hydrogen: overall, stars shine by converting mass into energy (Einstein's  $E=mc^2$ ).

We discuss how we can use the corpses of stars (white dwarfs, neutron stars, and black holes) to probe how space and time are related via Einstein's theories of relativity. We examine how stars are bound together into galaxies by gravity and how to use various wavelengths of light to determine why there are different types of galaxies: elegant spirals, massive ellipticals, and faint dwarf galaxies. We learn how the Doppler effect reveals that dark matter must produce some of the gravity that binds stars into galaxies, galaxies into clusters of galaxies, and clusters of galaxies into superclusters. We explore how we can use distant galaxies to study the development of the universe over its entire history, including the increasing importance of dark energy. We confront both the earliest moments and the far future of our universe's history: what we know, what we still hope to learn, and what we think we can ever learn. Finally, we join some modern scientists in the speculation about whether or not other universes might exist beyond the one we can perceive. Course credit exclusions: NATS 1740. NCR Note: No credit will be retained if this course is taken after SC/PHYS 1070 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.

## Course Learning Outcomes

Upon successful completion of this course students should be able to:

- Understand the scientific method and how it is applied to understand aspects of natural science such as astronomy.
- Understand and be able to describe the basic physics of why stars shine, and the relationships between basic properties of stars (e.g., mass, lifetime, brightness, size)
- Understand and be able to describe the basic premise of Einstein's theory of special relativity including concepts such as simultaneity, time dilation, and length contraction
- Understand and be able to describe the types of galaxies in the universe and their properties
- Understand and be able to describe the components that make up our universe and their relative proportions
- Understand and be able to describe the origin of the Universe as well as possible future outcomes of our universe

## Evaluation

### **In-class clicker quizzes and exercises (20%)**

A significant portion of the course grade will come from in-class participation. Please note that given the weight of in-class work (20%), you cannot achieve an "A" in this course without attending lecture regularly. In-class participation comes in several forms

- Short, multiple-choice clicker-based quizzes during/after the lecture to test understanding of the lecture material
- Short, multiple-choice clicker-based quizzes based on in-class exercises in the Extragalactic Astronomy Activity Manual (required text)
- Pre-lecture multiple-choice clicker quizzes based on textbook readings. These quizzes will be considered "bonus" quizzes and will be added to your quiz scores (up to a maximum of 100%, i.e., you cannot achieve >100% for a given lecture quiz from bonus quizzes).

If you do the readings, come to class, and pay attention in lecture it is very possible to achieve a perfect score in this component of the evaluation.

### **Mastering Astronomy Assignments (15%)**

Students will receive weekly or bi-weekly homework assignments on [MasteringAstronomy.com](https://www.masteringastronomy.com) (access can be purchased with your textbook or separately). These are online assignments that are meant to complement the lectures and textbook readings. **“Late” assignment rules:** Sometimes there are challenges to completing homework assignments on time (e.g., sickness, bereavement, heavy assignment load in other courses). For this reason, **your two lowest Mastering Astronomy assignment scores will be dropped**, no questions asked. This allows you the flexibility to manage your own homework load; however, it also means that dropping more than two assignments will not be considered.

### **Computer Simulation Lab (10%)**

Students will complete a computer lab due near the end of the course that simulates various concepts in the course.

### **Mid-Term Test (20%)**

A 50-minute term test will be given in-class on Friday October 20th covering all course material up to that point. The test will consist of a combination of multiple choice and short answer questions.

### **Final Exam (35%)**

A 2.5 hour final exam will be given during the exam period (Dec 5 - 21). The final exam will be a similar format as the term test and consist of multiple choice and short-answer questions. The final exam will cover all material in the course.

### **Extra Credit Assignments**

In order to be fair and consistent to the entire class, individual grades are not negotiable and “extra credit” assignments are not provided at any point during or after the course. Please contact the instructor about a grade **only** if there is a clear error (calculation, clerical, etc.) within two weeks of the grade being made available to you. All grades will be posted on **moodle** as soon as they are available. Please notify the Professor immediately if there is a discrepancy in any grade.

## **Course Materials**

**Textbook (required):** The Cosmic Perspective: Stars, Galaxies and Cosmology, 8th edition

[MasteringAstronomy.com](https://www.masteringastronomy.com) **(required):** A subscription to this service is required as it is where homework assignments will be completed. It can be purchased bundled with the textbook, or separately if a used textbook is purchased.

**Workbook (required):** Extragalactic Astronomy Activities Manual. Please note this is a required book for the course, many in-class exercises which will be quizzed are found in here.

**Response device (required):** In class clicker quizzes will be administered with the Reef/iclicker system. This requires a wifi-enabled device such as a smartphone, tablet or laptop. Please install the software on your device and bring it to each lecture. It is your responsibility to have the software working correctly and to bring your device.

## **Laboratory/Tutorial**

This class does not have a laboratory or tutorial component

## Course Content and Format

**Lecture material:** All lecture slides and other materials (movies, pictures) will be posted on the Moodle page **after** the day of lecture (within 48 hours), not before. It is still advised that you take your own notes in class to augment the lecture slides as they contain only basic information in point form.

**In-class activities:** Most lectures will feature an in-class activity, such as a workbook exercise or clicker quiz, so class attendance is absolutely necessary. The lectures and in-class activities greatly enhance the textbook, and participation will help you get a good mark. Also, many exam questions will be closely based on in-class work. In-class activities will be drawn almost exclusively from the workbook, so the Extragalactic Astronomy Activities Manual should be brought to every class. In class, after an introductory lecture, students will work on the activity in small groups while the professor answers questions and guides the activity. Finished in-class activities will sometimes be quizzed and will serve as good study guides.

**Reading assignments and Mastering Astronomy quizzes:** Reading assignments will be announced in class and posted on the course website. A MasteringAstronomy.com quiz covering the reading assignments will be due roughly once a week. Your understanding of the activities (and of future exam questions) will be greatly improved by doing the readings before class and taking the quizzes every week.

### Approximate course content and weekly schedule

1. Light, Telescopes and Space Probes (2 weeks): How is the science of astronomy done? How do light and matter interact, and how do we use light to understand objects in the sky? How do telescopes work?
2. The Sun and Stars (2 weeks): What is the power source of the Sun and other stars? How do we measure fundamental stellar properties? How can solar weather affect us on Earth?
3. Star Systems and Stellar Aging (2 weeks): What do multiple stars and star clusters tell us about the masses and ages of stars? How are stars born? How do they age and die? What types of stars produce white dwarfs, neutron stars, black holes, and supernovae?
4. The Milky Way Galaxy (2 weeks): What are its stellar, gaseous & dark components, and how do they interact? What is its size, shape, and structure?
5. Properties of Galaxies (2 weeks): What types of galaxies exist, and what are their properties? How are galaxies distributed in the Universe; What are quasars and how do they affect galaxies?
6. Relativity (1 week): The basics of Einstein's Special Theory of Relativity. How are space and time linked?
7. Cosmology (2 weeks): How old is our Universe? How big is our observable Universe? What does the expansion of the Universe tell us about how our Universe began and how it might end? Do we live in a Multiverse?

## Math Content

The course is not taught at an advanced mathematical level. Occasional use of high school mathematics up to the level of Grade 11 is all that is necessary (basic principles of geometry and algebra, but not calculus). Key numerical concepts are discussed in the lectures.

## Course Policies

**Assignment policies:** All Mastering Astronomy assignments will be submitted online. Late assignments will not be accepted for any reason. Please note as stated under "course format" the lowest two assignments will be dropped.

**Conduct in lectures and in-class assignments:** Some lecture time will be devoted to in-class activities in the activity manual. During this time you are encouraged to work in small teams and discuss with the people around you. The professor will also field questions during this time. However, this can lead a loud work environment at times. In-class work will be graded via clicker quizzes, so it is important that this time is used to work, not socialize. Students who do not use in-class work time to do the exercises and exhibit behavior that is distracting to other students will be asked to leave the lecture hall.

**Policy for Missed Exams:**

- If due to illness or unforeseen emergency, a student must miss a scheduled exam, the Professor (muzzin@yorku.ca) must be notified by the end of the day the exam is to be written in order to arrange a make-up.
- If sufficient notice is not given, the student will receive a mark of 0 for the exam.
- Emergencies come in many forms; however, please note that only in **very** extreme circumstances will a make up be permitted. Events that could be conducted by another individual such as taking a friend to a doctor's appointment or your pet to the vet are not considered acceptable reasons for a make-up exam.
- If exam is missed due to illness, the York University Attending Physician's statement form is required.

**Exam Policies**

- All students must show valid student card during exams.
- Cell phones and other electronic items are not allowed in exam. (Cell phones must be turned off and stored in students' bags during exams.)
- English translation dictionaries are allowed, but must be examined by the adjudicator prior to commencing the exam.
- Only pens, pencils, erasers and a student card are permitted on the desk during an exam.

## Copyright and Intellectual Property

**Copyright law:**

Some of the material shown in the lecture is protected by copyright law, which states that it is illegal for students to share or distribute copyright materials. In particular, diagrams and figures from the textbook that are on the lecture slides are protected by copyright, as is the content of the Astronomy Activity Manual. *Students who violate copyright law are at risk of being sued by the owners of the material.*

Some examples of illegal distribution include:

- Posting the lecture slides or videos on a website, either your own or someone else's
- Posting photographs/copies of the Activity Manual content on a website
- Posting photographs or screen captures of the lectures/videos on a website
- Printing out photographs or screen captures of the lecture/videos and making the printouts available for distribution

The best way to ensure that you are not in violation of copyright law is to use the course material as it was intended – namely, read the slides at their existing locations and do not download or copy them, or post them on websites of any kind, your own or third party.

## University Policies

**Important Sessional Dates**

Includes sessional start and end dates, drop deadlines, and withdrawal dates.

See the Office of the Registrar website at <http://www.registrar.yorku.ca/enrol/dates/>

### **Academic Honesty and Integrity**

Academic honesty requires that persons do not falsely claim credit for the ideas, writing or other intellectual property of others, either by presenting such works as their own or through impersonation. Similarly, academic honesty requires that persons do not cheat (attempt to gain an improper advantage in an academic evaluation), nor attempt or actually alter, suppress, falsify or fabricate any research data or results, official academic record, application or document. Finally, academic honesty requires that persons do not aid or abet others to commit an offence of academic dishonesty, including intentional acts to disrupt academic activities.

Suspected breaches of academic honesty will be investigated and charges shall be laid if reasonable and probable grounds exist.

#### **Academic Honesty and electronic devices during assessments (e.g. exams)**

- Internet capable and personal storage devices of all kinds must be turned off, including vibrators. These and any other unauthorized material must be placed under the student's chair and should not be accessed at any point during the exam. Failure to comply with directive may be considered a break of academic honesty.
- See <http://registrar.yorku.ca/exams/tipsheet>

Please familiarize yourself with the full Senate Policy on Academic Honesty, found at <http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/>

Please also familiarize yourself with the SPARK Academic Honesty tutorial found at <https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/>

### **Academic Accommodation for Students with Disabilities**

York University shall make reasonable and appropriate accommodations and adaptations in order to promote the ability of students with disabilities to fulfill the academic requirements of their programs.

The nature and extent of accommodations shall be consistent with and supportive of the integrity of the curriculum and of the academic standards of programs or courses.

Please familiarize yourself with the full Senate Policy on Academic Accommodations for Students with Disabilities, found at <http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/>

**Note: Students should submit accommodation letters from Counseling and Disability Services (CDS) to the course instructor within the first two weeks of the course or as soon as issued.**

Counseling and Disability Services - <http://cds.info.yorku.ca/>

York Accessibility Hub - <http://accessibilityhub.info.yorku.ca/>

**Note: A student registered with CDS, and choosing to write with Alternate Exams, is responsible for making the appropriate writing arrangements within the timeframes outlined by Alternate Exams.**

Alternate Exams - <http://altexams.students.yorku.ca/>

### **Religious Observance Accommodation**

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents.

<https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/15/wo/kmHGekTpzKLX6XYKBXYc8M/0.3.4.62.0>

**Note: Students who will have an academic conflict as a result of a religious observance, at any point in the term, should make the instructor aware of such at least three weeks prior to the conflict.**

For conflicts occurring during an official examination period, please complete the Examination Accommodation Form available at [http://www.registrar.yorku.ca/pdf/exam\\_accommodation.pdf](http://www.registrar.yorku.ca/pdf/exam_accommodation.pdf) and submit to your instructor at least three weeks prior to the final exam.

### **Student Conduct in Academic Situations**

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect and to refrain from actions disruptive to such a relationship. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. A statement of the policy and procedures regarding disruptive and/or harassing behaviour by students in academic situations is available on the website of the University Secretariat (<http://secretariat.info.yorku.ca/>).

### **Division of Natural Science Resources**

#### **NATS-AID**

Free peer tutoring for students enrolled in Natural Science Courses.

See <http://natsci.info.yorku.ca/nats-aid/>

#### **M-AID in NATS (Math Aid)**

Free math help for students enrolled in Natural Science Courses (TA tutors)

See <http://natsci.info.yorku.ca/m-aid-in-nats/>

### **Other Resources**

#### **Learning Commons**

The Learning Commons brings together key supports for your learning: writing, research, learning skills and career services. <http://www.library.yorku.ca/cms/learning-commons/>

#### **goSAFE**

goSAFE is a complimentary service provided to the York Community. At the Keele campus, goSAFE has two routes: North Route & South Route which will safely transport community members by vehicle from one specified hub to another on campus. goSAFE operates seven days a week, all year round, including University closures (with the exception at Glendon during the Christmas holiday closure).

Call the goSAFE office at 416-736-5454 or extension 55454 during hours of operation. Please give your name, location and destination. <http://www.yorku.ca/goSAFE/>

#### **Mental Health and Wellness at York University**

Outlines a variety of resources available to support mental health and wellness

<http://mhw.info.yorku.ca/resources/resources-at-york/students/>

#### **Good2Talk**

Post-Secondary Student 24 hour Helpline

<http://www.good2talk.ca/> 1-866-925-5454