

**Course Outline 2023-24**

*This course outline is tentative and subject to change.*

**ASTRO 2022B**

# The Origin Of The Universe



Although this academic year is still affected by the Covid-19 Pandemic, Western University is committed to a **thriving campus**. We encourage you to check out the [Digital Student Experience](#) website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: <https://www.uwo.ca/health/>.

## 1. Course Overview and Important Dates

**Delivery Mode**

**Lectures:** in-person

Please refer to the OWL website for time and location.

\*Details about design and delivery of the course are listed below in Section 4.



<b>Classes Start</b>	<b>Reading Week</b>	<b>Classes End</b>	<b>Study day</b>	<b>Exam Period</b>
January 8	February 17 - 25	April 8	April 9-10	April 11 - 30

\*March 7, 2023: Last day to drop a second-term half course without penalty

**OWL website**

- Students should regularly check the OWL site “ **ASTRONOM 2022B 001 FW23** “
- Weekly updates will be provided on the OWL site
- Emails will be monitored daily; students should expect a response in 48 hours
- This course will use the OWL forum for discussions
- Students should post all course-related questions on the discussion forum so that everyone can access the answers
- The discussion forums will be monitored by the instructor or the teaching assistant

## 2. Contact Information



### Instructor

Dr. **Francesca Vidotto** (*she/her*)

[https://physics.uwo.ca/people/faculty\\_web\\_pages/vidotto.html](https://physics.uwo.ca/people/faculty_web_pages/vidotto.html)

<https://www.uwo.ca/philosophy/people/vidotto.html>

### Teaching Assistants

Mrs. **Samantha Jade Lambier** (*she/her*)

Mrs. **Aishwarya Kumar** (*she/her*)

### Communication

Post **technical, administrative** or **course content** questions on the relevant **forums on the course OWL site**. For all official correspondence concerning confidential issues that can't be posted to the OWL forums, please use the Message function in the course OWL site. To compose a message go to ASTRONOM 2022B 001 FW21 and address your message to **fvidotto**. Messages sent through any other channel, particularly messages sent via email or phone messages may not be answered, and should not be considered official communications regarding this course.

### Office Hours

- Students must sign up for an appointment using **Sign Up**
- Students may request group office hours
- Please refer to the OWL website for the informations about location and contacts.

*Land Acknowledgement Western University is situated on the traditional territories of the Anishinaabeg, Haudenosaunee, Lunaapeewak and Attawandaron peoples, who have longstanding relationships to the land and region of southwestern Ontario and the City of London. The local First Nation communities of this area include Chippewas of the Thames First Nation, Oneida Nation of the Thames, and Munsee Delaware Nation. In the region, there are eleven First Nation communities and a growing Indigenous urban population. Western values the significant historical and contemporary contributions of local and regional First Nations and all of the Original peoples of Turtle Island (North America).*

### 3. Course Description and Design

During the last century our understanding of the universe has been completely changed and a new science, modern cosmology, started to marvel us with new discoveries. These were possible thanks to the two major revolutions of the XX century in physics: general relativity and quantum mechanics. This course will present these discoveries in an accessible manner, highlighting how the laws that govern the infinitesimally small and those that govern the infinitely large bring us a precise picture of the evolving cosmos and challenge us with new questions.

This course is designed for students not enrolled in a program in the Faculty of Science as an introduction to current ideas about the universe. The content of the course will be presented in a learned but accessible manner and no prerequisite is required for this course. On the other hand, the following courses would constitute an “antirequisite”: Earth Sciences 1086F/G, Physics 1101A/B, Physics 1201A/B, Physics 1401A/B, Physics 1501A/B (or equivalent courses from the previous years).

#### Learning Outcomes

Upon successful completion of this course, students will be able to:

- Frame modern cosmology in its historical development
- Understand the conceptual basis of the scientific notions of Space, Time and Matter
- Know what have been the main revolutions in the physics of the XX century
- Know what, according to the current understanding, the Universe is made of
- Understand the basics of modern cosmology
- Know what are the different messengers with which the Universe is now investigated



**Discovery Credits:** As of the 2018–19 academic year, students have had the option to declare a course as a “Discovery Credit,” so that it is graded as pass/fail on their transcript. This privilege is open only to students in their second year or higher, and cannot be used to meet a student’s modular requirements or essay requirements. Instructors will not know which students have declared their course as a Discovery Credit, and are expected to provide the same assessments, evaluated to the same standards, to all students.

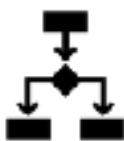
**Audit:** Audit students are welcome and they do not need to consult with the instructor before.

#### Online component

Extensive course material and links will be posted to OWL: <https://owl.uwo.ca/x/Gs9bz7>  
Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, 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.

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).



## 4. Course Content and Tentative Timeline

This plan may be subject to changes, please refer to the OWL website for updates.

Dates	Topic	Texts	Complementary BBC-4 Podcasts
<b>Week 1</b> Jan 11	Introduction	<b>C</b> Ch.1 Rovelli's text	Hindu Creation Nature
<b>Week 2</b> Jan 18	Observing the sky in the birth of science	Stamp's text and notes	Ptolemy and Ancient Astronomy
<b>Week 3</b> Jan 25	What is matter? 1) Quantum Mechanics	<b>Q</b> Ch.1 <b>Q</b> Ch.2	Measurement Problem in Physics The Physics of Reality States of Matter
<b>Week 4</b> Feb 1	What is matter? 2) Particles, Fields and Symmetries	<b>P</b> Ch.1 <b>P</b> Ch.2 <b>P</b> Ch.4 <b>P</b> Ch.7	Antimatter The Proton The Neutron Nuclear Fusion
<b>Week 5</b> Feb 8	What is space? 1) Special Relativity	<b>R</b> Ch.1	In Einstein's shadow - special relativity Speed of Light
<b>Week 6</b> Feb 15	What is space? 2) General Relativity	<b>R</b> Ch.2 <b>C</b> Ch.2	Relativity Graviton Black Holes
-	Reading Week		
<b>Week 7</b> Feb 29	MIDTERM TEST		First 6 lessons
<b>Week 8</b> Mar 7	Cosmic Bestiary 1) Planets, Stars, and all those little clouds	<b>A</b> Ch.3 <b>A</b> Ch.5	William and Caroline Herschel Comets The Life of Stars The Planets Exoplanets
<b>Week 9</b> Mar 14	Cosmology 1) What is the shape of the Universe?	<b>C</b> Ch.3 <b>C</b> Ch.4	Universe's Shape Age of the Universe Poincare Conjecture
<b>Week 10</b> Mar 21	Cosmology 2) What is the universe made of?	<b>C</b> Ch.5 <b>C</b> Ch.6 <b>C</b> Ch.7	Dark Matter The Cool Universe Dark Energy Vacuum of Space
<b>Week 11</b> Mar 28	Cosmology 3) Is there a start? Is there an end?	<b>C</b> Ch.8	Origin of the Universe Quantum Gravity Multiverse
<b>Week 12</b> Apr 4	Cosmic Bestiary 2) Contemporary Astrophysics	<b>P</b> Ch.5 <b>A</b> Ch.6	Cosmic Rays The Neutrino Galaxies Sheila Rowan on gravitational waves



Textbooks: **C** = Cosmology, **Q** = Quantum Theory, **P** = Particle Physics, **R** = Relativity, **A** = Astrophysics

## 5. Course Materials

### OWL website

Lessons and additional instructional material will be made available in the OWL website of the course. You need to have access to a desktop computer or laptop with internet connection. After entering your user id and password, you click on the course tab for your Astronomy course: **ASTRONOM 2022B 001 FW23**

### Textbooks

- Peter Coles, *Cosmology: A Very Short Introduction*, Oxford University Press
- John Polkinghorne, *Quantum Theory: A Very Short Introduction*, Oxford University Press
- Russell Stannard, *Relativity: A Very Short Introduction*, Oxford University Press
- James Binney, *Astrophysics: A Very Short Introduction*, Oxford University Press
- Frank Close, *Particle Physics - A Very Short Introduction*, Oxford University Press

We will use these texts for online reading assignments in Perusall and thus students must have access to them via Perusall. You must access the course's Perusall site via the OWL course site and enrol in the course using the button on the left menu of the webpage. It is mandatory to use your university ID number and your UWO email address to enrol. You will be prompted to purchase the book through Perusall when you first access the book in the platform. Please notice that it is compulsory to purchase the textbook on Perusall to complete the assignments: it is possible to choose the "renting" option for the duration of the term, that makes the total cost amounting to approximately \$20. This option is recommended. You can complete your reading on any other support, but you still need to connect to Perusall to complete the annotations and interact with the online forum there. You will work in a small group of peers, and you will be able to interact with your instructor and TAs. If you have any difficulty accessing Perusall and acquiring the textbook, contact the instructor and/or your academic counsellor immediately in the first week of classes.

### Podcasts

Lessons are complemented by podcasts from BBC-4 radio. These provide a way to deepen the understanding of the topic of each lesson. The recommended podcasts are accessible through links posted on the OWL webpage of each lesson.

### Further recommendations

Each OWL lesson page will be accompanied by reading suggestions, including articles and books, and other online material such as video and podcasts.

## 5. Methods of Evaluation

**Reading & Discussion assignments on Perusall:** A portion of the class marks will be assigned for performing the readings, for posing and answering questions, engaging with other students and making well-thought out comments on the Perusall website. Students have to create a separate Perusall account, using their ID number and their UWO email.

**Exam Part 1 (Midterm):** There will be an in-person exam on February 29, 4:30-6:30 PM concerning the content of lessons 1-6. Hand written or printed notes will be allowed during the test.

**Exam Part 2 (Final):** There will be a final in-person exam concerning the content of lessons 7-11. this could be taken by students who have missed one or both of the previous exams. Hand written or printed notes will be allowed during the test. The date and time will be determined and announced by the Office of the Registrar and announced on the OWL website.

Below is the evaluation breakdown for the course. Any deviations will be communicated.

<b>Assessment Format</b>	<b>Weight</b>	<b>Date</b>
Perusall Readings & Discussions	<b>20%</b>	<b>To complete</b> each week
Exam Part 1 (1-6 lessons)	<b>40%</b>	<b>In-person:</b>
Exam Part 2 (7-11 lessons)	<b>40%</b>	<b>In-person:</b> during the Exam Period TBA

**Grades:** Scores will be transferred to the Gradebook on OWL. Any errors, or appeals to your scores, must be reported within two weeks of their initial posting. Please note: a) your final exam mark will only be posted to OWL after the end of the exam period, b) your final course grade must come officially from the Registrar's Office, and c) in rare cases, final course grades may be adjusted in order to conform to the Physics & Astronomy department policy.

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

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

## 6. Recommendations

### Perusall

- Contribute thoughtful questions and comments to the class discussion, spread throughout the entire reading
- Start the reading early
- Break the reading into chunks (instead of trying to do it all at once)
- Read all the way to the end of the assigned reading
- Pose thoughtful questions and comments that elicit responses from classmates
- Answer questions from others
- Up-vote thoughtful questions and helpful answers

**Note:** The annotations on Perusall can be seen from all students within the study group and are supposed to be strictly on the reading material and on previous annotations of peer students of the study group. Perusall annotations can for instance be questions or a helpful response to a question, e.g. enlighten about unclear material, etc.: a learning tool. No personal comments are allowed, nor any disrespectful annotations. In the case, a student complains about being disrespectfully criticized or made fun of on Perusall about his/her annotations, questions, comments, etc. by a peer student, the student responsible for the inappropriate annotation and/or comment will be removed from the Perusall study group and will receive a mark of zero for the entire Perusall component of the course.

### Working Habits

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.

- Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
- Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
- Follow weekly checklists created on OWL or create your own to help you stay on track.
- Take notes as you go through the lesson material. Treat this course as you would a face-to-face course. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively than just reading or watching the videos.
- Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
- Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion forum or contact your instructor(s) and or teaching assistant(s).
- Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

### COVID-safe conduct for in-person classes, meetings or exams

“Students will be expected to wear triple layer non-medical masks at all times in the classroom as per Western policy and public health directives. Students who are unable to wear a mask for medical or religious reasons must seek formal accommodation through Accessible Education at [aew@uwo.ca](mailto:aew@uwo.ca).

Students are expected not to eat or drink while in class to ensure masks stay in place. Students will be able to eat and drink outside of the classroom during scheduled breaks.

Students unwilling to wear a mask as stipulated by Western policy and public health directives will be referred to the Department, and such actions will be considered a violation of the student Code of Conduct.”

# Western Academic Policies and Statements

## Course Commitments

The last day of scheduled classes in any course will be the last day on which course assignments will be accepted for credit in a course. Instructors will be required to return assignments to students as promptly as possible with reasonable explanations of the instructor's assessment of the assignment.

## Accommodations

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department. Documentation shall be submitted, as soon as possible, to the Office of the Dean of the student's Faculty of registration, together with a request for relief specifying the nature of the accommodation being requested. The UWO Policy on Accommodation for Medical Illness and further information regarding this policy can be found at [http://uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf).

## Self-reported absence

Students who experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render them unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) should self-declare using the online Self-Reported Absence portal. This option should be used in situations where the student expects to resume academic responsibilities within 48 hours or less.

The following conditions are in place for self-reporting of medical or extenuating circumstances:

<http://westerncalendar.uwo.ca/PolicyPages.cfm?>

[Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#SubHeading\\_322](http://westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#SubHeading_322)

## Accommodation for Religious Holidays

The policy on Accommodation for Religious Holidays can be viewed [here](#).

## Accessibility Statement

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 Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review [The policy on Accommodation for Students with Disabilities](#).

## Correspondence Statement

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. You can read about the privacy and security of the UWO email accounts [here](#).

## Academic Offences

"Scholastic offences are taken seriously, and students are directed [here](#) to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

## Plagiarism Checking

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com <http://www.turnitin.com>.

## Copyright and Audio/Video Recording Statement



Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

### **Rounding of Marks Statement**

Across the Basic Medical Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. Final grades on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark “bumping” will be denied.

### **Support Services**

Students who are in emotional/mental distress should refer to [Mental Health@Western](#) for a complete list of options about how to obtain help. Immediate help in the event of a crisis can be had by phoning 519.661.3030 (during class hours) or 519.433.2023 after class hours and on weekends.

The following links provide information about support services at Western University.

[Academic Counselling \(Science and Basic Medical Sciences\)](#)

[Appeal Procedures](#)

[Registrarial Services](#)