# PLANETSC 9604
# Impact Cratering Short Course and Field School
# Course Outline

## 1. Course Information

**Course Information**

PLANETSC 9604 (Impact Cratering Short Course and Field School) is a 7-day intensive field school. Some reading assignments and watching of pre-recorded lectures will also be required prior to the in-person field school.

**When:** November 01 to 08 2025.

**Where:** Sudbury, Ontario, Canada.

**Registration and Cost:**

**Western Graduate Student:** The **cost** for this course is **$1,000** and is payable in full by **September 30 2025.** The price includes transportation from London, Ontario, to Sudbury, field transportation, accommodation, course material costs, and breakfast and lunch from November 02 to 08. For MSc and PhD students in the Collaborative Specialization in Planetary Science and Exploration, the Institute for Earth and Space Exploration offers support for field schools through the Experiential Learning Award.

***Graduate students from other universities (Canadian and international) are welcome on this course. A number of spaces will be available on a first come, first served basis. Please see below for the costs for the different categories.***

**Graduate Student at another Ontario University:** The **cost** for this course is **$1,250** and is payable in full by **September 30 2025.** Payment of this amount is considered registration in the course. The price includes transportation from London*, Ontario, to Sudbury, field transportation, accommodation, course material costs, and breakfast and lunch from November 02 to 08.

The Ontario Visiting Graduate Student Plan allows a graduate student registered at a university in Ontario (Home University) to take graduate courses at Western (Host University) without completing further admission formalities. Interested students must complete an Ontario Visiting Graduate Student Application available ***at their current university*** and return it to their ***home department*** for approval.

**Graduate Student at a non-Ontario University:** The **cost** for this course is **$1,500** and is payable in full by **September 30 2025.** Payment of this amount is considered registration in the course. The price includes transportation from London*, Ontario, to Sudbury, field transportation, accommodation, course material costs, and breakfast and lunch from November 02 to 08.

*Pick-ups and drop offs at Toronto Pearson International Airport may be possible depending in timing (contact Dr. Osinski).

**Logistics:** Travel details will be shared with participants once confirmed. Accommodation will be in shared hotel rooms.

**List of Prerequisites**

In order to participate in this field school knowledge of basic rock types and geological processes are necessary. An undergraduate degree in an Earth Sciences-related field and/or graduate-level courses such as PLANETSC 9603 (Planetary Science Short Course) and/or GEOL 9635 (Planetary Surface Processes), or similar, will provide the necessary background (contact Dr. Osinski to discuss if you have questions).

# 2. Instructor Information

Dr. Gordon Osinski (gosinski@uwo.ca; +1-519-661-4208).

# 3. Course Syllabus, Schedule, Delivery Mode

This is a 7-day intensive field school that will take place in and around Sudbury, Ontario, from November 01 to 08 2025. Some reading assignments and watching of pre-recorded lectures will also be required prior to the in-person field school.

Impact cratering is one of the most fundamental, yet poorly understood, geological processes in the Solar System. On many planets, impact craters are the dominant geological landform. On Earth, erosion, plate tectonics and volcanic resurfacing continually destroy the impact cratering record, but even here, the geological, biological, and environmental effects of impact cratering are apparent. Impact events are destructive and have been linked to at least one of the "big five" mass extinctions over the past 540 Ma. In recent years, it has also become apparent that impact craters can also have beneficial effects: many impact craters are associated with economic metalliferous ore deposits and hydrocarbon reservoirs. Impact events can also deliver organize molecules and life-essential elements and create environments suitable for the emergence and subsequent evolution of life on early Earth and potentially on other planets such as Mars.

This course will introduce students to the processes and products of impact cratering on Earth and throughout the Solar System. This course will be based in Sudbury, Ontario, the site of an ~200 km diameter impact structure formed 1.85 billion years ago. The course will feature a mix of lectures, hands-on laboratory sessions, field excursions, and a group field research project. The Sudbury structure offers an exceptional opportunity to study impact melt rocks, various types of impact breccias, shatter cones, impact-induced hydrothermal alteration, and much more.

This course will focus on the following topics:

- Impact cratering processes:
    - Contact and compression.
    - Excavation and ejecta emplacement.
    - The modification stage and the formation of complex impact structures.
    - Impact-induced hydrothermal activity.
- Products of impact cratering.
    - Impactites: Introduction, classification, and overview.
    - Shock metamorphic effects in crystalline and sedimentary rocks.
    - Impact melt rocks and glasses.
- Effects of impact cratering: Destructive and beneficial:
    - Destructive environmental effects of meteorite impact events.

    - Beneficial microbial effects of meteorite impact events.
    - Economic potential of meteorite impact structures.
- Techniques and research methods:
    - Including remote sensing, geophysics, age dating techniques, etc.
- Comparative case studies of various impact structures.

A group research project will enable students to apply this knowledge and provide a hands-on experiential learning opportunity to explore an aspect(s) of ongoing research at the Sudbury impact structure.

# 4. Course Materials

Readings and links to pre-recorded lectures will be provided to students in September 2025. No textbooks are required for this course.

The course does, however, use content from the following book and having access to a copy would be beneficial:

Osinski G. R. and Pierazzo E. 2012. *Impact Cratering: Processes and Products*. Wiley Blackwell: Oxford. pp. 362.

# 5. Methods of Evaluation (*For those students taking the course for credit)

**Grading Scheme and Assessment Dates**

| | |
|---|---|
| Class Participation | 15% |
| Sudbury Field Research Project | 35% |
| Research Paper | 50% |
| | 100% |

**Course Evaluation (details):**

***Class Participation***

Attendance is required each day of the field school, unless special extenuating circumstances apply. Each student is expected to actively contribute to all class discussions. Students are encouraged to read widely beyond the readings specifically assigned for class and bring own readings and experiences into the class discussions. It is expected that each student will come prepared to debate, defend, and critique the readings and lecture material.

***Sudbury Field Research Project***

A research project conducted in groups will be carried out in the field at the Sudbury impact structure. Further details will be announced during the course.

***Research Paper***

Each student will prepare a research paper. Students will have the choice of writing a review-type paper on a particular subject or a research-based paper in the form of an extended conference abstract, which will be based on results and data gathered by the student during a small research project that will last for the duration of the semester following the short course. For both papers, students are encouraged to

consult with the Dr. Osinski regarding the choice of the topic. These papers will be due **11.59 pm Monday December 15 2025.**

Review papers should not exceed 20 pages (double spaced) and must include a title page, an abstract (maximum of 200 words), figures and tables (where appropriate) and a reference list.

The research-based paper will involve students taking on a small research project on a particular topic. Students will have the opportunity to investigate various suites of uncharacterized samples from several terrestrial impact structures. Students will have access to polished thin sections and hand specimens and basic optical microscopy facilities. Students are welcome to propose collecting geochemical data on their samples; however, this will depend on the availability of funds and instrumentation at the time of proposing and must be discussed with Dr. Osinski in advance. Other types of research projects – for example, application of computer modeling to cratering studies, or remote sensing studies of impact craters on Earth or another planetary body – are also permitted and are welcome. Students will prepare an LPSC-type extended abstract using a standard template available from the Lunar and Planetary Institute. Supplementary figures and text (not exceeding 5 pages) must be supplied detailing methodology, etc. All "raw" data collected (e.g., sample descriptions, analyses, etc.) must be submitted in an easily readable and traceable form (e.g., an MS Excel spreadsheet for detailed sample descriptions and analyses).

**Use of Generative AI Tools**
Generative AI tools (e.g., ChatGPT, Copilot, Gemini) are not permitted for any of the assessments for this course.

**General information about missed coursework**

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs,* posted on the Academic Calendar:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:

https://registrar.uwo.ca/academics/academic_considerations/

All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Sudbury Field Research Project.

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with**

**Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

**Evaluation Scheme for Missed Assessments**

Late assessments submitted within two hours of the deadline will receive a 2% penalty. For 5 days following the normal "Due Dates" (including weekend days), assessments may be submitted but will be subject to a mark deduction of 10 % per day late. No assessments will be accepted after 5 days.

# 6. Additional Statements

### 6.1 Religious Accommodation

When conflicts arise with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible, but not later than two weeks prior to the writing of the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays - https://www.edi.uwo.ca

### 6.2 Academic 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

### 6.3 General Academic Policies

The website for Registrar Services is https://www.registrar.uwo.ca/.

**Use of @uwo.ca email:** 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 email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

**Requests for Relief** (formally known as "appeals")

Policy on Request for Relief from Academic Decision:
https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

Procedures on Request for Relief from Academic Decision (Graduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/graduate_requests_for_relief_procedure.pdf

### 6.4 Scholastic Offences

Policy on Scholastic Offences:
https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Procedures on Scholastic Offences (Graduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/graduate_scholastic_offence_procedure.pdf

### Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is your responsibility to review and comply with these expectations.

### Use of Generative AI Tools

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations.

Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**.

If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is your responsibility to seek clarification before using any AI tools in academic work.

### 6.5 Support Services

Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, 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. If you have any questions regarding accommodations, you may also wish to contact Accessible Education at

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

Learning-skills counsellors at Learning Development and Success (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.

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