

# GEOL612: Geology and Geophysics of the Terrestrial Planets

Tuesday/Thursday, 12:30 PM –1:45 PM, PLS1164

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## Course Information

### Meeting times and locations

#### *Lectures :*

Tuesdays and Thursdays, 12:30 PM – 13:45 PM  
Plant Science building, room PLS1164

#### *Labs*

There are no labs associated with this class.  
Occasional tutorial GMT will be conducted in the Senior room (CHM 1215)

#### *Credit*

The course is offered for 3 Credits only.

### Instructor

#### **Dr. Laurent G. J. Montési**

Associate Professor, Department of Geology

**Office:** Chemistry 1221B

**Tel:** 5-7534

**email:** [montesi@umd.edu](mailto:montesi@umd.edu)

**Office hours:** Most Mondays and Fridays 12:00pm to 2:00pm (email to be sure)  
or upon appointment.

Don't hesitate to send me an email at the address above. It is the most reliable way to contact me.

### Website

A website for the class is available through the University ELMS/blackboard system. Follow the link to <https://elms.umd.edu/>, enter your directory ID and password. If you are registered, you should be able to see GEOL612 in your list of classes and access the website that way.

The website will contain a copy of each lecture as a PDF document and, when appropriate, scanned book chapters or links to external websites.

### Text

No text is required for the class but the following are good resources to complement the class

- *Introduction to Planetary Geomorphology*, by Ronald Greeley, Cambridge University Press, 2013, ISBN 978-0521867115
- *Planetary Surface Processes*, by H Jay Melosh, Cambridge University Press, 2010, ISBN 978-0521514187

## GEOL612 Geology and Geophysics of the Terrestrial Planets

- *Planetary Sciences*, by Imke de Pater and Jack J. Lissauer, Cambridge University Press, 2010, ISBN 978-0521853712

In additions, the book *Exploring the Solar System*, by Peter Bond (Wiley-Blackwell, 2012, ISBN 978-1405134996) provides a good introduction to each of the planets considered in this class – and the rest of the solar system.

Reading assignments may also consist on selected articles from major scientific journals, such as the *Annual Review of Earth and Planetary Sciences*, *Space Science Review*, *Planetary and Space Science*, *Earth and Planetary Science Letters*, *Icarus*, *Journal of Geophysical Research*, *Reviews of Geophysics*, *Science*, and *Nature*, all of which can be accessed electronically through the UMD library system.

Material for discussion will be available as PDF on ELMS.

### **Course Requisites**

#### *Prerequisites*

Permission of CMNS-Geology department  
OR Must have completed MATH141, and GEOL446

#### *Recommended*

Familiarity with MATLAB or MATHEMATICA

### **Technology**

Occasionally, homework may require access to Internet tools, computer calculation and simple programming. All the problems can be solved with Matlab. Some homeworks are designed to used the freely available GMT software. Computer labs with Matlab are available throughout campus. You may also use the department of Geology's senior's room, which will have GMT. If you do not have access to that room, you probably want to get obtain the GMT software (contact me for information on how to get it) and locate a Matlab license.

### **Method for Communication with Students Outside the Classroom**

Email, send through the ELMS website will be the preferred means of communication with students outside the classroom. Please make sure that forwarding to any non-UMD email address is fully functional. Students are responsible for receiving the messages sent through ELMS.

### **Emergency Protocol**

In the event of an emergency that closes the University for an extended period of time, lectures will be recorded by the instructor and posted on ELMS.

### **CORE/GED**

This class does not fulfill CORE or GED requirement.

## Course Description, Goals, and Expectations

### General Description

Geological features of Mercury, Venus, Mars and the Moon with an emphasis on results from recent NASA planetary mission. Class is organized to follow geological processes or observation throughout the inner solar system. Topics covered include interior structure, impact cratering, tectonic and volcanic history, surface conditions and climate change.

### Learning Outcomes:

- Students will gain an in-depth understanding of the manner that the interior structure of planets can be deduced from geophysical observations (GEOL-Geophysics)
- Students will gain appreciation for the variety of geological features on terrestrial planets and how these provide insight into the evolution of each planet.
- Students will gain first-hand experience in the generation of topographic maps of various planetary surface and how to access planetary science datasets using freely available tools.
- Students will derive analytical solution to simplified problems that reveal the fundamental characteristics of more complex geodynamical models and provide a toolkit to interpret geological observations (PC-4 Knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics)
- Students will understand the relation between physics concept, especially continuum mechanics and (laminar) fluid dynamics, and geological observations (Interdisciplinary understanding)

### General Organization

Lectures describing a suite of observations or a geological process at work in the inner solar system will typically be available as a video produced by the instructor and available online. A PDF of the lecture will be posted on ELMS for reference.

A few guest lecturers may be invited to present some of the newest developments in planetary exploration and describing recently collected datasets.

Several sessions will be dedicated to conducting guided exercises for practice in advance of homework. Some will involve accessing specialized software in the Geology Seniors' room (CHM1215)

The remaining sessions will consist of a discussion based on a reading assignment related to a topic previously covered in lecture. The students are expected to take turn leading the discussion. After approximately 45 minutes the class prepare a written report on a topic linked to the discussion. Every student will be expected to read assigned papers and to post comments on a class-specific blog before class.

**Course Sequence (subject to change)**

Brown shading: Lectures

Red shading: Dr. Montesi is away

Date	Class Activity	Homework Due
09/01/2014	Introduction	
09/03/2014	Geological Overview	
09/08/2014	Planetary Interiors	
09/10/2014	Discussion 1	Planetary Data
09/15/2014	Planetary Surfaces	
09/17/2014	Discussion	Interior Structure
09/22/2014	Homework practice	
09/24/2014	Cratering Mechanics	Spectroscopy
09/29/2014	Discussion	
10/01/2014	Surface Ages	Cratering Mechanics
10/06/2014	Topography	
10/08/2014	Discussion	Surface Ages
10/13/2014	GMT practice	
10/15/2014	GMT practice	
10/20/2014	GMT practice	
10/22/2014	Tectonics	Crater population
10/27/2014	Volcanism	
10/29/2014	Homework practice	
11/03/2014	Thermal Evolution	
11/05/2014	Homework practice	Tectonics/Volcanism
11/10/2014	Mars	
11/12/2014	Homework practice	Thermal Evolution
11/17/2014	GMT practice	
11/19/2014	GMT practice	
11/24/2014	Discussion	Mars
11/26/2014	<i>Thanksgiving</i>	<i>Thanksgiving</i>
12/01/2014	Goddard Visit	
12/03/2014	Goddard Visit	
12/08/2014	Research Reports	
12/10/2014	Research Reports	
12/18/2014	Final Due	

**Expectation of students**

GEOL 612 is a graduate level course in geology. A strong understanding of geology will be essential to identify pertinent questions for discussion and to fulfill class expectations. For that reason, permission of the instructor is required for students not enrolled in a graduate program in Geology.

## GEOL612 Geology and Geophysics of the Terrestrial Planets

We will derive several mathematical relations and describe their usage in Earth sciences. Familiarity with calculus and differential equations is essential to follow the course material.

Students should never hesitate to contact the instructor with any question or request for clarification. Email is the preferred contact methods. Posting on ELMS is equally acceptable, especially in a way that enables other students to listen in on the conversation. One-on-one meetings can be arranged, subject to instructor and student availability. Always request such a meeting by email

### **Grading Procedures**

#### *General instructions*

As there is no TA for the class, students need to talk to me (Dr. Montesi) when they encounter any problem. Please don't be shy! I am here to help you, and I hope you will come and seek help if you have any difficulty. I am not interested in correcting wrong or incomplete homework, so do come and ask me before it's too late!

You are welcome to discuss with each other the problem set but you need to write the answers yourself.

Problem sets will be available through the ELMS website. You can choose whether to submit your answers online or on papers. Grades and corrected versions will be posted online hopefully by the next class.

Precision and neatness is important for all the work done in this class. Any graph is expected to be done on a computer, or, if by hand, the student is expected to use rulers and protractors, as necessary. Axes must always be labeled by a caption and units must be specified whenever possible. Text answers must be argued. Numerical answers must be accompanied by an explanation of how the result was achieved. Points will be removed for insufficient explanations and for imprecise drawings.

#### *Homeworks (40 pts)*

Problem sets will be assigned most weeks, due the following week. See the detailed schedule for the current plan.

There will be no make-up homework because of the high frequency of assignments. You will receive a 0 mark for any late homework. However, at least one homework grade (the lowest) will be dropped to accommodate unavoidable difficulties. Request for delays must be received at least by 3 pm on the day before the homework is due, and be accompanied with a justification.

Every exercise in homework is required of GEOL612 students.

#### *In-Class Discussion (15 pts)*

Discussion of scientific papers is an integral part of the class. Each student is required to participate actively to the discussion of each paper and to post a comment or question related to the paper in advance of discussion (10 pts). Oral participation to the discussion

is counted for 5 pts. A short write-up (1 page maximum) on a topic related to the discussion will be collected at the end of each session (10 pts). For each component, the lowest grade will be dropped before averaging.

***Research report (25 pts)***

Students registered to GEOL612 will make groups of two and prepare an update on recent mission results. Each report should contain a summary of mission objectives, description of instruments, and results published to date. For the purpose of this exercise, missions to the outer solar system or to asteroids and comets are acceptable. Missions for 2015 may include Rosetta, Dawn, New Horizon, Mars Science Laboratory, Mars Express, Mars Odyssey, Mars Reconnaissance Orbiter, Venus Express, MESSENGER, etc. It is fully expected that this report will draw more heavily on press releases than published papers.

The report will be delivered in two parts: an oral presentation (20 minutes) during the last week of class and a written report due at the same time of the final (be prepared!) interaction with the audience, including the quality of answers to questions, will be considered when decided on the oral grade.

The oral presentation will be graded as follows:

- Understanding of the research topic; Thoroughness of the investigation? (10 pts)
- Organization, clarity, and completeness? (5 pts)

The oral presentation will be graded as follows

- Organization and clarity? (5 pts).
- Understand of mission objectives and results? (5 pts).

***Final exam (20 pts)***

A final exam will consist in the production of an essay during finals week. The topic of the essay will be given at the start of the conclusion of the course, and the essay must be submitted through ELMS by the end of the official exam time for the class, Friday December 18, at 10:00am. The exam is open book, which means that the students are allowed to consult any online resource they see fit. The essay topic will be open-ended. It will be graded as follows

- Does the essay contain a clear thesis to answer the question posed? (5 pts)
- Does the essay refer to specific facts and observations? (5 pts)
  - At least four subtopics should be discussed.
    - Each subtopic should contain sufficient supporting evidence; Said evidence should be concrete.
- Is the essay well organized? (5 pts). Does it contain:
  - An introduction that presents the topic and the structure of the essay
  - A conclusion summarizing the principle subtopic and brings them together to answer the question posed.
- Is the essay clearly written (5 pts)?
  - Each paragraph should focus on a specific idea. At the very least, each subtopic listed in the introduction should be contained in a specific paragraph.

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- The essay should be written in complete, grammatically correct sentences, with minimal typographic errors
- Expectations for GEOL612 students are higher than for GEOL412.

### *Grade calculation*

Letter grades will be assigned based on the following scale. Standard rounding will be used, with final scores rounded to the nearest integer percentage, such that a 69.4 would be a D+ and a 69.5 a C-.

100-97%	A+	96-94%	A	93-90%	A-
89-87%	B+	86-84%	B	83-80%	B-
79-77%	C+	76-74%	C	73-70%	C-
69-67%	D+	66-64%	D	63-60%	D-
<60%	F				

### **Appeal of grades**

You may appeal your grade on any exam prior to the posting of final course grades. In this as in all college courses, you should retain all graded items until proper grades have been recorded on your transcript.

## **Course Procedures and Policies.**

### **Attendance**

Attendance to the lectures is highly recommended, as provided by University Policy: *“The University expects each student to take full responsibility for his or her academic work and academic progress. The student, to progress satisfactorily, must meet all of the requirements of each course for which he or she is registered. Students are expected to attend classes regularly, for consistent attendance offers the most effective opportunity open to all students to gain command of the concepts and materials of their courses of study.”*

The full attendance policy is available at [www.testudo.umd.edu/soc/atedasse.html](http://www.testudo.umd.edu/soc/atedasse.html). It provides several cases for which student absence is excused. Any request to be excused must be submitted in writing and with appropriate documentation.

### *Religious Observances*

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. *It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance.*

If a homework due date falls on a religious holiday, students following that holiday will be allowed to turn in the homework by the following class time.

Students will be responsible to study the material missed during the religious holiday, using class handouts and the textbook. As always, these students are encouraged to post questions and requests for clarification on ELMS.

### ***Inclement Weather***

If the University Maryland is closed due to inclement weather, or a delayed opening overlaps with class time, the instructor will record a lecture and post it on ELMS. Any assignment due that day will be postponed until the following class. However, the schedule of subsequent assignments will remain unchanged, with the consequence that later homework may be separated by less than a week.

### ***Absences due to illness***

For every medically necessary absence from class, a reasonable effort should be made to notify the instructor in advance of the class. When returning to class, students must bring a note identifying the date of and reason for the absence, and acknowledging that the information in the note is accurate.

If a student is absent more than 3 time(s), the instructor may require documentation signed by a health care professional.

If a student is absent on a day an assignment is due, the student will need to post the assignment on ELMS or deliver it to the professor's mailbox in the Geology building by 3pm the same day. If a longer extension is needed, the student needs to contact the professor by email before 3pm, including a note identifying the date of and reason for the absence. Any request for extension that extends beyond the next scheduled class must be accompanied by documentation signed by a health care professional.

### **Academic integrity**

The Student Honor Council observes that:

*The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.shc.umd.edu>.*

*To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all examinations and assignments: "I pledge on my honor that I have not given or received any unauthorized assistance on this examination (assignment)."*

You are expected to take the Student Honor Pledge  
<http://www.studentconduct.umd.edu/aca/honorpledge.html>

***I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.***

I will consider it implicit that you took the pledge for every class assignment, including online assignments, even if the pledge does not appear on your copy.

### **Electronic devices**

To avoid unnecessary distractions during lectures, use of cell phones, including texting, is allowed only in case of emergency. If you choose to use a computer to take notes, do so in a manner that does not distract other students. You may have to stop if, for example, people around you start to look at your screen instead of the lecture. Text messaging is forbidden at all time during the lectures.

### **Class evaluation**

Every student for any class in which more than five students are registered is expected to complete a course evaluation using the [CourseEvalUM](#) system. This is YOUR chance to anonymously evaluate this class. Please use it!

[CourseEvalUM](#) will be open for students at the end of the semester to complete their evaluations. Students can go directly to the <http://www.courseevalum.umd.edu> website to complete their evaluations. You will be alerted via your official University account. Students who complete evaluations for all of their courses in the previous semester (excluding summer), can access the posted results via Testudo's CourseEvalUM Reporting link for any course on campus that has at least a 70% response rate.

If less than 5 students are registered for GEOL612, class evaluations will be conducted on paper copies filled by the students and given to Mrs. Dorothy Brown, GEOL1220.

If you have any issue with the class, I would appreciate you contact me so that we discuss and hopefully resolve it.

### **Special Needs**

I will make every possible effort to accommodate your request for special accommodations, when justified. However, any requests must be submitted as soon as possible and no later than the end of the schedule adjustment period. *Do not wait!*

### **Students with Disabilities**

If you have a documented disability, you should contact Disability Support Services at Susquehanna Hall (<http://www.counseling.umd.edu/DSS/>). Each semester, students with documented disabilities should apply to DSS for accommodation request forms, which you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site. Please provide evidence of eligibility before the end of September

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being paid to take lecture notes without the express written permission of the faculty teaching this course.