Scientific Inquiry:  
*Astronomy, Galileo, and the Birth of Modern Science*  
PHYS 104 & 104L (3 Credits)  
Gonzaga-in-Florence  
Summer 2017  
*Draft Syllabus*

**Class:** Monday-Thursday 11:40 am – 1:15 pm  
**Location:** Mozilo  
**Webpage:** Blackboard select PHYS 104 from “My Courses”  

**Instructor:** Erik Aver  
**Office:** Mozilo  
**Phone:** 011-39-055-____-_____
**E-mail:** aver@gonzaga.edu  

**Office Hours:** Monday-Thursday right after class, drop-in, or by appointment  

*Please bring any concerns and questions to my office hours.*

**Course Description**

Astronomy is the study the celestial objects found within the universe, such as stars, planets, and galaxies. This course is designed both to introduce you to the scientific field of Astronomy and to the evidence-based reasoning of science. This course will develop understanding of the fundamental principles of the scientific method and scientific reasoning. Laboratory activities will be integrated throughout the course. Measurement, numerical calculation, and proportional reasoning will be utilized, but the mathematics employed will not exceed basic algebra.

Benefiting from its Florence location, this course will highlight the key contributions to Astronomy and Physics by Galileo Galilei. His experiments and observations revolutionized our understanding the Sun-centered solar system advanced by Copernicus, the nature of gravity and motion, and reasoning based on evidence and experiment itself. In doing so he laid the groundwork for modern Astronomy and Physics.

Opportunities for local class field trips will enrich the course through historical discoveries and hands-on experiences. The nearby Pisa Cathedral was the site of Galileo’s discovery regarding pendulum motion, and the famous Leaning Tower is purported to have inspired his thought experiments regarding freely falling objects. The Museo Galileo in Florence houses many of Galileo’s original instruments, including the telescope he constructed and used...
to discover Jupiter’s moons. The Fondazione Scienza e Tecnica, also in Florence, offers a Planetarium, and the nearby, associated Osservatorio Astrofisico di Arcetri conducts active research across many areas of Astronomy and Astrophysics, as well as hosting public events and tours.

Learning Outcomes
- Demonstrate a basic understanding of theory and concepts central to the natural sciences.
- Through participation in scientific inquiry, demonstrate understanding of the elements and recursive nature of the scientific method including observations, models, predictions, testing, quantitative analysis, and communication of findings.
- Recognize that scientific understanding is based on evidence and that evidence evolves with new observations.
- Demonstrate understanding of the interdisciplinary nature of the natural sciences and the influence of the natural sciences on contemporary issues in society.

Course Goals
Astronomy & Galileo is designed to:
- Develop the historical progression of our understanding of the universe with its direct link to the emergence of scientific reasoning.
- Explore, in particular, Galileo Galilei’s crucial and fundamental contributions to Astronomy and Physics.
- Demonstrate the link between observations, experiment, and evidence and scientific understanding.
- Build understanding of the life cycle and evolution of stars.
- Enhance familiarity with celestial objects and phenomena.

Required Textbook
- eBook included with WebAssign.
- Galileo and the Scientific Revolution, by Laura Fermi & Gilberto Bernardini.

Office Hours and Physics Tutoring
Please bring any questions and concerns to my office hours. If you are struggling, please do not hesitate to come see me, and there is very little that I enjoy more than working with students during office hours.

Exams
Tests (50 minute) will be composed of descriptive explanations, quantitative problems, short answer, and/or multiple choice questions. The final exam (1 hr 45 min) will be comprehensive and formatted similar to the tests.
- Test 1: Monday, June 5
- Test 2: Monday, June 19
- Final Exam: Friday, June 30, 11:40 am – 1:15 pm
Written answers, as well as quantitative solutions, must communicate your understanding clearly; they should be specific and detailed, but need not (should not) be verbose. Partial credit will be awarded for logical, coherent approaches.

**Homework**
Homework problems will be assigned roughly twice a week. They will reinforce the reading and lecture material. Homework will be assigned through an online homework system, WebAssign, [https://www.webassign.net/login.html](https://www.webassign.net/login.html). Submitted answers will automatically be reported as correct or incorrect, and missed numerical problems can be re-attempted for reduced credit. Further instructions on setting up an account and using WebAssign will be provided. Some class sessions, assignments may also be given in class or as part of field trips.

**Lab**
The lab assignments will consist of lab activities, lab reports, a science and society paper, and a lab final exam.
- For each lab experiment, lab reports are due at the next lab meeting, and each lab group will turn in one lab report for the pair of students.
- Lab reports are comprised of the measured data, results tables and graphs, and answers to the lab questions.
- The goal of the science and society paper is to discuss a real-life example of multiple branches of natural sciences influencing a contemporary issue in society.

**Course Grade**
The course grade will determined by combining the following components:
1) Homework 30%
2) Lab 30%
3) Tests (2) 20%
4) Final Exam 20%

The letter grade for the course will be assigned according to the following approximate scale: A, A− (90–100), B+, B, B− (80–90), C+, C, C− (70–80), D+, D (60–70), F (below 60).
The grade ranges will not be adjusted up, but may be adjusted down at instructor discretion.
(Very) Tentative Course Schedule
- Changes will be announced in class.
- Homework will be assigned roughly twice a week.

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<tr>
<th>Dates</th>
<th>Topics</th>
<th>Lab</th>
<th>Exams</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>The Sun &amp; The Moon in the Sky</td>
<td>Orientation &amp; Syllabus</td>
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<td>05/22 – 05/25</td>
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<td>Activity - Measurements</td>
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<td>Development of Astronomy</td>
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<td>Galileo Galilei</td>
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<td>Activity - Calculations</td>
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<td>Week 2</td>
<td>Galileo Galilei</td>
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<td>05/29 – 06/01</td>
<td>Light &amp; Spectra / The Sun</td>
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<td>Lab - Density</td>
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<td>Week 3</td>
<td>Galileo Galilei</td>
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<td>M, 06/05 Test</td>
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<td>06/05 – 06/08</td>
<td>Galileo Galilei</td>
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<td>Light &amp; Spectra / The Sun</td>
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<td>Activity - Statistics and Random Errors</td>
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<td>Lab - How Many?</td>
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<td>Week 4</td>
<td>Stars, Formation &amp; Structure</td>
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<td>06/12 – 06/15</td>
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<td>Activity - Graphing Data</td>
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<td>Stars, Formation &amp; Structure</td>
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<td>Activity - Modelling and Relationships</td>
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<td>Week 5</td>
<td>Stellar Evolution &amp; End</td>
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<td>M, 06/19 Test</td>
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<td>06/19 – 06/22</td>
<td>(Black Holes!)</td>
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<td>Lab - Graphing</td>
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<td>Activity - Power Law Relationships</td>
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<td>Week 6</td>
<td>Galaxies &amp; Cosmology</td>
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<td>F, 06/30 Final Exam</td>
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<td>06/26 – 06/30</td>
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<td>Lab – Craters</td>
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<td>Lab Final Exam / Science in Society Reports Due</td>
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Course Policies

Attendance and Participation
This is an active lecture class, and as a result, attendance of every class session is mandatory. In the case of unavoidable, officially recognized absences, contact me in advance, as soon as possible. I follow strictly the university’s standard policy on absences: the maximum allowable absence is two class hours (100 minutes) for each class credit. For a three-credit class meeting four times a week for 95 minutes, the maximum number of absences allowed is three. The grade for excessive absences is “V”, which has the same effect as “F” (Fail) and is counted in the GPA. For further information, see also “Class Attendance Policy” on page 68 of the University’s online catalogue:

Drop/Add, Change Grade Base, and Withdrawal
The last day to add this course or change grade basis is Friday, May 26, 2017.
The last day to drop this course is Friday, May 26, 2017.
The last day to withdraw from this course is Friday, June 16, 2017.
Please consult the Registrar for further details:

Make-up Policy
Make-up tests are not allowed. In the case of highly unusual circumstances, contact me in advance to see if an accommodation can be made.

Late Work, Incomplete Work, Resubmission, and Extra Credit
Unless arranged and agreed upon in advance, late work is not accepted and will receive a score of zero. Incomplete assignments will be graded for partial credit based on the present work and reflecting the proportion of completion and correctness. Reworking and resubmitting assignments is not permitted. Extra credit is not available and will not be awarded on any assignments.

Contested Grades and Re-grade Procedure
If you feel you have been graded unfairly and would like to contest your score, please see me during my office hours.

Work Load
As described in the “Course Description”, this is a demanding, fast-paced course and it is of very important that you do not fall behind. You should expect and plan for a workload of at least eight hours per week outside of class time for an average student to receive an average grade.

Classroom Courtesy
All students are expected to arrive on time and attend the full lecture period. Lectures end when the idea or technique under discussion has been concluded and the lecturer has indicated that the students are free to leave. For this reason lectures are rarely expected to end exactly at the end of class time. Packing up books, putting on coats, or standing up while the lecture is in progress interferes with the learning of other students and shows disrespect for the educational process.
Electronic Devices
Do not allow your cell phone, laptop computer, or other electronic devices to distract yourself or other students during class. Cell phones, MP3 players, and similar devices must be silenced and put away during class. The one exception is the use of cell phones for in-class questions. You may use a laptop to take notes during lecture. Do not distract yourself or other students by using your computer during class for activities that are not related to class, such as e-mailing, surfing the web or playing games. A student who does not comply with this policy will lose their privilege to use the cell phone, computer or other electronic devices during class.

Course Evaluations
At Gonzaga, we take teaching very seriously, and we ask our students to evaluate their courses and instructors so that we can provide the best possible learning experience. In that spirit, we ask students to give us feedback on their classroom experience near the end of the semester. In this class, this semester, I ask that you participate in course/instructor evaluation on-line, sometime during the last two weeks of classes. I will remind you as that time approaches and I request that you will take the few minutes involved to provide your perceptions of this course and of my effectiveness by going on ZagWeb, selecting the Online Course Evaluations link, and responding to the questions asked there about this course. Please know that I appreciate your participation in this process. This is a vital part of our efforts at Gonzaga to improve continually our teaching, our academic programs, and our entire educational effort.

University Policies & Resources

Course Expectations
As a Jesuit university that seeks to provide an equal opportunity to learn for all students, this course is offered with the expectation that students are here voluntarily, and understand that the university expects all interactions relating to its courses to occur in the context of a professional academic work environment that is welcoming and accessible to all students regardless of gender, race, ethnicity, religion, disability, sexual orientation or identity and any other non-merit factor in educational programs or activities. This environment includes virtual course environments, such as Blackboard, and any course-related communications via e-mail and social media. We strive to create a healthy environment conducive to intellectual honesty and free inquiry; as such, behaviors which constitute harassment, discrimination, or hostile and/or inappropriate conduct will not be tolerated, and faculty, staff and administrators will take action to ensure such matters are addressed promptly and appropriately.

Academic Honesty
Academic honesty is expected of all Gonzaga University students. Academic dishonesty includes, but is not limited to cheating, plagiarism, and theft. Any student found guilty of academic dishonesty is subject to disciplinary action. Disciplinary action against a student found guilty of academic dishonesty may include but is not limited to: (1) a failing grade for the test or assignment in question; (2) a failing grade for the course; or (3) a recommendation for dismissal from the University. For further information, see also “Academic Honesty” on page 67 of the
University’s online catalogue and University policy, respectively:

Harassment and Non-Discrimination
Gonzaga University recognizes the inherent dignity of all individuals and promotes respect for all people in its activities and programs and in the relationships it shares with students, faculty, staff and the public. Further, the University expects all community members to promote dignity and respect in their daily interactions with each other. Consistent with its mission, the University seeks to assure that all community members are free to learn and work in an atmosphere free from harassment and discrimination. Harassing and discriminatory conduct is contrary to the positive educational environment Gonzaga seeks to foster and maintain. It threatens the well-being of its community members and will not be tolerated by the University. Gonzaga prohibits harassment on the basis of race, sex, gender, marital status, religion, national origin, ethnicity, color, age, veteran status, sexual orientation, physical or mental impairment or disability that substantially limits a major life activity, any other harassment prohibited by federal or state law, or any other non-merit factor in employment, educational program or activities that it operates. Full policy and procedure details, including a separate detailing sexual harassment, are included in the Student Handbook:

Sexual Misconduct
Consistent with its mission, Gonzaga seeks to assure all community members learn and work in a welcoming and inclusive environment. Title VII, Title IX and Gonzaga’s policy prohibit gender-based harassment, discrimination and sexual misconduct. Gonzaga encourages anyone experiencing gender-based harassment, discrimination or sexual misconduct to talk to someone from the Campus and Local Resources list found in the Gonzaga’s Harassment and Non-Discrimination Policy found here: http://www.gonzaga.edu/student-life/Community-Standards/harassment_and_discrimination_policy.asp. It may be helpful to talk about what happened in order to get the support needed and for Gonzaga to respond appropriately. There are options for support and resolution, namely confidential support resources, and campus reporting and support options available. Gonzaga will respond to all reports of sexual misconduct in order to stop the harassment or misconduct, prevent its recurrence and address its effects. Responses may vary from support service referrals to formal investigations. As a faculty member, I want to get you connected to the resources here on campus that can help you in this situation and therefore will report all incidents of sexual misconduct and thus cannot guarantee confidentiality. I will provide our Title IX coordinator with relevant details such as the names of those involved in the incident, and Title IX will reach out to you to explore options for support, safety measures and reporting. For more information about policies and resources or reporting options, please visit the following websites: www.gonzaga.edu/oe and www.gonzaga.edu/titleix. For inquiries, concerns, or to make a report about harassment, discrimination or sexual misconduct or the complaint process, please contact the Title IX Coordinator by phone, email, or in person: Stephanie N. Whaley, Title IX Coordinator, Business
Diversity
At Gonzaga University, diversity affirms our faith-inspired commitment to an inclusive community where human differences thrive within a campus community of equality, solidarity, and common human nature. We seek to nourish difference in an environment characterized by mutual respect and the sustainable creation of a campus climate that attracts and retains community members from diverse backgrounds. In this context, age, gender, ethnicity, disability, social class, religion, culture, sexual orientation, language, and other human differences all contribute to the richness of our academic community life. These differences grace us individually as human beings and collectively as a Jesuit, Catholic and humanistic university striving to fulfill our mission. We aspire to create a university environment that is welcoming and accessible to all students, regardless of gender, race, ethnicity, religion, disability or sexual orientation. Please visit the University Multicultural Education Center website for more information:

https://www.gonzaga.edu/Student-Life/UMEC/default.asp

Disabilities/Medical Conditions:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability/medical condition requiring an accommodation, please call or visit the Disability Access Office in Room 209 Foley Library and extension 4134. You may find more information by visiting their website at:

http://www.gonzaga.edu/disabilityaccess

Computer Labs & Library
Gonzaga-in-Florence provides a computer lab and library. Computers are equipped with a variety of software applications, including Microsoft Word and Excel, and access to internet, as well as printing.