

PHY 620: Modern General Relativity

Spring 2014

Instructor: Patrick Meade

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Class Meeting Time and Location: WF 8:30-9:50 P-125

Office Hours: TBD

Learning Outcomes:

Students who have completed this course

- Should have a deep understanding of the Einstein equations and their underlying mathematical structure
- Should understand the Lagrangian formulation of General Relativity
- Should be able to derive testable physical consequences of General Relativity in various solutions of Einstein's equations
- Should understand phenomena of various black holes and their basic thermodynamic properties
- Should have an understanding of cosmological solutions of General relativity

Required Text: "Spacetime and Geometry: An Introduction to General Relativity" by Sean Carroll (2004)

Course Outline: The first part of this course will focus on building from Special Relativity to General Relativity by investigating manifolds and curvature followed by Einstein's field equations, and the Lagrangian formulation of GR/GR as an effective field theory. We will then investigate solutions of Einstein's equations including certain types of Black Hole solutions and their predictions for GR compared to Newtonian gravity. The last part of the course will focus on the thermodynamic properties of black holes, QFT in curved spacetime, Hawking radiation, information loss paradox and cosmological solutions of GR and open questions in cosmology.

HW: HW assignments will be handed out in class or announced on blackboard throughout the semester. You may work together on them, but the work that you turn in must be your own.

Exams: There will be a midterm and a final exam. The midterm will be held in class on March 27th. The final exam is scheduled for 5/21 from 8:30-11:00 pm, but may be rescheduled!

Grading Policy: Your grade will be determined based on the higher of the following two grading schemes (Midterm 30%, HW 40%, Final 30%) or (Midterm 20%, HW 40%, Final 40%).

ACADEMIC INTEGRITY

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at

<http://www.stonybrook.edu/uaa/academicjudiciary/>

ELECTRONIC COMMUNICATION

Email to your University email account is an important way of communicating with you for this course. For most students the email address is 'firstname.lastname@stonybrook.edu', and the account can be accessed here: <http://www.stonybrook.edu/mycloud>. *It is your responsibility to read your email received at this account.*

For instructions about how to verify your University email address see this: <http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo> . You can set up email forwarding using instructions here: <http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail> . If you choose to forward your University email to another account, we are not responsible for any undeliverable messages.

RELIGIOUS OBSERVANCES

See the policy statement regarding religious holidays at <http://www.stonybrook.edu/registrar/forms/RelHolPol%20081612%20cr.pdf> Students are expected to notify the course professors by email of their intention to take time out for religious observance. This should be done as soon as possible but definitely before the end of the 'add/drop' period. At that time they can discuss with the instructor(s) how they will be able to make up the work covered.

DISABILITIES

If you have a physical, psychiatric/emotional, medical or learning disability that may impact on your ability to carry out assigned course work, you should contact the staff in the Disability Support Services office [DSS], 632-6748/9. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the website <http://www.sunysb.edu/ehs/fire/disabilities.shtml>

CRITICAL INCIDENT MANAGEMENT

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the University Police and the Office of University Community Standards any serious disruptive behavior that interrupts teaching, compromises the safety of the learning environment, and/or inhibits students' ability to learn. See more here: <http://www.stonybrook.edu/sb/behavior.shtml>