

# PHY 556: Solid State Physics II

## PHY 556: Solid State Physics II

**Instructor:** Marivi Fernandez-Serra, Physics B139, [marivi.fernandez-serra@stonybrook.edu](mailto:marivi.fernandez-serra@stonybrook.edu)

**Lecture Time:** Mondays and Wednesdays 2:00-3:20 pm

**Web:** <https://marivifs-teaching.github.io/PHY556-2025>

**Office Hours:** By Appointment,

### Texts:

We will use a combination of books, but our core book will be **Martin, Reining and Ceperley (Interacting electrons: Theory and Computational approaches, Cambridge University Press)**.

### Course Objectives:

- Gaining a practical understanding of computational electronic structure methods in condensed matter physics with focus on Many-Body Physics.
- Learning the theoretical background of many-body perturbation theory.
- Introduction to dynamical mean-field theory and Quantum Monte Carlo simulations.
- Gaining a broad overview in all these methods, acquiring the sufficient basis to enter in the field as a practitioner.

### Lecture organization and topics:

Course material will be presented through lectures on the blackboard, and occasionally with slides. Notes will be posted on the class website as well as further readings. Topics will include:

topic	Ch.
Overview of the Many Electron Problem	I
Experimental signatures of electron Correlation	II
Hamiltonian Models for Interacting Electrons	III
Mean Field Approaches	IV
Correlation functions	V
Many Body wave functions	VI
Particles and Quasi particles: Green's functions	VII
Functionals in Many body physics	VIII
Many Body Perturbation Theory	IX-X
RPA and GW	XI-XIII
Bethe Salpeter equation	XIV
Dynamical mean-field theory	XVI-XX

## Homework:

There will be little homework required, the course will be very interactive and participation through paper presentations will be required. **Participation and project presentation will be worth 100% of the final grade.**

## Exams:

This will be a participative class with no exams but students will be expected to engage in active discussions.

## Americans with Disabilities Act:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. 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. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at [http://www.stonybrook.edu/commcms/academic\\_integrity/](http://www.stonybrook.edu/commcms/academic_integrity/)

## 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 Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

## 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'. 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.

