



Surface Physics

PHYS 566

Fall 2014

[Dr. Carl Rau](#)

Office Hours

TTh 4.00 -
5.15pm

TTh 3.00 - 4.00pm

BRK 103

BRK 340

First meeting: Tuesday, August 26, 2014, 4 pm, room BRK 103. The class is planned to be scheduled for Tuesday and Thursday, 4.00pm - 5.15pm in room BRK 103. Upon request, these times can be rescheduled. Classes 563 and 564 are not prerequisites for this class.

Texts: "Physics at Surfaces", by A. Zangwill is recommended and will be on sale in the bookstore. Further relevant books will be announced in the class. Copies of assigned readings and of literature will be handed out. Links to recent review articles will be provided. The scripts of the class will be provided either as hardcopy printouts or as html-text linked to the chapters of the course outline.

This course will provide an introduction to experimental and theoretical surface physics covering experimental methods and their experimental requirements (ultra-high vacuum (UHV) technology), chemical analysis, epitaxy, nano-scale geometric and electronic structures and devices including nonmagnetic and magnetic quantum wells, artificial superlattices, nano-wires, nano-dots (3D, 2D and 1D confinement), crystal structure, phase transitions, surface- and nano-magnetism, elementary excitations and optical properties at the nano-scale.

This includes a discussion of recent developments in modern surface, nano- and picoscale spectroscopies (photo- and Auger-electron spectroscopy, scanning tunneling/force microscopy/spectroscopy, nano/picoscale non-magnetic and magnetic imaging, etc.) and new devices (spin valves, ferromagnetic single electron transistors, etc.). A large part of the course is dedicated to advancing and sharpening critical thinking skills. Achieving a deeper and more fundamental understanding of basic concepts of physics at macro-, micro- and nanoscales, opens for them the way to explore and discover new phenomena on their own.

The course grade will be based on a report on a selected topic assigned to each enrolled student after discussion with the student.

Students with Disabilities: Any student with a disability requiring accommodations in this course is encouraged to contact me after class or during office hours.

COURSE OUTLINE

0. Experimental surface physics
& experimental requirements (UHV technology)
1. Thermodynamics
2. Chemical analysis
3. Crystal structures
4. Electronic structures
5. Phase transitions
6. Elementary excitations
7. Optical properties
8. Epitaxy and nanoscale electronic structures
9. Surface spectroscopies and nano-devices
10. Outlook



March 27, 2014