Kursnamn Electron Spectroscopy
Name of course

Omfattning (högskolepoäng) 5 hp
ECTS credits

Tidsperiod VT2019 eller HT2019
Course period

Antal platser 25
Maximum number of participants

Undervisningsspråk Engelska
Language of instruction

Kursens syfte samt motivering till varför den bör vara fakultetsgemensam (max 150 ord)
Aim of course and motivation as to why it should be considered “multidisciplinary” to the extent that the faculty should allocate extra financing.

Electron spectroscopy is one of the most versatile and powerful methods to characterize solids, liquids and gases with respect to chemical and physical properties. For historic reasons (e.g. the Nobel prize to Kai Siegbahn), the technique can be viewed as a trade mark of Physics research at UU. The instrumental development has also lead to the founding of the Scienta company.

Electron spectroscopy is presently used by a large number of research groups in chemistry, physics and technology at the Ångström lab and elsewhere in Sweden, both in basic and applied science. The use of electron spectroscopy varies a lot in sophistication, ranging from simple material analysis of the chemical composition of a sample to advanced use of synchrotron radiation to study complex processes such as chemical reactions and charge transfer dynamics. The key feature of the present course is that it links standard use of synchrotron facilities such as MAX IV. That is, the participant obtains an in-depth understanding of several important aspects and gets information of the latest development of the technique (for example time-resolved studies). In this way, the participant will understand the strengths and pitfalls when using electron spectroscopies. In general, an intuitive grasp, rather than theoretical skill, will be emphasized. The course includes descriptions of instrumentation, interpretation of spectra and discussions on various phenomena associated with photoemission, photoabsorption and decay of excited states. Particularly important is to link the use of XPS in its simplest form to the more subtle details addressed in fundamental research.

Kursinnehåll, kursens uppläggning samt examinationsform (max 150 ord)
Contents, study format and form of examination

Introduction to electron spectroscopies, in order of emphasis:
* Photoelectron spectroscopy (UPS, XPS/ESCA, ARUPS, etc.; solids/surfaces and gas phase)
* Auger spectroscopy
* Resonant photoemission, Resonant Auger
* Inverse photoemission, X-ray absorption

Selected topics that will allow for an in depth analysis of material properties linked to the electronic structure are as follows: The photoemission process; Instrumental and experimental aspects; Surface sensitivity; Work function; The photoemission spectrum:
Lifetime broadening, spin orbit splitting, cross section, localization, screening, chemical shifts, core level satellites; Vibrational effects; Angular resolved photoemission (ARUPS) and band mapping; Auger electron spectroscopy; Core hole decay spectroscopy and dynamic effects; X-ray absorption spectroscopy; molecular adsorbate orientation and unoccupied states

Handouts (lecture notes and scientific articles)

The course is given in the form of lectures that cover the basis of the content. In addition, there will be work in groups and individually on various projects, including one oral presentation. Hands-on experience will be provided through practical exercises at one of the two in-house instruments used by the Molecular and Condensed Matter Physics group at the Dept. of Physics and Astronomy. Points will be awarded based on a home exam, project work/presentations and upon discussion participation.

Målgrupp/er (specifiera ämnen/inriktningar) samt rekommenderade förkunskaper
Target group/s (specify, if possible, subject/specialization) and recommended background
Target group: Graduate students interested in applications of one or more of the various electron spectroscopic techniques as a materials characterization method and/or because of the insight into new, fundamental physics.
Recommended background: Courses in Atomic- and Molecular Physics and Solid State Physics or Physical and Materials Chemistry

Huvudansvarig institution: Dept. of Physics and Astronomy
Department with main responsibility

Andra inblandade institutioner: Chemistry Ångström (Reza Younesi)
Other departments involved (specify how).
The contribution from Chemistry Ångströms concerns lecturing on how XPS can be used to study energy related materials.

Kontaktperson/er (namn, e-postadress)
Contact person (name, e-mail address)
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Anmälan om kursdeltagande till
Application from course participants should be sent to
See above!

Senast
Not later than