

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Spektroskopija trdne snovi

Course title: Solid State Spectroscopy

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Univerzitetni študijski program 2. stopnje Fizika	Fizika	2	prvi
2nd cycle academic study program Physics	Physics	2	first

Vrsta predmeta / Course type

izbirni predmet/selectable course

Univerzitetna koda predmeta / University course code:

???

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		15			105	5

Nosilec predmeta / Lecturer:

prof. dr. Janez Dolinšek

Jeziki / Languages:

Predavanja / Lectures: Slovensko/Slovene

Vaje / Tutorial: Slovensko/Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Vpis v letnik študija.

Enrollment into the program.

Vsebina:

- 1. Dielektrična spektroskopija:** makroskopske dielektrične lastnosti kristala; odziv snovi na časovno odvisno električno polje; relaksacijska dinamika; resonančna dinamika; meritev dielektrične konstante.
- 2. Nevtronsko sipanje:** energija, valovna dolžina in valovni vektor termičnih nevtronov; sipanje nevtronov na kristalu; določitev strukture kristalov s sipanjem nevtronov.
- 3. Sipanje svetlobe:** Ramansko, Brillouinovo in Rayleighovo sipanje.
- 4. NMR spektroskopija:** atomsko jedro v magnetnem polju; NMR v klasični in kvantni sliki, spinska relaksacija; spekter; interakcije med jedri in okolico v snovi; dvodimenzionalna NMR spektroskopija.

Content (Syllabus outline):

- 1. Dielectric spectroscopy:** macroscopic dielectric properties of crystals; response of matter to a time-dependent electric field; relaxational dynamics; resonant dynamics; measurement of the dielectric constant.
- 2. Neutron scattering:** energy, wavelength and wavevector of thermal neutrons; neutron scattering on a crystal; crystal structure determination by neutron scattering.
- 3. Light scattering:** Raman, Brillouin and Rayleigh scattering.
- 4. NMR spectroscopy:** atomic nucleus in a magnetic field; classical and quantum pictures of NMR; spin relaxation; the spectrum; interactions between atomic nuclei and surrounding atoms and electrons in matter; two-dimensional NMR spectroscopy.

Temeljni literatura in viri / Readings:

1. H. Kuzmany, Solid State Spectroscopy (Springer, Berlin, Heidelberg, 1998)
2. C. P. Slichter, Principles of Magnetic Resonance (Springer, Berlin, Heidelberg, 1980)
3. R. R. Ernst, G. Bodenhausen, A. Wokaun, Principles of Nuclear Magnetic Resonance in One and Two Dimensions (Clarendon Press, Oxford, 1987)

Cilji in kompetence:

Objectives and competences:

Cilji:

Študent spozna moderne spektroskopske metode za raziskave fizike snovi.

Predmetno specifične kompetence:
Poznavanje in razumevanje interakcije elektromagnetnega polja s snovjo; povezava spektroskopskih podatkov s fizikalnimi lastnostmi snovi.

Objectives:

Student gets acquainted with modern spectroscopic methods for the research of matter.

Competences:

Knowledge and understanding of interaction of the electromagnetic field with matter; relating spectroscopic data to physical properties of matter.

Predvideni študijski rezultati:**Znanje in razumevanje:**

Pridobitev znanja in razumevanja eksperimentalnih spektroskopskih metod za raziskave snovi.

Uporaba:

Sposobnost dela z različnimi tipi spektrometrov v eksperimentalnih laboratorijih.

Refleksija

Kritično ovrednotenje spektroskopskih eksperimentalnih podatkov, njihove natančnosti in zanesljivosti.

Prenosljive spretnosti - niso vezane le na en predmet

Sposobnost dela na kompleksnih aparaturah, zajemanja podatkov ter analize. Sposobnost določanja natančnosti meritve.

Intended learning outcomes:**Knowledge and understanding:**

Gaining knowledge and understanding of various experimental spectroscopic methods for the research of matter.

Application:

Ability to use different kinds of spectrometers in experimental research laboratories.

Reflection

Critical evaluation of spectroscopic data, their accuracy and reliability.

Transferable skills

The ability of using complex equipmental equipment, data collection and analysis. Ability of assessing the accuracy of measurements.

Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, vaje.	Lectures, exercises.
-------------------	----------------------

Načini ocenjevanja:

Delež (v
%) /
Weight (in
%)

Assessment:

pisni ali ustni izpit ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	100%	written or oral exam grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)
--	-------------	--

Reference nosilca / Lecturer's references:

<p>Janez Dolinšek</p> <p>Publications:</p> <ul style="list-style-type: none"> - 258 original papers in the period 1983-2014 in international journals in the fields of condensed matter physics, materials science and nuclear magnetic resonance; - more than 2600 pure citations in scientific literature; - Hirsch index = 26; - large number of invited lectures at international conferences, Universities and Institutes. <p>Awards:</p> <ul style="list-style-type: none"> - Zois prize 2010 of the Republic Slovenia for outstanding achievements in solid state physics - Zois recognition 2001 for important achievements in solid state physics.
--