Study plan

Name of study plan: Inženýrství pevných látek

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Solid State Engineering
Type of study: Follow-up master full-time
Required credits: 0
Elective courses credits: 120
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 0
The role of the block: P

Code of the group: NMSPIPL1
Name of the group: MDP P_IPLN 1st year
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 11 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11FDEL	**Physics of Dielectrics** *Zdeněk Bryknar, Kateřina Aubrechtová Dragounová **Kateřina Aubrechtová Dragounová** Kateřina Aubrechtová Dragounová (Gar.)*	ZK	2	2P+0C	L	P
11FKOV	**Physics of Metals** *Hanuš Seiner Hanuš Seiner (Gar.)*	ZK	2	2P+0C	Z	P
11FMGL	**Physics of Magnetic Solids** *Jaroslav Hamrle, Štefan Zajac **Štefan Zajac** Jaroslav Hamrle (Gar.)*	ZK	2	2P+0C	L	P
11POLO	**Physics of Semiconductors** *Martin Ledinský **Martin Ledinský** Martin Ledinský (Gar.)*	ZK	4	4P+0C	Z	P
11PSP	**Practical Exercises from Solid State Structure Analysis** *Jiří Čapek, Monika Kučeráková Jiří Čapek (Gar.)*	KZ	6		Z	P
11SAE1	**Seminar and Excursions 1** *Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)*	Z	5		Z	P
11SMEX1	**Seminar and Excursions 1** ***Jan Drahokoupil***	Z	4	2P+2S	Z	P
11SAE2	**Seminar and Excursions 2** *Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)*	Z	5		L	P
11SMEX2	**Seminar and Excursions 2** ***Jan Drahokoupil***	Z	4	2P+2S	L	P
11STPL	**Seminar in Solid State Theory** *Hanuš Seiner, Petr Sedlák, Dalibor Repček **Hanuš Seiner** Petr Sedlák (Gar.)*	KZ	2	0+2	L	P
11TPL1	**Solid State Theory 1** *Jaroslav Hamrle, Ladislav Kalvoda **Ladislav Kalvoda** Jaroslav Hamrle (Gar.)*	ZK	6	4+0	Z	P
11TPL2	**Solid State Theory 2** *Jaroslav Hamrle, Ladislav Kalvoda **Ladislav Kalvoda** Ladislav Kalvoda (Gar.)*	ZK	3	2+0	L	P
11VUIP1	**Research Project 1** *Ladislav Kalvoda **Ladislav Kalvoda** Ladislav Kalvoda (Gar.)*	Z	6	0+6	Z	P
11VUIP2	**Research Project 2** *Ladislav Kalvoda **Ladislav Kalvoda** Ladislav Kalvoda (Gar.)*	KZ	8	0+8	L	P

Characteristics of the courses of this group of Study Plan: Code=NMSPIPL1 Name=MDP P_IPLN 1st year

11FDEL	Physics of Dielectrics	ZK	2
Electrical, thermal, and mechanical properties of dielectrics and switching of polarization in ferroelectrics are described in details. Interaction of electromagnetic field with dielectric materials is studied in a wide frequency range from point of view of classical and quantum physics.			
11FKOV	Physics of Metals	ZK	2
The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of metals and alloys.			

11FMGL	Physics of Magnetic Solids	ZK	2
The origin of the magnetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substances with spontaneous magnetization - ferromagnetic, antiferromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance phenomena. Spintronics.			
11POLO	Physics of Semiconductors	ZK	4
Lectures give an overview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric, galvanomagnetic, thermoelectric, thermomagnetic, photoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of their effective modification and optimization. Considerable attention is also paid to explanation of the properties of P-N junction and metal-semiconductor contact.			
11PSP	Practical Exercises from Solid State Structure Analysis	KZ	6
The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.			
11SAE1	Seminar and Excursions 1	Z	5
The subject is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and undergraduates			
11SMEX1	Seminar and Excursions 1	Z	4
The subject is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and undergraduates			
11SAE2	Seminar and Excursions 2	Z	5
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11SMEX2	Seminar and Excursions 2	Z	4
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11STPL	Seminar in Solid State Theory	KZ	2
The purpose of this lecture is to solve numerical problems of theory of solids and physics of condensed state.			
11TPL1	Solid State Theory 1	ZK	6
Types of bonds in solids. Symmetry of crystalline solids. Vibrations of crystalline lattice and its thermal properties. Band electron structure of crystalline solids. Localized states of electrons in nonideal solids.			
11TPL2	Solid State Theory 2	ZK	3
Electric, magnetic and thermal properties of itinerant electrons in solids, Bolzmann kinetic equation, transport and optical phenomena in solids			
11VUIP1	Research Project 1	Z	6
11VUIP2	Research Project 2	KZ	8

Code of the group: NMSPIPL2
Name of the group: MDP P_IPLN 2nd year
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 8 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11DPIP1	**Master Thesis 1** *Ladislav Kalvoda* ***Ladislav Kalvoda*** *Ladislav Kalvoda (Gar.)*	Z	10	0+10	Z	P
11DPIP2	**Master Thesis 2** *Ladislav Kalvoda* ***Ladislav Kalvoda*** *Ladislav Kalvoda (Gar.)*	Z	20	0+20	L	P
11FPOR	**Physics of Surfaces and Interfaces** *Ladislav Kalvoda Ladislav Kalvoda (Gar.)*	ZK	2	2P+0C	Z	P
11OPTX	**Optical Properties of Solids** *Zdeněk Bryknar, Eva Mihóková* ***Eva Mihóková*** *Eva Mihóková (Gar.)*	ZK	2	2P+0C	Z	P
11SIKL	**Computer Simulation of Condensed Matter** *Ladislav Kalvoda* ***Ladislav Kalvoda*** *Ladislav Kalvoda (Gar.)*	ZK	4	2+2	Z,L	P
11SIK	**Computer Simulation of Condensed Matter** *Petr Sedlák, Ladislav Kalvoda Ladislav Kalvoda (Gar.)*	Z,ZK	5		Z	P
11SAE3	**Seminar and Excursions 3** *Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)*	Z	5		Z	P
11SMEX3	**Seminar and Excursions 3** ***Petr Kolenko***	Z	4	2P+2S	Z	P
11SMEX4	**Seminar and Excursions 4** ***Petr Kolenko***	Z	4	2P+2S	L	P
11SAE4	**Seminar and Excursions 4** *Jan Drahokoupil, Petr Kolenko Jan Drahokoupil (Gar.)*	Z	5		L	P
11VDM	**Intrinsic Dynamics of Materials** *Hanuš Seiner* ***Hanuš Seiner*** *Hanuš Seiner (Gar.)*	ZK	3	2+0	Z	P

Characteristics of the courses of this group of Study Plan: Code=NMSPIPL2 Name=MDP P_IPLN 2nd year

11DPIP1	Master Thesis 1	Z	10
On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.			
11DPIP2	Master Thesis 2	Z	20
On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.			

11FPOR	Physics of Surfaces and Interfaces	ZK	2
Description is provided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for bulk sysstems are juxtaposed with the changes due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to preparation of surface structures and to study of chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for analysis and prediction of properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies.			
11OPTX	Optical Properties of Solids	ZK	2
This course gives an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light propagation are discussed for a wide range of materials, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the observed phenomena are discussed from point of their application.			
11SIKL	Computer Simulation of Condensed Matter	ZK	4
Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. Thus, solution of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical background of basic computation methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed explication of the computation methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are using Material Studio simulation environment (Accelrys Software Inc.).			
11SIK	Computer Simulation of Condensed Matter	Z,ZK	5
Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. Thus, solution of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical background of basic computation methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed explication of the computation methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are using Material Studio simulation environment (Accelrys Software Inc.).			
11SAE3	Seminar and Excursions 3	Z	5
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11SMEX3	Seminar and Excursions 3	Z	4
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11SMEX4	Seminar and Excursions 4	Z	4
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11SAE4	Seminar and Excursions 4	Z	5
Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.			
11VDM	Intrinsic Dynamics of Materials	ZK	3
The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagation (and its interaction with the microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.			

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 0
The role of the block: PV

Code of the group: NMSPIPLPV1
Name of the group: MDP P_IPLN Required optional courses 1st year
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 0
Note on the group: Student si volí alespoň 1 předmět

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11EP	**Practical Training in Electronics** ***Pavel Jiroušek***	KZ	4	0+4	Z	PV
11EPR	**Practical Training in Electronics** *Pavel Jiroušek Pavel Jiroušek (Gar.)*	KZ	6		Z	PV
11PPOL	**Practical Training of Semiconductors** ***Petr Levinský***	KZ	4	4	L	PV
11PFPL	**Practical Training of Semiconductors** *Petr Levinský Petr Levinský (Gar.)*	KZ	6		L	PV
11PSP	**Practical Exercises from Solid State Structure Analysis** *Jiří Čapek, Monika Kučeráková Jiří Čapek (Gar.)*	KZ	6		Z	PV
11PSPL	**Practical Exercises from Solid State Structure Analysis** ***Jiří Čapek***	KZ	4	4	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPIPLPV1 Name=MDP P_IPLN Required optional courses 1st year

11PSP	Practical Exercises from Solid State Structure Analysis	KZ	6
The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.			

11EP	Practical Training in Electronics	KZ	4
Practical training in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation. Practical training includes linear circuits, digital circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem concerning their own scientific activity.			
11EPR	Practical Training in Electronics	KZ	6
Practical training in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation. Practical training includes linear circuits, digital circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem concerning their own scientific activity.			
11PPOL	Practical Training of Semiconductors	KZ	4
The aim of this practical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of basic properties of semiconductor materials and devices.			
11PFPL	Practical Training of Semiconductors	KZ	6
The aim of this practical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of basic properties of semiconductor materials and devices.			
11PSPL	Practical Exercises from Solid State Structure Analysis	KZ	4
The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.			

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: NMSPIPLV
Name of the group: MDP P_IPLN Optional courses
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
11AND	**Applied Neutron Diffractometry** *Monika Kučeráková, Stanislav Vratislav* ***Monika Kučeráková*** *Stanislav Vratislav (Gar.)*	ZK	2	2	Z	v
11CHA	**Chemical Aspects of Solids** *Karel Knížek* ***Karel Knížek*** *Karel Knížek (Gar.)*	ZK	2	2	L	v
11DAN	**Diffraction Analysis of Mechanical Stress** *Nikolaj Ganev, Ivo Kraus* ***Nikolaj Ganev*** *Nikolaj Ganev (Gar.)*	ZK	2	2	Z	v
11DMSX	**Diffraction Methods of Structural Biology** *Jan Dohnálek* ***Jan Dohnálek*** *Jan Dohnálek (Gar.)*	Z,ZK	3	2P+1C	L	v
11FPPL	**Physics of Solid State Phase Transitions** *Jiří Hlinka* ***Jiří Hlinka*** *Jiří Hlinka (Gar.)*	ZK	2	2	L	v
12FDD	**Physics of Detection and Detectors of Optical Radiation** *Ladislav Pína* ***Ladislav Pína*** *Ladislav Pína (Gar.)*	ZK	2	2+0	Z	v
02FG	**Physics of graphene described by Dirac equation** *Vít Jakubský* ***Vít Jakubský*** *Vít Jakubský (Gar.)*	Z	2	2P+0C	L	v
12FOPT	**Optical Physics** *Ivan Richter, Pavel Kwiecien* ***Pavel Kwiecien*** *Ivan Richter (Gar.)*	Z,ZK	3	3+0	Z	v
11KO	**Metallic Oxides** *Jiří Hejtmánek* ***Jiří Hejtmánek*** *Jiří Hejtmánek (Gar.)*	ZK	2	2	Z,L	v
12KOP	**Quantum Optics** *Ivan Richter, Miroslav Dvořák* ***Miroslav Dvořák*** *Ivan Richter (Gar.)*	Z,ZK	5	3+1	L	v
11MAM	**Magnetic Materials** *Oleg Heczko* ***Oleg Heczko*** *Oleg Heczko (Gar.)*	ZK	2	2+0	Z	v
11MONA	**Molecular Nanosystems** *Irena Kratochvílová* ***Irena Kratochvílová*** *Irena Kratochvílová (Gar.)*	ZK	2	2	Z	v
11NAMA	**Nanomaterials - Preparation and Characteristics** *Irena Kratochvílová* ***Irena Kratochvílová*** *Irena Kratochvílová (Gar.)*	Z,ZK	2	2+0	L	v
11NMV	**Neutronography in Material Research** *Monika Kučeráková, Stanislav Vratislav* ***Monika Kučeráková*** *Monika Kučeráková (Gar.)*	ZK	2	2	L	v
11OSAL	**Optical Spectroscopy of Inorganic Solids** *Zdeněk Potůček* ***Zdeněk Potůček*** *Zdeněk Potůček (Gar.)*	ZK	2	2	L	v
11PMK1	**Macromolecular Crystallography Laboratory 1** *Tomáš Kovaľ* ***Tomáš Kovaľ*** *Tomáš Kovaľ (Gar.)*	KZ	4	0+4	Z	v
11PMK2	**Macromolecular Crystallography Laboratory 2** *Tomáš Kovaľ* ***Tomáš Kovaľ*** *Tomáš Kovaľ (Gar.)*	KZ	4	0+4	L	v
11PAO	**Principles and Applications of Optical Sensors with Practical Trainings** *Jan Aubrecht* ***Jan Aubrecht*** *Jan Aubrecht (Gar.)*	ZK	2	2	L	v

11RTSW	**Real Time Software** *Pavel Jiroušek, Martin Dráb* ***Martin Dráb*** *Pavel Jiroušek (Gar.)*	Z	3	2	L	v
11SEM	**Scanning Electron Microscopy and Microbeam Analysis Methods** *Jaromír Kopeček* ***Jaromír Kopeček*** *Jaromír Kopeček (Gar.)*	ZK	2	2+0	Z	v
11SMAM	**Smart Materials and Their Applications** *Petr Sedlák, Zdeněk Potůček* ***Zdeněk Potůček*** *Zdeněk Potůček (Gar.)*	ZK	2	2+0	L	v
01SUP	**Start-up Project** *Přemysl Rubeš* ***Přemysl Rubeš*** *Přemysl Rubeš (Gar.)*	KZ	2	2P+0C		v
11SUPR	**Superconductivity and Low Temperature** *Martin Ledinský, Zdeněk Janů* ***Martin Ledinský*** *Martin Ledinský (Gar.)*	ZK	4	4	Z	v
11PCPC	**Theory and Construction of Photovoltaic Cells** *Jiří Pfleger* ***Jiří Pfleger*** *Jiří Pfleger (Gar.)*	ZK	2	2	Z	v
11VPSX	**Selected Topics of Solid State Structure** *Jan Drahokoupil* ***Jan Drahokoupil*** *Jan Drahokoupil (Gar.)*	Z,ZK	2	1P+1C	L	v

Characteristics of the courses of this group of Study Plan: Code=NMSPIPLV Name=MDP P_IPLN Optional courses

11AND	Applied Neutron Diffractometry	ZK	2

This lecture introduces the neutron diffraction method as the method used in solid state physics research and the materials sciences. The basic principles of the nuclear and magnetic neutron scattering are given, as well as the comparative properties to the X-ray method. The basic concept of this method is illustrated by many practical examples.

11CHA	Chemical Aspects of Solids	ZK	2

The purpose of this lecture is an interpretation of the chemical bonding in solids. The principle of band structure calculation is demonstrated with the help of Tight-binding method. The relations between crystal and electronic structure are manifested for selected materials.

11DAN	Diffraction Analysis of Mechanical Stress	ZK	2

Course description: The course contains the fundamentals of diffraction stress analysis with a strong emphasis on the illustrations of the capability of X-ray diffraction to solve engineering problems.

11DMSX	Diffraction Methods of Structural Biology	Z,ZK	3

Determination of 3D structure of biological macromolecules, such as proteins, nucleic acids or their complexes, by the means of physical methods is crucial for new trends in biotechnologies, biomedicine and also in basic molecular biology research. Individual methods of three-dimensional structure determination will be explained with a focus on the individual steps of single crystal diffraction analysis. Practical examples of application in biotechnologies and medicine will be discussed. The practicals will cover several basic steps leading to determination of a new molecular structure.

11FPPL	Physics of Solid State Phase Transitions	ZK	2

A number of interesting properties of crystalline materials are directly related or significantly influenced by occurrence of specific phase transitions. The purpose of this course is to provide unifying view on various types phase transitions encountered in solid state physics, with the emphasize on continuous symmetry braking phase transitions.

12FDD	Physics of Detection and Detectors of Optical Radiation	ZK	2

Electromagnetic spectrum. Sources of electromagnetic radiation. Radiometric and photometric units. Ideal detector. External and internal photoefect. Quantum fluctuations of radiation. Noise of detector and electronic circuits. Dynamic range. Detectors based on external photoefect. Photocathodes. Electron multipliers. Microchannel plates. Image intensifiers. Detectors based on internal photoefect. Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray detectors.. Pyroelectricity and pyrodetectors. Detector electronic circuits. Human eye.

02FG	Physics of graphene described by Dirac equation	Z	2

General description of crystal. Tight-binding model of graphene and its approximation in terms of Dirac equation.Transport of Dirac fermions in graphene in presence of external fields and related phenomena. Bilayer graphene, its description and properties in the external magnetic field. Carbon nanotubes, their classification. Basic description of graphene nanoribbons,boundary conditions and energy. Dirac fermions in curved space, fullerenes. Other Dirac materials.

12FOPT	Optical Physics	Z,ZK	3

The lecture covers the basics of optical physics. It systematically discusses the optical wave propagation in vacuum, in isotropic and anisotropic media, and on their boundaries. It also classifies types of optical waves. Next, it describes the polarization and its applications, statistical properties of polychromatic waves, fundamentals of two and multiwave interference.

11KO	Metallic Oxides	ZK	2

Crystal structures, chemical composition and characteristic electronic properties of oxides is presented. Namely electronic and thermal transport, specific heat, thermoelectric coefficient, magnetic interactions and long range magnetic order are discussed. Phase transitions as a consequence of mutual interplay of lattice, transport and magnetic effects and metal-insulator transition tuned via chemical composition and temperature are documented. Orbital, spin and charge ordered (disordered) states are exemplified using the salient oxide families - colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoelectrics.

12KOP	Quantum Optics	Z,ZK	5

The lecture covers the advanced topics in quantum optics, consequentially to the previous course of Quantum electronics. It systematically discusses especially the statistical properties of radiation, coherent states of electromagnetic field, quantum description of optical radiation, special states of fields, with respect to quasi-probability densities and characteristic functions. Next, the attention is given both to Dirac quantum theory of interaction of quantized electromagnetic field with a quantum system (including spontaneous emission) and quantum theory of scattering (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given both to the quantum theory of coherence (quantum theory of detection, quantum correlation functions), in relation to classical theory. The course is further devoted to generalized higher-order coherence theory, coherent properties of special states of fields, and quantum theory of damping (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally, the attention is given to review of nonclassical measuring techniques (photocounting, intensity interferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectroscopy), possibilities of measuring the quantum state of light, and some selected parts of modern quantum optics (squeezed states). The lectures are accompanied with practical example exercises.

11MAM	Magnetic Materials	ZK	2

The course deals with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general theoretical courses of magnetism) is followed by description of individual effects and their usage in recent technics and technologies. We will manifest that existence of the contemporary civilization without magnetic materials is impossible. Important part of the course is devoted to introduction into measurements of various magnetic properties of solids.

11MONA	Molecular Nanosystems	ZK	2

The main goal of the lecture is to show possibilities to use selected molecules properties in molecular nanodevices.

11NAMA	Nanomaterials - Preparation and Characteristics	Z,ZK	2

The course describes methods of preparation of nanomaterials, their structure, specific properties and applications. The properties of carbon and silicon nanobodies and layers will be analyzed in detail. The aim of the subject is to explain the relationships between physical / chemical properties of nanoparticulate materials and their main structural features.

11NMV	Neutronography in Material Research	ZK	2

Neutron diffraction is a powerful method for a detailed understanding of the static and dynamic properties on atomic scale of materials in many field of sciences and industry. This course introduces to the fundamental principles of nuclear and magnetic scattering and penetration of thermal neutrons. From this point of view the following aspects are very important: sample size in relation to industrial scaling, neutron penetration though machinable materials (and consequent case of construction of environmental chambers), neutron atomic contrast and magnetic scattering possibilities. Examples of the different neutron scattering techniques are given.

11OSAL	Optical Spectroscopy of Inorganic Solids	ZK	2
Relationship between experimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in solids, such as absorption spectrum, emission spectrum or decay and efficiency of luminescence, is illustrated by an example of color centers, rare-earth ions, and transition metal ions in insulators. Particular emphasis is put on influence of lattice symmetry and vibrations on spectroscopic properties of optically active centers. Attention is also paid to physical basis of the experimental techniques commonly used in optical spectroscopy of solids, to non-radiative energy transfer between adjacent centers and formation of their aggregates with distinct spectroscopic properties occurring in the case of sufficiently high concentrations of optical centers, and to optical processes operating in solid-state lasers.			
11PMK1	Macromolecular Crystallography Laboratory 1	KZ	4
The subject introduces the students to practical aspects of macromolecular crystallography.			
11PMK2	Macromolecular Crystallography Laboratory 2	KZ	4
The subject introduces the students to computational approaches of macromolecular crystallography.			
11PAO	Principles and Applications of Optical Sensors with Practical Trainings	ZK	2
This course gives an introductory into the optical sensors. The fundamental principles of absorption, luminescence and SPR sensors are discussed for a wide range of application.Course description: First part of this course gives an introductory into theory of the electromagnetic field. Second part describes the wave phenomena in mechanics and electromagnetism. Third part is devoted to introduction into atomic physics.			
11RTSW	Real Time Software	Z	3
The seminar is the introduction to the problematic of the real time software. It describes the specifics of RT software and shows commonly used solutions.			
11SEM	Scanning Electron Microscopy and Microbeam Analysis Methods	ZK	2
The aim of the lecture is to familiarize students with the work on scanning electron microscope (SEM) and the possibilities of bundle analytical methods available on such devices. With regard to physical principles, the display methods, analytical methods available on SEM and sampling techniques will be analyzed. The student should be able to easily train on a specific device, after the necessary practical training to prepare a sample and choose the right technique for solving a specific problem, but also to make general orientation in the available experimental techniques.			
11SMAM	Smart Materials and Their Applications	ZK	2
Smart or responsive materials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by changes in some external conditions. The properties responding to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for. The number of their applications is growing steadily. Passive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, vascular stents, eyeglass frames, cellular phone antennas, light sensitive glasses or photochromic and thermochromic clothes could serve as a few examples. Lectures are focused on physical properties, experimental methods of investigation and possible application of color changing materials, light emitting materials, piezoelectric materials, conducting polymers, dielectric elastomers, ferroelectric materials and shape-memory materials. Attention is also paid to the effect of phase transitions on physical properties of smart materials and to their numerical simulations.			
01SUP	Start-up Project	KZ	2
11SUPR	Superconductivity and Low Temperature	ZK	4
The subject of course is: low temperature physics, including cooling methods, low temperature technique, and measurement of low temperatures; macroscopic quantum phenomena in quantum fluids (superfluidity and superconductivity), quantum crystals and diffusion, mesoscopic phenomena in electron systems, quantum Hall effects, Coulomb blockade and single electron transistor.			
11PCPC	Theory and Construction of Photovoltaic Cells	ZK	2
The course is aimed to provide a theoretical background of the photovoltaic solar energy conversion. It is focused not only on the classical crystalline silicon cells but it follows also modern trends in exploiting new materials, including polymers, and new physical principles. The students will learn mathematical and theoretical background of the photovoltaic effect in various functional structures and materials. The part of the course will be dedicated to the practical and economical aspects of the application of solar cells in the distribution power networks. The life cycle assessment will provide students with better understanding of the relation between the photovoltaic cells application and environmental protection.			
11VPSX	Selected Topics of Solid State Structure	Z,ZK	2
The lecture cycle focuses on the structure of solids from the point of view of the arrangement of atoms. The first part focuses on application-interesting structures from metallic materials to molecular crystals. In the second part we will look at the possibilities of observing the atomic structure using X-rays, both from the point of view of the average and the local structure. Objective of the course is also the use of special programs designed to study and analyze the structure and microstructure of solids.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
01SUP	Start-up Project	KZ	2
02FG	Physics of graphene described by Dirac equation	Z	2
General description of crystal. Tight-binding model of graphene and its approximation in terms of Dirac equation.Transport of Dirac fermions in graphene in presence of external fields and related phenomena. Bilayer graphene, its description and properties in the external magnetic field. Carbon nanotubes, their classification. Basic description of graphene nanoribbons,boundary conditions and energy. Dirac fermions in curved space, fullerenes. Other Dirac materials.			
11AND	Applied Neutron Diffractometry	ZK	2
This lecture introduces the neutron diffraction method as the method used in solid state physics research and the materials sciences. The basic principles of the nuclear and magnetic neutron scattering are given, as well as the comparative properties to the X-ray method. The basic concept of this method is illustrated by many practical examples.			
11CHA	Chemical Aspects of Solids	ZK	2
The purpose of this lecture is an interpretation of the chemical bonding in solids. The principle of band structure calculation is demonstrated with the help of Tight-binding method. The relations between crystal and electronic structure are manifested for selected materials.			
11DAN	Diffraction Analysis of Mechanical Stress	ZK	2
Course description: The course contains the fundamentals of diffraction stress analysis with a strong emphasis on the illustrations of the capability of X-ray diffraction to solve engineering problems.			
11DMSX	Diffraction Methods of Structural Biology	Z,ZK	3
Determination of 3D structure of biological macromolecules, such as proteins, nucleic acids or their complexes, by the means of physical methods is crucial for new trends in biotechnologies, biomedicine and also in basic molecular biology research. Individual methods of three-dimensional structure determination will be explained with a focus on the individual steps of single crystal diffraction analysis. Practical examples of application in biotechnologies and medicine will be discussed. The practicals will cover several basic steps leading to determination of a new molecular structure.			

11DPIP1	Master Thesis 1	Z	10
	On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.		
11DPIP2	Master Thesis 2	Z	20
	On the basis of the assignment and under the supervision of the supervisor, the student prepares an individually assigned topic for 2 semesters.		
11EP	Practical Training in Electronics	KZ	4
	Practical training in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation. Practical training includes linear circuits, digital circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem concerning their own scientific activity.		
11EPR	Practical Training in Electronics	KZ	6
	Practical training in electronics gives practical experience in the design of selected electronic circuits. Students obtain basic skill in the circuit realisation. Practical training includes linear circuits, digital circuits and exercise in the programming of microprocessor control system. Students are allowed to work on the electronic problem concerning their own scientific activity.		
11FDEL	Physics of Dielectrics	ZK	2
	Electrical, thermal, and mechanical properties of dielectrics and switching of polarization in ferroelectrics are described in details. Interaction of electromagnetic field with dielectric materials is studied in a wide frequency range from point of view of classical and quantum physics.		
11FKOV	Physics of Metals	ZK	2
	The purpose of this lecture is to introduce the undergraduate students to the study of the physical properties of metals and alloys.		
11FMGL	Physics of Magnetic Solids	ZK	2
	The origin of the magnetic moment. Fundamental magnetic interactions. Magnetic susceptibility. Diamagnetism and paramagnetism. Substances with spontaneous magnetization - ferromagnetic, antiferromagnetic, ferrimagnetic ordering. Domain structure and magnetization processes. Magnetic relaxation and resonance phenomena. Spintronics.		
11FPOR	Physics of Surfaces and Interfaces	ZK	2
	Description is provided of basic thermodynamic properties, atomary and electronic structure of surfaces and interfaces. The physical models valid for bulk sysstems are juxtaposed with the changes due to introduction of new surface/interface. The theoretical treatment is followed by overview of experimental techniques applied to preparation of surface structures and to study of chemical composition and structural arrangement of the latter. In addition, brief overview is given of simulation approaches suitable for analysis and prediction of properties of selected systems. All the subjects are demonstrated on praktical exaples of case studies.		
11FPPL	Physics of Solid State Phase Transitions	ZK	2
	A number of interesting properties of crystalline materials are directly related or significantly influenced by occurrence of specific phase transitions. The purpose of this course is to provide unifying view on various types phase transitions encountered in solid state physics, with the emphasize on continuous symmetry braking phase transitions.		
11KO	Metallic Oxides	ZK	2
	Crystal structures, chemical composition and characteristic electronic properties of oxides is presented. Namely electronic and thermal transport, specific heat, thermoelectric coefficient, magnetic interactions and long range magnetic order are discussed. Phase transitions as a consequence of mutual interplay of lattice, transport and magnetic effects and metal-insulator transition tuned via chemical composition and temperature are documented. Orbital, spin and charge ordered (disordered) states are exemplified using the salient oxide families - colossal magnetoresistance manganites, high temperature superconducting cuprates and cobalt oxide thermoelectrics.		
11MAM	Magnetic Materials	ZK	2
	The course deals with a broad scale of magnetic materials with emphasis on their applications. A brief introduction (referring to the former, more general theoretical courses of magnetism) is followed by description of individual effects and their usage in recent technics and technologies. We will manifest that existence of the contemporary civilization without magnetic materials is impossible. Important part of the course is devoted to introduction into measurements of various magnetic properties of solids.		
11MONA	Molecular Nanosystems	ZK	2
	The main goal of the lecture is to show possibilities to use selected molecules properties in molecular nanodevices.		
11NAMA	Nanomaterials - Preparation and Characteristics	Z,ZK	2
	The course describes methods of preparation of nanomaterials, their structure, specific properties and applications. The properties of carbon and silicon nanobodies and layers will be analyzed in detail. The aim of the subject is to explain the relationships between physical / chemical properties of nanoparticulate materials and their main structural features.		
11NMV	Neutronography in Material Research	ZK	2
	Neutron diffraction is a powerful method for a detailed understanding of the static and dynamic properties on atomic scale of materials in many field of sciences and industry. This course introduces to the fundamental principles of nuclear and magnetic scattering and penetration of thermal neutrons. From this point of view the following aspects are very important: sample size in relation to industrial scaling, neutron penetration though machinable materials (and consequent case of construction of environmental chambers), neutron atomic contrast and magnetic scattering possibilities. Examples of the different neutron scattering techniques are given.		
11OPTX	Optical Properties of Solids	ZK	2
	This course gives an introductory into the optical properties of solids. The fundamental principles of absorption, reflection, luminescence and light propagation are discussed for a wide range of materials, including crystalline insulators, semiconductors, and metals. Classical and quantum models are used as appropriate, and the observed phenomena are discussed from point of their application.		
11OSAL	Optical Spectroscopy of Inorganic Solids	ZK	2
	Relationship between experimental data and theoretical models that allow us elucidate and predict spectroscopic properties of optical centers in solids, such as absorption spectrum, emission spectrum or decay and efficiency of luminescence, is illustrated by an example of color centers, rare-earth ions, and transition metal ions in insulators. Particular emphasis is put on influence of lattice symmetry and vibrations on spectroscopic properties of optically active centers. Attention is also paid to physical basis of the experimental techniques commonly used in optical spectroscopy of solids, to non-radiative energy transfer between adjacent centers and formation of their aggregates with distinct spectroscopic properties occurring in the case of sufficiently high concentrations of optical centers, and to optical processes operating in solid-state lasers.		
11PAO	Principles and Applications of Optical Sensors with Practical Trainings	ZK	2
	This course gives an introductory into the optical sensors. The fundamental principles of absorption, luminescence and SPR sensors are discussed for a wide range of application.Course description: First part of this course gives an introductory into theory of the electromagnetic field. Second part describes the wave phenomena in mechanics and electromagnetism. Third part is devoted to introduction into atomic physics.		
11PCPC	Theory and Construction of Photovoltaic Cells	ZK	2
	The course is aimed to provide a theoretical background of the photovoltaic solar energy conversion. It is focused not only on the classical crystalline silicon cells but it follows also modern trends in exploiting new materials, including polymers, and new physical principles. The students will learn mathematical and theoretical background of the photovoltaic effect in various functional structures and materials. The part of the course will be dedicated to the practical and economical aspects of the application of solar cells in the distribution power networks. The life cycle assessment will provide students with better understanding of the relation between the photovoltaic cells application and environmental protection.		
11PFPL	Practical Training of Semiconductors	KZ	6
	The aim of this practical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of basic properties of semiconductor materials and devices.		
11PMK1	Macromolecular Crystallography Laboratory 1	KZ	4
	The subject introduces the students to practical aspects of macromolecular crystallography.		

11PMK2	Macromolecular Crystallography Laboratory 2	KZ	4
	The subject introduces the students to computational approaches of macromolecular crystallography.		
11POLO	Physics of Semiconductors	ZK	4
	Lectures give an overview of fundamental physical phenomena used for design and operation of semiconductor elements. Physics of electric, galvanomagnetic, thermoelectric, thermomagnetic, photoelectric and optical properties of intrinsic and doped semiconductors is explained in detail with respect to possibilities of their effective modification and optimization. Considerable attention is also paid to explanation of the properties of P-N junction and metal-semiconductor contact.		
11PPOL	Practical Training of Semiconductors	KZ	4
	The aim of this practical training is to introduce the students with the fundamentals of semiconductors technology and with practical measurements of basic properties of semiconductor materials and devices.		
11PSP	Practical Exercises from Solid State Structure Analysis	KZ	6
	The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.		
11PSPL	Practical Exercises from Solid State Structure Analysis	KZ	4
	The aim of this practical training is to introduce the students the fundamentals of X-ray and neutron diffraction methods for diagnostics of structure dependant properties of solids.		
11RTSW	Real Time Software	Z	3
	The seminar is the introduction to the problematic of the real time software. It describes the specifics of RT software and shows commonly used solutions.		
11SAE1	Seminar and Excursions 1	Z	5
	The subject is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and undergraduates		
11SAE2	Seminar and Excursions 2	Z	5
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SAE3	Seminar and Excursions 3	Z	5
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SAE4	Seminar and Excursions 4	Z	5
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SEM	Scanning Electron Microscopy and Microbeam Analysis Methods	ZK	2
	The aim of the lecture is to familiarize students with the work on scanning electron microscope (SEM) and the possibilities of bundle analytical methods available on such devices. With regard to physical principles, the display methods, analytical methods available on SEM and sampling techniques will be analyzed. The student should be able to easily train on a specific device, after the necessary practical training to prepare a sample and choose the right technique for solving a specific problem, but also to make general orientation in the available experimental techniques.		
11SIK	Computer Simulation of Condensed Matter	Z,ZK	5
	Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. Thus, solution of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical background of basic computation methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed explication of the computation methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are using Material Studio simulation environment (Accelrys Software Inc.).		
11SIKL	Computer Simulation of Condensed Matter	ZK	4
	Computer simulation in condensed-matter physics is becoming an important tool used by both experimentalist and theorists to develop new materials and technologies. Thus, solution of many practical problems can be transferred from the real to a "virtual" laboratory. During the course, students will be introduced to the theoretical background of basic computation methods and let to test the acquired knowledge in practical exercises. Each lesson is organized as a tutorial where typical problems are solved with detailed explication of the computation methods used. The course is taking place in Computer classroom of the Department of Solid State Physics. Practical demonstration and exercises are using Material Studio simulation environment (Accelrys Software Inc.).		
11SMAM	Smart Materials and Their Applications	ZK	2
	Smart or responsive materials have one or more properties, such as shape, conductivity or color, that can be dramatically and reversibly altered by changes in some external conditions. The properties responding to external stimuli (heat, stress, electric field, light) influences what types of applications the smart material can be used for. The number of their applications is growing steadily. Passive and active vibration damping, airbag sensors, acoustic transducers, precision positioners, miniature ultrasonic motors, vascular stents, eyeglass frames, cellular phone antennas, light sensitive glasses or photochromic and thermochromic clothes could serve as a few examples. Lectures are focused on physical properties, experimental methods of investigation and possible application of color changing materials, light emitting materials, piezoelectric materials, conducting polymers, dielectric elastomers, ferroelectric materials and shape-memory materials. Attention is also paid to the effect of phase transitions on physical properties of smart materials and to their numerical simulations.		
11SMEX1	Seminar and Excursions 1	Z	4
	The subject is recommended for preparation of the diploma thesis solution. It consists of lectures of research workers, advisors, postgraduates and undergraduates		
11SMEX2	Seminar and Excursions 2	Z	4
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SMEX3	Seminar and Excursions 3	Z	4
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11SMEX4	Seminar and Excursions 4	Z	4
	Excursions of students to selected departments of partner universities and institutes of Czech Academy of Sciences (CAS). Practical demonstrations and active participation of students on hot topics of solid state physics. Discussion of own research results and their presentation as a training for defenses of students theses.		
11STPL	Seminar in Solid State Theory	KZ	2
	The purpose of this lecture is to solve numerical problems of theory of solids and physics of condensed state.		
11SUPR	Superconductivity and Low Temperature	ZK	4
	The subject of course is: low temperature physics, including cooling methods, low temperature technique, and measurement of low temperatures; macroscopic quantum phenomena in quantum fluids (superfluidity and superconductivity), quantum crystals and diffusion, mesoscopic phenomena in electron systems, quantum Hall effects, Coulomb blockade and single electron transistor.		
11TPL1	Solid State Theory 1	ZK	6
	Types of bonds in solids. Symmetry of crystalline solids. Vibrations of crystalline lattice and its thermal properties. Band electron structure of crystalline solids. Localized states of electrons in nonideal solids.		

11TPL2	Solid State Theory 2	ZK	3
Electric, magnetic and thermal properties of itinerant electrons in solids, Bolzmann kinetic equation, transport and optical phenomena in solids			
11VDM	Intrinsic Dynamics of Materials	ZK	3
The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagation (and its interaction with the microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.			
11VPSX	Selected Topics of Solid State Structure	Z,ZK	2
The lecture cycle focuses on the structure of solids from the point of view of the arrangement of atoms. The first part focuses on application-interesting structures from metallic materials to molecular crystals. In the second part we will look at the possibilities of observing the atomic structure using X-rays, both from the point of view of the average and the local structure. Objective of the course is also the use of special programs designed to study and analyze the structure and microstructure of solids.			
11VUIP1	Research Project 1	Z	6
11VUIP2	Research Project 2	KZ	8
12FDD	Physics of Detection and Detectors of Optical Radiation	ZK	2
Electromagnetic spectrum. Sources of electromagnetic radiation. Radiometric and photometric units. Ideal detector. External and internal photoefect. Quantum fluctuations of radiation. Noise of detector and electronic circuits. Dynamic range. Detectors based on external photoefect. Photocathodes. Electron multipliers. Microchannel plates. Image intensifiers. Detectors based on internal photoefect. Semiconductor detectors. Scintilators. Detectors of IR, VIS and UV radiation. X-ray detectors.. Pyroelectricity and pyrodetectors. Detector electronic circuits. Human eye.			
12FOPT	Optical Physics	Z,ZK	3
The lecture covers the basics of optical physics. It systematically discusses the optical wave propagation in vacuum, in isotropic and anisotropic media, and on their boundaries. It also classifies types of optical waves. Next, it describes the polarization and its applications, statistical properties of polychromatic waves, fundamentals of two and multiwave interference.			
12KOP	Quantum Optics	Z,ZK	5
The lecture covers the advanced topics in quantum optics, consequentially to the previous course of Quantum electronics. It systematically discusses especially the statistical properties of radiation, coherent states of electromagnetic field, quantum description of optical radiation, special states of fields, with respect to quasi-probability densities and characteristic functions. Next, the attention is given both to Dirac quantum theory of interaction of quantized electromagnetic field with a quantum system (including spontaneous emission) and quantum theory of scattering (Rayleigh, Thomson, Raman, resonance fluorescence). The attention is further given both to the quantum theory of coherence (quantum theory of detection, quantum correlation functions), in relation to classical theory. The course is further devoted to generalized higher-order coherence theory, coherent properties of special states of fields, and quantum theory of damping (quantum damped harmonic oscillator, Heisenberg-Langevin approach). Finally, the attention is given to review of nonclassical measuring techniques (photocounting, intensity interferometry, Brown-Twiss effect, stellar correlation interferometer, correlation spectroscopy), possibilities of measuring the quantum state of light, and some selected parts of modern quantum optics (squeezed states). The lectures are accompanied with practical example exercises.			

For updated information see http://bilakniha.cvut.cz/en/FF.html
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