Study plan

Name of study plan: Nuclear and Particle Physics

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Nuclear and Particle Physics

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: P_J FN #

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: NMSPJCF1

Name of the group: MDP P_J FN 1st year

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 10 courses

Credits in the group: 0

Note on the group: Studenti povinně absolvují alespoň jednu skupinu předmětů E, I nebo T

Note on the grou	p. Studenti povinne absolvuji ales	pori jedila si	apina pi	Carricta	L, THOSO	•
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
02KTPA1	Quantum Field Theory 1 Václav Zatloukal Václav Zatloukal Martin Štefa ák (Gar.)	Z,ZK	8	4P+2C	Z	Р
02KTPA2	Quantum Field Theory 2 Petr Jizba Václav Zatloukal Martin Štefa ák (Gar.)	Z,ZK	8	4P+2C	L	Р
02MTD	Modern Detectors Jaroslav Adam Jaroslav Adam (Gar.)	ZK	2	2P+0C	Z	Р
02SE1	Seminar 1 Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	3	3S	Z	Р
02SE2	Seminar 2 Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	3	3S	L	Р
02SZD1	Statistical Data Analysis 1 Miroslav Myška Miroslav Myška Miroslav Myška (Gar.)	Z,ZK	4	2P+2C	Z	Р
02SZD2	Statistical Data Analysis 2 Miroslav Myška Miroslav Myška Miroslav Myška (Gar.)	Z,ZK	4	2P+2C	L	Р
02SDSD	Detector Systems and Data Acquisition Michal Broz Martin Štefa ák Michal Broz (Gar.)	ZK	2	2P+0C	L	Р
02VUJC1	Research Project 1 Jaroslav Biel ik Jaroslav Biel ik (Gar.)	Z	6	6C	Z	Р
02VUJC2	Research Project 2 Martin Štefa ák, Jaroslav Biel ík, Michal Broz, Petr Chaloupka, Dominika Mašlárová, Boris Tomášik, Jakub Vícha, Solangel Rojas Torres, Michal Mar išovský, Jaroslav Biel ík Jaroslav Biel ík (Gar.)	KZ	8	8C	L	Р

Characteristics of the courses of this group of Study Plan: Code=NMSPJCF1 Name=MDP P_J FN 1st year

construction, ways of using and constrains. Emphasis is given also to electronic detector control and voltage suppliers.

02K I PA1	Quantum Field Theory 1	Z,ZK	8				
The lecture aims to intro	The lecture aims to introduce the students to both fundamental and applied parts of quantum field theory. The focus is in particular on equations of relativistic quantum mechanics,						
canonical quantization of	canonical quantization of scalar and bispinor field, perturbation theory (Feynmans rules) and basics of renormalization. The content of the lecture can serve as a base for further study						
in fields of exactly solva	in fields of exactly solvable models, theory of critical phenomena, molecular chemistry and biochemistry or quantum gravity.						
02KTPA2	Quantum Field Theory 2	Z,ZK	8				
The lecture aims at intro	oducing the students to the Feynmans functional integral and its applications. The focus is on broadening the knowledge of m	nodern parts of rel	ativistic and				
non-relativistic quantum	field theory and statistical physics. The content of the lecture can serve as a base for further study in fields of exactly solvable.	ole models, theory	of critical				
phenomena, molecular	chemistry and biochemistry or quantum gravity.						
02MTD	Modern Detectors	ZK	2				
Lectures will cover all ty	Lectures will cover all types of detectors used in modern nuclear and particle physics. Topics include principles of construction of particular types of detectors, materials used for their						

02SE1 Seminar 1 The aim of the seminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields of particle physics studied in research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics. 02SE2 Seminar 2 3 The aim of the seminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields of particle physics studied in research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics The course is primarily focused on practical application of methods of experimental data analysis. Students obtain knowledge of different statistical methods and their usage, fitting methods, and testing of hypothesis. The course quickly recapitulates basis of mathematical probability theory but it is recommended to attend a full course of the mathematical probability. 02SZD2 Statistical Data Analysis 2 Individual students work will include implementation and testing of a program for analysis of generated data sample. Background understanding of Monte Carlo generators for hadron collision will be explained. The course covers methods of data smearing and subsequent deconvolution of data. Basics understanding and usage of neural networks and machine learning will be covered. 02SDSD **Detector Systems and Data Acquisition** The goal of the lecture is to present knowledge of modern detector systems. We will concentrate on the aspects of construction and usage for charged-particle tracking, momentum and energy measurement as well as particle identification via various methods from time-of-flight to transition radiation. The lecture will cover also the topic of signal shaping and processing, digitalization, data acquisition and further data processing at the modern collider experiments. Research Project 1 The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions

The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common

ΚZ

8

Code of the group: NMSPJCF2

Name of the group: MDP P_J FN 2nd year

Research Project 2

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 0 Note on the group:

regular meetings and discussions.

02VUJC2

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
02DPJC1	Master Thesis 1 Jaroslav Biel ik Jaroslav Biel ik (Gar.)	Z	10	10C	Z	Р
02DPJC2	Master Thesis 2 Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	20	20C	L	Р
02SE3	Seminar 3 Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	3	3S	Z	Р
02SE4	Seminar 4 Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	3	3S	L	Р
02ZQCD	Quantum Chromodynamics Jana Biel íková Jan epila Jana Biel íková (Gar.)	Z,ZK	6	3+2	Z	Р
02ZELW	Introduction to Theory of Electroweak Interactions	Z,ZK	6	3P+2C	Z	Р

the topics covered in the lectures (such as first measurements of W and Z gauge bosons, Higgs boson discovery) are envisioned.

02DPJC1	Master Thesis 1	Z	10
The master thesis is	based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the	project supervisor	during commor
regular meetings an	d discussions.		
02DPJC2	Master Thesis 2	Z	20
The master thesis is	based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the	project supervisor	during commor
regular meetings an	d discussions.		
02SE3	Seminar 3	Z	3
The aim of the semi	nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field	ds of particle physic	cs studied in
	nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field diploma theses of their colleagues. Participants will be informed about recent results in particle physics.	ds of particle physic	cs studied in
		ds of particle physic	cs studied in
research tasks and o	diploma theses of their colleagues. Participants will be informed about recent results in particle physics.	Z	3
research tasks and on 02SE4 The aim of the semi	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4	Z	3
research tasks and on 02SE4 The aim of the semi	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4 nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field	Z	3
research tasks and of 02SE4 The aim of the semi-research tasks and of 02ZQCD	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4 nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field diploma theses of their colleagues. Participants will be informed about recent results in particle physics.	Z ds of particle physic	3 cs studied in
research tasks and of 02SE4 The aim of the semi- research tasks and of 02ZQCD The goal of these led	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4 nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Quantum Chromodynamics	Z ds of particle physic Z,ZK avour symmetry, ste	3 cs studied in 6 udies of nucleor
research tasks and of 02SE4 The aim of the semi- research tasks and of 02ZQCD The goal of these leastructure in deep ine	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4 nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Quantum Chromodynamics ctures is to acquire knowledge about basic principles of strong interaction starting from the constituent quark model and SU(3) flat	Z ds of particle physic Z,ZK avour symmetry, ste	3 cs studied in 6 udies of nucleor
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research tasks and of 02SE4 The aim of the semi research tasks and of 02ZQCD The goal of these led structure in deep ine in high energy physion 02ZELW	diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Seminar 4 nar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the field diploma theses of their colleagues. Participants will be informed about recent results in particle physics. Quantum Chromodynamics ctures is to acquire knowledge about basic principles of strong interaction starting from the constituent quark model and SU(3) flatastic scattering of leptons on nucleons and parton model to basics of Quantum Chromodynamics and its practical applications in cas and physics of ultra-relativistic heavy-ion collisions.	Z ds of particle physic Z,ZK avour symmetry, steether context of curr	3 cs studied in 6 udies of nucleorent experiments

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: NMSPJCFSE

Name of the group: MDP P_J FN group E experimental

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 2 courses

Credits in the group: 0

Note on the group:

Studenti povinně absolvují alespoň jednu skupinu předmětů E, I nebo T

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
02FUJS	Physics of Ultrarelativistic Nuclear Collisions Oliver Matonoha Jaroslav Biel ík Oliver Matonoha (Gar.)	ZK	2	2P+0C	L	PV
02VPJRS	Selected topics from relativistic nucleus-nucleus collisions Barbara Antonina Trzeciak Martin Štefa ák Barbara Antonina Trzeciak (Gar.)	Z,ZK	3	2P+1C	L	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCFSE Name=MDP P_J FN group E experimental

O2FUJS Physics of Ultrarelativistic Nuclear Collisions ZK 2
The goal of this subject is to introduce students the principles of physics of heavy-ion collisions at large energies. Students will gain insight into phases of a nuclear collision, properties of the created matter (quark-gluon plasma (QGP)), probes which contain information about the QGP and other phases of the collision, and knowledge that these signals brought to us based on the recent measurements at present experiments.

02VPJRS Selected topics from relativistic nucleus-nucleus collisions

Z,ZK

3

The aim of the lecture is to discuss in more depth the physics of the extreme state of the nuclear matter created in relativistic nucleus-nucleus collisions. The course will cover selected topics from the physics of relativistic nucleus-nucleus collisions. The focus will be put on thermodynamic and statistical physics applications to the high-energy nuclear collisions, as well as the medium description using a hydrodynamic approach. Moreover, the in-medium parton energy loss and a related concept of the jet quenching will be discussed. The course will be complemented with computational exercises.

Code of the group: NMSPJCFSI

Name of the group: MDP P_J FN group I Instrumental

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 2 courses

Credits in the group: 0

Note on the group:

Studenti povinně absolvují alespoň jednu skupinu předmětů E, I nebo T

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
02UC1	Particles Accelerators 1 Miroslav Kr s Miroslav Kr s (Gar.)	ZK	2	2P+0C	Z	PV
02UC2	Particle Accelerators 2 Miroslav Kr s Miroslav Kr s (Gar.)	ZK	2	2+0		PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCFSI Name=MDP P J FN group I Instrumental

02UC1	Particles Accelerators 1	ZK	2		
Introduction to physics	Introduction to physics and technology of classical (electrostatic and radiofrequency) particle accelerators.				
02UC2	Particle Accelerators 2	ZK	2		
Introduction to physics	ntroduction to physics and technology of modern and next generation accelerators based on laser and plasma technology.				

Code of the group: NMSPJCFST

Name of the group: MDP P J FN group T Theoretical

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: Studenti povinně absolvují alespoň jednu skupinu předmětů E, I nebo T

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
02GTR	General Theory of Relativity Boris Tomášik Boris Tomášik Boris Tomášik (Gar.)	Z,ZK	4	2P+2C	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCFST Name=MDP P_J FN group T Theoretical

02GTR General Theory of Relativity

The goal is to learn the basics of General Relativity theory as well as its applications, mainly in cosmology. The students will get acquainted with the starting points of General Relativity. The course includes the explanation of necessary mathematics: differential geometry. Classic results are derived, like the precession of Mercury, gravitational frequency shift and gravitational bending of light. The participants learn about Schwarzschild metrics and its solution leading to black holes. In the application part the Friedman-Robertson-Walker metrics is introduced and dynamics of the Universe is discussed.

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: NMSPJCFV

Name of the group: MDP P_J FN Optional courses

Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0

Note on the o	Name of the course / Name of the group of courses	I		1		
Code	(in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
02AQCD	Applied Quantum Chromodynamics at High Energies Ján Nem ík Ján Nem ík Ján Nem ík (Gar.)	ZK	2	2+0		V
02ACF1	Astroparticle physics 1 Jakub Vícha Jakub Vícha (Gar.)	ZK	2	2P+0C	Z	V
02ACF2	Astroparticle physics 2 Jakub Vícha Jakub Vícha Jakub Vícha (Gar.)	ZK	2	2P+0C	L	V
01DAS	Data science Jií Franc Jií Franc (Gar.)	KZ	3	1P+2C		V
02EPM	Electromagnetic production of mesons Dalibor Skoupil Dalibor Skoupil (Gar.)	ZK	3	2P+0C	L	V
02EXSH	Extreme States of Matter Michal Šumbera Jaroslav Biel ík Jaroslav Biel ík (Gar.)	ZK	2	2P+0C	Z	V
02FAJ	Physics of Atomic Nuclei Ji í Adam, Petr Veselý Ji í Adam Ji í Adam (Gar.)	ZK	4	4+0	L	V
02BSM	Physics beyond the Standard Model Jesus Guillermo Contreras, Zden k Hubá ek Zden k Hubá ek (Gar.) Hubá ek (Gar.)	Z	2	2P+0C	Z	V
02JSP	Nuclear Spectroscopy Vladimír Wagner Martin Štefa ák Vladimír Wagner (Gar.)	Z,ZK	5	2+2	L	V
02KMP	Quantum Many-Body Problem in the Theory of Atomic Nuclei Petr Veselý Martin Štefa ák Petr Veselý (Gar.)	ZK	2	2P+0C	Z	V
04MGA1	English for Academic Purposes Speaking Practice - intermediate Nathaniel Patton (Gar.)	Z	2	0+2	L,Z	V
04MGA2	Academic English Writing and Presentation Course - intermadiate Darren Copeland (Gar.)	Z	2	0+2	L,Z	٧
02MAT	Materials for Experimental Nuclear Physics Libor Škoda Martin Štefa ák Libor Škoda (Gar.)	ZK	2	2+0		V
18MEMC	Monte Carlo Method Jaromír Kukal, Miroslav Virius Miroslav Virius (Gar.)	Z,ZK	4	2P+2C	Z	V
01NSN	Neural Networks, Machine Learning, and Randomness Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	2	1P+1C		V
1800P	Object Oriented Programming Miroslav Virius Miroslav Virius Miroslav Virius (Gar.)	Z	2	2C	Z	V
02LPA	Particle plasma accelerators Miroslav Kr s Miroslav Kr s Miroslav Kr s (Gar.)	ZK	2	2P+0C	L	V
17PRE	Computer Control of Experiments Martin Kropík Martin Kropík Martin Kropík (Gar.)	Z,ZK	3	2+1	Z	V
02REP	Matrix Lie group representations Ji í Hrivnák, Lenka Motlochová Lenka Motlochová (Gar.)	Z	2	2+0	Z	V
02ROZ3	Seminar on Quark-Gluon Plasma 3 Jaroslav Biel ík Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	2	2P+0C	Z	V
02ROZ4	Seminar on Quark-Gluon Plasma 4 Jaroslav Biel ík, Boris Tomášik, Jana Biel íková Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	2	2P+0C	L	V
02ROZ5	Seminar on Quark-Gluon Plasma 5 Jaroslav Biel ik Jaroslav Biel ik Jaroslav Biel ik (Gar.)	Z	2	2P+0C	Z	V
02ROZ6	Seminar on Quark-Gluon Plasma 6 Jaroslav Biel ík, Boris Tomášik, Jana Biel íková Jaroslav Biel ík Jaroslav Biel ík (Gar.)	Z	2	2P+0C	L	V

02SPRA1	,					
UZOFIKAT	Special Practicum 1 Jan epila Jan epila (Gar.)	KZ	6	0+4	Z	V
02SPRA2	Special Practicum 2 Jan epila Jan epila (Gar.)	KZ	6	0+4	L	V
01SUP	Start-up Project Pemysl Rubeš Pemysl Rubeš Pemysl Rubeš (Gar.)	KZ	2	2P+0C		V
02AST	Introduction to Astrophysics Raffaele Del Grande Martin Stefa ák Raffaele Del Grande (Gar.)	ZK	3	2P+0C	L	V
02PRF	Selected topics from probability theory for physicists Michal Šumbera Michal Šumbera Michal Šumbera (Gar.)	Z	2	2P+0C	Z	V
02VS2	Workshop 2	Z	1	7D	Z	V
02VS3	Jaroslav Biel ik Jaroslav Biel ik (Gar.) Workshop 3	Z	1	7D	Z	V
	Jaroslav Biel ik Jaroslav Biel ik Jaroslav Biel ik (Gar.)			_		
	courses of this group of Study Plan: Code=NMSPJCFV Name:	=MDP P_J F	N Optio		es ZK	2
	plied Quantum Chromodynamics at High Energies vide basic applications of quantum chromodynamicks that corresponds to understandi	ng of the dynamic	s of proces	1		
·	s that are currently measured by experiments at RHIC and LHC colliders. Complement	•		•		
will be provided.					•	-
02ACF1 Ast	troparticle physics 1				ZK	2
	ory of astroparticle physics 2. Introduction to astronomy (scales, observation windows,		•		,	•
** *	ies, spectral index, age) 4. Direct detection of cosmic radiation (experiments, findings)					
	position of cosmic radiation (types of measurements, results, open problems) 7. Spread	-		-	_	-
,	 Sources of cosmic radiation (exotic sources, acceleration mechanisms) Indirect c Irradiation (fluorescence and cherenkov techniques, reconstruction) Surface detection 					•
12. Detection of gamma rays		on or snowers or c	USITIIC Taula	illori (types o	i detectors, it	econstruction
	troparticle physics 2				ZK	2
	ection of neutral particles in the cosmic radiation data (neutrons, photons, neutrinos) 2.	Radio detection	of showers			
	d use of secondary mions from cosmic radiation (accelerators, tomography) 4. Models				•	
•	n of showers of cosmic radiation (derivation, algorithms) 6. Hands-on public astropartic		•			
· · ·	mology, relict radiation) 8. Nuclear processes in stars (nuclear synthesis, creation of ne		_			
experiments, proton decay, d	louble beta decay) 10. Detection of gravitational waves (principles, experiments) 11. Da	ark matter (theory	, experime	nts) 12. Multi	messengers	(connections
between detection of neutral	and charged particles)					
01DAS Da	ta science				KZ	3
Practical application of mathe	ematical modeling methods, statistics and machine learning needs wide range of tasks	s from data prepa	ration and	collection to	design of an	appropriate
	units for development and implementation into the production. Last, but not least, the c	-	-	-		
	of required tools will be presented on lectures. Further, these procedures will be applie	ed during exercise	s with an e	mphasis on t	eam collabo	ration, projec
	purse, students will present their results to other teams.					
l l	ctromagnetic production of mesons				ZK	3
	magnetic production of mesons, with emphasis on the process of photoproduction. Into	roducing basic co	ncepts and	importand a	spects of the	models (with
	on effective Lagrangians) for understanding the topic.				71.6	
l l	treme States of Matter			1	ZK	2
•	n states of matter in extreme conditions. It deals with broad spectra of phenomena from	J	•	0 1	s of nuclear	matter at higi
		ansion of the Univ			(: .: :\\	
•	highly speculative forms of matter that may be responsible for initially accelerated expanding and the service of modern accomplant, connected				(inflation) or	for its current
acceleration (dark energy). L	ectures may also serve as a brief introduction to parts of modern cosmology connecte			sics.		
acceleration (dark energy). L	ectures may also serve as a brief introduction to parts of modern cosmology connecte ysics of Atomic Nuclei	ed to nuclear and	particle phy	rsics.	ZK	4
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interac	ectures may also serve as a brief introduction to parts of modern cosmology connecte ysics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle r	nodel, collective	particle phy	rsics. tree-Fock ap	ZK proximation,	4 TDA method
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interac RPA method, pairing, quasi-p	ectures may also serve as a brief introduction to parts of modern cosmology connected ysics of Atomic Nuclei ction, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear	nodel, collective	particle phy	rsics. tree-Fock ap	ZK proximation, of nuclear re	4 TDA method eactions)
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi- 02BSM Phy	ectures may also serve as a brief introduction to parts of modern cosmology connected ysics of Atomic Nuclei brion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear ysics beyond the Standard Model	ed to nuclear and model, collective of ar reactions (kine	particle phy motion, Har matics and	rsics. tree-Fock apmechanisms	ZK proximation, of nuclear re	4 TDA method eactions)
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi-p 02BSM Phy Standard model of particle pl	ectures may also serve as a brief introduction to parts of modern cosmology connected sysics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear sysics beyond the Standard Model hysics is one of the most successful physical theories. It describes the elementary particles	ed to nuclear and model, collective a ar reactions (kine	particle phy motion, Har matics and ne matter a	rsics. tree-Fock ap mechanisms	ZK proximation, of nuclear rezervation.	4 TDA method eactions) 2 weak and
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi-p 02BSM Phy Standard model of particle pl strong interactions. It is howe	ectures may also serve as a brief introduction to parts of modern cosmology connected sysics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear sysics beyond the Standard Model hysics is one of the most successful physical theories. It describes the elementary particles are incomplete theory and there are several questions which it can not answer. The	ed to nuclear and model, collective a ar reactions (kine	particle phy motion, Har matics and ne matter a	rsics. tree-Fock ap mechanisms	ZK proximation, of nuclear rezervation.	4 TDA method eactions) 2 weak and
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acceleration (dark energy). L O2FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi-p O2BSM Phy Standard model of particle pl strong interactions. It is howe model and show potential dir O2JSP Nuclear spectroscopy compredevoted to fundamentals of > O2KMP Qu 1. Nuclear Hamiltonian and concellective model O4MGA1 Eng Optional course offers Master will respond to specific profer O4MGA2 Acc Optional course, a possible frand presentation skills. Syllat instruction on writing Master course. O2MAT Ma This lecture is designed for s	ectures may also serve as a brief introduction to parts of modern cosmology connected visics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear ysics beyond the Standard Model hysics is one of the most successful physical theories. It describes the elementary particle are incomplete theory and there are several questions which it can not answer. The vections where the new physics beyond the Standard model could be found. Clear Spectroscopy isses several experimental techniques which are of ultimate importance for experimental candidates and gamma-ray, charged particle and neutron spectroscopy. Cantum Many-Body Problem in the Theory of Atomic Nuclei distinguishing the degrees of freedom within nuclei 2. Collective and one-body dynamic of functional for the excited states 5. Selfconsistent mean-field model 6. Post Hartree-Forence in Motion Phonon Method 10. Generator Coordinate Method 11. Restoration of symmet regists for Academic Purposes Speaking Practice - intermediate levels of successional interests and situations of students and choice of topics will be agreed on with addemic English Writing and Presentation Course - intermadiate ree sequel to course 04MGA1, offers Master's degree students at intermediate level of bus will respond to specific professional needs of participants, but will include also write thesis in English and presenting chosen facts. Course will thus prepare students for putterials for Experimental Nuclear Physics tudents of experimental nuclear physics. The lecture gives the overview of materials putterns of experimental nuclear physics. The lecture gives the overview of materials putterns of tudents of experimental nuclear physics. The lecture gives the overview of materials putterns of the professional nuclear physics.	and to nuclear and model, collective is ar reactions (kines ar reactions) (kines ar reactions	particle phymotion, Harmatics and he matter a re is to review and various and various and various ory of the emm-Danco methods of vocabulary non-grade e to develog a presentanterences.	tree-Fock apmechanisms Ind their election with the mission of their election of the	ZK proximation, of nuclear r Z promagnetic, ng points in t ZK py functional tion 8. Rando Cluster Meth Z ng skills. Count course. Z nd strengthe research top non-graded a	4 TDA method eactions) 2 weak and he Standard 5 cture will be 2 in nuclei 4. om Phase od 13. Bohr 2 rse syllabus 2 in their writin olic, a search assessment 2
acceleration (dark energy). L 02FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi-r 02BSM Phy Standard model of particle pl strong interactions. It is howe model and show potential dir 02JSP Nuclear spectroscopy compredevoted to fundamentals of >> 02KMP Qu 1. Nuclear Hamiltonian and of the the energy density Approximation 9. Equation of collective model 04MGA1 Eng Optional course offers Maste will respond to specific profered 04MGA2 Acc Optional course, a possible from the prosentation skills. Syllatinstruction on writing Master course. 02MAT Ma This lecture is designed for serious strong pairing and presentation of the course.	ectures may also serve as a brief introduction to parts of modern cosmology connected visics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear ysics beyond the Standard Model hysics is one of the most successful physical theories. It describes the elementary particle are incomplete theory and there are several questions which it can not answer. The vections where the new physics beyond the Standard model could be found. Clear Spectroscopy isses several experimental techniques which are of ultimate importance for experimental candidates and gamma-ray, charged particle and neutron spectroscopy. Cantum Many-Body Problem in the Theory of Atomic Nuclei distinguishing the degrees of freedom within nuclei 2. Collective and one-body dynamic of functional for the excited states 5. Selfconsistent mean-field model 6. Post Hartree-Forent Motion Phonon Method 10. Generator Coordinate Method 11. Restoration of symmet and situations of students and choice of topics will be agreed on with addemic English Writing and Presentation Course - intermediate level or bus will respond to specific professional needs of participants, but will include also write thesis in English and presenting chosen facts. Course will thus prepare students for putterials for Experimental Nuclear Physics	and to nuclear and model, collective is ar reactions (kines ar reactions) (kines ar reactions	particle phymotion, Harmatics and he matter a re is to review and various and various and various ory of the emm-Danco methods of vocabulary non-grade e to develog a presentanterences.	tree-Fock apmechanisms Ind their election with the mission of their election of the	ZK proximation, of nuclear re Z promagnetic, ng points in te proximation, z promagnetic, ng points in te proximation to the course of the course. Z promagnetic, ng skills. Count course. Z promagnetic to the course of the cours	4 TDA method eactions) 2 weak and he Standard 5 cture will be 2 in nuclei 4. om Phase od 13. Bohr 2 rse syllabus 2 in their writing oic, a search, assessment 2
acceleration (dark energy). L O2FAJ Phy Nucleon-nucleon(NN) interact RPA method, pairing, quasi-p O2BSM Phy Standard model of particle pi strong interactions. It is howe model and show potential dir O2JSP Nuclear spectroscopy compredevoted to fundamentals of X O2KMP Qu 1. Nuclear Hamiltonian and of the energy density Approximation 9. Equation of collective model O4MGA1 Energy density Approximation 4. English master will respond to specific profest O4MGA2 According to the energy density Approximation of the energy density Approximation 9. Equation of the energy density Approximatio	ectures may also serve as a brief introduction to parts of modern cosmology connected visics of Atomic Nuclei stion, few-body systems, G matrix, nuclear properties, nuclear models (single-particle reparticles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear ysics beyond the Standard Model hysics is one of the most successful physical theories. It describes the elementary particle are incomplete theory and there are several questions which it can not answer. The vections where the new physics beyond the Standard model could be found. Clear Spectroscopy isses several experimental techniques which are of ultimate importance for experimental candidates and gamma-ray, charged particle and neutron spectroscopy. Cantum Many-Body Problem in the Theory of Atomic Nuclei distinguishing the degrees of freedom within nuclei 2. Collective and one-body dynamic of functional for the excited states 5. Selfconsistent mean-field model 6. Post Hartree-Forence in Motion Phonon Method 10. Generator Coordinate Method 11. Restoration of symmet regists for Academic Purposes Speaking Practice - intermediate levels of successional interests and situations of students and choice of topics will be agreed on with addemic English Writing and Presentation Course - intermadiate ree sequel to course 04MGA1, offers Master's degree students at intermediate level of bus will respond to specific professional needs of participants, but will include also write thesis in English and presenting chosen facts. Course will thus prepare students for putterials for Experimental Nuclear Physics tudents of experimental nuclear physics. The lecture gives the overview of materials putterns of experimental nuclear physics. The lecture gives the overview of materials putterns of tudents of experimental nuclear physics. The lecture gives the overview of materials putterns of the professional nuclear physics.	and to nuclear and model, collective is ar reactions (kines ar reactions) (kines ar reactions	particle phymotion, Harmatics and he matter a re is to review and various and various and various ory of the emm-Danco methods of vocabulary non-grade e to develog a presentanterences.	tree-Fock apmechanisms Ind their election with the mission of their election of the	ZK proximation, of nuclear r Z promagnetic, ng points in t ZK py functional tion 8. Rando Cluster Meth Z ng skills. Count course. Z nd strengthe research top non-graded a	4 TDA method eactions) 2 weak and he Standard 5 cture will be 2 in nuclei 4. om Phase od 13. Bohr 2 rse syllabus 2 in their writing oic, a search, assessment 2

OANCN	Neural Naturalia Machina Learning and Dandamage	7 71/	2
01NSN	Neural Networks, Machine Learning, and Randomness of artificial intelligence is largely due to generative systems built using modern machine learning methodsespecially advanced	Z,ZK	
	of artificial intelligence is largely due to generative systems built using modern machine learning methodsespecially advanced which rely on randomness, play a crucial role in constructing and training these networks and other machine learning models.	•	
· · · · · · · · · · · · · · · · · · ·	istics in other courses, this course offers a systematic explanation of how stochastic methods relate to training neural network	O	
	s of neural networks that fundamentally depend on randomness, as well as specific stochastic techniques used in their training		-
'	s of riedial networks that fundamentally depend of randomness, as well as specific stochastic techniques used in their training polyage to the stochastic approach to training neural networks and shows how machine learning models including neural networks are used in one	-	
١. ٠	astic optimization methods, such as evolutionary algorithms.	or the most import	ant applications
1800P	Object Oriented Programming	Z	2
	of the contributions of students concerning given topics concerned on technologies uded in program development.	2	2
		71/	
02LPA	Particle plasma accelerators	ZK	2
	r physics and technology, CPA systems 2. Physics of plasma and plasma wave generation 3. Plasma instabilities, beam-plasm of beam injection to plasma wave 6. Ultrashort particle bunch generation 7. Dynamics of bunch in plasma wave 8. Plasma diaç		
	waveguides 10. Plasma charged particle optics 11. Ultrashort bunch diagnostics 12. Handling and transport of ultrashort bunc		
bunches	waveguides 10. Frasilia dilanged particle optics 11. Ottastion button diagnostics 12. Handling and transport of ditrastion button	nes 13. Application	or ultrasmort
17PRE	Computer Control of Evacriments	Z,ZK	3
	Computer Control of Experiments	1 ' 1	_
	mation about standard interfaces of personal computers - parallel, serial, USB, LAN and special interface cards; about standa rial lines or GPIB (IEEE488) interface, further about measuring systems with VME, VXI and LXI interfaces, discuss their advar		
· ·	gramming of measuring systems - special dedicated software, problems of use of high programming languages and especially use	-	_
· ·	e LabView); data acquisition and evaluation. Finally, students prepare individual software project for data acquisition and evalu		ed development
02REP		Z	2
	Matrix Lie group representations netric group, homomorphism, isomorphism, group action, direct product, semidirect product, normal group, simple and semisin	. – .	
			• •
	, Lorentz group, Poincaré group. 2.One-parameter group, Lie algebras, Lie group Lie algebra correspondence, exponential ma 3) and SU(2). 4.Representation theory, unitary representation, regular representation, equivalent representation, irreducibility, i	•	00 .
	a representation and their connection to Lie group representation, projective representation. 6.Irreducible representations of SO	-	
	sentation. 7.Finite-dimensional representations of Lorentz group, tensor product of representations. 8.Representations of SU(3)	. ,	
roots. 9. Young tableau		, Gen-Marin matric	es, weights and
02ROZ3		7	
	Seminar on Quark-Gluon Plasma 3	Z	2
	eoretical work related to problems of quark-gluon plasma. Students participate on the seminar by preparing the presentation a	about selected pape	
02ROZ4	Seminar on Quark-Gluon Plasma 4		2
	experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentation		
02ROZ5	Seminar on Quark-Gluon Plasma 5	Z	2
	experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentation	1	
02ROZ6	Seminar on Quark-Gluon Plasma 6	Z	2
	experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentation	about selected par	ers.
02SPRA1	Special Practicum 1	KZ	6
Physics measuremen	t focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chose	en so that students	can familiarize
·	f experimental physics and metrology.		
02SPRA2	Special Practicum 2	KZ	6
Physics measuremen	t focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chose	en so that students	can familiarize
with advanced pats of	f experimental physics and metrology.		
01SUP	Start-up Project	KZ	2
02AST	Introduction to Astrophysics	ZK	3
l	s is to offer students an engaging introduction to the fascinating world of astrophysics. They will gain a basic understanding of t	1 1	universe, stellar
	e intriguing intersections between nuclear physics and astrophysics.		
02PRF	Selected topics from probability theory for physicists	Z	2
	bus probability distributions (Binomial, Poisson, negative binomial, normal, etc.) as well as the processes that lead to their original	1 1	
	economics. The impetus for the further expansion of these divisions in the 20th century was their application to the description		-
1	In the spread of infectious diseases. The generalization of the properties of these distributions has later on led to the discovery		
l ·	stable distributions, which are currently widely used in physics and finance.		
02VS2	Workshop 2	Z	1
	I participate on annual Workshop J F, where they will present results obtained during the work on their bachelor thesis. During	. – .	•
	o get familiar with scientific topics developed at the department and with methods other colleagues use for their scientific work	· -	
02VS3	Workshop 3	Z	1
	WORKSHOP 3 participate on annual Workshop J=F, where they will present results obtained during the work on their bachelor thesis. During	1	-
, wolldor. Olddellio Wil	r paradipate on annual frencing of 1, where they will present results obtained during the work on their bachelor thesis. During	, outor proscritation	orri otuuciilo

List of courses of this pass:

and staff, they will also get familiar with scientific topics developed at the department and with methods other colleagues use for their scientific work.

Code	Name of the course	Completion	Credits
01DAS	Data science	K7	3

Practical application of mathematical modeling methods, statistics and machine learning needs wide range of tasks from data preparation and collection to design of an appropriate method and its division into units for development and implementation into the production. Last, but not least, the cooperation in group and management of a modern data project is crucial. The actual standard of required tools will be presented on lectures. Further, these procedures will be applied during exercises with an emphasis on team collaboration, project planning. At the end of the course, students will present their results to other teams.

01NSN	Neural Networks, Machine Learning, and Randomness	Z,ZK	2
	se of artificial intelligence is largely due to generative systems built using modern machine learning methodsespecially advanced vari	-	
	ls, which rely on randomness, play a crucial role in constructing and training these networks and other machine learning models. Alth statistics in other courses, this course offers a systematic explanation of how stochastic methods relate to training neural networks an	_	
	types of neural networks that fundamentally depend on randomness, as well as specific stochastic techniques used in their training.		•
•	stochastic approach to training neural networks and shows how machine learning modelsincluding neural networksare used in one of t		
	of randomness: stochastic optimization methods, such as evolutionary algorithms.		
01SUP	Start-up Project	KZ	2
02ACF1	Astroparticle physics 1	ZK	2
	ure: 1. History of astroparticle physics 2. Introduction to astronomy (scales, observation windows, types of objects, contemporary prol		-
	n (properties, spectral index, age) 4. Direct detection of cosmic radiation (experiments, findings) 5. Showers of cosmic radiation (expar		
	nodel) 6. Composition of cosmic radiation (types of measurements, results, open problems) 7. Spreading of cosmic radiation and gam netic fields) 8. Sources of cosmic radiation (exotic sources, acceleration mechanisms) 9. Indirect detection of cosmic radiation (experi		•
	rs of cosmic radiation (fluorescence and cherenkov techniques, reconstruction) 11. Surface detection of showers of cosmic radiation (typ		•
	12. Detection of gamma rays (principles, experiments)	00 0. 00.00.0.0, .0	
02ACF2	Astroparticle physics 2	ZK	2
Outline of the lectu	ire: 1. Detection of neutral particles in the cosmic radiation data (neutrons, photons, neutrinos) 2. Radio detection of showers of cosm	ic radiation (Aska	ryans effect,
	tection and use of secondary mions from cosmic radiation (accelerators, tomography) 4. Models of hadronic interactions (Glaubers m		
•	n, simulation of showers of cosmic radiation (derivation, algorithms) 6. Hands-on public astroparticle data (fits data, Auger and KASC	•	
•	tion to cosmology, relict radiation) 8. Nuclear processes in stars (nuclear synthesis, creation of neutrinos, final stages of stars) 9. Dete		
experiments, proto	n decay, double beta decay) 10. Detection of gravitational waves (principles, experiments) 11. Dark matter (theory, experiments) 12. I between detection of neutral and charged particles)	viuitimessengers	(connections
02AQCD	Applied Quantum Chromodynamics at High Energies	ZK	2
	philed Quantum Chromodynamics at Fight Energies nted to provide basic applications of quantum chromodynamicks that corresponds to understanding of the dynamics of processes in page 1.5.		_
	ear targets that are currently measured by experiments at RHIC and LHC colliders. Complementary informations to lectures of Basics		
	will be provided.		<u> </u>
02AST	Introduction to Astrophysics	ZK	3
The aim of the cou	rse is to offer students an engaging introduction to the fascinating world of astrophysics. They will gain a basic understanding of the s	tructure of the uni	iverse, stellar
	evolution, and explore intriguing intersections between nuclear physics and astrophysics.	_	
02BSM	Physics beyond the Standard Model	Z	2
	of particle physics is one of the most successful physical theories. It describes the elementary particles which form the matter and their		
strong interactions	i. It is however an incomplete theory and there are several questions which it can not answer. The goal of the lecture is to review the r model and show potential directions where the new physics beyond the Standard model could be found.	nissing points in t	ne Standard
02DPJC1	Master Thesis 1	Z	10
	is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the proj	_	-
The mader areas	regular meetings and discussions.	oot oupot tioo. au	9 00
02DPJC2	Master Thesis 2	Z	20
The master thesis	is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the proj	ect supervisor du	ring common
	regular meetings and discussions.		
02EPM	Electromagnetic production of mesons	ZK	3
An introduction to t	he electromagnetic production of mesons, with emphasis on the process of photoproduction. Introducing basic concepts and importa	nd aspects of the	models (with
005/011	emphasis on models based on effective Lagrangians) for understanding the topic.	71/	
02EXSH	Extreme States of Matter le basics in states of matter in extreme conditions. It deals with broad spectra of phenomena from electromagnetic plasma through ph	ZK	2
•	ensities to highly speculative forms of matter that may be responsible for initially accelerated expansion of the Universe in its early sta		_
•	cceleration (dark energy). Lectures may also serve as a brief introduction to parts of modern cosmology connected to nuclear and pa		
02FAJ	Physics of Atomic Nuclei	ZK	4
Nucleon-nucleon(N	IN) interaction, few-body systems, G matrix, nuclear properties, nuclear models (single-particle model, collective motion, Hartree-Foc	k approximation, ⁻	TDA method,
	iring, quasi-particles, nuclear deformations), electromagnetic and weak processes in nuclei, nuclear reactions (kinematics and mecha		
02FUJS	Physics of Ultrarelativistic Nuclear Collisions	ZK	2
-	oject is to introduce students the principles of physics of heavy-ion collisions at large energies. Students will gain insight into phases of		
of the created matt	er (quark-gluon plasma (QGP)), probes which contain information about the QGP and other phases of the collision, and knowledge the based on the recent measurements at present experiments.	nat these signals i	brought to us
02GTR	General Theory of Relativity	Z,ZK	4
	General Theory of Relativity the basics of General Relativity theory as well as its applications, mainly in cosmology. The students will get acquainted with the starti	· '	1
-	des the explanation of necessary mathematics: differential geometry. Classic results are derived, like the precession of Mercury, grav		-
	ng of light. The participants learn about Schwarzschild metrics and its solution leading to black holes. In the application part the Friedn	="	-
	is introduced and dynamics of the Universe is discussed.		
02JSP	Nuclear Spectroscopy	Z,ZK	5
Nuclear spectroso	opy comprises several experimental techniques which are of ultimate importance for experimental nuclear physics and various applic	ations as well. Le	cture will be
	devoted to fundamentals of X- and gamma- ray, charged particle and neutron spectroscopy.		
02KMP	Quantum Many-Body Problem in the Theory of Atomic Nuclei	ZK	2
	onian and distinguishing the degrees of freedom within nuclei 2. Collective and one-body dynamics in nuclei 3. Theory of the energy	-	
•	ergy density functional for the excited states 5. Selfconsistent mean-field model 6. Post Hartree-Fock methods 7. Tamm-Dancoff Appr Equation of Motion Phonon Method 10. Generator Coordinate Method 11. Restoration of symmetries in many-body methods 12. Cou		
pp. omination 3.	collective model	Ja Gradioi Midili	
02KTPA1	Quantum Field Theory 1	Z,ZK	8
	to introduce the students to both fundamental and applied parts of quantum field theory. The focus is in particular on equations of rel	,	l .
	tion of scalar and bispinor field, perturbation theory (Feynmans rules) and basics of renormalization. The content of the lecture can se	•	
	in fields of exactly solvable models, theory of critical phenomena, molecular chemistry and biochemistry or quantum gravity	y.	

		_	
02KTPA2	Quantum Field Theory 2	Z,ZK	8
	at introducing the students to the Feynmans functional integral and its applications. The focus is on broadening the knowledge of mo		
non-relativistic	quantum field theory and statistical physics. The content of the lecture can serve as a base for further study in fields of exactly solvab phenomena, molecular chemistry and biochemistry or quantum gravity.	e models, theory of	critical
02LPA	Particle plasma accelerators	ZK	2
-	ן b laser physics and technology, CPA systems 2. Physics of plasma and plasma wave generation 3. Plasma instabilities, beam-plasma	l l	
	ods of beam injection to plasma wave 6. Ultrashort particle bunch generation 7. Dynamics of bunch in plasma wave 8. Plasma diagno		
	sma waveguides 10. Plasma charged particle optics 11. Ultrashort bunch diagnostics 12. Handling and transport of ultrashort bunche		
· ·	bunches		
02MAT	Materials for Experimental Nuclear Physics	ZK	2
This lecture is desi	gned for students of experimental nuclear physics. The lecture gives the overview of materials physics with respect to materials frequency	ently used in the exp	perimental
r	uclear physics, particularly their construction properties and influence of the ionizing radiation on their properties and possible use in	experiment.	
02MTD	Modern Detectors	ZK	2
Lectures will cover	all types of detectors used in modern nuclear and particle physics. Topics include principles of construction of particular types of det	ectors, materials use	ed for their
	construction, ways of using and constrains. Emphasis is given also to electronic detector control and voltage suppliers.		
02PRF	Selected topics from probability theory for physicists	Z	. 2
	nuous probability distributions (Binomial, Poisson, negative binomial, normal, etc.) as well as the processes that lead to their origin has a second construction. The impactual for the further expansion of these divisions in the 20th contrary was their explication to the description of		-
	and economics. The impetus for the further expansion of these divisions in the 20th century was their application to the description o n and the spread of infectious diseases. The generalization of the properties of these distributions has later on led to the discovery of		
particle productio	infinitely divisible and stable distributions, which are currently widely used in physics and finance.	riew classes of distri	ibutions
02REP	Matrix Lie group representations	7	2
-	mmetric group, homomorphism, isomorphism, group action, direct product, semidirect product, normal group, simple and semisimple	- 1	
	SU(n), Lorentz group, Poincaré group. 2.One-parameter group, Lie algebras, Lie group Lie algebra correspondence, exponential map.		
	O(3) and SU(2). 4.Representation theory, unitary representation, regular representation, equivalent representation, irreducibility, redu		
	bra representation and their connection to Lie group representation, projective representation. 6.Irreducible representations of SO(3) a		
operators, spin rep	resentation. 7. Finite-dimensional representations of Lorentz group, tensor product of representations. 8. Representations of SU(3), Ge	II-Mann matrices, we	eights and
000070	roots. 9. Young tableaux.		
02ROZ3	Seminar on Quark-Gluon Plasma 3	Z	2
	Is with theoretical work related to problems of quark-gluon plasma. Students participate on the seminar by preparing the presentation	about selected pap	
02ROZ4	Seminar on Quark-Gluon Plasma 4	Z	2
	ut recent experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentation	7	2
02ROZ5	Seminar on Quark-Gluon Plasma 5 ut recent experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentatio	- 1	
02ROZ6	Seminar on Quark-Gluon Plasma 6	Z	2
	ut recent experimental measurements of the properties of the QGP. Students participate on the seminar by preparing the presentatio		
02SDSD	Detector Systems and Data Acquisition	ZK	2
	cture is to present knowledge of modern detector systems. We will concentrate on the aspects of construction and usage for charged	l l	
-	surement as well as particle identification via various methods from time-of-flight to transition radiation. The lecture will cover also the	· -	
	processing, digitalization, data acquisition and further data processing at the modern collider experiments.		
02SE1	Seminar 1	Z	3
The aim of the se	eminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields		tudied in
	research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics		
02SE2	Seminar 2	Z	3
The aim of the se	eminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields		tudied in
00050	research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics		
02SE3	Seminar 3	Z	3
The aim of the St	eminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics		lualea III
02SE4	Seminar 4	Z	3
	eminar is that students get familiar with basics skills to present the own scientific results. Students get also knowledge from the fields	_	
	research tasks and diploma theses of their colleagues. Participants will be informed about recent results in particle physics		
02SPRA1	Special Practicum 1	KZ	6
Physics measuren	nent focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen s	o that students can f	familiarize
	with advanced pats of experimental physics and metrology.		
02SPRA2	Special Practicum 2	KZ	6
Physics measuren	nent focused on instrumental techniques that are mainly used in physics and technical professions. Topics of each parts are chosen s	o that students can f	familiarize
	with advanced pats of experimental physics and metrology.		
02SZD1	Statistical Data Analysis 1	Z,ZK	4
· · · · · · · · · · · · · · · · · · ·	marily focused on practical application of methods of experimental data analysis. Students obtain knowledge of different statistical methods for the process of the statistical methods for the process of the statistical process of the sta	_	1
	ng of hypothesis. The course quickly recapitulates basis of mathematical probability theory but it is recommended to attend a full course		
02SZD2	Statistical Data Analysis 2	Z,ZK	4
	work will include implementation and testing of a program for analysis of generated data sample. Background understanding of Mon explained. The course covers methods of data smearing and subsequent deconvolution of data. Basics understanding and usage of n	-	
	learning will be covered.		
02UC1	Particles Accelerators 1	ZK	2
	Introduction to physics and technology of classical (electrostatic and radiofrequency) particle accelerators.		=
02UC2	Particle Accelerators 2	ZK	2
	Introduction to physics and technology of modern and next generation accelerators based on laser and plasma technology		
02VPJRS		7 714	_
02 11 3110	Selected topics from relativistic nucleus-nucleus collisions	Z,ZK	3
	Selected topics from relativistic nucleus-nucleus collisions ure is to discuss in more depth the physics of the extreme state of the nuclear matter created in relativistic nucleus-nucleus collisions.		

well as the medium	description using a hydrodynamic approach. Moreover, the in-medium parton energy loss and a related concept of the jet quenching will be complemented with computational exercises.	will be discussed.	The course		
02VS2	Workshop 2	Z	1		
	will participate on annual Workshop J F, where they will present results obtained during the work on their bachelor thesis. During other	ı er presentations frc	m students		
	nd staff, they will also get familiar with scientific topics developed at the department and with methods other colleagues use for their s				
02VS3	Workshop 3	Z	1		
Abstract: Students	will participate on annual Workshop J F, where they will present results obtained during the work on their bachelor thesis. During other	er presentations fro	m students		
an	d staff, they will also get familiar with scientific topics developed at the department and with methods other colleagues use for their so	cientific work.			
02VUJC1	Research Project 1	Z	6		
The research project	ct is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the proj	ect supervisor duri	ng common		
	regular meetings and discussions.				
02VUJC2	Research Project 2	KZ	8		
The research project	ct is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the proj	ect supervisor duri	ng common		
	regular meetings and discussions.				
02ZELW	Introduction to Theory of Electroweak Interactions	Z,ZK	6		
The goal of these	lectures is to acquire knowledge about theory of weak interaction from Fermi theory of -decay, introduction of charged intermediate	vector boson to un	fication of		
electromagnetic a	nd weak interaction in the framework of Standard model including Higgs mechanism. Short student presentations dedicated to experi	mental discoveries	related to		
	the topics covered in the lectures (such as first measurements of W and Z gauge bosons, Higgs boson discovery) are envision	ned.			
02ZQCD	Quantum Chromodynamics	Z,ZK	6		
The goal of these le	ectures is to acquire knowledge about basic principles of strong interaction starting from the constituent quark model and SU(3) flavour	r symmetry, studies	s of nucleon		
structure in deep in	elastic scattering of leptons on nucleons and parton model to basics of Quantum Chromodynamics and its practical applications in the	context of current e	experiments		
	in high energy physics and physics of ultra-relativistic heavy-ion collisions.				
04MGA1	English for Academic Purposes Speaking Practice - intermediate	Z	2		
Optional course offers Master's Degree students at intermediate level of English a chance to improve, develop, and strengthen their vocabulary and speaking skills. Course syllabus will respond to specific professional interests and situations of students and choice of topics will be agreed on with tutor. Course is a non-graded assessment course.					
04MGA2	Academic English Writing and Presentation Course - intermadiate	Z	2		
Optional course, a	possible free sequel to course 04MGA1, offers Master's degree students at intermediate level of English a chance to develop, improv	e, and strengthen	their writing		
and presentation s	kills. Syllabus will respond to specific professional needs of participants, but will include also writing and preparing a presentation on	own research topic	c, a search,		
instruction on writi	ing Master thesis in English and presenting chosen facts. Course will thus prepare students for presentations at conferences. Course	is a non-graded as	ssessment		
	course.				
17PRE	Computer Control of Experiments	Z,ZK	3		
Lectures provide in	formation about standard interfaces of personal computers - parallel, serial, USB, LAN and special interface cards; about standalone	equipment that co	mmunicate		
with computers via	a serial lines or GPIB (IEEE488) interface, further about measuring systems with VME, VXI and LXI interfaces, discuss their advanta	jes and disadvanta	iges. Next,		
	rogramming of measuring systems - special dedicated software, problems of use of high programming languages and especially use of g		evelopment		
	(Agilent VEE ane LabView); data acquisition and evaluation. Finally, students prepare individual software project for data acquisition				
18MEMC	Monte Carlo Method	Z,ZK	4		
	This courseis devoted to the numerical method Monte Carlo and to its selected applications.				
1800P	Object Oriented Programming	Z	2		
	This course consists of the contributions of students concerning given topics concerned on technologies uded in program develo	pment.			

For updated information see http://bilakniha.cvut.cz/en/FF.html Generated: day 2025-11-14, time 08:53.