CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ AKTP/12	**Course name:** Applications of Quantum Field Theory in Contemporary Condensed Matter Physics
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 4.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate sufficient theoretical knowledge of the methods of quantum field theory used in the study of phase transitions in condensed matter. The credit evaluation of the subject takes into account the following student workload: direct learning - 2 credits, study of recommended literature - 1 credit, exam preparation - 2 credits.	
Learning outcomes: To acquaint the students with modern methods of quantum field theory and their application in the condensed matter physics.	
Brief outline of the course: Hypothesis of scaling (critical scaling) in thermodynamics; Ising model and thermodynamics of ferromagnetism; Scaling of Green functions; Landau theory; Fluctuation theory and critical behaviour; Foundations of quantum field theory; Physical quantum fields and their equations – Dirac equations, Klein-Gordon equaiton; Quantization of fields; Evolution operator; S-matrix; Green functions and generation functional; T- and N-products; Wick theorems; Feynman diagrammatic technique; Functional form of Green functions, generating functional and statistical sum; Phase transitions; Universal behaviour of statistical sum in the vicinity of phase transition point; Landau fluctuation theory for description of phase transitions; Anomalous scaling; Renormalization of Landau theory; Epsilon-expansion and calculation of renormalization constants; Renormalization group and differential equations for Green functions; Asymptotic scaling solutions in the region of large scales,determination of their stability; Calculation of anomalous and critical exponents.	
Recommended literature: 1. N.N. Bogolyubov, D.V. Shirkov: Quantum fields, Nauka, Moskva, 2005 (in russian) 2. A.N. Vasilev: Renormalization group in Critical Behavior Theory and Stochastic Dynamics Chapman & Hall/CRS , Boca Raton London New York Washington D.C., 2004.	
Course language: slovak, english	

Notes:
The course is carried out in the full-time form, or if necessary remotely in the MS Teams environment.

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: prof. RNDr. Michal Hnatič, DrSc.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ASTF/15	**Course name:** Astrophysics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate a sufficient understanding of the formation of spectra in stellar atmospheres and their properties. Knowledge of chemical analysis, determination of stellar radii, temperatures and photospheric pressures, stellar rotation, micro and macroturbulence is required. The condition for obtaining credits is preparation of seminar essay and passing an oral exam, which consists of three theoretical questions within the curriculum presented during the course. The credit evaluation of the course considers the following student workload: direct teaching (2 credits), self-study (3 credits), individual consultations (2 credits) and assessment (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).

Learning outcomes:
After completing lectures, the student will master important concepts of the physics of stellar atmospheres. It will also have sufficient physical knowledge and mathematical apparatus to independently solve a wide range of astronomical problems related to the analysis of stellar spectra, such as performing chemical analysis, determining stellar radii, temperatures and photospheric pressure, rotational velocity and micro and macroturbulence parameters.

Brief outline of the course:
1. Chemical analysis: Curve of growth. Dependence on the temperature, pressure. Saturation. A reference curve of growth. Derivation of abundances, differential analysis, and synthesis method. The solar chemical composition, stellar abundances, and their evolutionary changes. Chemically peculiar stars.
2. Stellar radii and temperatures: speckle photometry, the interferometers, eclipsing binaries, the bolometric flux method, the surface-brightness method. The effective temperature from absolute flux, the Paschen continuum, colour indices, the Balmer jump, spectral lines of hydrogen and metals.
3. Photospheric pressure: the continuum as a pressure indicator, the spectral lines of hydrogen. The gravity-temperature diagram. The helium abundance.
4. Stellar rotation: the rotation profile, spectroscopic measurements of rotation, Fourier analysis, rotation dwarfs and evolved stars. Rotation and magnetic activity. Rotation of binary stars. Rotational mapping.

5. Velocity fields in stellar photospheres: Micro-turbulence and macro-turbulence. Line asymmetries. Stellar granulation. Modelling. Stellar wind.

Recommended literature:
1. Gray, D.F., The observation and analysis of stellar photospheres, Cambridge University Press, Cambridge, 1992;
2. Böhm-Vitense, E., Introduction to stellar astrophysics, Stellar atmospheres, Cambridge University Press, Cambridge, 1997;
3. Kipenhahn, R., Weigert, A., Stellar Structure and evolution, Springer-Verlag, Berlin, 1990;

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/PVS/04	**Course name:** Author's patents, discoveries, software
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week:** **Per study period:** **Course method:** distance, present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Patent filed, invention, software product created.	
Learning outcomes: The PhD student demonstrates the ability to create an innovative product in a given scientific field, or with impact on an interdisciplinary scale or in technical practice.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 48	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ COK/22	**Course name:** Certified training course
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a certified professional/training course.	
Learning outcomes: The PhD student acquires up-to-date scientific knowledge, develops the capabilities of scientific work and familiarizes himself with the methodologies of making scientific knowledge available. He confronts his own knowledge and skills with other course participants, develops the abilities of peer discussion in the given scientific field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 7	
abs	n
100.0	0.0
Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SPAV/22	**Course name:** Co-investigator of the applied research project
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Co-investigator of the applied research project	
Learning outcomes: The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective of applied research and to take responsibility for assigned tasks. By solving an applied research project, he acquires the ability to implement the project objective according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of applied research outputs. The PhD student gains valuable experience from the practical course of a grant project with a focus on applied research.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 16	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SIG/22	**Course name:** Co-worker of project supported by internal grant schemes (VVGS)

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-worker of project supported by internal grant schemes (VVGS)

Learning outcomes:
The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective within the internal grant system at UPJŠ. By solving the internal VVGS grant, he acquires the ability to implement the project plan according to the established procedure, adhere to the project schedule, coordinate his own activities with colleagues, and participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 16

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SMPR/04	**Course name:** Co-worker of project supported by international grant schemes

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 15

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Membership in the research team of an international project.

Learning outcomes:
Active involvement by solving a specific task within a team of international project solvers. The PhD student demonstrates the ability to work in a team, take responsibility for the assigned task, adhere to the time schedule and fulfill the project outputs. The PhD student gains personal experience from the implementation of an international project, participation in its key stages, creation of measurable outputs, grant funding of science

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 131

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SDPR/22	**Course name:** Co-worker of project supported by national grant schemes

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-investigator of the domestic project

Learning outcomes:
The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective and to take responsibility for the assigned tasks. By solving the domestic project, he acquires the ability to implement the project intention according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 51

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ POCF/13	**Course name:** Computational Physics
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, it is necessary for the student to demonstrate a sufficient degree of understanding of the principles of selected advanced computational methods. Lectures are organized in blocks, with a selection of topics reflecting the needs of currently registered students. The course ends with a final oral exam, the completion of which is conditioned by the submission of the project electronically and with the attached computer program. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits), self-study (2 credits), project work (2 credits), individual consultations (1 credit), and exam (1 credit). The minimum limit for completing the course is to obtain at least 50% of the total score.	
Learning outcomes: To acquaint students with modern methods of computational physics and their application to various physical and non-physical systems. Students have the opportunity to get acquainted with modern Monte Carlo methods and methods of molecular dynamics, developed for demanding simulations of complex systems using parallel programming, as well as their various interdisciplinary applications.	
Brief outline of the course: 1. Modern Monte Carlo methods for application to problematic complex systems with rugged energy surfaces. Multicanonical methods. Parallel tempering method (replica exchange). Calculation of density of states and free energy using the Wang-Landau method. Massively parallelized Wang-Landau replica exchange method for petaflop supercomputers. 2. Molecular Dynamics. Advanced concepts of computer simulation techniques used in statistical physics and their importance for understanding physical systems. Approach of molecular dynamics and its application in problems of statistical physics. Cellular automata for lattice gas. Problems of dynamics. 3. Other models and applications. Sociophysical models based on spin models. Galam's models. Voting model in hierarchical systems. Group decision model. Dynamics of opinion formation. Sznajd's model and its applications. Applications of statistical physics approaches in modeling spatio-temporal data. Time series predictions and digital image processing. Geostatistical applications.	
Recommended literature: Basic literature:	

LANDAU, D.P., BINDER, K.: A Guide to Monte Carlo Simulations in Statistical Physics, Cambridge Univ. Press, 5-th edition, 2021.
BOTTCHER, L., HERRMANN, H.J., Computational Statistical Physics, Cambridge Univ. Press, 2021.
BINDER, K., HEERMANN, D.W., Monte Carlo simulation in statistical physics, Springer-Verlag, Berlin, 2002.
HAILE, J.M., Molecular dynamics simulations, John Wiley & Sons. INC., New York, 1992.
KAMBERAJ, H., Molecular Dynamics Simulations in Statistical Physics: Theory and Applications, Springer Nature Switzerland AG, 2020.
VAN KAMPEN, N.G., Stochastic processes in physics and chemistry, North-Holland, 1990.
CHAKRABARTI, B.K. et al. (Editors), Econophysics and sociophysics: Trends and perspectives, Wiley-VCH, 2006.
GALAM, S., Sociophysics: A Physicist's Modeling of Psycho-political Phenomena, Springer, 2012.

Course language:

Notes:

Course assessment
Total number of assessed students: 13

N	P
0.0	100.0

Provides: prof. RNDr. Milan Žukovič, PhD.

Date of last modification: 16.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ODZP/14	**Course name:** Defence of Doctoral Thesis

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
The Dissertation thesis is the result of the student's own scientific research. It must not show elements of academic fraud and must meet the criteria of correct research practice defined in the Rector's Decision no. 21/2021, which lays down the rules for assessing plagiarism at Pavel Jozef Šafárik University in Košice and its constituents. Fulfillment of the criteria is verified mainly in the process of supervising and in the process of the thesis defense. Failure to do so is grounds for disciplinary action.

Learning outcomes:
The Dissertation thesis has elements of a scientific work and the student demonstrates extensive mastery of the theory and professional terminology of the field of study, acquisition of knowledge, skills and competences in accordance with the declared profile of the graduate of the field of study, as well as the ability to apply them in an original way in solving selected problems of the field of study. The student demonstrates the ability of independent scientific work in terms of content, formal and ethical aspects. Further details of the Dissertation thesis are determined by Directive no. 1/2011 on the essential prerequisites of final theses and by the Study Rules of Procedure at UPJŠ in Košice for doctoral studies.
The doctoral student demonstrated the ability and readiness for independent scientific and creative activity in the field of study of philology in accordance with the expectations of the relevant qualification framework and the profile of the graduate.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 135

N	P
0.74	99.26

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MDU/04	**Course name:** Detection Methods and Experiments on Large Colliders

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Conditions for continuous evaluation:
1. Presence at the lectures as specified by the rules of study and indicated by the lecturer.
2. Activity at seminars.
Conditions for the final evaluation:Research work on a selected topic.
Conditions for the successful course completion:
1. Active presence at lectures.
2. Fulfillment of the conditions of continuous and final evaluation at more than 90% level.
Credit evaluation of the course: direct teaching, individual consultations, self-study (1 credit), practical activities – research work (2 credits), evaluation (1 credit).

Learning outcomes:
The student can demonstrate sufficient knowledge about the physics principles and measurement methods in the high energy and particle physics in large experiments with particle accelerators. Aqcuired knowledge can be actively used during the physics analysis of the real experimental data.

Brief outline of the course:
1. Passage of radiation through matter.
2. Gaseous detectors: principles of operation, ionization chamber, proportional chamber, spark chamber, streamer chamber, MWPC, drift chamber, TPC.
3. Scintillation detectors: Geiger and Marsden experiments, scintillation detectors, photomultipliers.
4. Calorimeters: calorimetry in the high energy physics, electromagnetic calorimeters, Rossi-Heitler model of the electromagnetic shower, electromagnetic showers, practical realization of electromagnetic calorimeters, energetic resolution of electromagnetic calorimeters.
5. Hadron calorimeters: hadron showers, electromagnetic and hadronic shower components, calorimeter response, compensation, energy resolution.
6. Cherenkov radiation detectors: Cherenkov radiation, differential Ch. detectors, RICH.
7. Transition radiation detectors.
8. Semiconductor detectors: conduction, semiconductors, P-N junction, microstrip detectors, pixel detectors, drift detectors.
9. Time of flight method.

10. Muon detectors: multiple scattering, Branson plane.
11. Photoemulsion detectors.
12. Experiments at large accelerators. ALICE experiment at LHC at CERN.

Recommended literature:
Dorin N. Poenaru and Walter Greiner: Experimental Techniques in Nuclear Physics, Walter de Gruyter, Berlin-New York, 1997
Kleinknecht k.:Detectors for particle radiation, Cambridge University press,1986
S. Tavernier, Experimental Techniques in Nuclear and Particle Physics, Springer-Verlag Berlin Heidelberg, 2010

Course language:
slovak or english

Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: RNDr. Ivan Králik, CSc.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DPSD/14	**Course name:** Distributed data processing

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Term project, evaluation.
Credit evaluation of the course: direct teaching, individual consultations and self-study (1 credit), practical activities – term project (2 credits), evaluation (1 credit). Minimum limit for completion of the course is to obtain at least 51% of the total evaluation.

Learning outcomes:
Lectures on parallel data processing on analysis farms.

Brief outline of the course:
Introduction to batch systems and network storage.
Generate multiple events using event generator and run multiple simulations on cluster.
Analyze these data to produce physics results.
Merge these results when analysis is done.

Recommended literature:
https://www.gnu.org/software/bash/
http://www.adaptivecomputing.com/products/open-source/torque/
http://root.cern.ch/drupal/
http://xrootd.org/
https://eos.readthedocs.org/en/latest/

Course language:
English

Notes:

Course assessment
Total number of assessed students: 10

N	P
0.0	100.0

Provides: RNDr. Martin Vaľa, PhD.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VPZP/22	**Course name:** Elaboration of reviewer report

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Elaboration of reviewer report

Learning outcomes:
The PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly recommend another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VPKF2/13	**Course name:** Energetic particles and heliosphere

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Literature search and compilation on one particular subject selected. Concluding work.
Credit evaluation of the course: direct teaching,
individual consultations and self-study (1 credit), practical activities – concluding work (2 credits), evaluation (1 credit).

Learning outcomes:
To acquaint with the know edge of selected physical processes in the inner and outer heliosphere.

Brief outline of the course:
1. Introduction. Radial structure of the Sun. 2. Sun atmosphere. Solar flares. Acceleration of particles in eruptions. Solar neutrons and gamma radiation. 3. Solar wind. Interplanetary magnetic field. Corotion interaction areas. 4. Plasma waves in the interplanetary environment. Three-dimensional structure of the heliosphere. 5. Active processes in the Sun. Eruptions and outbursts of coronal matter. Shock waves. 6. Solar radio emissions. Thermal emission. Microwave domain. Radio emissions after eruptions and disturbances in the interplanetary environment. 7. Energy particles in the heliosphere. Populations and resources. Solar energy particles. 8. Transport of particles in the interplanetary field. Theoretical foundations. Spatial diffusion. Diffusion in the space of pitch angles. Diffusion in the space of momentum. 9. Interactions of waves and particles in the heliosphere. Transport equations. 10. Observations of particle propagation in the interplanetary environment. Comparison with experiment. 11. Acceleration of particles on shock waves - theoretical models. 12. Particles on shock waves in the interplanetary environment. 13. Galactic cosmic rays and modulation models.

Recommended literature:
R. Schwenn, E. Marsch (editors), Physics of the Inner Heliosphere II, Particles, Waves and Turbulence, Springer Verlag, 1991
Reames, D. V., Particle acceleration at the Sun and in the heliosphere, Space Science Reviews, vol. 90, pp. 413–491, 1999. doi:10.1023/A:1005105831781.
K. Scherer, H. Fichtner, E. Marsch, The Outer Heliosphere: Beyond the Planets, Copernicus Gesellschaft e.V., 2000
Lee, M.A., Mewaldt, R.A., and Giacalone, J., Shock Acceleration of Ions in the Heliosphere, 2012, Space Science Reviews, 173, 247. doi:10.1007/s11214-012-9932-y.

Marius S. Potgieter, Solar Modulation of Cosmic Rays, Living Reviews in Solar Physics volume 10, Article number: 3 (2013)

Course language:

Notes:

Course assessment
Total number of assessed students: 3

N	P
0.0	100.0

Provides: RNDr. Pavol Bobík, PhD.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VPKF1/13	**Course name:** Energetic particles and magnetospheres

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Literature search and compilation on one particular subject selected. Concluding work.
Credit evaluation of the course: direct teaching,
individual consultations and self-study (1 credit), practical activities – concluding work (2 credits), evaluation (1 credit).

Learning outcomes:
To acquaint with the know edge of selected physical processes in magnetosphere, especially that of Earth.

Brief outline of the course:
1. Particle drifts and the first adiabatic invariant. Guiding center approach. Homogeneous magnetic field. 2. Drifts of zero, first and second order. The first adiabatic invariant. Particle drift at the geomagnetic equator. 3. Oscillating motion between mirror points. Particle capture. Equation of parallel motion with respect to a lineof force. Energy equation. 4. Drift envelopes. The second adiabatic invariant. 5. Drift of particles in a dipole magnetic field. 6. Monitoring of drift envelopes in a real model of a geomagnetic field. 7. Effects of external forces on particles near the equatorial plane. 8. Periodic drift movement. Drift envelopes in a time-dependent magnetic field. 9. Third adiabatic invariant. Influence of ring current on the path of particles near the equator. 10. Effect of sudden compressions and adiabatic expansions of the magnetosphere. 11. Distribution of trapped particles. Directional flow. 12. Distribution functions of particles in the magnetosphere. 13. Mapping of trapped particles in the inner magnetosphere. Coordinates B-L. 14. Disruption of adiabatic invariants. Diffusion mechanisms. 15. Coordinates and distribution functions used. 16. Diffusion equation. Radial diffusion. Angular diffusion in a symmetric field. Combined radial and angular diffusion.

Recommended literature:
Roederer, J., Dynamics of Geomagnetically Trapped Radiation, Springer, 1970
M.G. Kivelson and C.T. Russell, Introduction to Space Physics, Cambridge University Press, 1995
J. P. Eastwood, H. Hietala, G. Toth, T. D. Phan & M. Fujimoto , What Controls the Structure and Dynamics of Earth’s Magnetosphere?, Space Science Reviews volume 188, pages251–286, 2015

S. E. Milan, L. B. N. Clausen, J. C. Coxon, J. A. Carter, M.-T. Walach, K. Laundal, N. Østgaard, P. Tenfjord, J. Reistad, K. Snekvik, H. Korth & B. J. Anderson, Overview of Solar Wind–Magnetosphere–Ionosphere–Atmosphere Coupling and the Generation of Magnetospheric Currents, Space Science Reviews volume 206, pages547–573, 2017

Course language:

Notes:

Course assessment
Total number of assessed students: 3

N	P
0.0	100.0

Provides: RNDr. Pavol Bobík, PhD.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ AJD1/07	**Course name:** English Language for PhD Students 1

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of e-course English for PhD Students (lms.upjs.sk), consultations (1-3).
Written assignments - Professional/Academic CV, Short Academic Biography.

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking; improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects; development of pragmatic competence - students acquire skills for effective and purposeful communication, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Specific aspects of academic and professional English with focus on correct pronunciation, vocabulary development (noun and verb collocations, phrasal verbs, prepositional phrases, word-formation, formal/informal language, etc.), selected aspects of English grammar (prepositions, grammar tenses, passive voice, etc.), academic writing (professional/academic CV, Short Academic Biography).

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí – cvičebnica. Košice, Vydavateľstvo ŠafárikPress, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.
lms.upjs.sk

Course language:
English, level B2 according to CEFR

Notes:

Course assessment
Total number of assessed students: 813

N	Ne	P	Pr	abs	neabs
0.0	0.0	43.79	0.0	56.09	0.12

Provides: Mgr. Zuzana Kolaříková, PhD., Mgr. Ivana Kupková, PhD.

Date of last modification: 06.09.2024

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ AJD2/07	**Course name:** English Language for PhD Students 2

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Test, oral exam in accordance with the exam requirements (available at the web-site of the LTC and in MS TEAMS)

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Academic communication (self-presentation, presenting at scientific meetings and conferences). Specific aspects of academic and professional English with focus on vocabulary development (formality, academic word-list), English grammar (passive voice, nominalisatio), language functions (expressing opinion, cause/effect, presenting arguments, giving examples, describing graphs/charts/schemes, etc.). Cross-language interference.

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí (cvičebnica). UPJŠ Košice, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.

Course language:
B2 level according to CEFR

Notes:

Course assessment
Total number of assessed students: 776

N	Ne	P	Pr	abs	neabs
0.26	0.0	94.07	1.03	4.51	0.13

Provides: Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 03.02.2025

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ERS/13	**Course name:** Exactly Solved Models in Statistical Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
The student has to prove sufficient understanding of basic notions, concepts and applications in the field of statistical physics of exactly solvable models in order to successfully complete the present subject. The knowledge of basic terms of statistical physics at the level of their mathematical definition as well as physical meaning is required in addition to concrete applications. The student has to learn the topics in order to be capable of active and creative solving of concrete tasks within the project and pass oral exam. Credit assignment of the subject accounts for the following engagement of the student: lectures (3 credits), independent studies (3 credits), individual consultations (1 credit) and examination (1 credit). The minimal requirement for passing through the subject is to show a good orientation in the curriculum as well as to deeper understand the subject matter. The evaluation scale uses the grades: pass and fail.

Learning outcomes:
After passing lectures the student will have sufficient physical knowledge and mathematical apparatus in order to be capable of independent solving a wide class of traditional as well as state-of-the-art scientific problems of statistical physics. The student will gain overview about diverse applications of statistical physics in the field of magnetism, solid-state physics, atomic and molecular physics.

Brief outline of the course:
1. Exact solution for one-dimensional quantum Ising chain and quantum XY chain in a transverse magnetic field. Jordan-Wigner, Fourier and Bogoliubov transformations. Quantum critical points and anomalous behaviour of quantities in their close vicinity.
2. Exact solution for one-dimensional quantum Heisenberg chain within the framework of second-quantization formalism, the introduction to Bethe ansatz method. Elementary excitation spectrum, free and bound states of the Heisenberg model with two spin deviations.
3. Two-dimensional Ising model: dual transformation, star-triangle transformation, decoration-iteration transformation and theory of generalized algebraic transformations. Exact calculation of critical temperatures of ferromagnetic ising models.
4. The formulation of exact solution of a two-dimensional Ising model through the transfer-matrix method. An equivalence of solving a two-dimensional Ising model with dimer covering problem, Pfaffian method.

5. The Ising model as a model of lattice gas, binary alloys, phase separation of liquid mixtures: Frenkel-Louis and Lin-Taylor model.
The selection from aforedescribed topics is made by the supervisor according to scientific orientation of the dissertation thesis.

Recommended literature:

1. R.J. Baxter, Exactly Solved Models in Statistical Mechanics, Academic, New York, 1989.
2. J.B. Parkinson, D.J.J. Farnell, An Introduction to Quantum Spin Systems, Lecture Notes in Physics 816, Springer, Berlin, 2010.
3. D.C. Mattis, The Many-Body Problem, World Scientific, Singapore, 1993.
4. F.Y. Wu, Exactly Solvable Models, World Scientific, Singapore, 2008.
5. D.A. Lavis, G.M. Bell, Statistical Mechanics of Lattice Systems, Volume 1, Springer, Berlin, 1999.
6. B. Nachtergaele, J.P. Solovej, J. Yngvason, Condensed Matter Physics and Exactly Soluble Models, Selecta of E. H. Lieb, Springer, Berlin, 2004.
7. J. Strečka, Exactly Solvable Models in Statistical Physics, supportive textbook, ESF 2005/ NP1-051 11230100466, Košice, 2008.

Course language:
1. Slovak; 2. English

Notes:

Course assessment
Total number of assessed students: 16

N	P
0.0	100.0

Provides: doc. RNDr. Jozef Strečka, PhD.

Date of last modification: 19.09.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ESH/09

Course name: Extremal States of Matter

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Literature search and compilation on one particular subject selected. Concluding work.
The credit evaluation of the course: direct teaching, individual consultations and self-study (1 credit), practical activities – concluding work (2 credits), evaluation (1 credit).

Learning outcomes:
The main goal of lectures is introduction to matter extremal states topic.

Brief outline of the course:
1. Inroduction to basic
2. Plasma
3. Quark-hadrons phase transition
4. Short introduction to modern cosmology
5. Space expansion
6. Simple cosmological models
7. Big hot explosion
8. Phase transitions in early space
9. Elements nucleosynthesis and origin of light elements
10. Compact stars
11. Dark matter, dark energy
12. Inflation space

Recommended literature:
1. Andrew Liddle, An introduction to modern cosmology, Chichester, UK: Wiley (1998) 129 str.
2. Joseph Silk, The Big Bang
3. Jean Letessier, Johan Rafelski: Hadrons and quark-gluon plasma, Camb. Monogr.Part. Phys. Nucl. Phys. Cosmol. 18: 1-397, 2002.
4. K.Yaki, T. Hatsuda, Y.Miake, Quark-gluon plasma: From big bang to little bang. Camb. Monogr.Part. Phys. Nucl. Phys. Cosmol. 23: 1-446, 2005.

Course language:

Notes:

Course assessment
Total number of assessed students: 3

N	P
0.0	100.0

Provides: RNDr. Pavol Bobík, PhD., doc. RNDr. Marek Bombara, PhD.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ASVE/15	**Course name:** High energy astrophysics
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate sufficient understanding of the basics of high energy astrophysics. Knowledge of astrophysical mechanisms of origin and properties of high-energy radiation in various types of space objects, as well as methods of detection and analysis of X-rays and gamma rays is required. The condition for obtaining credits is preparation of seminar essay and passing an oral exam, which consists of three theoretical questions within the curriculum presented during the course. The credit evaluation of the course considers the following student workload: direct teaching (2 credits), self-study (3 credits), individual consultations (2 credits) and assessment (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).	
Learning outcomes: After completing the lectures, the student will master the basic knowledge of astrophysical mechanisms of origin and properties of high-energy radiation in various types of space objects, as well as methods of detection and analysis of X-rays and gamma rays. It will also have sufficient physical knowledge and mathematical apparatus to enable independent solving of a wide range of astronomical problems related to high energy astrophysics.	
Brief outline of the course: 1. High energy astrophysics: the discovery, properties, and mechanisms for generating of X-rays and gamma rays, observing of high energy photons from cosmic sources. X-ray and gamma ray detectors, location of cosmic X-ray sources, spectroscopy, timing, significant missions. 2. Solar system X-rays: The production of planetary X-rays, Earth and other planets, the Moon, comets. The interstellar medium: absorption of X-ray by interstellar and intergalactic gas, shadows, scattering of X-ray by interstellar dust. 3. Active stellar coronae: The Sun, the dynamo model, coronal emission from binary systems, high-resolution X-ray spectra, X-ray Doppler imaging, Flare stars, young stars. 4. Early-type stars: O stars, stellar winds, X-rays from single stars, colliding winds, Eta Carinae, Superbubbles. 5. Supernova explosions and their remnants: X-ray from supernovae, evolution of supernovae remnants, young shell-like remnants.	

6. Neutron stars and pulsars: The Crab nebula, rotation and spin-down, the glitch, pulsed radiation, structure of neutron stars, cooling, pulsar wind nebulae, anomalous pulsars, soft-gamma repeaters, magnetars.
7. Cataclysmic variable stars (CVs): geometry of accretion in CVs, dwarf nova outbursts, X-rays from dwarf novae, formation and evolution of CVs, magnetic CVs, X-ray spectroscopy of CVs, AM CVn systems, super-soft sources.
8. X-ray binaries: high-mass and low-mass X-ray binaries, black-hole X-ray binaries and their observed properties, soft X-ray transients.
9. Galaxies, active galactic nuclei (AGNs) and clusters of galaxies: X-ray sources in the Milky Way, Local Group, star-burst galaxies, the unified model, and structure of AGNs, central supermassive black holes, jets, out-flowing wings, X-rays from inter cluster medium (ICM), temperature and morphology of ICM, the Sunyaev-Zeldovitch effect.
10. The diffuse X-ray background and Gamma-ray bursts (GRBs): extragalactic source populations and cosmic variance, diffuse galactic emission, discovery, afterglows and precise location of GBRs, present understanding.

Recommended literature:

1. Melia, F., High-Energy Astrophysics, Princeton University Press, Princeton, 2009;
2. Lewin, W.H.G., van der Klis, M., Compact Stellar X-ray Sources, Cambridge University Press, Cambridge, 2006;
3. Longair, M. S., High Energy Astrophysics, Cambridge University Press, Cambridge, 2011;
4. Seward, F. D., Charles, P. A., Exploring the X-ray Universe, Cambridge University Press, Cambridge, 2010;

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DKZU/22	**Course name:** Home Conference with Foreign Participation

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in a national conference with foreign participation.

Learning outcomes:
By actively participating in a scientific conference, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology in his scientific field. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence to use existing theories and concepts in an innovative way, as well as generate new original scientific knowledge and communicate research results to a wider audience by adequate means and through Slovak or a foreign language.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 69

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ NEM/04	**Course name:** Implementation of new experimental methodology
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course: 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 100	

abs	n
100.0	0.0

Provides:	
Date of last modification:	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZC/22	**Course name:** International Journal

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a foreign journal as an author/co-author.

Learning outcomes:
By publishing in a foreign journal as an author/co-author, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 4

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ZSP1/22	**Course name:** International Study Stay less than 30 Days

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of a foreign study stay lasting less than 30 days.

Learning outcomes:
By completing a shorter study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 34

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZSP2/22	**Course name:** International Study Stay more than 30 Days
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a foreign study stay lasting more than 30 days.	
Learning outcomes: By completing the study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 13	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MKZ/22	**Course name:** International abroad conference

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in an international conference abroad.

Learning outcomes:
By actively participating in an international scientific conference abroad, the phD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology in his scientific field. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence to use existing theories and concepts in an innovative way, as well as generate new original scientific knowledge and communicate research results to a wider audience by adequate means and through a foreign language.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 109

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ USM/04	**Course name:** Introduction to Standard Model
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Knowledge of the subject at a sufficient level, exam. Credit evaluation of the course takes into account the following student workload: direct teaching and individual consultations (2 credits), self-study (2 credits), evaluation (1 credit).	
Learning outcomes: The student learns basic facts about development of the theory of weak interactions.	
Brief outline of the course: 1. Basic properties of the beta dacay and the first attempt to explain observed phenomena. A hypothetical particle neutrino. 2. Revolutionary Fermi theory of the beta decay. 3. Parity conservation in weak interaction. The experimental proof of parity violation in the beta decay. 4. A general form of the weak interaction Hamiltonian. 5. Experimetal determination of all free parameters of the weak interaction Hamiltonian.	
Recommended literature: 1. J. Hořejší: Introduction to electroweak unification (World Scientific, Singapore 1994); czech version: Elektroslabé sjednocení a stromová unitarita (Karolinum, Praha 1993). 2. P. Renton: Electroweak interactions (Cambridge Univ. Press, Cambridge 1990). 3. Francis Halzen, Alan D. Martin: Quarks and Leptons, John Wiley&Sons; in russian: F.Helzen, A.D.Martin: Kvarki i leptoni, Mir, Moskva, 1987. 4. Cheng T.P., Li L.F.: Gauge theory of elementary particle Physics, Claredon Press, Oxford, 1984.	
Course language: slovak and english	
Notes:	

Course assessment
Total number of assessed students: 19

N	P
0.0	100.0

Provides: prof. RNDr. Michal Hnatič, DrSc., RNDr. Ivan Králik, CSc.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ DC/22	**Course name:** Local journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Publication accepted in a national journal as author/co-author.	
Learning outcomes: By publishing in a national journal as an author/co-author, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 2	
abs	n
100.0	0.0
Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MAG/08	**Course name:** Magnetochemistry

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 1 **Per study period:** 28 / 14
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: II., III.

Prerequisities:

Conditions for course completion:
Continuous active acquisition of the subject is required during the course of Magnetochemistry, which is necessary for independent mastery of individual tasks in self-study and in solving specific homework assignments. During the semester, the student will get a theoretical project based on the study of foreign journal literature (understanding of a specific scientific article and based on it the elaboration and presentation). Another condition for completing the course is active participation in lectures and seminars. In the exercises, the student will get a concrete idea of how the experimental data are analyzed. Subsequently, the student independently analyzes the experimental data of the selected magnetic compound in the frame of two to three home projects and presents the results of the analysis at a joint meeting. Another condition for obtaining credits is successful completion of the exam from the theoretical part in the form of an extensive oral discussion, where the student demonstrates understanding of basic concepts and relationships between them, finding connections and understanding the course as a coherent whole logically built on the basis of gradual incorporation of individual interactions. The minimum threshold for passing the course is successful completion of self-study projects and individual assignments during the semester and mastering the final oral exam by more than 50 percent.
Credit evaluation takes into account the scope of direct teaching (2 credits), self-study of recommended literature and preparation of presentation (1 credit) elaboration of home assignments (1 credit), consultations and evaluation (1 credit)

Learning outcomes:
After completing the course, the students will gain a basic perspective, which will allow them to sufficiently orient themselves in the current scientific literature focused on quantum magnetism. Based on the acquired theoretical knowledge and practical experience, they will be able to independently study magneto-structural correlations in electrically non-conductive materials and identify their magnetic state, which is important especially for quantum technologies but also for practical applications such as magnetic cooling especially at low temperatures. Based on the acquired knowledge, discussions and the creation of individual projects, they will also learn the basics of critical thinking in this field.

Brief outline of the course:

1. Development of theories of the structure of atom. Bohr model of atom. Electron in the hydrogen atom. Wave functions and orbitals. Quantum numbers. Magnetomechanical parallelism. Spin of electron. Atoms with higher number of electrons. Electron-electron interactions. Ground state of atom. Hund's rules. Terms. Multiplets.
2. Atom in magnetic field: I. Magnetic properties of atom. Paramagnet. Macroscopic properties of paramagnetic materials. Specific heat – Schottky maximum, experimental techniques of heat capacity measurements. Magnetization - Brillouin function, experimental techniques of magnetization measurements.
3. Atom in magnetic field II: Magnetic susceptibility – Curie law, experimental techniques of susceptibility measurements. Electron paramagnetic resonance. Field induced magnetic moment of filled electronic shells. Diamagnetic susceptibility. Pascal's constants.
4. Atom in crystal field. Weak, medium, strong crystal field. Medium crystal field: Ions with one electron in the unfilled subshell, ions with two and more electrons in the unfilled subshell. Freezing of angular momentum. Jahn-Teller effect.
5. Spin-orbit coupling in the first and second order of perturbation theory. Spin Hamiltonian. Spin Hamiltonian for tetragonal symmetry of the medium crystal field. Kramers theorem. Thermodynamics of the system of paramagnetic ions in crystal field. Specific heat. Magnetization. Magnetic susceptibility. Electron paramagnetic resonance of the systems with crystal field.
6. Magnetic correlations. Exchange coupling. Molecule of hydrogen. Heisenberg Hamiltonian. Exchange pathway. Direct and undirect exchange interaction. Anderson model of superexchange. Goodenough-Kanamori empirical rules.
7. Spatial arrangement of exchange pathways. Cluster. Chain. Layer. Low-dimensional magnetic systems.Three-dimensional magnetic systems. Phase transitions. Correlation length. Ehrenfest's theorems. Long range order. Short-range order. Magnetic dimer: Specific heat. Magnetization. Magnetic susceptibility. Electron paramagnetic resonance.
8. Anisotropy in the exchange interactions. Sources of anisotropy. Dipolar interaction. Heisenberg model. Ising model. XY model.
9. Analysis of the structure of selected compounds based on Ni(II) and Cu(II) ions. Determination of exchange pathways and the influence of crystal field. Suggestion of appropriate magnetic models for the compounds. Using scientific software Origin each student will perform analysis of experimental data of temperature dependence of specific heat of Ni(II) compound, i.e. separation of lattice contribution, calculation of magnetic entropy, comparison with expected theoretical values.
10. Application of theoretical prediction of chosen model for magnetic specific heat of Ni(II) compound and considering the correctness of the model, explanation origin of deviations of experimental data from the applied model .
11. Analysis of magnetic susceptibility of Ni(II) compound-subtraction of diamagnetic contribution, calculation of magnetic moment and g-factor. Application of Curie-Weiss law, then fitting exp. data by a model prediction yielding g-factor and strength of crystal field.
12. Comparison of results obtained from the analysis of specific heat and susceptibility. Then magnetization is calculated and compared with experimental data. Students will make hypothesis about the ground state of the system and they will suggest new experiments on the studied compound.
13. Comparison of the results obtained by individual students which provides information about the influence of individual approach, as number of particular analyses, which test robustness of obtained material parameters etc. Monitoring and examination of elaboration of analogic home projects on Cu(II) compound, accompanied with consultations.

Recommended literature:

1.R.L. Carlin, A.J. Duyneveldt: Magnetic properties of transition metal compounds. New York, inc. Springer Verlag, 1977.

2. J-P. Launay, M. Verdaguer, Electrons in Molecules, Oxford 2018.
3. A. Abragam, B. Bleaney, Electron Paramagnetic Resonance of Transition Ions, Oxford, 2012.

Course language:
english

Notes:
The course Magnetochemistry is realized in the attendance form. In some special cases (as was pandemics of Covid) the teaching is realized online using software MS Teams, which enables to keep the contact with students and to keep the level and quality of the course.

Course assessment
Total number of assessed students: 33

A	B	C	D	E	FX	N	P
42.42	12.12	24.24	3.03	6.06	0.0	0.0	12.12

Provides: doc. RNDr. Alžbeta Orendáčová, DrSc.

Date of last modification: 27.09.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MMTF/13	**Course name:** Mathematical Methods in Theoretical Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Final evaluation conditions:
Demonstration of knowledge through a test and a seminar paper on a selected topic. The total weight of the test and the seminar paper is 50%.
The content of the test covers the individual topics.
The credit evaluation of the course takes into account the following student workload: direct instruction (3 credits), self-study (2 credits) and assessment (3 credits).
Prerequisites for successful completion of the course:
Mastery of the midterm and final assessment requirements at a minimum of 50% overall.

Learning outcomes:
To improve students in the use of mathematical methods in theoretical physics.
The student will be able to apply methods such as Green's function, perturbation calculus, and complex analysis to analytical study of physics problems.

Brief outline of the course:
Week 1:
Differential equations of mathematical physics. Generalized functions. Delta function.
Differential calculus of generalized functions.
Week 2-3:
Fourier series of the delta function. Green's function for one-dimensional boundary value problems.
Green's function for the Poisson equation.
Week 4:
Asymptotic methods and perturbation theory. Classification of singular points.
Week 5:
The theory of asymptotic series. Asymptotic development of the integral. Laplace's method and the stationary phase method.
Week 6:
Regular and singular perturbation theory. Summation of divergent series. Padé summation.
Week 7:
Dynamical systems and chaos. Geometric interpretation.
Week 8:

Fixed points and their stability. Bifurcations.
Week 9:
Two-dimensional flows. Phase portrait. Strange attractors.
Week 10:
Complex analysis. Analytic continuation in plane and space. Conformal representations.
Week 11:
Applications to harmonic functions and Laplace's equation.
Week 12:
Applications in fluid flow. Poisson's equation and Green's function.

Recommended literature:

AHLFORS, Lars V. Complex analysis. An introduction to the theory of analytic functions of one complex variable. New York, McGraw-Hill Book Co., 1978.
ARFKEN, George. WEBER, Hans. Mathematical Methods for Physicists. Elsevier, 2012.
BENDER, Carl M. ORSZAG, Steven A. Advance Mathematical Methods for Scientists and Engineers I. New York, Springer, 1999.
LANDAU, Lev D. LIFSHITZ, Evgeni M. Fluid Mechanics: Volume 6. Butterworth-Heinemann, 1987.
OLVER, Peter J. Introduction to Partial Differential Equations. Cham, Springer, 2014.
STRAUSS, Walter A. Partial Differential Equations: An Introduction. John Wiley & Sons. 2nd edition, 2008.
STROGATZ, Steven H. Nonlinear dynamics and chaos. Boulder, Westview Press, 2015.

Course language:
1. Slovak
2. English

Notes:

Course assessment
Total number of assessed students: 8

N	P
0.0	100.0

Provides: RNDr. Tomáš Lučivjanský, PhD., univerzitný docent

Date of last modification: 26.09.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/MONB/22	**Course name:** Monograph

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-author of the monograph.

Learning outcomes:
By publishing a monograph, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. It demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The doctoral student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MONA/22	**Course name:** Monograph in a renowned publishing house

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 40

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-author of a monograph in a renowned publishing house.

Learning outcomes:
By publishing a monograph in a renowned publishing house, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The doctoral student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DK/04	**Course name:** National Conference

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the home conference.

Learning outcomes:
By actively participating in the national scientific conference, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology in his scientific field. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence in using existing theories and concepts in an innovative way, as well as generating new original scientific knowledge and communicating research results to a wider audience using adequate means and through the Slovak language.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 187

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NRZ/22	**Course name:** Non-Reviewed International or National Proceedings

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
A publication published in a non-reviewed foreign or national journal as an author/co-author.

Learning outcomes:
By publishing in a non-reviewed foreign or national journal as an author/co-author, the PhD student demonstrates the ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The phD student demonstrates the ability to finalize his own thoughts in a written speech.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 18

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NMAS/15	**Course name:** Numerical methods of astrophysics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, it is necessary for the student to demonstrate a sufficient understanding of various numerical methods used in astrophysics, be able to apply machine learning approaches and simulate some astrophysical processes. Lectures are organized in blocks. In order to obtain an evaluation and thus also credits, the student must create a software project on a given topic and present the achieved results. Credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).

Learning outcomes:
After completing the course, the student will have the knowledge that will enable him to independently solve complex numerical problems in astrophysics, such as Monte-Carlo simulations, integration of N-body motion, etc. They will also be able to apply machine learning approaches and methods to different types of astronomical data.

Brief outline of the course:
Monte-Carlo simulations in astrophysics, energy transfer in a star, determination of parameter errors, simulations of light curves of eclipsing binary stars - ELISA module. Simulations of mass transfer and accretion disks. Dynamics of systems with N bodies. Machine-learning and eclipsing binaries

Recommended literature:
1. Press et. al.: 2002, Numerical Recipes in C.: Cambridge University Press
2. Robert, A. & Cassela, M.: 2005, Monte Carlo Statistical Methods, Springer
3. Raschka, S.: 2016, Python Machine Learning, Packt Publishing
4. Željko, I., et. al.: 2014, Statistics, Data Mining, and Machine Learning in Astronomy, Princeton University Press
5. software manuals NumPy, SciPy, PyKE, published papers

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 8

N	P
0.0	100.0

Provides: doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ DCK/14	**Course name:** Particle detection by calorimetric methods
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Knowledge of the subject at a sufficient level, evaluation. The credit evaluation of the course takes into account the following student workload: direct teaching (1 credit), self-study (2 credits) and evaluation (1 credit).	
Learning outcomes: Special lectures oriented towards particle calorimetry.	
Brief outline of the course: Interactions of particles with matter: electrons, protons, charged particles, photons, muons. Energy loss, range. Interactions at high energy. Calorimeters: Principles of Calorimetry. Electromagnetic and Hadronic Showers. Shower Profiles and Containment. Electromagnetic calorimeters. Hadronic calorimeters. Free electron drift velocities in liquid ionization chamber. Types of Calorimeters: Compensating and non-compensating. Total Absorption, Sampling, homogeneous Scintillation, Ionization, Cherenkov. Signal Detection. Shower shapes in hadron calorimeters. Fluctuations in hadronic energy measurements. Position resolution in the calorimeters. Shower maximum detectors. Signal read-out, processing, calibration of readout electronics. Physics calibration of electromagnetic and hadron calorimeters, jet reconstruction, determination of missing energy and that of the jet energy scale. (Getting from calorimetry to physics results).	

Energy and position resolution in calorimetry.

Recommended literature:
http://indico.cern.ch/getFile.py/access?contribId=24&resId=0&materialId=slides&confId=44587
http://pdg.lbl.gov/2013/reviews/contents_sports.html
http://indico.cern.ch/getFile.py/access?contribId=24&resId=0&materialId=slides&confId=44587
http://www.slidefinder.net/c/
calorimetry_energy_measurements_prof_robin/252b_lecture8/27257380
http://www.kip.uni-heidelberg.de/atlas/seminars/WS2009_JC/compensation1

Course language:
English

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: RNDr. Pavol Strížence, CSc.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KPE/PgVU/17	Course name: Pedagogy for University Teachers

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 28s
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
1. Development of a teaching diary—100%
2. Compulsory active participation and attendance in accordance with the Study Regulations.

Learning outcomes:
After completing the course, the student will acquire knowledge, skills, and competencies, i.e., will be able to:
Knowledge
Define and apply basic didactic principles, methods, forms, and tools in the teaching process of university-level professional subjects. Identify and specify educational procedures of a university teacher aimed at effective teaching management, pedagogical diagnostics, and assessment of learning outcomes. Recognize different approaches to pedagogical evaluation and their impact on improving the quality of the educational process at the university level.
Skills
Implement effective educational methods and techniques into the teaching of professional subjects, tailored to the needs of university students. Conduct pedagogical diagnostics, assess students' progress, and apply appropriate evaluation methods to improve learning outcomes. Analyze and reflect on one's own teaching process, identify areas for improvement, and enhance the teaching of professional subjects, including the rationalization of the time and content structure of teaching. Present specific proposals for improving the teaching process, including the use of new technologies and innovative pedagogical approaches.
Competencies
Confidently and effectively manage the teaching of university subjects, applying educational competencies that consider the specifics of higher education. Critically reflect on one's own pedagogical practice and the learning outcomes of students to improve teaching methods and achieve a higher quality of the educational process. Apply innovative solutions to streamline and optimize the teaching process, aiming to increase the engagement and success of university students.

Brief outline of the course:
The personality of a university teacher. Teaching styles. Student in university education. Student learning styles. Possibilities of adapting teaching styles and student learning styles. University teacher–student interaction and communication in the teaching process. Pedagogical competencies

of a university teacher. Didactic analysis of the curriculum; teaching materials and textbooks. Forms of university teaching. Methods of university teaching. Verification methods and student assessment. Creation of a didactic test. Designing university teaching process. University teacher self-reflection.

Recommended literature:

Beránek, J. (2023). Moderní pedagogické metody a přístupy. Praha: Portál.
Fiala, M. (2023). Didaktika a metodika v současné škole. Praha: Grada Publishing.
Kováč, M. (2023). Vzdelávanie v 21. storočí: Inovatívne prístupy a metódy. Nitra: Vydavateľstvo UKF v Nitre.
Koudelka, J. (2023). Moderní didaktika a její aplikace. Praha: Karolinum.
Křížová, M., & Šebová, P. (2023). Vzdělávání učitelů: Teoretické a praktické přístupy. Praha: Triton.
Kučerová, M. (2023). Vzdělávání učitelů a profesionální rozvoj. Praha: Triton.
Mocová, M., & Lázňovská, M. (2023). Pedagogika a jej aplikácie v praxi. Bratislava: Vydavateľstvo Spolku slovenských pedagogických pracovníkov.
Novák, J., & Pol, M. (2024). Pedagogické výzkumy a inovace ve vzdělávání. Praha: Portál.
Sikora, J. (2022). Didaktika a metodika vzdelávania: Nové výzvy a trendy. Bratislava: Vydavateľstvo Univerzity Komenského v Bratislave.
Škoda, J. (2022). Efektivní výuka: Praktické strategie a metody. Praha: Grada Publishing.
Švec, J. (2023). Didaktika a školní politika: Teorie a praxe. Praha: Grada Publishing.
Vojtová, K. (2024). Diferenciace a inkluze ve vzdělávání. Praha: Wolters Kluwer.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 152

abs	n	neabs
98.03	0.66	1.32

Provides: doc. PaedDr. Renáta Orosová, PhD.

Date of last modification: 14.09.2024

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice
Faculty: Faculty of Science
Course ID: ÚFV/ FOTA/15 | **Course name:** Photometry
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present
Number of ECTS credits: 8
Recommended semester/trimester of the course: 1.
Course level: III.
Prerequisities:
Conditions for course completion: To successfully complete the course, it is necessary for the student to demonstrate a sufficient understanding of astronomical photometry and be able to apply the correct approaches to the processing of various photometric observations. Lectures are organized in blocks and the course ends with a final oral exam. Credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).
Learning outcomes: After completing the lectures, the student will be able to process photometric measurements using various methods and approaches. They will be able to apply the right approaches for specific data and made the transformation to a standard photometric system
Brief outline of the course: Detection of objects, background determination. Aperture photometry, apertures optimization, profile fitting. PSF photometry. Image substraction method. Measurements calibration, removing systematic trends and errors. Transformation to international system.
Recommended literature: 1. Budding & Demircan: 2007, Introduction to Astronomical Photometry, Cambridge University Press 2. Howell : 2000, Handbook of CCD Astronomy, Cambridge University Press 3. Lena et al.: 1996, Observational Astrophysics, Springer-Verlag 4. Martinez a Klotz: 1998, A practical giude to CCD Astronomy, Cambridge University Press. manuals to software packages, published papers and internet sources
Course language: Slovak, English
Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ UFRJZ/22	**Course name:** Physics of Relativistic Nuclear Collisions

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Elaboration of a term project on a given topic. Passing the oral exam.
Detailed conditions are updated annually on the electronic notice board of the subject in AiS2 or within the repository for digital support materials (LMS UPJŠ, MS Teams UPJŠ, etc.)
Credit evaluation of the course takes into account the following student workload: direct teaching and individual consultations (1 credit), self-study (1 credit), practical activities - project (2 credits), evaluation (1 credit). The minimum threshold for completing the course is to obtain at least 51% of the total score.

Learning outcomes:
Acquisition of basic knowledges from the heavy ion physics from intermediate to ultra-relativistic energies.

Brief outline of the course:
1. Introduction
2. Basic overview of the phenomenology of heavy ion collisions
3. Introduction to relativistic kinetic theory
4. Relativistic Boltzmann transport equation
5. Equation of state
6. Relativistic fluid dynamics
7. Simple models
8. Measurable quantities
9. Scaling in hydrodynamic model
10. Direct solution of the kinetic equation
11. Search for quark-gluon plasma
12. Relation to astrophysics

Recommended literature:
1. J. Bartke, Introduction to Relativistic Heavy Ion Physics, World Scientific Publishing Co. Pte. Ltd., Singapore, 2009.
2. R. Vogt, Ultrarelativistic Heavy-Ion Collisions, Elsevier, 2007.
3. J. Letessier, J. Rafelski: Hadrons and quark-gluon plasma, Camb. Monogr. Part. Phys. Nucl. Phys. Cosmol. 18: 1-397, 2002.

Course language:
slovak and english

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: doc. RNDr. Adela Kravčáková, PhD.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ FTDV/15	**Course name:** Physics of the close binaries
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, it is necessary for the student to demonstrate a sufficient understanding of the physical processes that take place in close binary stars, such as mass transfer, the formation of the accretion disk, as well as to know about their origin and development. Lectures are organized in blocks and the course ends with a final oral exam. Credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).	
Learning outcomes: After completing the lectures, the student will have knowledge of the formation and development of close binary stars, of the processes that take place between the two components, such as mass transfer, the formation of the accretion disk and tidal pulsations. They will be able to determine the photometric and absolute parameters of the components and the path elements.	
Brief outline of the course: Kopal's classification of close binaries. Creation and evolution of close binaries. Physical processes in close binaries: mass transfer, outflow, tidal pulsations, accretion disks, mass flows. Methods of observations: photometry, spectroscopy, interferometry, polarimetry, Doppler thomography. Determination of orbital parameters and absolute parameters of bodies.	
Recommended literature: 1. Hilditch, R.W.: 2001, An introduction to Close binary Stars, Cambridge University Press 2. Kallrath, J., Milone, E.F.: 1999, Eclipsing Binary Stars, Springer Verlag 3. Kallrath, J., Milone, E.F.: 2009, Eclipsing Binary Stars: Modeling and Analysis,Springer Verlag 4. Richards, M.T., Hubeny, I. (eds.):2012, "From Interacting Binaries to Exoplanets: Essential Modeling Tools", proceedings of IAU Symposium 282, Cambridge University Press	
Course language: Slovak, English	
Notes:	

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: RNDr. Theodor Pribulla, CSc.

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PLSD/15	**Course name:** Planetary systems

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, it is necessary for the student to demonstrate a sufficient understanding of the physical processes that take place in the formation of planetary systems, the influence of the stellar wind on their formation and evolution and understand the dynamics of planetary systems. Lectures are organized in blocks and the course ends with a final oral exam. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).

Learning outcomes:
After completing the course, the student will have knowledge of physical processes that lead to the formation of planetary systems, the influence of the stellar wind on their formation and development, and will control the dynamics of planetary systems.

Brief outline of the course:
Methods of exoplanets detection. Origin and evolution of exoplanets, evolution of protoplanetary disks. Exoplanet atmosphere. Dynamics of exoplanets and exoplanets in multiple planetary systems.

Recommended literature:
1. Haswell: 2010, Transiting exoplanets, Cambridge University Press
2. Perryman: 2011, The exoplanet handbook, Cambridge University Press
3. Seager (eds.): 2010, Exoplanets, The University of Arizona Press, Tuscon

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 5

N	P
0.0	100.0

Provides: Mgr. Martin Vaňko, PhD.

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PK/04	**Course name:** Plasma in Space

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Literature search and compilation on one particular subject selected. Final examination.
Credit evaluation of the course: direct teaching and
individual consultations (1 credit), self-study (1 credits), practical activities – iterature search and compilation (2 credits), evaluation (1 credit).

Learning outcomes:
To acquaint with the specifics of plasma formations in space.

Brief outline of the course:
1. Differences of matter in cosmic plasma formations from solids, liquids and gases. 2. Distribution function, description of particles in 6D phase space, relation of distribution function and measured flow characteristics. 3. Basic equations for the description of the flow of energetic particles in cosmic plasma. 4. Geomagnetic field. 5. Development of geomagnetic field in the past. IGRF models. 6. Geomagnetic disturbance. Geomagnetic activity indices. The main areas of the Earth's magnetosphere. 7. Particles trapped in magnetic field traps. Description using adiabatic invariants. Disorders of movement and dumping of particles into the upper atmosphere. 8. Atmospheric layers. Influence of cosmic rays on the atmosphere. Radiation doses at different heights and their changes. 9. Propagation of radio waves and the state of the Earth's ionosphere. 10. Plasma of the solar wind. Concentration, flow rate and temperature. The influence of the solar wind on the immediate vicinity of the Earth. 11. Basic data on solar flares. Models of acceleration in eruptions. Classification of eruptions. 12. Plasma and magnetic field in the solar system. Discharges of coronal substance. 13. What is space weather, how is it monitored and what are the prediction methods.

Recommended literature:
1. Rossi B., Olbert S.: Introduction to the Physics of Space, ruský preklad, Moskva, 1974.
2. George K. Parks, Physics of Space Plasmas, 2004, Westview Press
3. Paul M. Bellan, Fundamentals of Plasma Physics, Cambridge University Press, 2006
4. Current materials published in cosmic physics.

Course language:

Notes:

Course assessment
Total number of assessed students: 3

N	P
0.0	100.0

Provides: RNDr. Pavol Bobík, PhD.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/POP/22	**Course name:** Popularisation of science

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active involvement in the popularization of science.

Learning outcomes:
Demonstrated ability to present science to the lay public, use interactive methods of scientific communication, identify the target group and adapt the communication language to the level of professional knowledge. A PhD student is able to arouse interest and motivate specific target groups in the field of his scientific work, but also in the wider context of science

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 69

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PTMH/15	**Course name:** Populations of the interplanetary bodies
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 1.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, it is necessary for the student to demonstrate a sufficient degree of understanding of the physical properties and dynamics of various types of interplanetary matter. Lectures are organized in blocks and the course ends with a final oral exam. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).	
Learning outcomes: After completing the course, the student will have knowledge of the physical properties of individual components and populations of interplanetary matter and their dynamics.	
Brief outline of the course: Orbits, distribution of asteroids in the Solar System Types of asteroids according to albedo. Taxonomic types. Populations of asteroids near the Earth's orbit. Meteoroid streams and major meteor showers. Populations of the Edgeworth Kuiper belt. Population of comets with perihelions close to the Sun. Relationship between comets and asteroids. Comets in the final stages of evolution. The relationship of asteroids, comets and meteor streams.	
Recommended literature: 1. Michel, Demeo, Bottke: 2015, Asteroids IV, University of Arizona Press 2. Hawkes, Mann, Brown: 2005, Modern Meteor Science, Springer 3. Fernández, Lazzaro, Prialnik, Schulz: 2010, Icy Bodies of the Solar System, Cambridge University Press 4. Swamy: 2010, Physics of comets, World Scientific	
Course language: Slovak, English	
Notes:	

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: Mgr. Zuzana Kaňuchová

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice
Faculty: Faculty of Science
Course ID: ÚFV/ VYS/22 — **Course name:** Presentation in Seminar
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week:** **Per study period:** **Course method:** distance, present
Number of ECTS credits: 5
Recommended semester/trimester of the course:
Course level: III.
Prerequisities:
Conditions for course completion: Presentation at the seminar
Learning outcomes: By actively participating in the seminar, the PhD student demonstrates the ability to identify, evaluate, and apply correct scientific methods or research methodology in his field of study. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence in using existing theories and concepts in an innovative way, as well as generating new original scientific knowledge and communicating research results by adequate means and through Slovak or a foreign language.
Brief outline of the course:
Recommended literature:
Course language:
Notes:
Course assessment Total number of assessed students: 44

abs	n
100.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZRIG/22	**Course name:** Principal investigator of an internal grant (VVGS)

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Principal investigator of an internal grant (VVGS)

Learning outcomes:
The PhD student demonstrates the ability to process a successful application for his own research problem within the internal grant system at UPJŠ. Acquires skills with the design of research stages, their time schedule, measurable outputs and adequate distribution of funds. The very solution of the internal VVGS grant acquires the ability to implement the project intention according to the established procedure, to be responsible for achieving the set outputs. As a responsible researcher, the PhD student acquires competencies in project management, its administration, and presentation of results.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 22

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KPPaPZ/PsVU/17	**Course name:** Psychology for University Lecturers

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: **Per study period:** 28s
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Case study, micro-output, its analysis
Current modifications of the course are listed in the electronic bulletin board of the course.

Learning outcomes:
After completing the course, students will gain knowledge that allows them to understand, summarize and explain selected psychological knowledge from cognitive psychology, emotion and motivation psychology, personality psychology, developmental, social, educational psychology and health psychology. They will acquire skills to apply the above psychological knowledge necessary for the professional, competent performance of university teaching practice of doctoral students
to create and implement the teaching of a professional topic with applied psychological knowledge and develop the competences to create and implement teaching of a professional topic with the application of psychological knowledge, as well as to evaluate their performance and the performance of their classmates in the form of constructive feedback.

Brief outline of the course:
The content of the course is based on selected psychological knowledge of cognitive psychology, psychology of emotions and motivation, personality psychology, developmental, social, educational psychology and health psychology. Teaching is realized by a combination of lectures with interactive, experiential methods, discussion, open communication with mutual respect, support of independence, activity and motivation of students. Syllabus: University teacher and his work in the teaching process with a focus on: teachers in relation to themselves (cognitive, personal, social and competencies in the use of methods), in relation to students and as part of the teacher-student relationship on the basis of selected areas of cognitive psychology, psychology of emotions and motivation, developmental psychology, social psychology, educational psychology and health psychology with application to the university environment

Recommended literature:
Alexitch, L. R. (2005). Applying social psychology to education. Social Psychology.–Ed.: Schneider F., Gruman J., Coutts L.–Sage Publications, Inc, 205-228.
Fry, H., Ketteridge, S., & Marshall, S. (2008). A handbook for teaching and learning in higher education: Enhancing academic practice. Routledge.
Mareš, J.: Pedagogická psychologie. Portál, 2013.

Kniha psychologie. Universum, 2014
Čáp, J., Mareš, J.: Psychologie pro učitele. Praha: Portál 2007.
Vágnerová, M.: Školní poradenská psycholôgie pro pedagogy. Praha: Karolínum 2005.
Cuevas, J. A., Childers, G., & Dawson, B. L. (2023). A rationale for promoting cognitive science in teacher education: Deconstructing prevailing learning myths and advancing research-based practices. Trends in neuroscience and education, 100209.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 87

abs	n	neabs
98.85	0.0	1.15

Provides: PhDr. Anna Janovská, PhD.

Date of last modification: 09.12.2024

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q1SA/22	**Course name:** Q1 journal as co-author

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q1 as co-author.

Learning outcomes:
By publishing in a journal of category Q1 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 26

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ Q11A/22	**Course name:** Q1 journal as first or corresponding author
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 40	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Publication accepted in a journal of category Q1 as first or corresponding author	
Learning outcomes: By publishing in a journal of category Q1 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 12	
abs	n
100.0	0.0
Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q2SA/22	**Course name:** Q2 journal as co-author

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q2 as co-author.

Learning outcomes:
By publishing in a journal of category Q2 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 23

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/Q21A/22	**Course name:** Q2 journal as first or corresponding author

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q2 as first or corresponding author.

Learning outcomes:
By publishing in a journal of category Q2 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 16

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q3SA/22	**Course name:** Q3 journal as co-author

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 15

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q3 as co-author.

Learning outcomes:
By publishing in a journal of category Q3 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/Q31A/22	**Course name:** Q3 journal as first or corresponding author
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 25	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Publication accepted in a journal of category Q3 as first or corresponding author	
Learning outcomes: By publishing in a journal of category Q3 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 2	
abs	n
100.0	0.0
Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/Q4SA/22	**Course name:** Q4 journal as co-author

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q4 as co-author.

Learning outcomes:
By publishing in a journal of category Q4 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ Q41A/22	**Course name:** Q4 journal as first or corresponding author
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Publication accepted in a journal of category Q4 as first or corresponding author.	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 2	
abs	n
100.0	0.0
Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ KCHD/04	**Course name:** Quantum Chromodynamics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Knowledge of the subject at a sufficient level, exam. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits), self-study (2 credits) and evaluation (1 credit).

Learning outcomes:
Lectures are oriented on explanation of the strong interaction on the base of first principles, their description and analysis of both elastic and deep-inelastic scattering of hadrons and leptons.
Determination of the color is introduced, which is basic quantum number for strongly interacting particles and fundamental physical principle on which quantum chromodynamics (QCD) is constructed. Basic features of this theory are explaned and it is demonstrated its application for calculation cross sections of typical interacting processes in presence of mesons and baryons.

Brief outline of the course:
1. The concept of color as the basic quantum number of hadrons and the basic principle for formulating a fundamental theory for strongly interacting particles.
2. Color special unitary calibration group SUc (3).
3. Quarks and gluons as SUc multiplets (3).
4. Partons, cross sections, formfactors (basic knowledge).
5. Deep-elastic scattering of electrons on a proton. Neutrino scattering on a nucleon. Summation rules.
6. Additive parton model.
7. The concept of structural function. Bjorken scaling.
8. Quantum chromodynamics as a theory of strong interactions and its Lagrangian.
9. Feynman graphs in momentum representation.
10. Binding constant for QCD and asymptotic freedom.
11. Confinement of quarks and gluons.
12. QCD within the standard model.

Recommended literature:
Cheng T.P., Li L.F.: Gauge theory of elementary particle Physics, Claredon, Press, Oxford, 1984.
Yndurain F.J.: Quantum chromodynamics. An introduction to the theory of Quarks and gluons, Springer-Verlag, Berlín, 1983;

Francis Halzen, Alan D. Martin: Quarks and Leptons, John Wiley&Sons, 1984

Course language:
slovak and english

Notes:

Course assessment
Total number of assessed students: 22

N	P
0.0	100.0

Provides: prof. RNDr. Michal Hnatič, DrSc.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ KTP/13	**Course name:** Quantum Field Theory

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Knowledge of the subject at a sufficient level, exam.
Credit evaluation of the course takes into account the following student workload: direct teaching and individual consultations (4 credits), self-study (2 credits), evaluation (2 credits).

Learning outcomes:
To acquaint with quantum field theory methods and their application in theory of elementary particles and statistical physics.

Brief outline of the course:
1. Quantum field, Lagrange formalism, interacting quantum fields, Wick theorems and Feynman diagrammatic technique, higher orders of perturbation theory.
2. Application of quantum field theory in the theory of elementary particles: standard model, unified theories of elementary particles.
3. Application of quantum field theory in statistical physics. Feynman diagrams.
4. Critical dynamics and description of scaling at phase transitions by means of quantum-field technique and renormalization group.
Selection of aforementioned topics will be made by supervisor according to the content and aims of PhD thesis

Recommended literature:
1. L.H. Ryder, Quantum Field Theory, Cambridge University Press, Cambridge, 1996.
2.A. Zee, Quantum Field Theory in Nutshell, Princeton University Press, Princeton, 2010.
3. P. Ramond, Field Theory: A Modern Primer, Westview Press, 1990.
4. Zinn-Justin J., Quantum Field Theory and Critical Phenomena, Claredon Press, Oxford, 2004.
5. W. Greiner, J. Reinhardt, Field Quantization, Springer, Berlin, 1996.
6. W. Greiner, J. Reinhardt, Quantum Electrodynamics, Springer, Berlin, 2009.
7. W. Greiner, S. Schramm, E. Stein, Quantum Chromodynamics, Springer, Berlin, 2007.
8. A.N. Vasiliev, The Field Theoretic Renormalization Group in Critical Behavior Theory and Stochastic Dynamics, Chapman & Hall/CRC Press Company Boca Raton, London, 2004.

Course language:

Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: prof. RNDr. Michal Hnatič, DrSc.

Date of last modification: 15.12.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ KTMS/04	**Course name:** Quantum Theory of Many-Body Systems
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion: The student has to prove sufficient understanding of basic notions and concepts of selected numerical methods. The ability to create own functional numerical codes in arbitrary programming language is required. It is expected that the student will be capable to work with understanding with new-acquired notions, which result to their active utilisation for solving the concrete tasks within the project. The course finish with an oral exam. Credit assignment of the subject: lectures (2 credits), individual studies (1 credit), individual consultations (1 credit) and examination (1 credit). The minimal requirement for passing through the subject is to show a good orientation in the curriculum as well as to deeper understand the subject matter. The final evaluation scale: pass and fail.	
Learning outcomes: After passing lectures the student will have fundamental knowledge about advanced numerical methods, as a sufficient tool for analysing the selected problems in the condensed matter physics. After the course finishing the student should be able to create own numerical code of selected method with an appropriate processing of respective data for a subsequent analyse of physical problems.	
Brief outline of the course: 1. Diagonalization methods, Lanczos method, Davidson method. 2. Density Matrix Renormalization Group (DMRG) Method. 3. Transfer Matrix Method and its application on the low-dimensional lattice-statistical models. Quantum-Classical correspondence. 4. Transfer Matrix Renormalization Group (TMRG) Method. 5. Corner Transfer Matrix Renormalization Group (CTMRG) Method. Application of CTMRG method on the study of relevant thermodynamics properties of selected quantum models	
Recommended literature: [1] E. Dagotto, Rev. Mod. Phys. 66 (1994) 763. [2] E.R. Davidson, Comput. Phys. 17 (1975) 87. [3] I. Peschel, X. Wang, M. Kaulke, K. Hallberg, Density Matrix Renormalization - A new Method in Physics, lecture notes in Physics, Springer Verlag Vol. 528 1999. [4] S. R. White, Phys. Rev. Lett. 69 (1992) 2863. Phys. Rev. B 48 (1993) 10345. [5] U. Schollwock, Rev. Mod. Phys. 77 (2005) 259.	

[6] U. Schollwock, Ann. Phys. 326 (2011) 96.
[7] T. Nishino, K. Okunishi, J. Phys. Soc. Jpn. 65 (1996) 891.
[8] T. Nishino, K. Okunishi, J. Phys. Soc. Jpn. 66 (1997) 3040.

Course language:

Notes:

Course assessment
Total number of assessed students: 11

N	P
0.0	100.0

Provides: RNDr. Pavol Farkašovský, DrSc., RNDr. Martin Gmitra, PhD., RNDr. Hana Vargová, PhD.

Date of last modification: 18.12.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SAVKSM/13	**Course name:** Quantum-Statistical Methods for Strongly-Correlated Systems
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Successful passing test and final exam.	
Learning outcomes: To provide students with models, methods and physical applications in the area of strongly correlated electron systems.	
Brief outline of the course: Occupation number representation. Second quantization. Models of strongly correlated electron systems. Hubbard model. Periodic Anderson model. Falicov-Kimball model. t-J model. Analytical and numerical methods in the theory of strongly correlated electron systems. Method of canonical transformations. Green's function method. Perturbation theory. Gutzwiller variation method. Lanczos method. Collective Phenomena. Valence transitions. Metal-insulator transitions. Formation of charge and spin ordering. Itinerant magnetism.	
Recommended literature: [1] P. Farkašovský, H. Čenčariková, Kooperatívne javy v sústavách silne korelovaných fermiónov, SFS Košice 2011, ISBN: 978-80-970625-2-1. [2] P. Farkašovský, H. Čenčariková, Analytické a numerické metódy v teórii silne korelovaných elektrónových systémov, ÚEF SAV Košice 2013, ISBN: 978-80-89656-03-5. [3] H. Haken, Kvantovopoľová teória tuhých látok, ALFA, Bratislava 1987. [4] P. Fazekas, Lecture note on Electron Correlation and Magnetism, World Scientific Publishing Co. (1999). [5] D. N. Zubarev, Soviet Physics Uspechi 3, 320 (1960). [6] C. Lanczos, J. Res. Nat. Bur. Stand 45, 255 (1950). [7] E. Daggoto, Rev. Mod. Phys. 66, 763 (1994).	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 8

N	P
0.0	100.0

Provides: RNDr. Hana Vargová, PhD.

Date of last modification: 01.03.2024

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ RMU/22	**Course name:** Radiobiological Modeling of the Effect of Ionizing Radiation
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 1.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To analyze irradiation plan with the use of radiobiological models NTCP and TCP, exam. Credit evaluation of the course: direct teaching and individual consultations (1credit), self-study (1 credit), practical activities – to analyze IP (2 credits), evaluation (1 credit).	
Learning outcomes: To provide basic knowledge of radiobiological models and their use in radiation planning.	
Brief outline of the course: 1. Radiobiological principles of radiotherapy : cell and cell cycle, cell survival curves, linear quadratic model, biological effective dose, normalised total dose 2. Early and late radiation morbidity, inclusion of repopulation, reparation, reoxygenation and redistribution into LQ model 3. Planning of radiotherapy, Dose volume histogram, DVH reduction techniques, Tolerance doses 4. Historical development of radiobiological models, Lyman-Kucther-Burman model 5. LOGEUD model, Relative seriality model, Critical element model, Critical volume model 6. Modelling of tumor response : Tumor control probability model, Uncomplicated tumor control probability 7. Use of software Biogray for radiobiological modelling 8. Parameters of radiobiological models , fitting of parameters 9. Linear-quadratic-linear model for stereotactic radiotherapy 10. Radiobiological modelling of reirradiation, Impact of radiotherapy prolongation on tumor control 11. Radiobiological basics of proton therapy 12. Optimization of irradiation plans with the use of radiobiological modelling	
Recommended literature: 1. DALE, R., JONES,B. 2007. Radiobiological models in radiation oncology. London: British institute of radiology, 2007. 292 s. ISBN13-978-0-905749-60-0 2. MATULA, P., KONCIK, J. 2018. Key to radiobiological modelling effects in radiation oncology. ‎LAP LAMBERT Academic Publishing 2018. 104s. ISBN13-978-6137342244	

3. FELTL, D., CVEK, J. 2008. Klinická rádiobiológie. Praha: Tobiáš, 2008. 105 s. ISBN 9788073111038

Course language:

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: RNDr. Barbora Hostová, PhD.

Date of last modification: 18.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/RZ/22	**Course name:** Reviewed International or National Proceedings

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
A publication published in a peer-reviewed foreign or national proceedings as an author/co-author.

Learning outcomes:
By publishing in a peer-reviewed foreign or national journal as an author/co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 82

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VPZ/22	**Course name:** Scientific work after sending to the editorial office

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Scientific work after being sent to the editorial office as an author/co-author.

Learning outcomes:
By sending a manuscript to the editors of a scientific journal as an author/co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to formulate his own ideas in a structured form.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 21

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VDM/11	**Course name:** Selected Detection Methods of Nuclear Radiaton

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 2 **Per study period:** 28 / 28
Course method: distance, present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Written work and its presentation, preparation and measurement of selected laboratory tasks, exam. Credit evaluation of the subject: direct teaching and consultations (1), self-study (1), practical activities- lab. tasks (2), evaluation (1), total 5 credits. Minimum limit for completion of the course is to obtain at least 51% of the total evaluation.

Learning outcomes:
To extend the theoretical and experimental knowledge about current detection methods and selected detection systems. Gaining knowledge in the preparation of laboratory tasks and experiments in nuclear physics.

Brief outline of the course:
General Charateristics of Detectors.
Detectors: ionization, scintillation, semiconductor.
Pulse Signals in Nuclear Electronics. Signal Transmission.
Electronics for Pulse Signal Processing.
Pulse Height Selection and Coincidence.
Laboratory practice from selected detection methods.

Recommended literature:
1. W.R.Leo, Techniques for Nuclear and Particle Physics Experiments, Springer Verlag, 1994
2.J.R.Cooper, K.Randle, R.S. Sokhi: Radioactive Releases in the Environment, Impact and Assessment, J.Wiley &Sons, Ltd., 2003
3.R.L. Murray, Nuclear Energy, An Introduction to the Concepts, Systems and Aplications of Nuclear Processes, 6th Edition, Elsevier, 2009
4. S.N.Ahmed, Physics & Engineering of Radiation Detection, Elsevier, 2015

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 10

N	P
0.0	100.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice
Faculty: Faculty of Science
Course ID: ÚFV/ VKJSF/04 — **Course name:** Selected Topics from Nuclear and Subnuclear Physics
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** distance, present
Number of ECTS credits: 10
Recommended semester/trimester of the course: 1.
Course level: III.
Prerequisities:
Conditions for course completion: preparation of a paper draft using several selected key publications Credit distribution: lectures + consulting: 37 hours - 2 credits preparation the paper draft + study: 95 hours - 5 credits writing the paper draft: 56 hours - 3 credit
Learning outcomes: Gain knowledge on the heavy ion experimental programme at CERN SPS accelerator leading to the discovery of the kvark-gluon plasma. Gain knowledge on heavy-ion programme at RHIC collider at BNL and at CERN LHC.
Brief outline of the course: I. block (1.-6. week): 1. Ultrarelativistic heavy ion collisions. Introduction. Discovery of QGP. 2. SPS accelarator, heavy ion beams and the key experiments at CERN. 3. NA44 experiment. 4. NA45 experiment. 5. NA49 experiment. 6. NA50 experiment. 7. WA97 and NA57 experiments. 8. WA98 experiment. 9. Ingredients of the CERN QGP. 10. Claim of discovery. II. block (7.-12. week): 1. Experiment STAR at RHIC. 2. Discovery of Ridge structure. 3. Indication of Mach cone. 4. Elliptical flow at RHIC. 5. Jet quenching. 6. QGP signatures at CERN LHC. 7. Possible signatures in small systems at ALICE experiment.

Applied, medical physics:
General part: Rutherford scattering, nuclear phenomenology, nuclear models, nuclear radiation, use of nuclear physics, energy losses in matter, particle detection, accelerators, elementary particle properties, symmetry, discrete transformations, neutral kaons, oscillations and CP violation, Standard model.
Special part: Nuclear reactions, biological effects of radiation, industrial and analytical applications, nuclear medicine.

Recommended literature:

1. Griffiths D.: Introduction to Elementary Particle, WILEY-VCH, 4th Reprint, 2010
2. Bettini A.: Introduction to Elementary Particle Physics, Cambridge Univ. Press, Reprinted 2010
3. Perkins D.H.: Introduction to High Energy Physics, Cambridge University Press, 2000
4. Slugeň V. a iní: Jadrovo-energetické zariadenia, STU Bratislava, 2003
5. Fernow R.: Introduction to Experimental Particle Physics, Cambridge University Press, 1986
6. Das A., Ferbel T.: Introduction to Nuclear and Particle Physics, (2nd Edition), World Scientific Publishing Co. Pte. Ltd., Singapore, 2003
7. Lilley J.S.: Nuclear Physics - Principles and Application, J. Wiley & Sons, Ltd., Chichester, 2001
8. Ashok Das, Thomas Ferbel, Introduction to Nuclear and Particle Physics, (2nd Edition), 2003, World Scientific Publishing Co. Pte. Ltd., Singapore, ISBN 981-238-744-7.
9. John.S. Lilley, Nuclear Physics - Principles and Aplications, 2001, John Wiley& Sons, Ltd., Chichester, ISBN-0 471 97935 X, ISBN-0 471 97936 8.

Course language:
slovak and english

Notes:

Course assessment
Total number of assessed students: 28

N	P
0.0	100.0

Provides: doc. RNDr. Marek Bombara, PhD., doc. RNDr. Janka Vrláková, PhD., RNDr. Ivan Králik, CSc.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ QFT/18	**Course name:** Selected Topics from Quantum Field Theory
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 1., 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Final evaluation conditions: Demonstration of knowledge through a test and a seminar paper on a selected topic. The total weight of both the test and the seminar paper is 50%. The credit evaluation of the course takes into account the following student load: direct instruction (2 credits), self-study (1 credit) and assessment (2 credits). Prerequisites for successful completion of the course: Mastery of the midterm and final assessment requirements at a minimum of 50% overall.	
Learning outcomes: The aim of the course is to introduce the formalism of quantum and statistical field theory with emphasis on their applications in the theory of phase transitions. The student will be able to understand the construction of perturbation theory in the form of Feynman diagrams. The student can independently verify the correctness of of the numerical expressions to which the Feynman diagrams correspond. The student is able to apply the renormalization group method to analyse the critical behaviour of selected models. Is able to determine the values of critical indices.	
Brief outline of the course: Week 1. Path integrals in quantum mechanics and field theory. Introduction and calculation of the path integral. 2-3. Week: The path integral for the harmonic oscillator. Functional integral. 4-5. Week 4-5: Functional methods and perturbation theory. Disturbance development in direct and momentum representation. Week 6: Rules for computing Feynman graphs. Continuous Feynman diagrams. Legendre transform. 1-irreducible Feynman graphs. Week 7: Renormalization. Canonical dimensions. Primitive and apparent divergences of Feynman diagrams. Week 8:	

Relevant, irrelevant and marginal operators. Renormalization of phi^3 theory.
Week 9:
Renormalization of phi^4 theory.
Week 10:
Dimensional regularization.
Week 11:
Solving the renormalization group equations. Callan-Symanzik equations.
Week 12:
The epsilon development technique.

Recommended literature:
VASILIEV, Alexander N. The field theoretic renormalization group in critical behavior theory and critical dynamics. Boca Raton, Chapman & Hall/CRC, 2004.
AMIT, Daniel J., MARTÍN-MAYOR V. Field theory, the renormalization group, and critical phenomena (3th edition). World Scientific, New Jersey, 2005.
ZINN-JUSTIN, Jean. Quantum field theory and critical phenomena. Oxford, Oxford University Press, 2002.
CARDY, John. Scaling and renormalization in statistical physics. Cambridge, Cambridge University Press, 1996.
MUSSARDO, Giuseppe. Statistical field theory. Oxford, Oxford University Press, 2010.

Course language:

Notes:

Course assessment
Total number of assessed students: 4

abs	n
100.0	0.0

Provides: RNDr. Tomáš Lučivjanský, PhD., univerzitný docent

Date of last modification: 26.09.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VKTF/15	**Course name:** Selected Topics from Theoretical Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of all the basic concepts of theoretical mechanics, electromagnetic field theory, quantum mechanics, thermodynamics and statistical physics within the course syllabus. Since the content of the lecture includes topics that the student has already partially acquainted with during the study at the bachelor's and master's level, each student must be able to actively master the content of this curriculum at a higher formal and content level through self-study and consultation with teachers. The condition for obtaining credits is the elaboration of home assignments and the successful completion of the final oral commission exam. The minimum limit for passing the exam is to obtain 51% of the total score, which takes into account all required activities with relevant weight.

Learning outcomes:
The educational goal of this lecture is to bring students' knowledge and skills in various areas of theoretical physics to the same starting level. By completing this course, all students will achieve a minimum knowledge of basic physical theories, concepts and mathematical procedures in various areas of theoretical physics, which are necessary for their further study and independent scientific research.

Brief outline of the course:
Theoretical mechanics:
1. Constrained motion of a system of material points. Constrains and their classification. The principle of virtual work; search for equilibrium positions. D'Alembert's principle. Lagrange equations of the first kind. Generalised coordinates, generalised forces and momentums.
2. Lagrange equations of the second kind, generalised potential.
3. Integral principles. Hamilton's principle. Hamilton's function. Hamilton's canonical equations.
Electromagnetic field theory:
1. System of Maxwell's equations in vacuum and in the material environment. Scalar and vector potential, wave equations for potentials.
2. Conservation law in electromagnetic field theory, Poynting vector, Maxwell voltage tensor.
3. Dielectric polarisation and magnetisation of magnets. Dielectric and magnetic susceptibility, permittivity and permeability. Boundary conditions at the interface of two dielectrics and magnets.

4. Quasi-stationary electromagnetic field, electromagnetic waves, refraction and reflection of a plane monochromatic wave at the interface of two media.
Quantum Mechanics:
1. Wave and matrix formulation of quantum mechanics, postulates of quantum mechanics.
Timeless and temporal Schrödinger equation, continuity equation.
2. Current immeasurability of physical quantities, Heisenberg uncertainty relations.
3. Particle in a rectangular potential well, bound and scattering states. Particle passage through a rectangular potential barrier, tunneling and barrier reflection.
4. Solution of Schrödinger equation for linear harmonic oscillator and hydrogen atom.
5. Spin and Pauli matrix. Principle of indistinguishability of identical particles, fermions and bosons. Pauli's exclusion principle.
6. Stationary and non-stationary perturbation theory for non-degenerate and degenerate quantum-mechanical systems with discrete, continuous and discrete-continuous energy spectrum.
7. Normal and anomalous Zeeman effect, linear and quadratic Stark effect.
8. Ritz's variational method and its applications in quantum mechanics.
9. Solution of Schrődinger equation for helium, multielectron atoms and hydrogen molecule.
Thermodynamics and statistical physics:
1. State of thermodynamic equilibrium. Thermodynamic temperature, internal energy, work and heat in thermodynamics. First, second and third laws of thermodynamics for quasi-static processes
3. Thermodynamic potentials for systems with constant and variable number of particles. Maxwell's relations. Mathematical formulation of the second law of thermodynamics for non-static processes. Heterogeneous systems. Gibbs phase rule.
4. Microcanonical, canonical and grand canonical ensemble in classical and quantum statistical physics. Canonical and grand canonical partition function, internal energy, entropy, free energy and grand canonical potential within classical and quantum statistical physics. Statistics of ideal fermion and boson gases.

Recommended literature:

1. W. Greiner: Classical Mechanics: Systems of Particles and Hamiltonian Dynamics (2nd ed.) Springer, Berlin, 2010.
2. L.D. Landau, E. M. Lifshitz: Mechanics, Butterworth-Heinemann, 1974.
3. W. Greiner: Classical Electrodynamics, Springer, New York, 1998.
4. G. Lehner: Electromagnetic Field Theory for Engineers and Physicists. Springer, Berlin, 2010.
5. L.D. Landau, E. M. Lifshitz: The classical theory of fields, Butterworth-Heinemann, Oxford, 1994.
6. W. Greiner, Quantum Mechanics, 4th edition, Springer, Berlin, 2000.
7. A. C. Philips, Introduction to Quantum Mechanics, Wiley, Weinheim, 2003.
8. D. J. Griffiths, Introduction to Quantum Mechanics, Prentice Hall, New Jersey, 1995.
9. G. Auletta, M. Fortunato, G. Parisi, Quantum Mechanics, Cambridge University Press, Cambridge, 2009.
10. L.D. Landau, E. M. Lifshitz: Quantum mechanics: non-relativistic theory, Pergamon Press, Oxford, 1991.
11. L.E. Reichl: A Modern Course in Statistical Mechanics, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2016.
12. R.K. Pathria, P.D. Beale: Statistical Mechanics, Elsevier, Amsterdam, 2011.
13. W. Greiner, L. Neise, H. Stöcker: Thermodynamics and Statistical Mechanics, Springer, Berlin, 2001.
14. L.D. Landau, E. M. Lifshitz: Statistical Physics, vol. I, Elsevier Science, Butterworth-Heinemann, Oxford, 2001.

Course language:
slovak, english

Notes:

Course assessment
Total number of assessed students: 20

N	P
0.0	100.0

Provides: doc. RNDr. Jozef Strečka, PhD., prof. RNDr. Michal Jaščur, CSc.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VKTKL/15	**Course name:** Selected Topics of Condensed Mattter Theory

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 2 **Per study period:** 28 / 28
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate a deep understanding of all basic concepts and applications of quantum statistical physics, which is the main theoretical tool for describing the thermodynamic properties of various models of crystalline solids. Based on lectures, which are carried out in the form of block teaching, the student must be able to acquire in detail the methods of theoretical calculations so that he can actively and creatively use the acquired knowledge in solving specific problems during exercises and independent homework. In addition to direct participation in classes, the student is obliged to study within the self-study current research topics assigned by the teacher and also to develop and present in the form of a seminar four home assignments. Mastering the solutions of specific theoretical model systems requires a high degree of independence of students in the study of book and current journal literature. The professional focus of individual home assignments is tied to the syllabus of the course. When studying and developing projects, students can actively consult professional problems with the teacher throughout the semester as needed.
In addition to attending classes, the condition for obtaining credits is the elaboration of home assignments. The minimum limit for passing the exam is to obtain 51% of the total score, which takes into account all required activities with relevant weight.

Learning outcomes:
After completing lectures and exercises, the student will acquire specific knowledge and skills aimed at creating model systems for various crystalline systems. The student will get acquainted in detail with advanced methods of quantum statistical physics enabling the calculation of all relevant physical quantities for various model systems and will be able to competently compare theoretical calculations with experimental data. Specific models for study are determined by the teacher in accordance with the current syllabus of the course.

Brief outline of the course:
Complex theory of solids. Identification of relevant energy contributions to the total energy of the solid and their theoretical description. Static lattice energy, Lenard-Jones and Morse potential of a solid. Vibrational, electron and magnetic contribution to crystal energy and construction of theoretical models within statistical physics. The need to take into account anharmonic effects. Volumetric expansion of the lattice due to temperature and magnetic field. Grüneisen's theory of

anharmonic oscillations of a lattice Anharmonic Debye and Einstein's theory of oscillations of a lattice. Theory of localized magnetic models with distance-dependent exchange interaction. Calculation of relevant thermodynamic quantities for various model systems. Exactly solvable low-dimensional complex models and their thermodynamics.

Recommended literature:

1. L. A. Girifalco: Statistical Mechanics of Solids, Oxford University Press (2000).
2. A.L. Kuzemsky: Statistical Mechanics and the Physics of Many-Particle Systems, World Scientific (2017).
3. T. Balcerzak, K. Szalowski ans M. Jaščur, A simple thermodynamic description of the combined Einstein and elastic models, Journal of Physics: Condensed Matter 22 (2010) 425401.
4. T. Balcerzak, K. Szalowski ans M. Jaščur, A self-consistent thermodynamic model of metallic systems. Application for the description of gold, Journal of Applied Physics 116 (2014).
5. T. Balcerzak, K. Szalowski ans M. Jaščur, Self-consistent model of a solid for the description of lattice and magnetic properties, Journal of Magnetism and Magnetic Materials 426 (2017) 310.
6. T. Balcerzak, K. Szalowski ans M. Jaščur, Thermodynamic model of a solid with RKKY interaction and magnetoelastic coupling, Journal of Magnetism and Magnetic Materials 452 (2018) 360.
7. 6. T. Balcerzak, K. Szalowski ans M. Jaščur, T
Thermodynamic properties of the one-dimensional Ising model with magnetoelastic interaction, Journal of Magnetism and Magnetic Materials 507 (2020) art. no. 166825.

Course language:
slovak, english

Notes:

Course assessment
Total number of assessed students: 10

N	P
0.0	100.0

Provides: prof. RNDr. Michal Jaščur, CSc.

Date of last modification: 19.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SSOL/13	**Course name:** Self-motivated Study on Scientific Literature
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 2., 4.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 8	

N	P
0.0	100.0

Provides:	
Date of last modification:	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SSOLZ/22	**Course name:** Self-motivated Study on Scientific Literature
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 1., 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 8	

abs	n
100.0	0.0

Provides:	
Date of last modification:	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF1a/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 24

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF1b/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation in English (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 23

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF2a/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 21

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF2b/04	Course name: Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation in English (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 20

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF3a/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 5.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 17

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/SJSF3b/04	Course name: Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 6.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation in English (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 16

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF4a/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 7.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SJSF4b/04	**Course name:** Seminar from Nuclear and Subnuclear Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 8.

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in seminars, presentation at a seminar. The credit evaluation of the course takes into account the following student workload: practical activity - preparation of the contribution and its presentation in English (3credits).

Learning outcomes:
To bring the topical problems, methodics and tools of high energy physics to the students.

Brief outline of the course:
Department seminar - selected topical problems of the nuclear and subnuclear physics.

Recommended literature:

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 14

abs	n
100.0	0.0

Provides: doc. RNDr. Janka Vrláková, PhD.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SASTb/15	**Course name:** Seminar in Astrophysics
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 3 **Per study period:** 42 **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate progress in the preparation of the dissertation thesis and present the partial results. The credit evaluation of the course takes into account the following student workload: self-study (2 credits), evaluation - presentation of an interim report on the preparation of the dissertation (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).	
Learning outcomes: The student will master the methods and procedures for solving scientific problems and demonstrate the ability to solve them independently and creatively in accordance with current scientific methods and procedures used in astrophysics. The student is also able to critically approach the analysis of possible research tasks and the creation of models. After completing the course, the student will be able to evaluate the progress of preparing the dissertation thesis and based on comments and recommendations will be able to modify the next steps in its preparation.	
Brief outline of the course: Study of assigned problems, acquisition of literary sources and observational data. Processing and analysis of observational data, physical interpretation of results. Processing and presentation of achieved partial results of the dissertation thesis. Consultations of the processes and results of dissertation thesis.	
Recommended literature: Current papers in astronomical and astrophysical journals. According to the topic of particular dissertation thesis.	
Course language: Slovak, English	
Notes:	

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD., doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/SASTa/15	**Course name:** Seminar in astrophysics

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 3 **Per study period:** 42
Course method: distance, present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate progress in the preparation of the dissertation thesis and present the partial results. The credit evaluation of the course takes into account the following student workload: self-study (2 credits), evaluation - presentation of an interim report on the preparation of the dissertation (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).

Learning outcomes:
The student will master the methods and procedures for solving scientific problems and demonstrate the ability to solve them independently and creatively in accordance with current scientific methods and procedures used in astrophysics. The student is also able to critically approach the analysis of possible research tasks and the creation of models. After completing the course, the student will be able to evaluate the progress of preparing the dissertation thesis and based on comments and recommendations will be able to modify the next steps in its preparation.

Brief outline of the course:
Study of assigned problems, acquisition of literary sources and observational data.
Processing and analysis of observational data, physical interpretation of results.
Processing and presentation of achieved partial results of the dissertation thesis.
Consultations of the processes and results of dissertation thesis.

Recommended literature:
Current papers in astronomical and astrophysical journals.
According to the topic of particular dissertation thesis.

Course language:
Slovak, English

Notes:

Course assessment Total number of assessed students: 9	
N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD., doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SASTc/15	**Course name:** Seminar in astrophysics
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 3 **Per study period:** 42 **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 3.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate progress in the preparation of the dissertation thesis and present the partial results. The credit evaluation of the course takes into account the following student workload: self-study (2 credits), evaluation - presentation of an interim report on the preparation of the dissertation (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).	
Learning outcomes: The student will master the methods and procedures for solving scientific problems and demonstrate the ability to solve them independently and creatively in accordance with current scientific methods and procedures used in astrophysics. The student is also able to critically approach the analysis of possible research tasks and the creation of models. After completing the course, the student will be able to evaluate the progress of preparing the dissertation thesis and based on comments and recommendations will be able to modify the next steps in its preparation.	
Brief outline of the course: Study of assigned problems, acquisition of literary sources and observational data. Processing and analysis of observational data, physical interpretation of results. Processing and presentation of achieved partial results of the dissertation thesis. Consultations of the processes and results of dissertation thesis.	
Recommended literature: Current papers in astronomical and astrophysical journals. According to the topic of particular dissertation thesis.	
Course language: Slovak, English	
Notes:	

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD., doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SASTd/15	**Course name:** Seminar in astrophysics
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 3 **Per study period:** 42 **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 4.	
Course level: III.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate progress in the preparation of the dissertation thesis and present the partial results. The credit evaluation of the course takes into account the following student workload: self-study (2 credits), evaluation - presentation of an interim report on the preparation of the dissertation (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).	
Learning outcomes: The student will master the methods and procedures for solving scientific problems and demonstrate the ability to solve them independently and creatively in accordance with current scientific methods and procedures used in astrophysics. The student is also able to critically approach the analysis of possible research tasks and the creation of models. After completing the course, the student will be able to evaluate the progress of preparing the dissertation thesis and based on comments and recommendations will be able to modify the next steps in its preparation.	
Brief outline of the course: Study of assigned problems, acquisition of literary sources and observational data. Processing and analysis of observational data, physical interpretation of results. Processing and presentation of achieved partial results of the dissertation thesis. Consultations of the processes and results of dissertation thesis.	
Recommended literature: Current papers in astronomical and astrophysical journals. According to the topic of particular dissertation thesis.	
Course language: Slovak, English	
Notes:	

Course assessment Total number of assessed students: 9	
N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD., doc. Mgr. Štefan Parimucha, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SETF/24	**Course name:** Seminar on theoretical physics
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 0 / 2 **Per study period:** 0 / 28 **Course method:** present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 1., 2.., 3., 4..	
Course level: III.	
Prerequisities:	
Conditions for course completion: The subject is formally evaluated with a grade of "passed" and credits are awarded at the end of the semester for active participation in seminars and personal presentations at the seminar.	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	
abs	n
0.0	0.0
Provides:	
Date of last modification: 28.02.2024	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MSF/04	**Course name:** Simulation of Experiments and Processes in Subatomic Physics
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 1.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Term project, its presentation, evaluation. The credit evaluation of the course takes into account the following student workload: direct teaching (1 credit), self-study (1 credit), practical activities - project, tasks (2 credits) and evaluation (1 credit). The minimum limit for completing the course is to obtain at least 51% of the total score.	
Learning outcomes: The student will have good knowledge of the theoretical basis of different models used in heavy ion physics and will be able to choose a suitable model to simulate a particular phenomenon or observable as well as to use the available modeling software.	
Brief outline of the course: 1. Phenomenology of relativistic nuclear collisions, basic observables and physical phenomena 2. Statistical model 3. Hydrodynamic modeling and initial state models 4. Hadronic transport models 5. Lund model 6. Hybrid modeling	
Recommended literature: W. Florkowski: Phenomenology of Ultra-Relativistic Heavy-Ion Collisions, 2010, World Scientific A.K. Chaudhuri: A Short Course on Relativistic Heavy Ion Collisions, 2014, IOP Publishing U.W. Heinz: Concepts of Heavy Ion Physics, 2004, arXiv:hep-ph/0407360 [hep-ph] C. Bierlich et al.: A comprehensive guide to the physics and usage of PYTHIA 8.3, 2022, arXiv:2203.11601 [hep-ph] K. Kauder et al.: JETSCAPE v1.0 Quickstart Guide, Nucl.Phys.A 982 (2019) 615-618, arXiv:1807.09615 [hep-ph]	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 18

N	P
0.0	100.0

Provides: RNDr. Martin Vaľa, PhD., RNDr. Zuzana Paulínyová, PhD.

Date of last modification: 17.01.2024

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SLAA/15	**Course name:** Solar activity

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, it is necessary for the student to demonstrate a sufficient degree of understanding of the relationship between the solar interior and cycles of solar activity and understand the influence of the magnetic field on the activity and energy transfer in the Sun's atmosphere. Lectures are organized in blocks and the course ends with a final oral exam. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credit), self-study (3 credits), individual consultations (2 credit), and exam (1 credit).

Learning outcomes:
After completing the lectures, the student will have knowledge of the physical properties of plasma in the solar interior and in the solar atmosphere, the influence of the magnetic field on the active areas. Gain knowledge about the cycle of solar activity and energy transfer between the layers of the solar atmosphere.

Brief outline of the course:
Solar interior - solar activity cycles, Tachocline, solar atmosphere - energy transfer and radiation, magnetic field of the Sun and active regions, solar spots, eruptions, coronal mass ejections, Solar dynamics, Helioseismology

Recommended literature:
1. Aschwanden Markus, Physics of the Solar Corona: An Introduction with Problems and Solutions, Springer, 2006
2. Priest, E.R.: Solar Magnetohydrodynamics, Reidel, 1982.
3. Stix M.: The Sun, An Introduction, Springer, 2nd edition, 2002.
4. Sturrock, Holzer, Mihalas, Ulrich, Physics of the Sun I. II. III. Geophysics and Astrophysics Monorgaphs, Riedel Publ. Dodrecht 1968
5. Zirin, H., Astrophysics of the Sun, Cambridge Univ. Press, Cambridge, 1988

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: Mgr. Peter Gömöry, PhD.

Date of last modification: 07.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SPKD/15	**Course name:** Spectroscopy

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basics of acquisition, processing, and analysis of stellar spectra. Knowledge of different types of spectroscopic instruments and detectors is required, as well as knowledge of the practical determination of the properties of the stellar continuum and spectral lines. The condition for obtaining credits is preparation of seminar essay and passing an oral exam, which consists of three theoretical questions within the curriculum presented during the course. The credit evaluation of the course considers the following student workload: direct teaching (2 credits), self-study (3 credits), individual consultations (2 credits) and assessment (1 credit). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: passed (50-100%), failed (0-49%).

Learning outcomes:
After completing the lectures, the student will master the basics of acquisition, reduction, and analysis of stellar spectra. It will also have sufficient physical knowledge and mathematical apparatus to independently solve a wide range of astronomical problems related to the analysis of stellar spectra, such as determining the properties of the stellar continuum and spectral lines.

Brief outline of the course:
1. Spectroscopic tools: spectrographs, diffraction and blazed reflection gratings. Shadowing, grating ghosts, satellites, and anomalies. Spectrograph cameras. Echelle spectrographs. Interferometers.
2. Detectors: Quantum efficiency and spectral response. Linearity, detector background output, noise, signal to noise ratio, dynamic range and well capacity. Spatial and spectral resolution.
3. The measurement and the behaviour of stellar continua: ultra-low resolution spectrographs and continuum scanners. Absolute calibration, photometric standard stars, measured continua. Continua from photospheric models. Line absorption. A comparison of models to stellar continua. Bolometric flux.
4. The measurement of spectral lines: The coude grating spectrograph, the Richardson image slicer, diffraction grating spectrographs. Instrumental profile, the reconstruction process, noise. The discrete Fourier transform. Measurement of the instrumental profile. Scattered light: measurement and correction.

Recommended literature:

1. Gray, D.F., The observation and analysis of stellar photospheres, Cambridge University Press, Cambridge, 1992;
2. Böhm-Vitense, E., Introduction to stellar astrophysics, Stellar atmospheres, Cambridge University Press, Cambridge, 1997;
3. Kipenhahn, R., Weigert, A., Stellar Structure and evolution, Springer-Verlag, Berlin, 1990;

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. RNDr. Rudolf Gális, PhD.

Date of last modification: 11.07.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: Dek. PF UPJŠ/JSD/14	**Course name:** Spring School for PhD Students

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 4d
Course method: distance, present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the Spring School of PhD students of UPJŠ.

Learning outcomes:
By actively participating in the Spring School of PhD Students of UPJŠ, the PhD student demonstrates a high level of ability to process the issues of his dissertation for a multidisciplinary audience with an emphasis on clarifying the motivation, scientific problem, processing methodology and own contribution to the solution of the selected topic. The PhD student demonstrates the ability to professionally discuss various research topics, present his own positions and accept a plurality of opinions. Demonstrates the ability to communicate research results to a wider professional audience with adequate means and through the Slovak language.

Brief outline of the course:
1. Interdisciplinary lectures from the fields of medicine, natural sciences, law, public affairs, humanities. Lecturers - top foreign or national experts from the mentioned fields.
2. Scientific lectures in sections created within related disciplines. Lecturers - top experts from UPJŠ from the mentioned fields.
3. Scientific contributions of PhD students in sections of related fields.
4. Panel discussions on the issue of PhD studies and current trends in the development of scientific disciplines at UPJŠ.

Recommended literature:
Proceedings of the Spring School of Doctoral Students.

Course language:

Notes:

Course assessment
Total number of assessed students: 203

abs	n
100.0	0.0

Provides: doc. RNDr. Marián Kireš, PhD.

Date of last modification: 08.11.2022
Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ STATF/13	**Course name:** Statistical Physics

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 4 **Per study period:** 56
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student is required to understand various approximate approaches to the study of phase transitions and critical phenomena, the concept of nonequilibrium thermodynamics and the basics of statistical physics of polymers. Lectures are organized in blocks, with a selection of topics reflecting the needs of currently registered students. The condition for obtaining credits is successful completion of the final oral exam, the completion of which is conditioned by the submission of the project electronically and with the attached computer program. Credit evaluation of the course takes into account the following student workload: direct teaching (2 credits), self-study (2 credits), project work (2 credits), individual consultations (1 credit), and exam (1 credit). The minimum limit for completing the course is to obtain at least 50% of the total score.

Learning outcomes:
To acquaint students with the modern theory of phase transitions, current ideas of nonequilibrium thermodynamics and modern statistical physics of polymers. Emphasis is placed on the nature, possibilities and limitations of using different approximate approaches to the solution of complex systems.

Brief outline of the course:
1. Phase transitions and critical phenomena. Mean-field theory and its improvements. Critical indices. Concept of universality, static hypothesis of similarity and scaling. Kadanoff block spins transormation. Theory of the renormalization group. Phase diagrams and fixed points. The perturbative renormalization group. Random systems.
2. Nonequilibrium statistical thermodynamics. Equilibrium and nonequilibrium processes. Linear nonequilibrium thermodynamics. Phenomenological equations and Onsager relations. Fluctuation dissipation theorem. Kinetic theory. Master equation, Boltzmann equation, Langevin equation and Fokker-Planck equation.
3. Statistical physics of macromolecules. Thermodynamic properties of polymer solutions and mixtures. Polymer gels. Molecular motion of the polymeric systems
Selection from this topics makes supervisor depending on the scope of the dissertation.

Recommended literature:
PLISCHKE, M., BERGERSEN, B., Equilibrium Statistical Physics, World Scientific, Singapore, 2006.

MA, S.K., Statistical Mechanics, World Scientific, Singapore, 1993.
STREČKA, J., JAŠČUR, M., A brief account of the Ising and Ising-like models: Mean-field, effective-field and exact results, Acta Physica Slovaca 65 (2015) 235–367.
KADANOFF, L.P., Statistical Physics: Statics, Dynamics and Renormalization, World Scientific, Singapore, 2000.
CARDY, J., Scaling and Renormalization in Statistical Physics, Cambridge, 2002.
DE GROT, S.R., MAZUR, P., Non-equilibrium Thermodynamics, Dover Publications, Inc., New York, 1984.
PRIGOGINE, I., Non-Equilibrium Statistical Mechanics, Dover Publications, 2017.
VAN KAMPEN, N.G., Stochastic Processes in Physics and Chemistry, Elsevier, 2007.
DOI, M., Introduction to Polymer Physics, Clarendon, Oxford, 1996.

Course language:
1. Slovak,
2. English

Notes:

Course assessment
Total number of assessed students: 24

N	P
0.0	100.0

Provides: prof. RNDr. Milan Žukovič, PhD.

Date of last modification: 16.09.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VPSV/22	**Course name:** Supervision of Student's Scientific Activity

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Supervision of Student's Scientific Activity

Learning outcomes:
By guiding a student within the SOČ or ŠVOČ, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 5

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VZP/22	**Course name:** Supervisor/consultant of fianl thesis
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Supervisor of the final thesis.	
Learning outcomes: By supervising the final thesis, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 2	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PPC1/22	**Course name:** Teaching activities 1h/s

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 1 semester hour

Learning outcomes:
Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/PPC2/22	Course name: Teaching activities 2h/s

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 2 semester hours

Learning outcomes:
Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PPC3/22	**Course name:** Teaching activities 3h/s

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 3 semester hours

Learning outcomes:
Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 10

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PPC4/22	**Course name:** Teaching activities 4h/s
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week:** **Per study period:** **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Direct teaching activity 4 semester hours	
Learning outcomes: Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 7	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/KZP/22	**Course name:** Thesis consultant

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: distance, present

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Final thesis consultant.

Learning outcomes:
By consulting the final thesis, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PSU/04	**Course name:** Tools for Data Analysis and Processing
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Student will make a root macro for data analysis related to the student's research area. The results will be presented at a final seminar. Credit distribution: lectures + consulting: 37 hours - 2 credits study + preparation for the final seminar: 37 hours - 2 credits	
Learning outcomes: Extending the knowledge of the modern statistical data processing, archivation and visualisation of experimental and theoretical data, basic knowledge of the work with object oriented applications for analysis and data visualisation - ROOT and GRID.	
Brief outline of the course: I. block (1.-9. week): Selected topics from methods of experimental data analysis in physics, particle physics and from programming of basic physical applications in GRID and ROOT environment. II. block (10-12.week): Data analysis in particle physics, data fitting, error propagation, statistical and systematic uncertainties.	
Recommended literature: An Object Oriented Data Analysis Framework, http://root.cern.ch. GridCafe, http://gridcafe.web.cern.ch/gridcafe/ Wikipedia article on the World Community Grid: Contains additional links for each project being conducted on the World Community Grid. A Gentle Introduction to Grid Computing and Technologies (pdf). Retrieved on 2005-05-06, http://www.buyya.com/papers/GridIntro-CSI2005.pdf	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 11

N	P
0.0	100.0

Provides: doc. RNDr. Marek Bombara, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Michal Jaščur, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ POVK/22	**Course name:** Work in Organizing Committee of Conference
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Work in the organizing committee of the conference	
Learning outcomes: By working in the organizing committee of the conference, the PhD student demonstrates the abilities and competences to organize a scientific or professional event independently or in a team, to manage the implementation in terms of time and content, to communicate effectively verbally and in writing using various technical means as needed, including in a foreign language at a professional level with various types of people, if necessary, correctly recommend solutions or make independent decisions.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 20	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Michal Jaščur, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/PDS/22	**Course name:** Writing Dissertation Work

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: **Per study period:**
Course method: distance, present

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtaining the required number of credits in the prescribed composition according to the UPJŠ study regulations, preparation and defense of the thesis, successfully completed dissertation examination

Learning outcomes:
The PhD student demonstrated the prerequisites for successful continuation of the study by fulfilling the conditions prescribed by the study regulations for the study and scientific part of the doctoral study related to the topic of the dissertation.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 27

N	P
3.7	96.3

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Michal Jaščur, CSc.