

UNIVERSITY OF DEBRECEN, DEBRECEN, HUNGARY

PhD SCHOOLS

Doctoral School of **Physics**, Director: **Prof. Dr. Ferenc Kun**, DSc.**List of courses registered till 2022***(For the description of the courses visit the homepage of the doctoral school: <http://physphd.unideb.hu>)***I. Program of Atomic and molecular physics**

Name of the lecturer	Title of the course	Code	Character L,D,S,E	Hours/ week	Credit value	Remark
Dr. József Cseh	Symmetries in Two-body and Many-body Systems	PF1/319-97	L	2	2	
Dr. András Csehi	Atoms and molecules in electromagnetic fields	PF1/328-20	E	2	2	
Dr. András Csehi	Introduction to molecular quantum dynamics	PF1/329-20	E	2	2	
Dr. Róbert Erdélyi	Plasma Physics – Introduction	PF1/326-18	L	2	2	
Dr. Zsolt Gulácsi	Many-body Calculation Techniques and Applications I.-II.	PF1/37-93	L	2	2x2	2 semesters
Dr. János Zsolt Mezei	Low energy collisions in molecular astrophysics	PF1/330-20	E	2	2	
Dr. Ágnes Nagy	Quantum Mechanics of Classical Chaotic Systems (Quantum Chaos)	PF1/321-00	L	2	2	
Dr. Ágnes Nagy	Non-linear Phenomena, Chaos	PF1/315-93	L	2	2	
Dr. Ágnes Nagy	Density Functional Theory I.-II.	PF1/39-93	L	2	2x2	2 semesters
Dr. József Pálinkás and Dr. László Sarkadi	Experimental Atomic Collision Physics	PF1/35-93	L	2	2	
Dr. László Sarkadi	Theory of Atomic Collisions	PF1/34-93	L	2	2	
Dr. Károly Tőkési	Computational Simulation of Phenomena of Physics	PF1/322-08	L	2	2	
Dr. Károly Tőkési	Basic Examples in Programming	PF1/323-08	L	2	2	

Dr. Károly Tőkési (Joachim Burgdörfer)	Introduction to the theory of attophysics	PF1/325-14	L		2	2
Dr. Károly Tőkési	Modelling of collision processes by Monte Carlo technique	PF1/327-20	L	2	2	
Dr. Ágnes Vibók	Atomic and Molecular Physics	PF1/32-93	L	2	2	
Dr. Ágnes Vibók	Atomic Physics I.-II.	PF1/31-93	L	2	2x2	2 semesters

II. Program of Nuclear physics

Name of the lecturer	Title of the course	Code	Character L,D,S,E	Hours/ week	Credit value	Remark
Dr. István Angeli, Dr. Barna Nyakó	Charge and Mass Distributions of Atomic Nuclei I.-II.	PF2/31-93	L	2	2x2	2 semesters
Dr. István Angeli	High-Energy Accelerators I.-II.	PF2/340-13	L	2	2x2	2 semesters
Dr. József Cseh	Symmetries in Two-body and Many-body Systems	PF2/32-93	L	2	2	
Dr. József Cseh	Seminars on Nuclear Physics	PF2/330-97	L	2	2	
Dr. Julius Csikai	Neutron and Reactor Physics	PF2/324-95	L	2	2	
Dr. Julius Csikai	Application of Nuclear Methods in Science and Technology	PF2/325-95	L	2	2	
Dr. Julius Csikai	Radioactivity and Nuclear Physics	PF2/326-95	L	2	2	
Dr. Zoltán Elekes	Exotic nuclear physics	PF2/342-14	L	2	2	
Dr. Róbert Erdélyi	Plasma Physics – Introduction	PF2/344-18	L	2	2	
Dr. Andrea Ilona Furka	Evaluation of novel techniques in radiotherapy	PF2/348-22	E	2	2	
Dr. Zsolt Fülöp, (Dr. Thomas Rauscher)	Introduction to Nuclear Astrophysics	PF2/338-12	L	2	2	
Dr. Zsolt Fülöp, (Dr. Kai Zuber)	Neutrino Physics	PF2/345-18	L	2	2	
Dr. Zsolt Fülöp, (Dr. Jordi Jose)	Nucleosynthesis in Stellar Explosions	PF2/346-20	L	2	2	
Dr. Zsolt Fülöp	Asztrofizika, asztrokémia és az élet eredete	PF2/347-21	E	2	2	
Dr. Dezső Horváth	The Standard Model and its experimental tests I.-II.	PF2/339-12	L	2	2x2	2 semesters
Dr. Attila Krasznahorkay	Measurements with magnetic spectrograph	PF2/323-94	E	2	2	
Dr. Attila Krasznahorkay	Experiments with magnetic mass separator	PF2/335-06	E	2	2	
Dr. Attila Krasznahorkay	Collective excitations in atomic nuclei	PF2/336-10	L	2	2	
Dr. Attila Krasznahorkay, Dr. Lóránt Csige	Modern nuclear instruments and methods	PF2/341-14	L	2	2	

Dr. Tamás Lakatos, Dr. János Gál	Electronic Measurement of Physical Quantities	PF2/37-93	L+Gy	2+1	3	
Dr. Rezső Lovas	(Structure and Reactions of) Light Exotic Nuclei	PF2/333-01	L	2	2	
Dr. János Zsolt Mezei	Calculations of molecular photoabsorption and electron collisions cross sections for astrophysics and other purposes	PF2/349-22	E	2	2	
Dr. Mihály Molnár (Dr. Ulrich Ott)	Meteorites, the Early Solar System and Nuclear Astrophysics	PF2/343-14	L	2	2	
Dr. Sándor Nagy	Methods and Practice of Gamma Spectrometry	PF2/310-93	L+E	2+1	3	
Dr. Sándor Nagy	Nuclear Fission	PF2/311-93	L	2	2	
Dr. Zoltán Papp	Quantum Mechanical Few-Body Problem	PF2/331-97	L	2	2	
Dr. Péter Raics, Dr. Sándor Sudár	Methods for the Analysis of Nuclear Reactions	PF2/312-93	L	2	2	
Dr. Kornél Sailer	Introduction to Quantum Field Theory	PF2/315-93	L	2	2	
Dr. Kornél Sailer	String Theory I.-II.	PF2/322-94	L	2	2x2	2 semesters
Dr. Kornél Sailer	Symmetries and Symmetry Breaking in Quantum Field Theory I.-II.	PF2/317-93	L	2	2x2	2 semesters
Dr. Kornél Sailer	Renormalization Group Methods in Physics	PF2/328-96	L	2	2	
Dr. Kornél Sailer	TRIANGLE-course	PF2/314-93	L	2	2	
Dr. Kornél Sailer	Finite Temperature Quantum Field Theory	PF2/327-95	L	2	2	
Dr. Kornél Sailer	Non-equilibrium Statistical Physics	PF2/313-93	L	2	2	
Dr. Kornél Sailer, Dr. Zsolt Schram	Models and Methods in Theoretical Physics	PF2/334-02	L	2	2	
Dr. Endre Somorjai Dr. Gábor Kiss	Nuclear Astrophysics	PF2/36-93	L	2	2	
Dr. János Timár	The rotating nucleus: an experimental view	PF2/337-11	L	2	2	
Dr. Zoltán Trócsányi	Standard Model	PF2/321-94	L	2	2	
Dr. Tamás Vertse	Numerical Methods in Practice	PF2/329-97	E	2	2	
Dr. Tamás Vertse	Nuclear Models I.-II.	PF2/35-93	L	2	2x2	2 semesters
Dr. László Végh	Advanced Quantum Mechanics	PF2/318-93	L+D	2+1	2	
Dr. László Zolnai	Angular Distribution Measurement of the	PF2/320-93	E	3	3	

Dr. László Zolnai

Elastically Scattered alpha-particles
Science technology

PF2/332-00 L

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III. Program of **Solid state physics and material science**

Name of the lecturer	Title of the course	Code	Character L,D,S,E	Hours/ week	Credit value	Remark
Dr. Dezső Beke	Solid State Physics I.-II.	PF3/31-93	L	2	2x2	2 semesters
Dr. Dezső Beke	Plastic Deformations and Fracture	PF3/319-93	L	2	2	
Dr. Dezső Beke	New Materials and Technologies	PF3/33-93	L	2	2	
Dr. Dezső Beke	Nonequilibrium Materials	PF3/322-94	L	2	2	
Dr. Dezső Beke	Micro- and nanomagnetism I.-II.	PF3/331-97	L	2	2x2	2 semesters
Dr. Dezső Beke	Advance Topics in Nanotechnology	PF3/341-12	L	2	2	
Dr. Csaba Cserháti	Electron Microscopy	PF3/316-93	L	2	2	
Dr. Attila Csík	X-ray related technics for solid state studies	PF3/346-14	L+E		2+1	2
Dr. Lajos Daróczi	Martensitic transformations	PF3/342-13	L	2	2	
Dr. Gábor Erdélyi	Solid State Reactions	PF3/39-93	L	2	2	
Dr. Zoltán Erdélyi	Diffusion and Segregation in Nanostructures	PF3/339-02	L	2	2	
Dr. Zsolt Gulácsi	Theoretical Solid State Physics	PF3/32-93	L	2	2	
Dr. Zsolt Gulácsi, Dr. Dezső Beke	Phase-transitions I.-II.	PF3/35-93	L	2	2x2	2 semesters
Dr. Zsolt Gulácsi	Magnetism	PF3/320-93	L	2	2	
Dr. Zsolt Gulácsi	Many-body Calculation Techniques and Applications I.-II.	PF3/323-94	L	2	2x2	2 semesters
Dr. Zsolt Gulácsi	Quantum Phase Transitions	PF3/334-97	L	2	2	
Dr. Zsolt Gulácsi	Spin Glasses	PF3/335-97	L	2	2	
Dr. Zsolt Gulácsi	Polarization, Screening and Response Functions	PF3/336-98	L	2	2	
Dr. Zsolt Gulácsi (Dr. deChatel P.)	Description of Superconductivity	PF3/338-00	L	2	2	
Dr. Zsolt Gulácsi	Many-body systems in periodic potential	PF3/340-08	L	2	2	
Dr. Zsolt Gulácsi, (Dr. Miklós Gulácsi)	Theory of Strongly Correlated Systems	PF3/343-14	L	2	2	
Dr. Zsolt Gulácsi	Quantum information and quantum computation	PF3/344-14	L	2	2	
Dr. Ferenc Kun	Computer simulation I.-II.	PF3/327-95	L	2	2x2	2 semesters

Dr. Sándor Kökényesi	Solid State- and Optoelectronics	PF3/332-97	L		2	2
Dr. László Kövér	Investigations of Solid State Surfaces	PF3/311-93	L		2	2
Dr. László Kövér	Electronic Structure of Surface and Interface Formation	PF3/326-95	L		2	2
Dr. Gábor Langer	Vacuumtechnique and Production of Thin Films	PF3/317-93	L		2	2
Dr. Gábor Langer	Thin Films	PF3/324-94	L		2	2
Dr. Sándor Mészáros	Superconductivity	PF3/36-93	L		2	2
Dr. Sándor Mészáros	Modern Methods of Investigation in the Material Science	PF3/37-93	L		2	2
Dr. István Szabó	Atomic resolution microscopy	PF3/329-96	L		2	2
Dr. István Szabó	Intermetallic compounds	PF3/330-96	L		2	2
Dr. István Szabó, (Dr. László Szunyogh)	Introduction to spintronics	PF3/345-14	L		2	2

IV. Program of **Physical methods in interdisciplinary researches**

Name of the lecturer	Title of the course	Code	Character L,D,S,E	Hours/ week	Credit value	Remark
Dr. György Csepura	Radiation protection	PF4/36-04	L	2	2	
Dr. István Csige	Subsurface Flow	PF4/315-12	L	2	2	
Dr. Julius Csikai	Application of Neutrons in Elemental Analysis	PF4/33-93	L	2	2	
Dr. Róbert Erdélyi	Waves	PF4/320-15	L	2	2	
Dr. Róbert Erdélyi	Solar Magnetohydrodynamics	PF4/321-15	L	2	2	
Dr. Róbert Erdélyi	Advanced Solar Magnetohydrodynamics	PF4/322-16	L	2	2	
Dr. Róbert Erdélyi	Sunpy	PF4/323-16	L	2	2	
Dr. Róbert Erdélyi	Plasma physics – Introduction	PF4/324-18	L	2	2	
Dr. Árpád Kiss et al.	Atomic- and Nuclear Microanalysis	PF4/31a-93	L	2	2	
Dr. Árpád Kiss et al.	Atomic- and Nuclear Microanalysis Labor	PF4/31b-93	E	4	4	connected to the prev. lectures
Dr. Zsófia Kertész, Dr. Mihály Molnár	Atmosphere and Climate	PF4/39-09	L	2	2	
Dr. Zsófia Kertész	Atmospheric Aerosol Sampling Procedures and Analysis Techniques Using Ion Beam and XRF	PF4/311-12	L	2	2	
Dr. Ferenc Kun	Computer simulation I.-II.	PF4/310-10	L	2	2x2	2 semesters
Dr. Ferenc Kun	Physics of Complex Systems	PF4/313-12	L	2	2	
Dr. Ferenc Kun, (Dr. Illés Farkas)	Perl Programming and Networks in Computational Biology	PF4/317-14	L	2	2	
Dr. Ferenc Kun, (Dr. Frank Raichel)	Criticality and Complex Systems	PF4/318-14	L	2	2	
Dr. Ferenc Kun	Complex Networks	PF4/325-18	L	2	2	
Dr. Ferenc Kun, (Dr. Géza Ódor)	Universality Classes in Non-equilibrium Systems	PF4/326-18	L	2	2	
Dr. Sándor Mészáros	Superconductivity	PF4/328-19	L	2	2	

Dr. Mihály Molnár, Dr. László Palcsu	Radioactive Dating	PF4/38-09	L	2	2
Dr. Mihály Molnár, (Dr. Timothy Jull)	Geochronology and Paleoclimate	PF4/316-13	L	2	2
Dr. Mihály Molnár (Dr. Ulrich Ott)	Meteorites, the Early Solar System and Nuclear Astrophysics	PF4/319-14	L	2	2
Dr. Ágnes Nagy	Non-linear Phenomena, Chaos	PF4/312-12	L	2	2
Dr. László Palcsu, Dr. István Csige, Dr. Mihály Molnár	Nuclear Environmental Protection	PF4/37-09	L	2	2
Dr. Andrea Somogyi	Synchrotron radiation based X-ray microprobe methods	PF4/35-04	L	2	2
Dr. István Szabó	Atomic Resolution Microscopy	PF4/327-18	L	2	2
Dr. Károly Tőkési	Modelling of collision processes by Monte Carlo technique	PF4/329-20	L	2	2

V. Program of **Particle physics**

Name of the lecturer	Title of the course	Code	Character L,D,S,E	Hours/ week	Credit value	Remark
Dr. István Angeli	High-Energy Accelerators I.-II.	PF5/31-95	L	2	2x2	2 semesters
Dr. József Cseh	Symmetries in Two-body and Many-body Systems	PF5/321-97	L	2	2	
Dr. Gábor Dávid, Dr. Sándor Nagy	Modelling, Simulation, Analysis in Experimental Particle Physics I.-III.	PF5/33-95	L	2	3x2	3 semesters
Dr. Gábor Dávid	Data Acquisition, Triggering and Online Monitoring	PF5/331-10	L	2	2	
Dr. Zsolt Fülöp, (Dr. Kai Zuber)	Neutrino Physics	PF5/340-18	L	2	2	
Dr. Dezső Horváth	The Standard Model and its experimental tests I.-II.	PF5/326-00	L	2	2x2	2 semesters
Dr. Dezső Horváth	Experimental techniques of particle physics	PF5/327-01	L	2	2	
Dr. Ádám Kardos	Introduction to Effective Field Theories	PF5/339-18	L	2	2	
Dr. Ádám Kardos	Introduction to FORM programming	PF5/343-22	E	2	2	
Dr. Tamás György Kovács	Statistical field theory	PF5/334-14	L	2	2	
Dr. Tamás György Kovács	Solitons and Instantons	PF5/341-19	L	2	2	
Dr. Tamás György Kovács	Lattice Field Theory 2	PF5/342-19	L	2	2	
Dr. Sándor Nagy	Quantum renormalization group	PF5/338-17	L	2	2	
Dr. Sándor Nagy	Nyílt rendszerek kvantumelmélete	PF5/344-22	E	2	2	
Dr. Sándor Nagy	Zárt időtengelyes formalizmus a fizikában	PF5/345-22	E	2	2	
Dr. István Nándori	Basics of functional renormalization group method	PF5/337-16	L	2	2	
Dr. Péter Raics	Particle Detectors	PF5/311-95	L	2	2	
Dr. Kornél Sailer	Introduction to Quantum Field Theory	PF5/312-95	L	2	2	
Dr. Kornél Sailer	Symmetries and Symmetry Breaking in Quantum Field Theory I.-II.	PF5/314-95	L	2	2x2	2 semesters
Dr. Kornél Sailer	General Relativity	PF5/323-98	L	2	2	
Dr. Kornél Sailer, Dr. Sándor Nagy	Functional renormalization group method	PF5/333-13	L	2	2	

Dr. Kornél Sailer	Finite Temperature Quantum Field Theory	PF5/334-13	L	2	2	
Dr. Kornél Sailer	Cosmology	PF5/335-14	L	2	2	
Dr. Zsolt Schram	Lattice Field Theory	PF5/322-97	L	2	2	
Dr. Zsolt Schram	Variational principles of theoretical physics	PF5/332-11	L	2	2	
Dr. Gábor Somogyi	Methods of computing Feynman integrals	PF5/336-15	L	2	2	
Dr. Zoltán Trócsányi	Standard Model	PF5/317-95	L	2	2	
Dr. Zoltán Trócsányi	Grand Unified Theories	PF5/318-95	L	2	2	
Dr. Zoltán Trócsányi	Perturbative Quantum Chromodynamics I.-II.	PF5/320-97	L	2	2x2	2 semesters
Dr. Gyula Zilizi	Electronics in the Experimental Particle Physics	PF5/316-95	L	2	2	

Abbreviations: L = Lectures, D = Discussions, S = Seminars, E = Exercises