Physics and Astronomy Classification Scheme

PACS codes adopted by AAPT for their journal indexing.

| <u>COMMUN</u> | ICATION, EDUCATION, HISTORY | 02.40k | Geometry, differential geometry, and topology |
|----------------|--|---------------------------|---|
| AND PHILOSOPHY | | 02.50r | Probability theory, stochastic processes, and statistics |
| 01.10m | Announcements, news, and organizational activities | 02.60x | Numerical approximation and analysis |
| | 0 | 02.70с | Computational techniques; simulations |
| | Physics literature and publications | 02.90.+p | Other topics in mathematical methods in physics |
| 01.30.Bb | Publications of lectures (advanced institutes, summer | 1 | |
| | schools, etc.) | SPECIAL R | RELATIVITY |
| 01.30.Cc | Conference proceedings | 03.50z | Classical field theories |
| 01.30.Ee | Monographs and collections | 03.65w | Ouantum mechanics |
| 01.30.Ki | Handbooks, dictionaries, tables, and data compilations | 03.70.+k | Theory of quantized fields |
| • • • • | Physics laboratory manuals | | |
| 01 30 la | Secondary schools | 04.00 GEN | JERAL RELATIVITY AND GRAVITATION |
| 01.30 lb | Undergraduate schools | 01.00 <u>GEI</u> | |
| 01.90.10 | Textbooks | STATISTIC | CAL PHYSICS THERMODYNAMICS AND |
| 01.30 mm | Textbooks for graduates and researchers | NONLINE | AR DVNAMICAL SVSTEMS |
| 01.30 mp | Textbooks for undergraduates | $\frac{110111111}{05.20}$ | Classical statistical mechanics |
| 01.30.mp | Taxtbooks for students in grades 0 12 | 05.20y | Kinotic theory |
| 01.30.mt | Textbooks for students in grades V-12 | 05.20.Du | Eluctuation abonamente condem ano conce |
| 01.30.111 | Peole of conorel interest to physics too how | 05.40a | Chass nonlinear dynamics and nonlinear dynami |
| 01.30.Os | books of general interest to physics teachers | 03.43a | Chaos; noninear dynamics and noninear dynami- |
| 01.30.Rr | Surveys and tutorial papers; resource letters | 05 (0 1 | cal systems |
| 01.30.1t | Bibliographies | 05.60k | Iransport processes |
| 01 (0 D) | Education | 05./0a | Thermodynamics |
| 01.40.Di | Course design and evaluation | 05./0.Ce | Thermodynamic functions and equations of state |
| | Science in school | | |
| 01.40.eg | Elementary school | METROLO | DGY, MEASUREMENTS, AND LABORATORY |
| 01.40.ek | Secondary school | PROCEDU | J <u>RES</u> |
| 01.40.Fk | Research in physics education | 06.20.Dk | Measurement and error theory |
| | Curricula and evaluation | | Units and standards |
| 01 40 ab | Teaching methods and strategies | $06.20 f_{2}$ | Units |
| 01.40.gb | Theory of testing and techniques | 06.20.fb | Standards and calibration |
| 01.40.gr | Learning theory and science teaching | 06.20.10 | Determination of fundamental constants |
| 01.40.11a | Learning theory and science teaching | 06.20.JI | Special dimensione |
| | Toology maining | 06.30.Bp | Mass and density |
| 01 /0 :- | Descrite training | 00.30.Dr | Time and for some and |
| 01.40.jc | | 00.30.FL | V 1 V 1 V 1 V 1 V 1 V V |
| 01.40.jn | Inservice training | 06.30.Gv | velocity, acceleration, and rotation |
| | Educational aids | 06.30.Ka | Basic electromagnetic quantities |
| 01 50 61 | Audio and visual aids | 06.60c | Laboratory procedures |
| 01.50.fd | Audio devices | 07.05 | |
| 01.50.ff | Films; electronic video devices | 07.05t | Computers in experimental physics |
| 01.50.fh | Posters, cartoons, art, etc. | 07.05.Kf | Data analysis: algorithms and implementation; data |
| | Computers in education | | management |
| 01.50.ht | Instructional computer use | 07.07.Hj | Display and recording equipment |
| 01.50.hv | Computer software and software reviews | 07.07.Mp | Transducers |
| 01.50.My | Demonstration experiments and apparatus | 07.07.Tw | Servo and control equipment; robots |
| 01.50.Pa | Laboratory experiments and apparatus | 07.10h | Mechanical instruments and equipment |
| 01.50.Qb | Laboratory course design, organization, and evaluation | 07.20n | Thermal instruments and apparatus |
| 01.50.Rt | Physics tournaments and contests | 07.20.Mc | Cryogenics, refrigerators, low temperature detectors |
| 01.50.Wg | Physics of toys | 07.30t | Vacuum apparatus |
| 01.50.Zv | Errors in physics classroom materials | 07.35.+k | High-pressure apparatus; shock tubes; diamond anvil cells |
| 01.55.+b | General physics | 07.50е | Electrical and electronic instruments and components |
| 01.60.+q | Biographies, tributes, personal notes, and obituaries | 07.55w | Magnetic instruments and components |
| 01.65.+g | History of science | 07.57.Ty | Infrared spectrometers, auxiliary equipment, techniques |
| 01.70.+w | Philosophy of science | 07.60j | Optical instruments and equipment |
| 01.75.+m | Science and society | 07.68.+m | Photography, photographic instruments; xerography |
| 01.80.+b | Physics of games and sports | 07.75.+h | Mass spectrometers |
| 01.85.+f | Careers in physics and science | 07.77n | Atomic, molecular, and charged-particle sources and |
| 01.90.+0 | Other topics of general interest | · · · / · · · | detectors |
| | | 07.78.+8 | Electron, positron, and jon microscopes: electron |
| MATHEMA | TICAL METHODS IN PHYSICS | 0, 1, 0110 | diffractometers |
| 02 10 -v | Logic set theory and algebra | 07 81 +2 | Electron and ion spectrometers |
| 02.101 | Logic, set theory, and algebra | 07.01.Td | Exection and ion spectrometers |

| 07.85m | X- and gamma-ray instruments |
|----------|-----------------------------------|
| 07.90.+c | Other topics in metrology, measur |

| | 8 |
|----------|--|
| 07.90.+c | Other topics in metrology, measurements, and labo- |
| | ratory procedures |

THE PHYSICS OF ELEMENTARY PARTICLES

AND FIELDS

| <u>mu nu</u> | |
|--------------|--|
| 11.00 | General theory of fields and particles |
| 12.00 | Specific theories and interaction models; particle |
| | systematics |
| 13.00 | Specific reactions and phenomenology |
| 14.00 | Properties of specific particles |
| | |

NUCLEAR PHYSICS

| 21.00 | Nuclear structure |
|-------|---|
| 23.00 | Radioactive decay and in-beam spectroscopy |
| 24.00 | Nuclear reactions: general |
| 25.00 | Nuclear reactions: specific reactions |
| 27.00 | Properties of specific nuclei listed by mass ranges |
| 28.00 | Nuclear engineering and nuclear power studies |
| | |

ATOMIC AND MOLECULAR PHYSICS

| 31.00 | Electronic structure of atoms and molecules: theory |
|-------|--|
| 32.00 | Atomic properties and interactions with photons |
| 33.00 | Molecular properties and interactions with photons |
| 34.00 | Atomic and molecular collision processes and |
| | interactions |
| 36.00 | Exotic atoms and molecules; macromolecules; clusters |
| | |

ELECTROMAGNETISM

| 41.20q | Applied classical electromagnetism |
|----------|--|
| 41.20.Cv | Electrostatics; Poisson and Laplace equations, |
| | boundary-value problems |
| 41.20.Gz | Magnetostatics; magnetic shielding; magnetic |
| | induction, boundary-value problems |
| 41.20.Jb | Electromagnetic wave propagation; radiowave |
| | propagation |

| 41.60m | Radiation | bv | moving | charges |
|----------|-----------|-----|--------|---------|
| 11.00111 | Raulation | Uy. | moving | charges |

- Positive-ion beams 41.75.Ak
- 41.75.Cn Negative-ion beams
- 41.75.Fr Electron and positron beams
- 41.75.Ht Relativistic electron and positron beams 41.85.-p Beam optics
- 41.90.+e Other topics in electromagnetism

OPTICS

| 42.15.Dp | Wave fronts and ray tracing |
|----------|--|
| 42.25.Bs | Wave propagation, transmission and absorption |
| 42.25.Dd | Wave propagation in random media |
| 42.25.Fx | Diffraction and scattering |
| 42.25.Gy | Edge and boundary effects; reflection and refraction |
| 42.25.Hz | Interference |
| 42.25.Ja | Polarization |
| 45.25.Kb | Coherence |
| 42.25.Lc | Birefringence |
| 42.30d | Imaging and optical processing |
| 42.40i | Holography |
| 42.55f | Lasers |
| 42.66р | Physiological optics |
| 42.68w | Atmospheric and ocean optics |
| 42.70a | Optical materials |
| 42.72g | Optical sources and standards |
| 42.79е | Optical elements, devices, and systems |
| 42.79.Bh | Lenses, prisms, and mirrors |
| 42.90.+m | Other topics in optics |
| | |

ACOUSTICS

- 43.28.+h Aeroacoustics and atmospheric sound
- Underwater sound 43.30.+m
- 43.35.+d Ultrasonics, quantum acoustics, and physical effects of sound
- 43.38.+n Transduction: acoustical devices for the generation and reproduction of sound
- Structural acoustics and vibrations 43.40.+s
- 43.50.+y Noise: its effects and control
- 43.55.+p Architectural acoustics
- 43.58.+z Acoustical measurements and instrumentation
- 43.60.+d Acoustic signal processing
- 43.64.+r Physiological acoustics
- 43.66.+y Psychological acoustics
- Speech production 43.70.+i
- Speech perception 43.71.+m
- 43.72.+q Speech processing and communication systems
- 43.75.+a Music and musical instruments
- 43.80.+p Bioacoustics
- 43.90.+v Other topics in acoustics

HEAT TRANSFER

| 44.10.+i | Heat conduction |
|----------|-------------------------------|
| 44.25.+f | Natural convection |
| 44.27.+g | Forced convection |
| 44.90.+c | Other topics in heat transfer |
| | |

CLASSICAL MECHANICS OF DISCRETE SYSTEMS

| Newtonian mechanics | | | |
|---------------------|---|--|--|
| 45.20.da | Forces and torques | | |
| 45.20.dc | Rotational dynamics | | |
| 45.20.df | Momentum conservation | | |
| 45.20.dg | Mechanical energy, work, and power | | |
| 45.20.dh | Energy conservation | | |
| | Dynamics and kinematics of rigid bodies | | |
| 45.40.Aa | Translation kinematics | | |
| 45.40.Bb | Rotational kinematics | | |
| 45.50.Tn | Collisions | | |
| | | | |

CONTINUUM MECHANICS OF SOLIDS

- 46.25.-y Static elasticity
- 46.35.+z Viscoelasticity, plasticity, viscoplasticity
- 46.40.-f Vibrations and mechanical waves
- 46.55.+d Tribology and mechanical contacts

FLUID DYNAMICS 47.10.-g

| | Wave propagation, transmission and absorption | 47.10g | General theory |
|---|--|----------|--|
| ł | Wave propagation in random media | 47.15x | Laminar flows |
| | Diffraction and scattering | 47.20k | Flow instabilities |
| 7 | Edge and boundary effects; reflection and refraction | 47.27i | Turbulent flows |
| z | Interference | 47.32у | Vortex dynamics; rotating fluids |
| | Polarization | 47.35i | Hydrodynamic waves; free surface flows |
|) | Coherence | 47.40x | Compressible flows; shock waves |
| | Birefringence | 47.45n | Rarefied gas dynamics |
| | Imaging and optical processing | 47.55t | Multiphase and stratified flows |
| | Holography | 47.65d | Magnetohydrodynamics and electrohydrodynamics |
| | Lasers | 47.70n | Reactive and radiative flows |
| | Physiological optics | 47.80v | Instrumentation and measurement methods |
| | Atmospheric and ocean optics | 47.90.+a | Other topics in fluid dynamics |
| | Optical materials | | |
| | Optical sources and standards | | Physics of gases |
| | Optical elements, devices, and systems | 51.10.+y | Kinetic and transport theory of gases |
| 1 | Lenses, prisms, and mirrors | 51.20.+d | Viscosity, diffusion, and thermal conductivity |
| n | Other topics in optics | 51.30.+i | Thermodynamic properties, equations of state |

| 51.40.+p | Acoustical properties | INTERDISC | CIPLINARY PHYSICS AND RELATED AREAS OF |
|---|---|---|--|
| 51.50.+v | Electrical properties (ionization, breakdown, etc.) | SCIENCE A | ND TECHNOLOGY |
| 51.60.+a | Magnetic properties | 81.00 | Materials science |
| 51.70.+f | Optical and dielectric properties | 82.00 | Physical chemistry and chemical physics |
| 51.90.+r | Other topics in the physics of gases | 82.47a | Applied electrochemistry |
| 52.00 | Physics of plasmas and electric discharges | 82.60s | Chemical thermodynamics |
| | | 84.00 | Electronics; radiowave and microwave technology; |
| CONDENS | ED MATTER: STRUCTURAL, MECHANICAL AND | | direct energy conversion and storage |
| THERMAL PROPERTIES | | | Electronic circuits |
| | Mechanical and acoustical properties of | 84.30.Bv | Circuit theory |
| <i></i> | condensed matter | 84.32.Dd | Connectors, relays, and switches |
| 62.10.+s | Mechanical properties of liquids | 84.32.Ff | Conductors, resistors |
| 62.20x | Mechanical properties of solids | 84.32.Hh | Inductors and coils; wiring |
| 62.20.Dc | Elasticity, elastic constants | 84.40.Az | Waveguides, transmission lines, striplines |
| 62.30.+d | Mechanical and elastic waves; vibrations | 84.40.Ba | Antennas: theory, components and accessories |
| 62.60.+v | Acoustical properties of liquids | 84.47.+w | Vacuum tubes |
| 62.65.+k | Acoustical properties of solids | 84.60h | Direct energy conversion and storage |
| 62.90.+K | Other topics in mechanical and acoustical properties | | Electronic and magnetic devices: microelectronics |
| (2.00 | I stting for some in | 85 25 -i | Superconducting devices |
| 64.00 | Lattice dynamics | 85 30 -7 | Semiconductor devices |
| 04.00 | Equations of state, phase equilibria, and phase | 85 50 -n | Dielectric ferroelectric and piezoelectric devices |
| | transitions | 85.60 -a | Optoelectronic devices |
| | Thermal properties of condensed matter | 85.70w | Magnetic devices |
| 65.20.+w | Thermal properties of liquids: heat capacity, thermal | 85.80b | Thermoelectromagnetic and other devices |
| | expansion | 85.90.+h | Other topics in electronic and magnetic devices and |
| | Thermal properties of crystalline solids | | microelectronics |
| 65.40.Ba | Heat capacity | 87.00 | Biological and medical physics |
| 65.40.De | Thermal expansion; thermomechanical effects | 89.00 | Other areas of applied and interdisciplinary physics |
| 65.40.Gr | Entropy and other thermodynamical | 89.20.Bb | Industrial and technological research and |
| · · · · · | properties | | development |
| 65.90.+i | Other topics in thermal properties of condensed | 89.30g | Energy resources |
| | matter | 89.40a | Transportation |
| 66.00 | Transport properties of condensed matter | 89.60k | Environmental studies |
| (7.00) | (nonelectronic) | 89.65.Lm | Urban planning and construction |
| 6/.00 | Quantum fluids and solids; liquid and solid helium | 89.70+c | Information theory and communication theory |
| 68.00 | Surfaces and interfaces; thin films and low- | 91.00 | Solid Earth Physics |
| | dimensional systems (structure and nonelectronic | 92.00 | Hydrospheric and atmospheric geophysics |
| 72.00 | Floatenie transport in condensed motter | 93.00 | Geophysical observations, instrumentation, and |
| 72.00 | Electronic transport in condensed matter | | techniques |
| / 5.00 | faces interfaces this films and low dimensional | 94.00 | Physics of the ionosphere and magnetosphere |
| | itaces, interfaces, unit finits and low-dimensional | | |
| 73.20 # | Electron states at surfaces and interfaces | FUNDAME | ENTAL ASTRONOMY AND ASTROPHYSICS; |
| 74.00 | Superconductivity | INSTRUMENTATION, TECHNIQUES, AND ASTRONOMI- | |
| 75.00 | Magnetic properties and materials | CAL OBSEI | RVATIONS |
| 76.00 | Magnetic resonances and relaxations in condensed | 95.10a | Fundamental astronomy |
| / 0.00 | matter. Mossbauer effect | 95.30k | Fundamental aspects of astrophysics |
| 77.00 | Dielectrics, piezoelectrics, and ferroelectrics and | 95.40.+s | Artificial Earth satellites |
| //.00 | their properties | 95.45.+i | Observatories and site testing |
| 77.65i | Piezoelectricity and electromechanical effects | 95.55n | Astronomical and space-research instrumentation |
| ,,, | | 95./5z | Observation and data reduction techniques; |
| OPTICAL P | ROPERTIES, CONDENSED MATTER | 05.00 | computer modeling and simulation |
| SPECTROS | COPY AND OTHER INTERACTIONS OF | 95.80.+p | Astronomical catalogs, atlases, sky surveys, |
| RADIATION AND PARTICLES WITH CONDENSED MATTER | | 05.05 | databases, retrieval systems, archives, etc. |
| | Optical properties of bulk materials and | 95.85e | Astronomical observations |
| | thin films | 93.90.+v | Filstorical astronomy and archaeoastronomy |
| 78.40q | Absorption and reflection spectra: visible and | | and other topics in rundamental astronomy and |
| 1 | ultraviolet | | astrophysics; instrumentation, techniques, and |
| 78.66w | Optical properties of specific thin films | 96.00 | Solar System: planetology |
| 78.90.+t | Other topics in optical properties, condensed matter | 97.00 | Stare |
| | spectroscopy and other interactions of particles and | 98.00 | Stellar systems: interstellar medium: galactic and |
| | radiation with condensed matter | 20.00 | extragalactic objects and systems: the Universe |
| | | 99.10x | Errata and other corrections |
| | | , , A | |