APPLIED & ENGINEERING PHYSICS

Fundamentals of Nonclassical Physics

Allocation : 2 + 2 **Year / Semester :** 1 - 2 / Fall **Lecturer :** L. Drska

Objectives / Prerequisites

1. Objectives : The course offers a non-traditional presentation of modern physics concepts with intense ICT learning support, substantial part of the course is realized in a computational laboratory . 2. Prerequisites : Sound knowledge of classical physics is expected, reasonable knowledge and skills for individual work in the computational laboratory are essential.

Short Syllabus

1. Introduction : Non-Classical Physics *(Lecture 1)* -- 2. Contemporary Physics : Methods *(Lecture 2 – 3)* - 2.1 Integrated Computing Systems. Intensive Computing. - 2.2 Simulation Methods. Computerized Experiments. – *2.3 Facultative : ICS Fundamentals. Intensive Computing*. -- 3. Microworld : Quantum Systems *(Lecture 4 – 6)* 3.1 Quantum Physics Concepts. Schroedinger Equation. - 3.2. Visual Quantum Mechanics. Unbound States. - 3.3 Bound States. 3D Systems, H-like / High-Z Atoms. – *3.4 Facultative : Lasers. Quantum Computing.* -- *Test 1 : Chap. 2 – 3. Microproject : Submission.*-- 4. Megaworld : Relativistic Systems *(Lecture 7 – 8)* -- 4.1 Special Relativity Concepts. Relativistic Kinematics. - 4.2 Relativistic Dynamics. General Relativity Outline – *4.3 Facultative : Particle Accelerators. Relativistic Astrophysics.* .-- 5. Real World : Real / Complex Systems *(Lecture 9 – 11)* -- 5.1 Real Physics Conceps. Physical Kinetics. - 5.2 Particle Simulation. Algorithmic Physics - 5.3 Nonlinear Physics. Strongly-Coupled Systems. – *5.4 Facultative : Plasma. High Energy Density Systems.* -- *Test 2 : Chap. 4 – 5. Microproject : Evaluation*. -- 6. Conclusion : Postmodern Physics *(Lecture 12)*

Sample References

[1] Hey T., Walters P.: *The New Quantum Universe.* 2nd Ed. Cambridge University Press 2003. ISBN 0-521-56457-3 [2] Krane R. : *Modern Physics*. 2nd Ed. Wiley 1996. ISBN 0-471-82872-6 – [3] Harris R. :*Nonclassical Physics : Beyond Newton's View.* Addison Wesley 1998. ISBN 0-201-83436-7 – [4] Thornton S.T., Rex A. : *Modern Physics for Scientists and Engineers*. 3rd Ed. Brooks Cole 2005. ISBN 0-534-41781-7 – [5] Belloni M., Christian W., Cox A. : *Physlet Quantum Physics : An Interactive Introduction*. Prentice Hall 2005. ISBN 0-13-101970-8 – [6] Wolfram Research Inc.: *Mathematica CalcCenter 3.* http://www.wolfram.com/products/calccenter/ – [7] Giancoli D.C. :*Physics for Scientists and Engineers with Modern Physics.* 3rd Ed. Prentice Hall *2000*. ISBN 0-13-021517-1 – [8] Landau R. H. : *A First Course in Scientific Computing*. Princeton University Press 2005. ISBN 0-691-12183-4. – [9] Thaller B. : *Visual Quantum Mechanics.* Springer / TELOS 2000. ISBN 0-387-98929-3. – [10] Wang F.Y: Physics with Maple: *The Computer Algebra Resource for Mathematical Methods in Physics*. Wiley-VCH 2006. ISBN 3-527-40640-9. http://faculty.lagcc.suny.edu/fwang/maplebook/ .

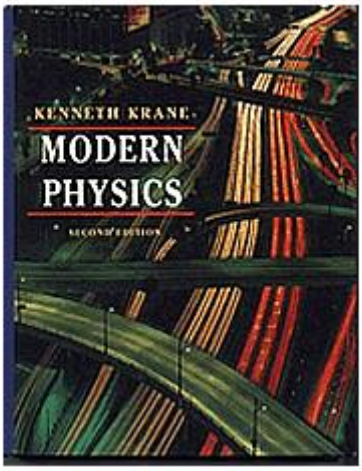
Examen Information

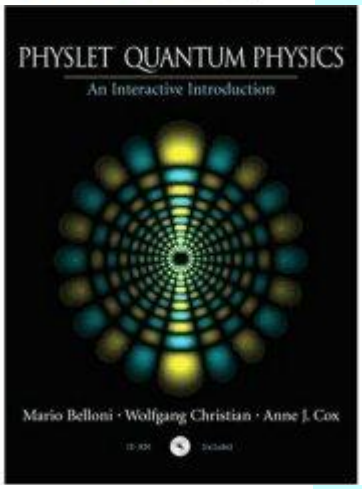
1. Tests : Two tests / quizes through class period are required (30%) 2. Microproject : Realization and presentation of a small, computer-supported individual study project (40%) . 3. Final examen : Solution of some examples and discussion (30%).

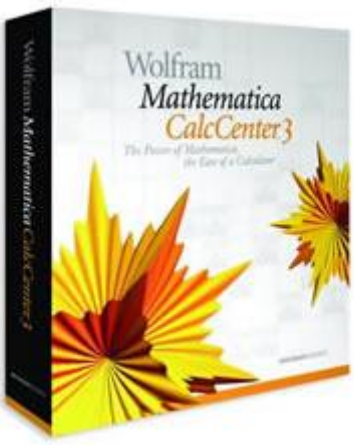
Fundamentals of Nonclassical Physics

TOP 3 + 3

Version A : Elementary







Version B : Advanced