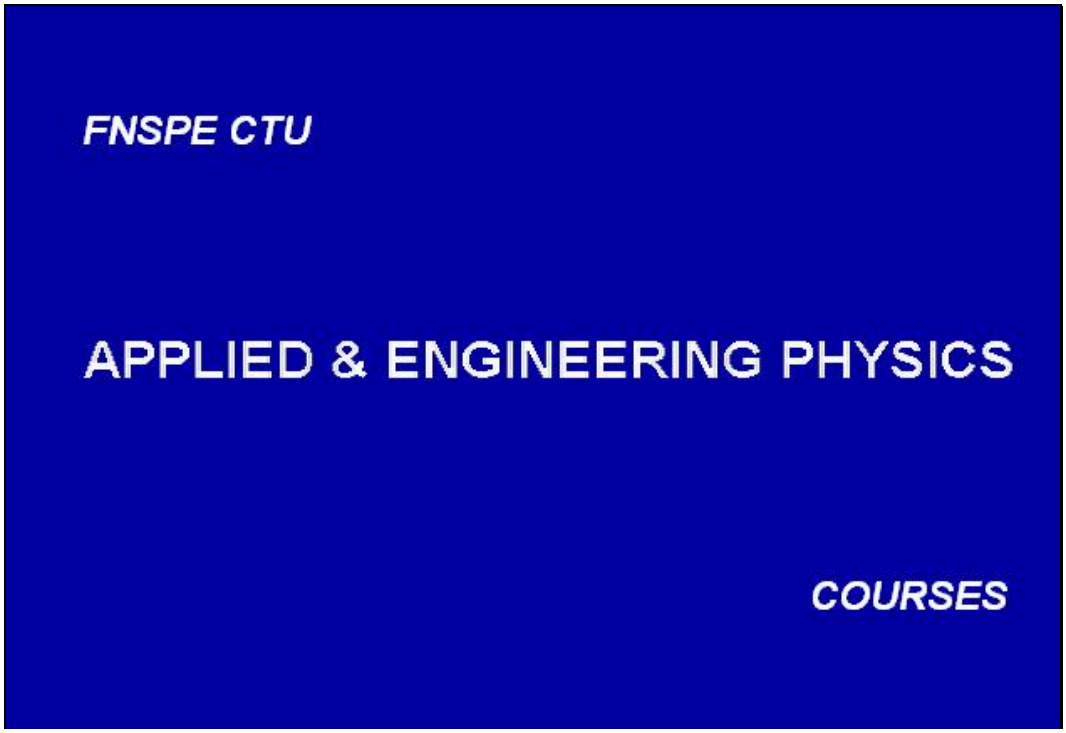
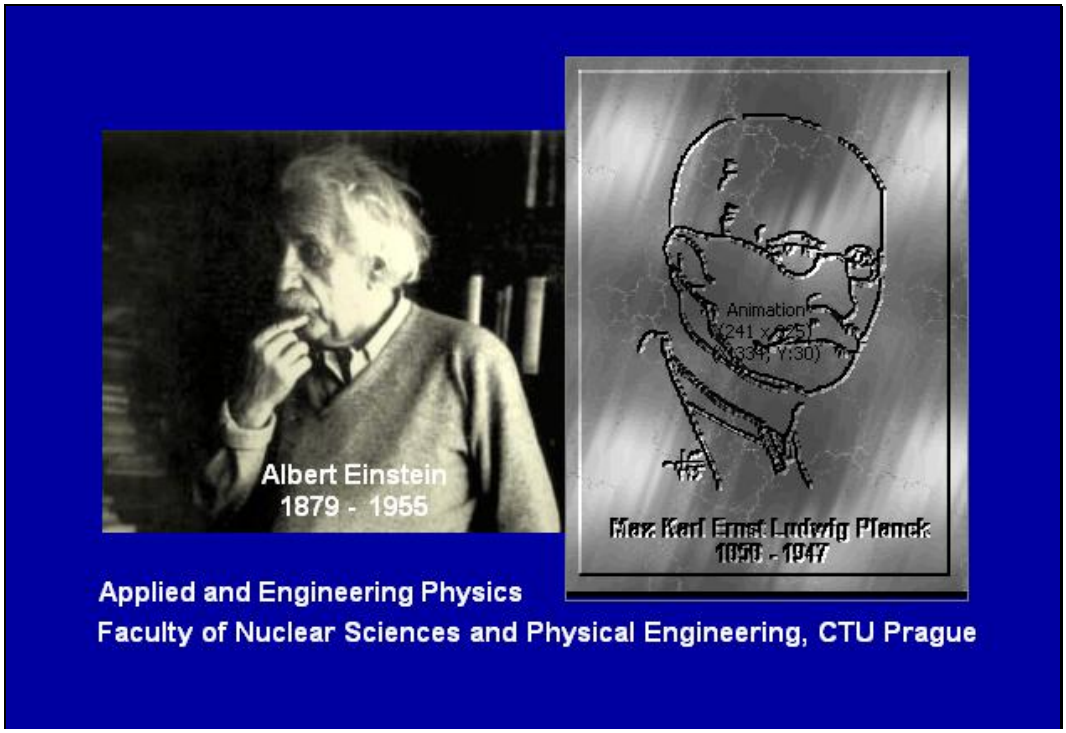
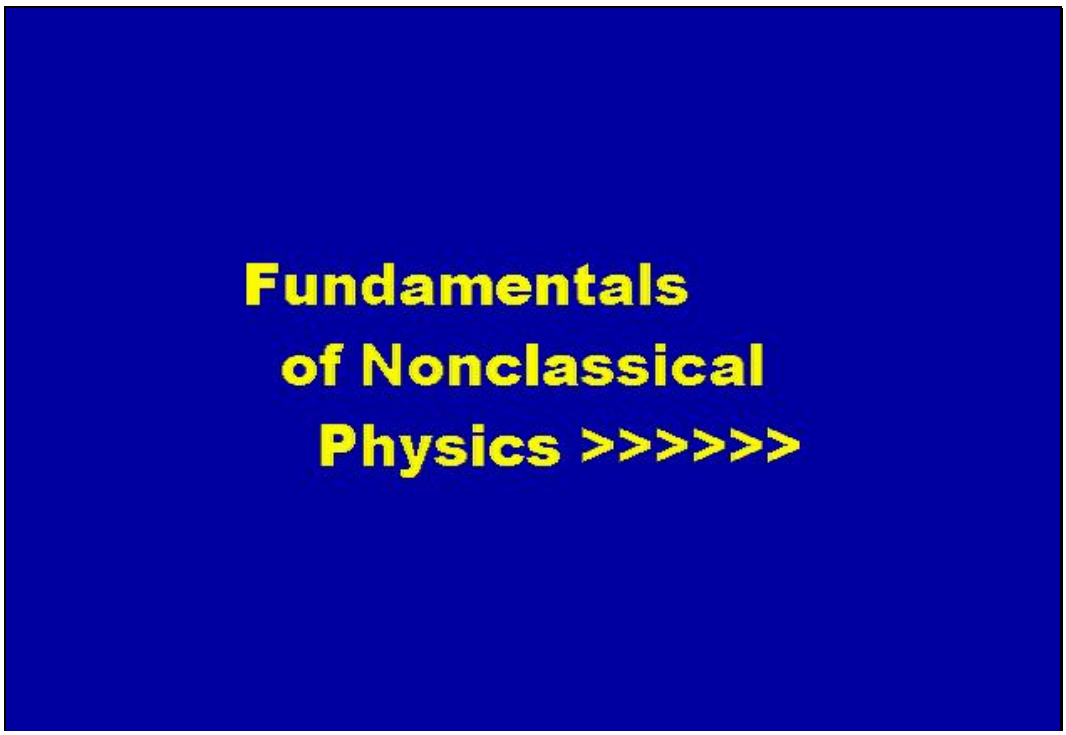
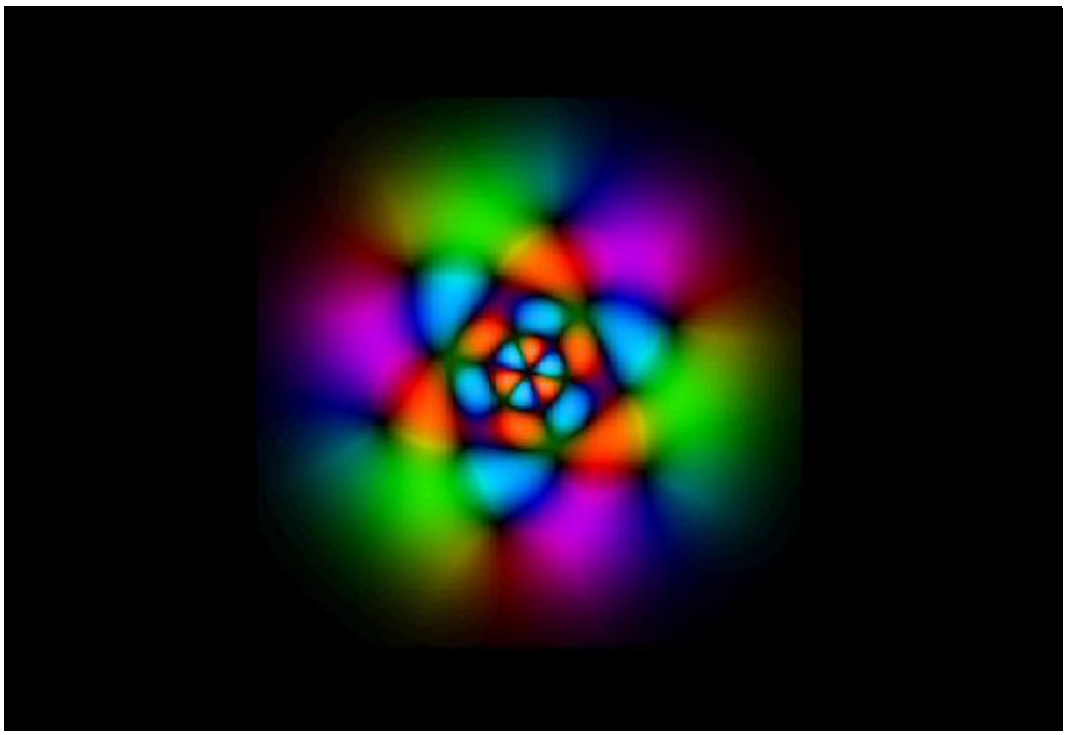
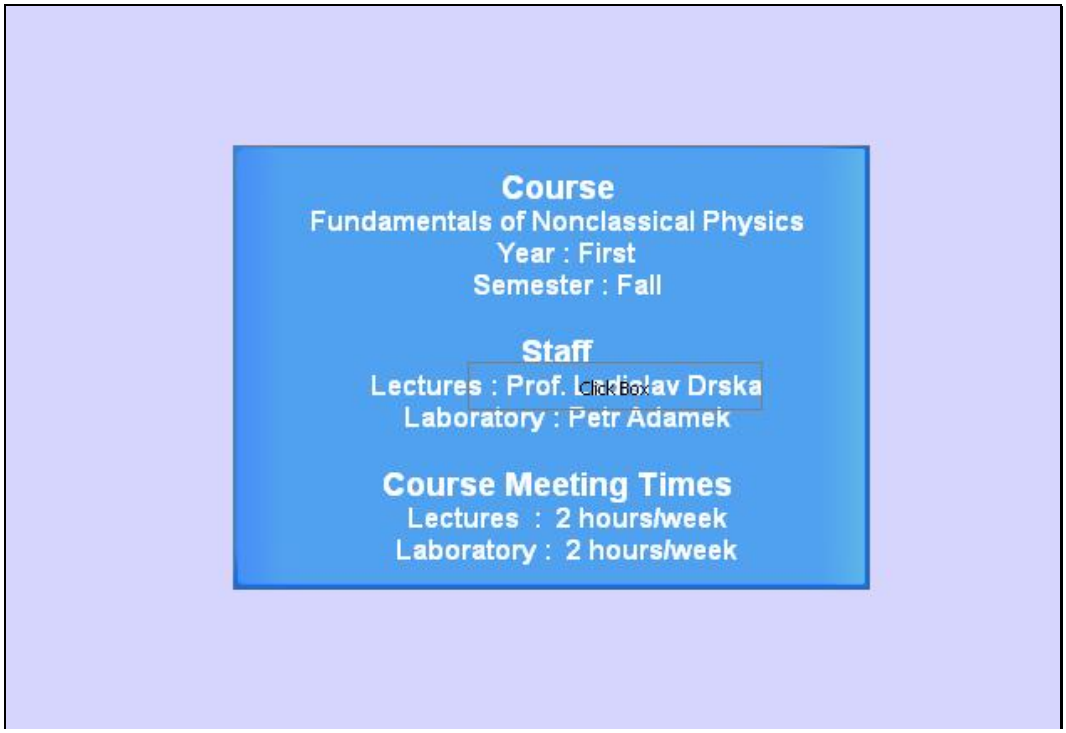
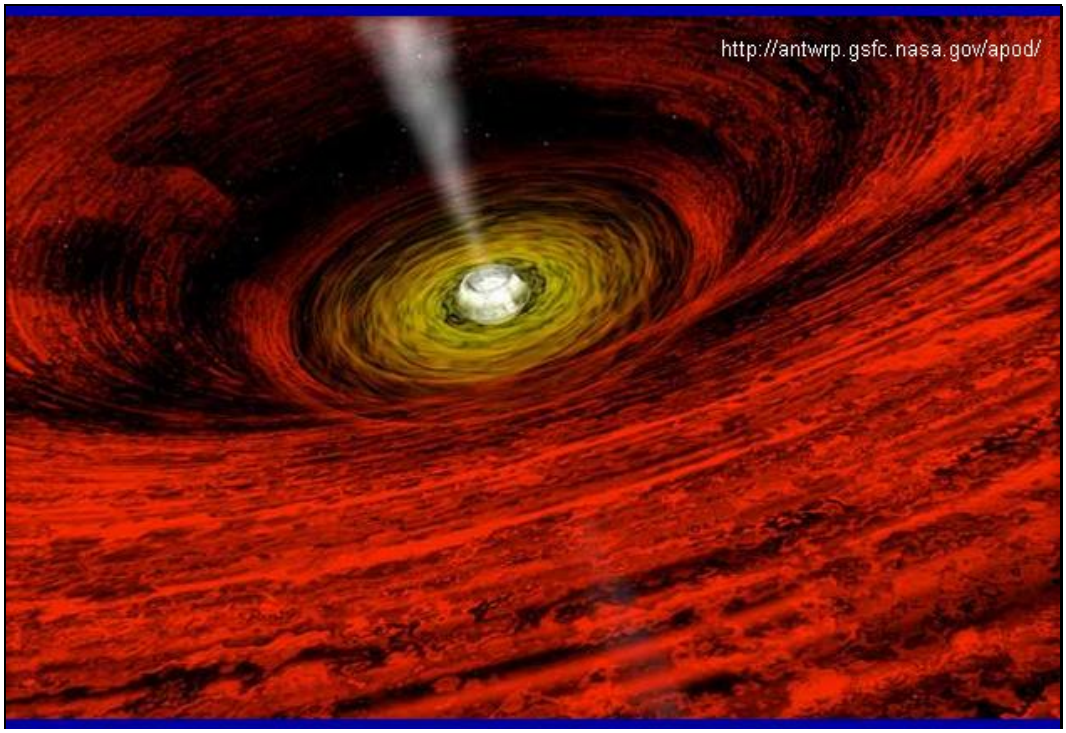

FNSPE CTU
APPLIED & ENGINEERING PHYSICS
COURSES


Albert Einstein
1879 - 1955
Animation
Max Karl Ernst Ludwig Planck
1858 - 1947
Applied and Engineering Physics
Faculty of Nuclear Sciences and Physical Engineering, CTU Prague

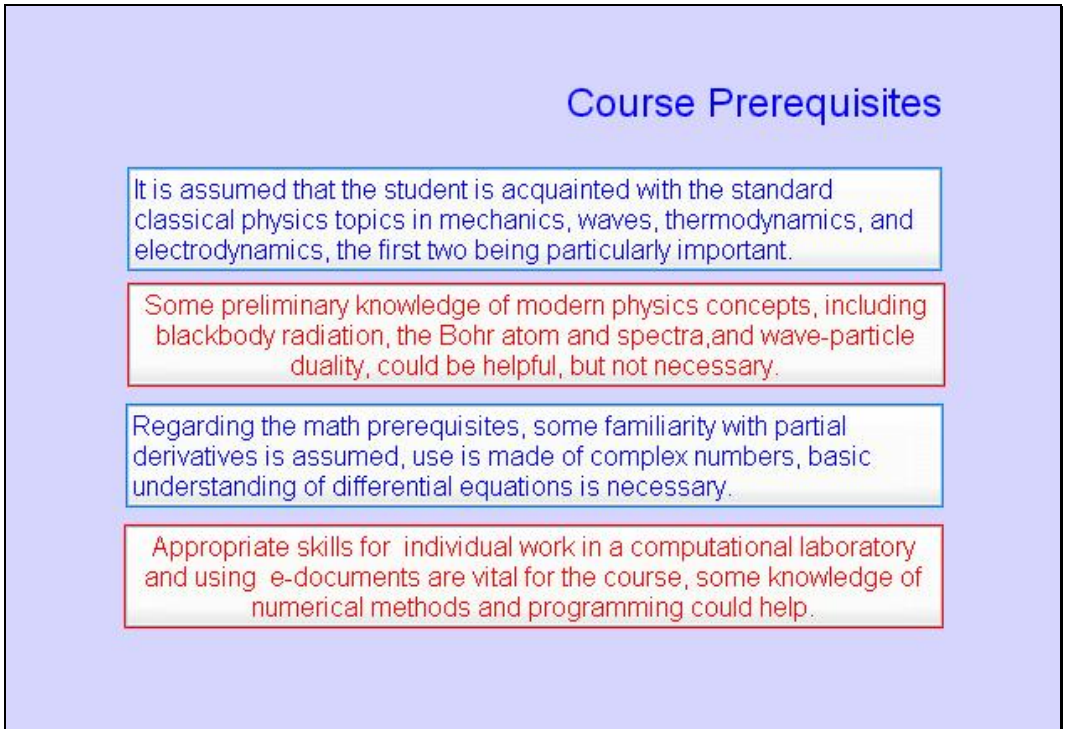

Fundamentals
of Nonclassical
Physics >>>>>>



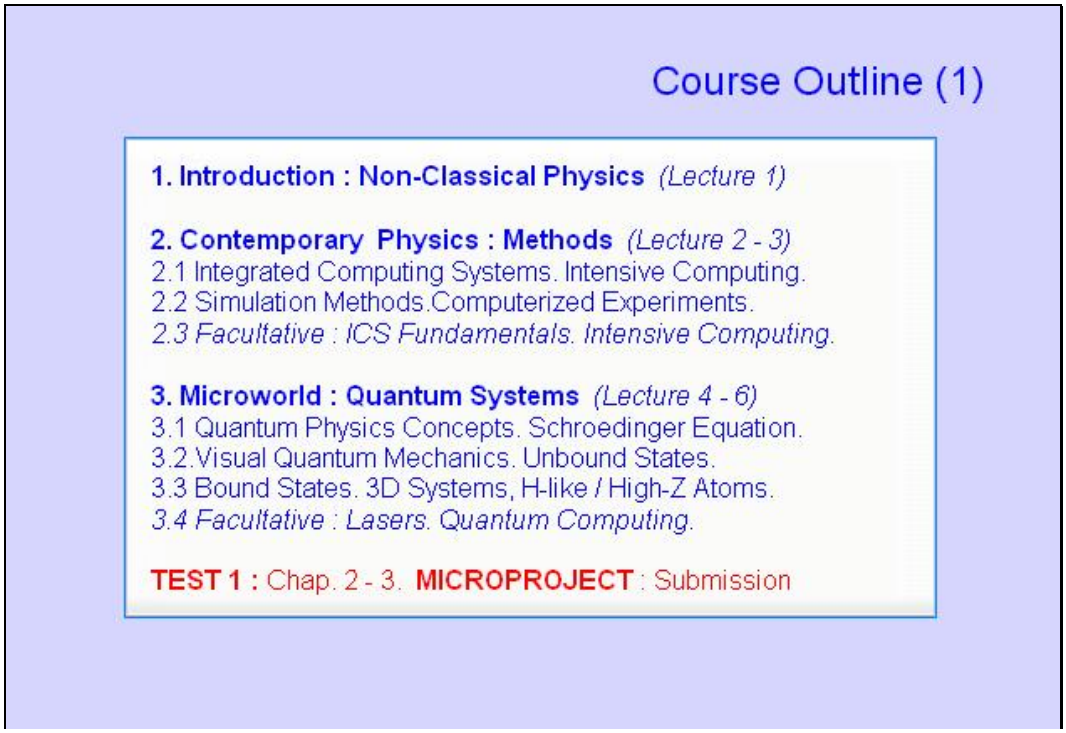

Course
Fundamentals of Nonclassical Physics
Year : First
Semester : Fall
Staff
Lectures : Prof. Ladislav Drska
Laboratory : Petr Adamek
Course Meeting Times
Lectures : 2 hours/week
Laboratory : 2 hours/week

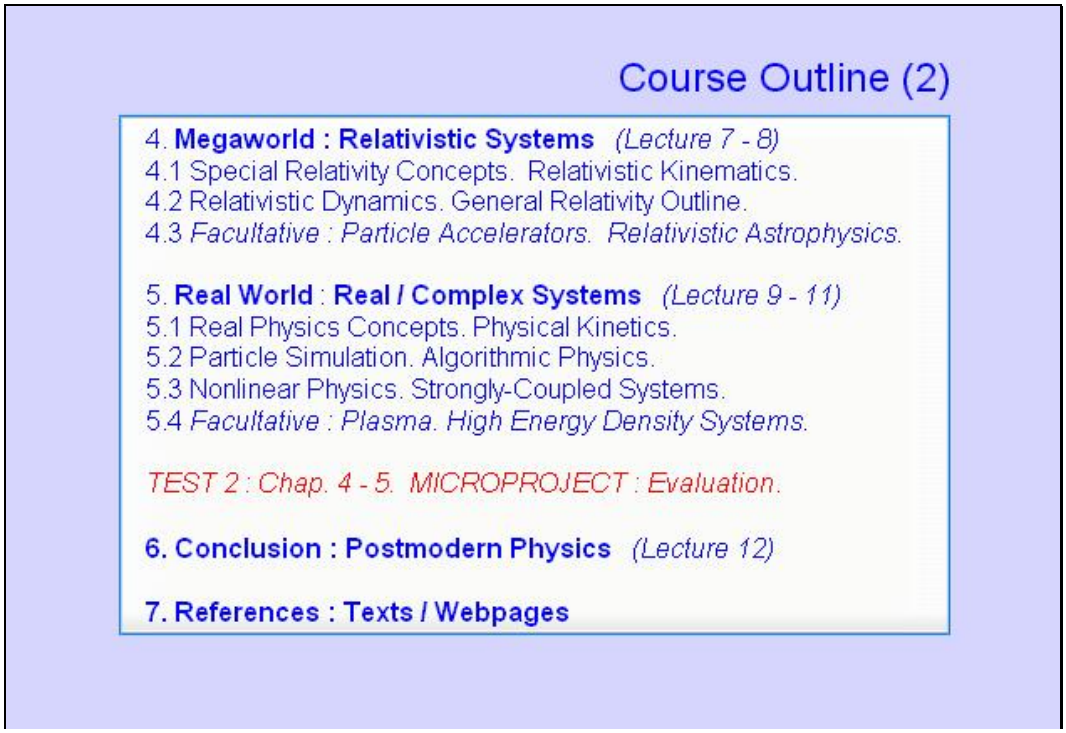

http://antwrp.gsfc.nasa.gov/apod/

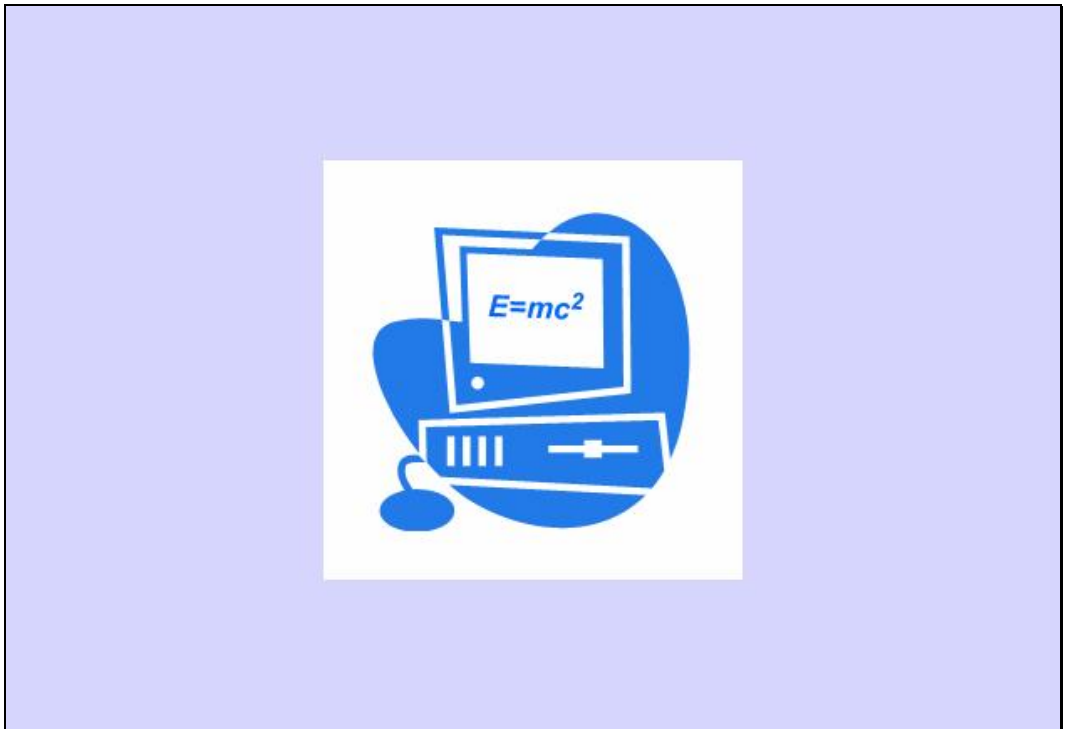

Course Description

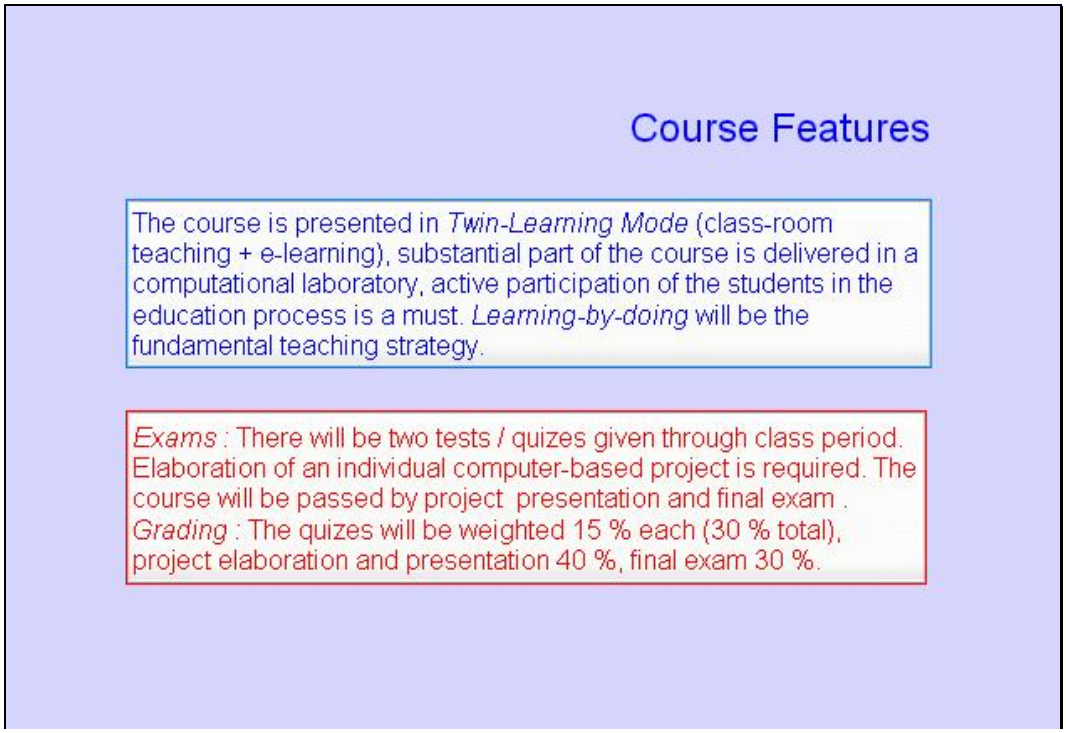

Course Prerequisites
It is assumed that the student is acquainted with the standard classical physics topics in mechanics, waves, thermodynamics, and electrodynamics, the first two being particularly important.
Some preliminary knowledge of modern physics concepts, including blackbody radiation, the Bohr atom and spectra,and wave-particle duality, could be helpful, but not necessary.
Regarding the math prerequisites, some familiarity with partial derivatives is assumed, use is made of complex numbers, basic understanding of differential equations is necessary.
Appropriate skills for individual work in a computational laboratory and using e-documents are vital for the course, some knowledge of numerical methods and programming could help.


FUNDAMENTALS
OF NONCLASSICAL
PHYSICS

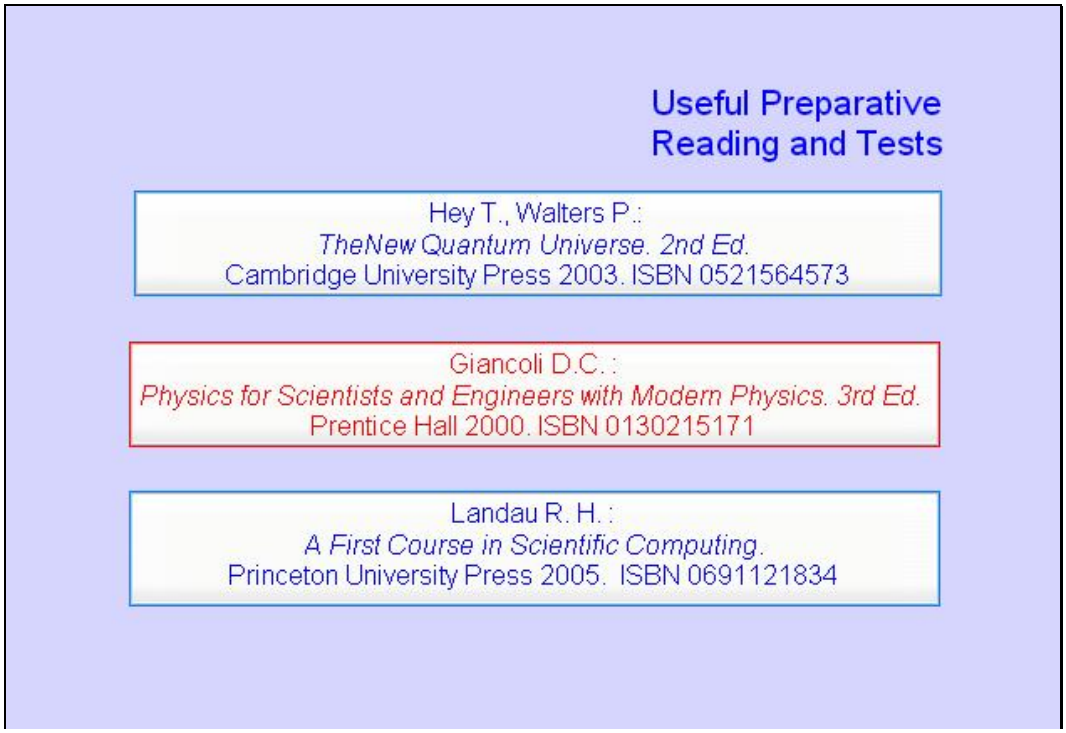

Course Outline (1)
1. Introduction : Non-Classical Physics (Lecture 1)
2. Contemporary Physics : Methods (Lecture 2 - 3)
2.1 Integrated Computing Systems. Intensive Computing.
2.2 Simulation Methods.Computerized Experiments.
2.3 Facultative : ICS Fundamentals. Intensive Computing.
3. Microworld : Quantum 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

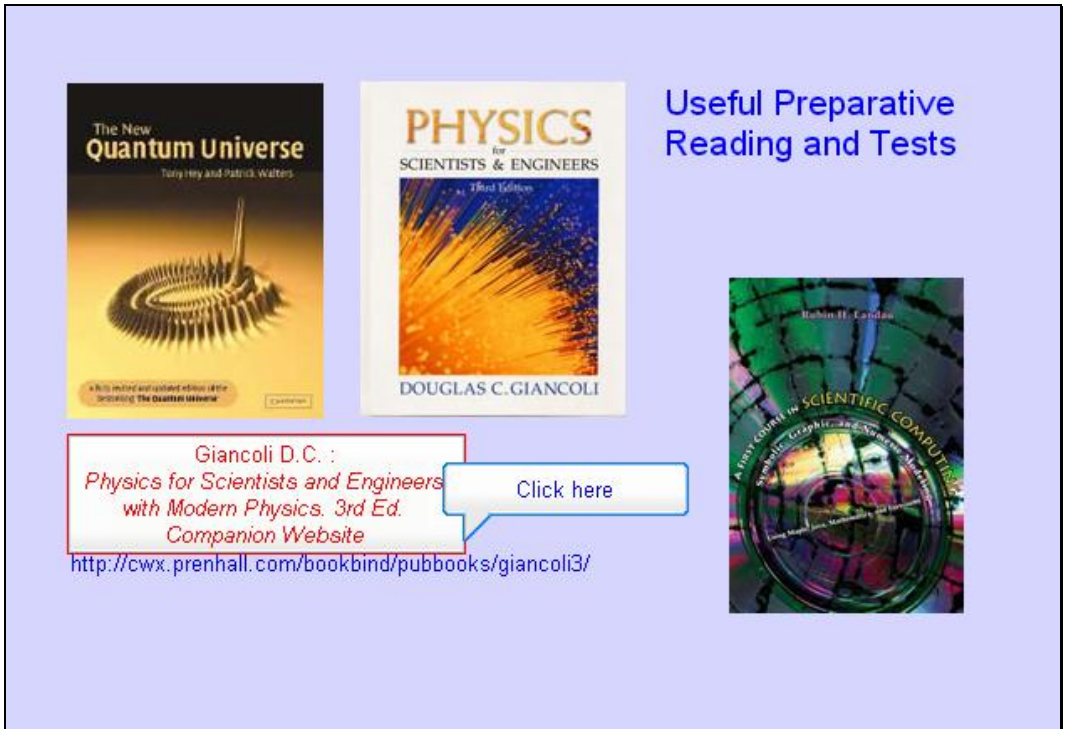

Course Outline (2)
4. Megaworld : Relativistic Systems (Lecture 7 - 8)
4.1 Special Relativity Concepts. Relativistic Kinematics.
4.2 Relativistic Dynamics. General Relativity Outline.
4.3 Facultative : Particle Accelerators. Relativistic Astrophysics.
5. Real World : Real / Complex Systems (Lecture 9 - 11)
5.1 Real Physics Concepts. 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)
7. References : Texts / Webpages

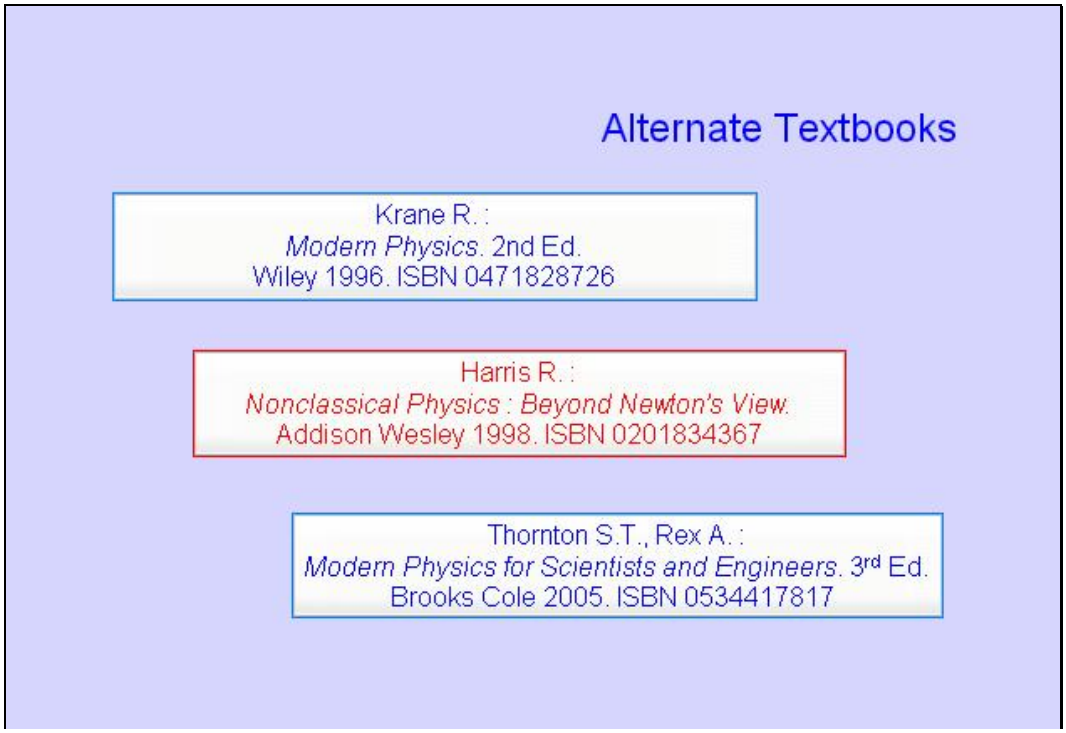

E=mc2


Course Features
The course is presented in *Twin-Learning Mode* (class-room teaching + e-learning), substantial part of the course is delivered in a computational laboratory, active participation of the students in the education process is a must. *Learning-by-doing* will be the fundamental teaching strategy.
Exams : There will be two tests / quizes given through class period. Elaboration of an individual computer-based project is required. The course will be passed by project presentation and final exam .
Grading : The quizes will be weighted 15 % each (30 % total), project elaboration and presentation 40 %, final exam 30 %.

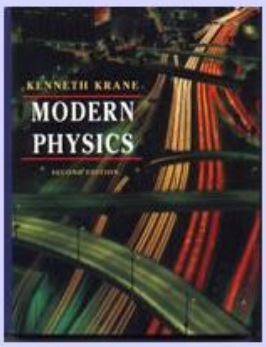

Course Resources

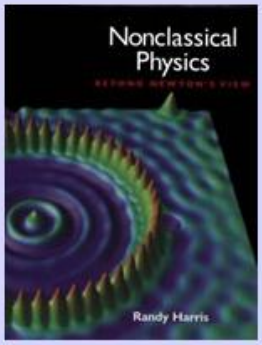

Useful Preparative
Reading and Tests
Hey T., Walters P.:
TheNew Quantum Universe. 2nd Ed.
Cambridge University Press 2003. ISBN 0521564573
Giancoli D.C. :
Physics for Scientists and Engineers with Modern Physics. 3rd Ed.
Prentice Hall 2000. ISBN 0130215171
Landau R. H. :
A First Course in Scientific Computing.
Princeton University Press 2005. ISBN 0691121834

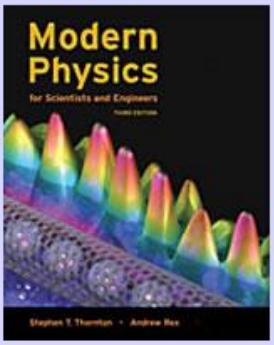

The New
Quantum Universe
PHYSICS
for
SCIENTISTS & ENGINEERS
DOUGLAS C. GIANCOLI
Useful Preparative
Reading and Tests
Giancoli D.C. :
Physics for Scientists and Engineers
with Modern Physics. 3rd Ed.
Companion Website
Click here
http://cwx.prenhall.com/bookbind/pubbooks/giancoli3/
SCIENTIFIC COMPUTING


Alternate Textbooks
Krane R. :
Modern Physics. 2nd Ed.
Wiley 1996. ISBN 0471828726
Harris R. :
Nonclassical Physics : Beyond Newton's View.
Addison Wesley 1998. ISBN 0201834367
Thornton S.T., Rex A. :
Modern Physics for Scientists and Engineers. 3rd Ed.
Brooks Cole 2005. ISBN 0534417817

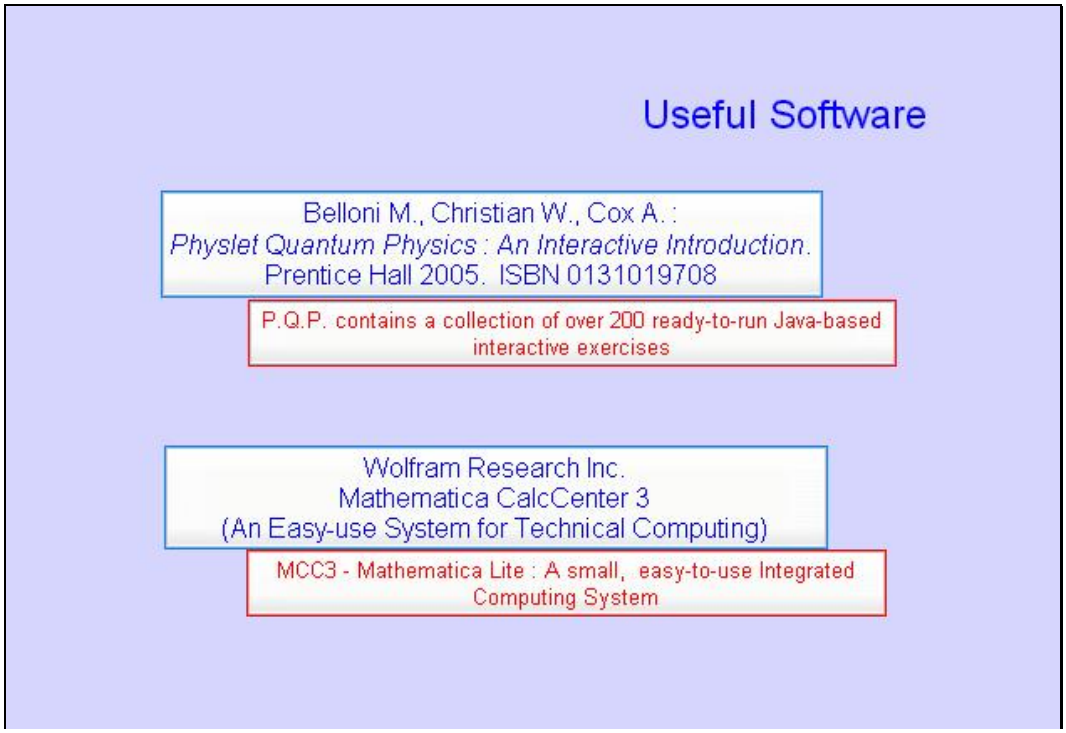
Alternate Textbooks

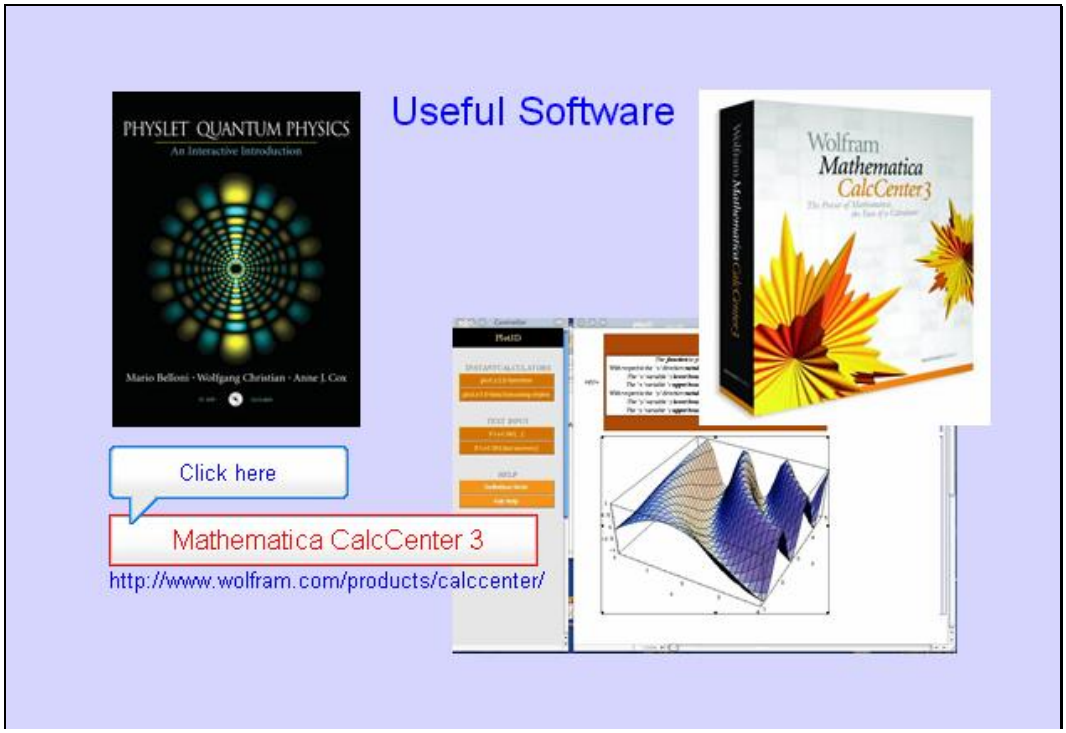


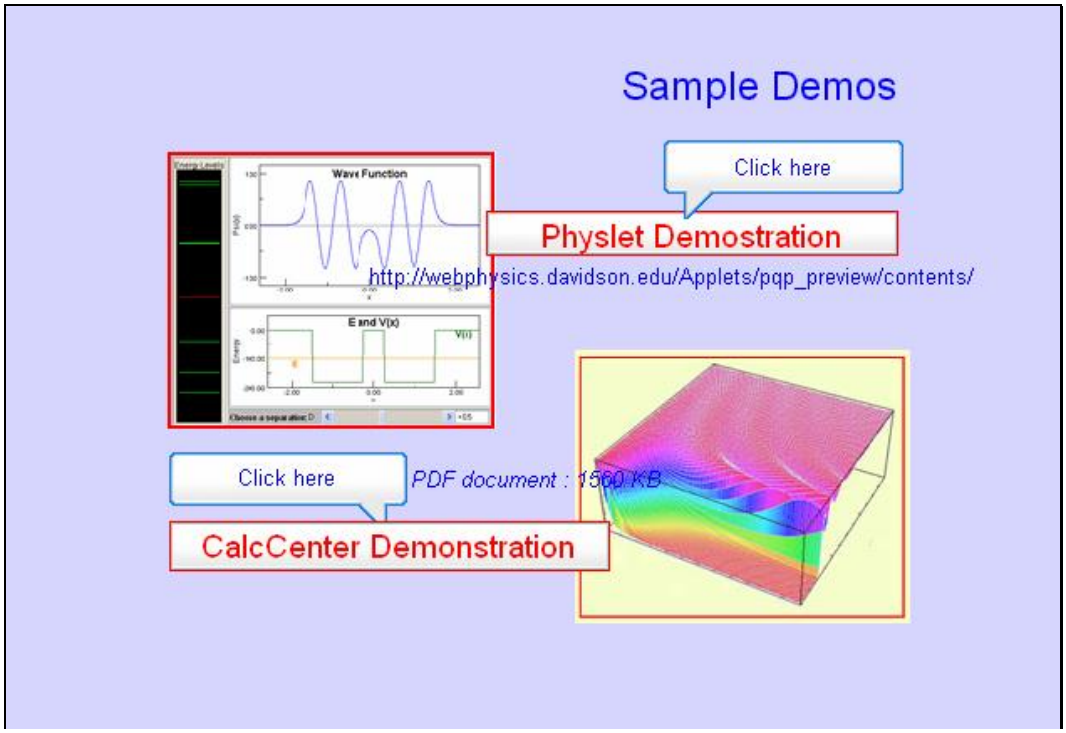


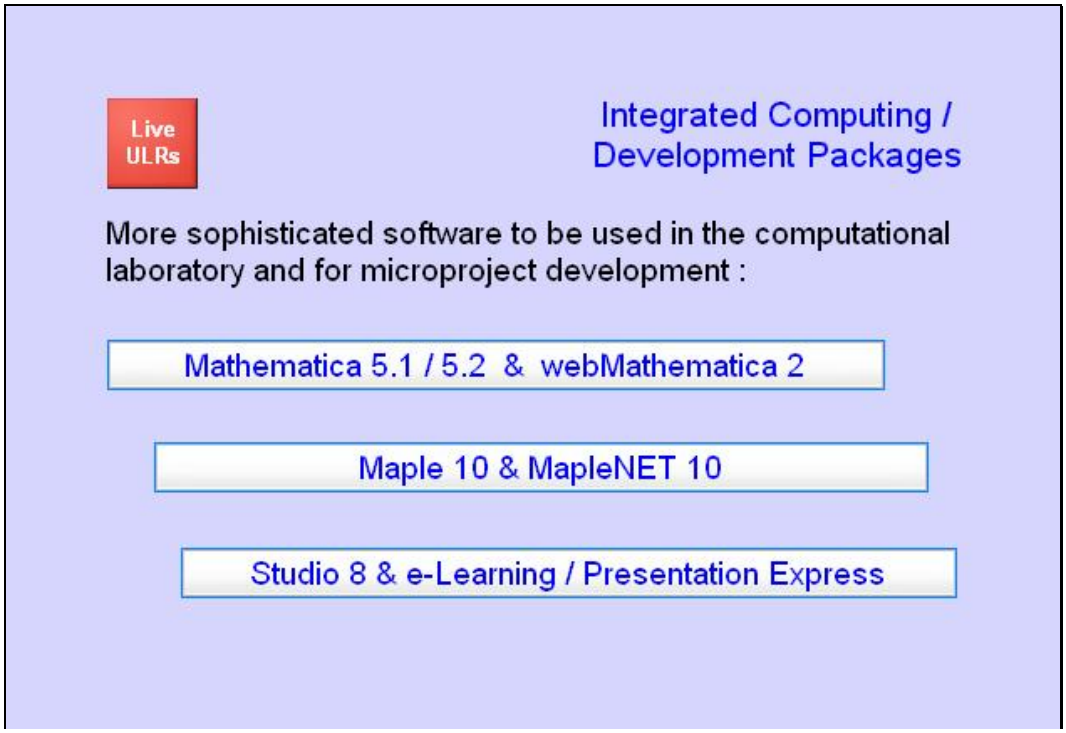


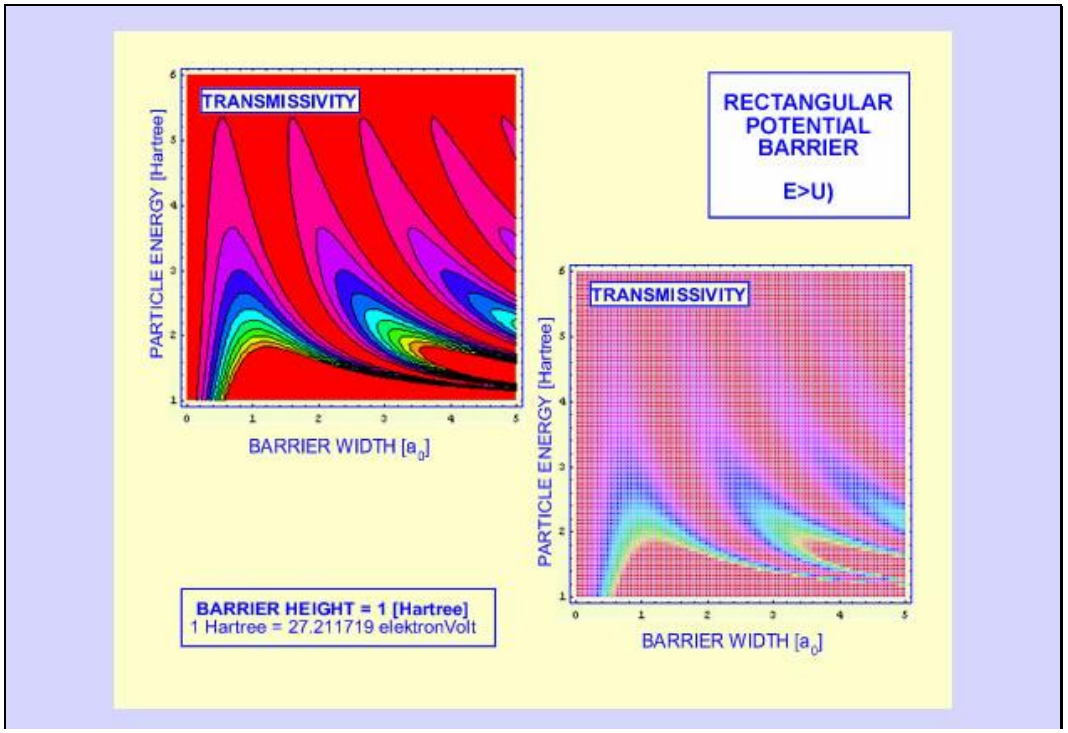
Choose one of them


Useful Software
Belloni M., Christian W., Cox A. :
Physlet Quantum Physics : An Interactive Introduction.
Prentice Hall 2005. ISBN 0131019708
P.Q.P. contains a collection of over 200 ready-to-run Java-based interactive exercises
Wolfram Research Inc.
Mathematica CalcCenter 3
(An Easy-use System for Technical Computing)
MCC3 - Mathematica Lite : A small, easy-to-use Integrated Computing System


Useful Software
PHYSLET QUANTUM PHYSICS
An Interactive Introduction
Mario Belloni · Wolfgang Christian · Anne J. Cox
Wolfram
Mathematica
CalcCenter3
Click here
Mathematica CalcCenter 3
http://www.wolfram.com/products/calccenter/


Sample Demos
Wave Function
E and V(x)
Click here
Physlet Demostration
http://webphysics.davidson.edu/Applets/pqp_preview/contents/
Click here
PDF document : 1560 KB
CalcCenter Demonstration


Live
ULRs
Integrated Computing /
Development Packages
More sophisticated software to be used in the computational laboratory and for microproject development :
Mathematica 5.1 / 5.2 & webMathematica 2
Maple 10 & MapleNET 10
Studio 8 & e-Learning / Presentation Express


TRANSMISSIVITY
PARTICLE ENERGY [Hartree]
BARRIER WIDTH [a0]
RECTANGULAR POTENTIAL BARRIER
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PARTICLE ENERGY [Hartree]
BARRIER WIDTH [a0]
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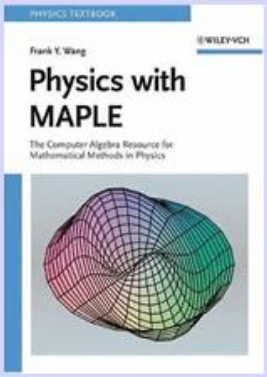
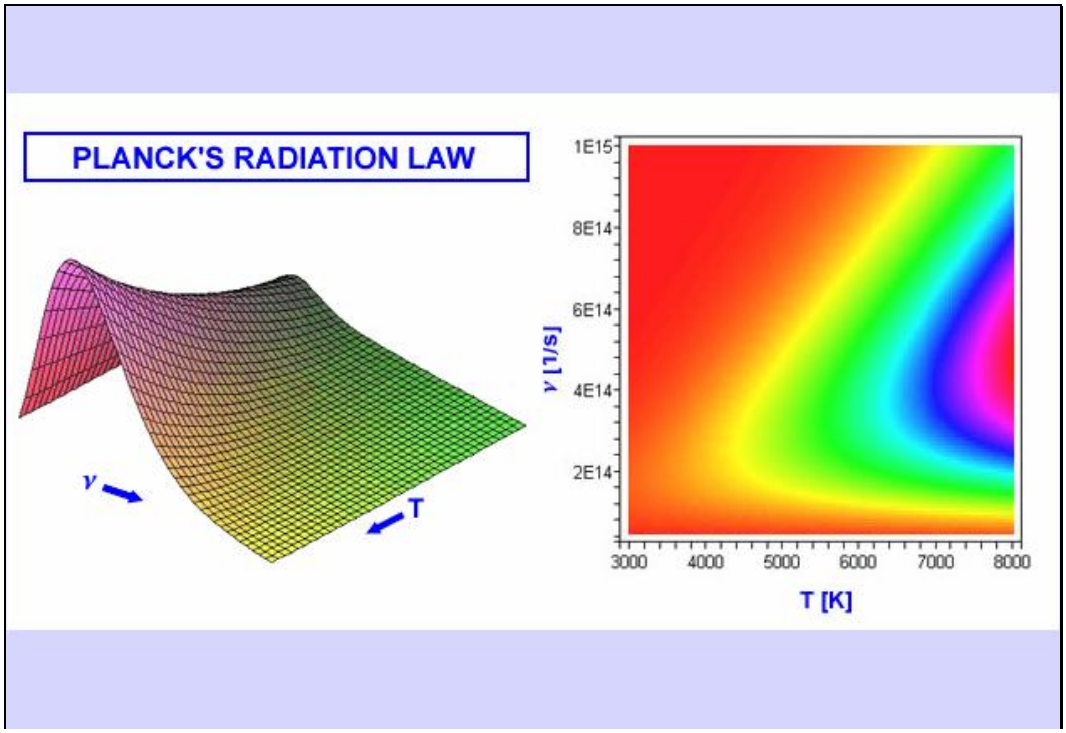


Additional Excellent Textbook

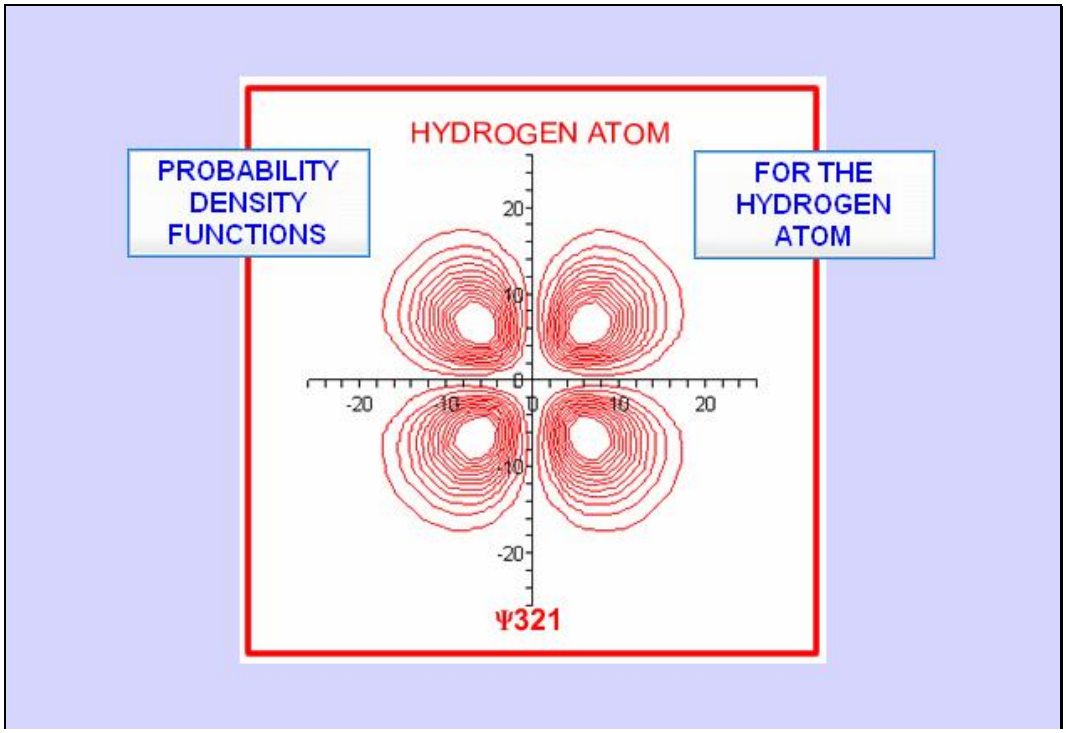
The Maple Worksheets (Versions 9.5,10)

http://faculty.lagcc.cuni.edu/fwang/maplebook/

Wang F.Y. :
Physics with Maple : The Computer Algebra Resource for Mathematical Methods in Physics.
Wiley-VCH 2006. ISBN 3527406409


PLANCK'S RADIATION LAW
ν
T
1E15
8E14
6E14
4E14
2E14
ν [1/s]
3000
4000
5000
6000
7000
8000
T [K]


Live ULRs
Excellent Addenda for Experts
Wolfram Research Inc.
Mathematica
Cambridge University
Cambridge Relativity
Thaller B. : Visual Quantum Mechanics.
Springer / TELOS 2000 ISBN 0387989293
Kelly J.J.
Statistical Physics Using Mathematica
Thaller B. :
Visual Quantum Mechanics : Home
Wikipedia :
Theoretical Physics.
Deutsch D. :
Lectures on Quantum Computation
Thorne K.:Applications of Classical Physics : Chapters 23 - 28
Weiskopf D. :
Special Relativity : Visualization
MIT OpenCourseWare :
Introduction to Plasma Physics I.


HYDROGEN ATOM
PROBABILITY DENSITY FUNCTIONS
FOR THE HYDROGEN ATOM
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-10
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-20
-10
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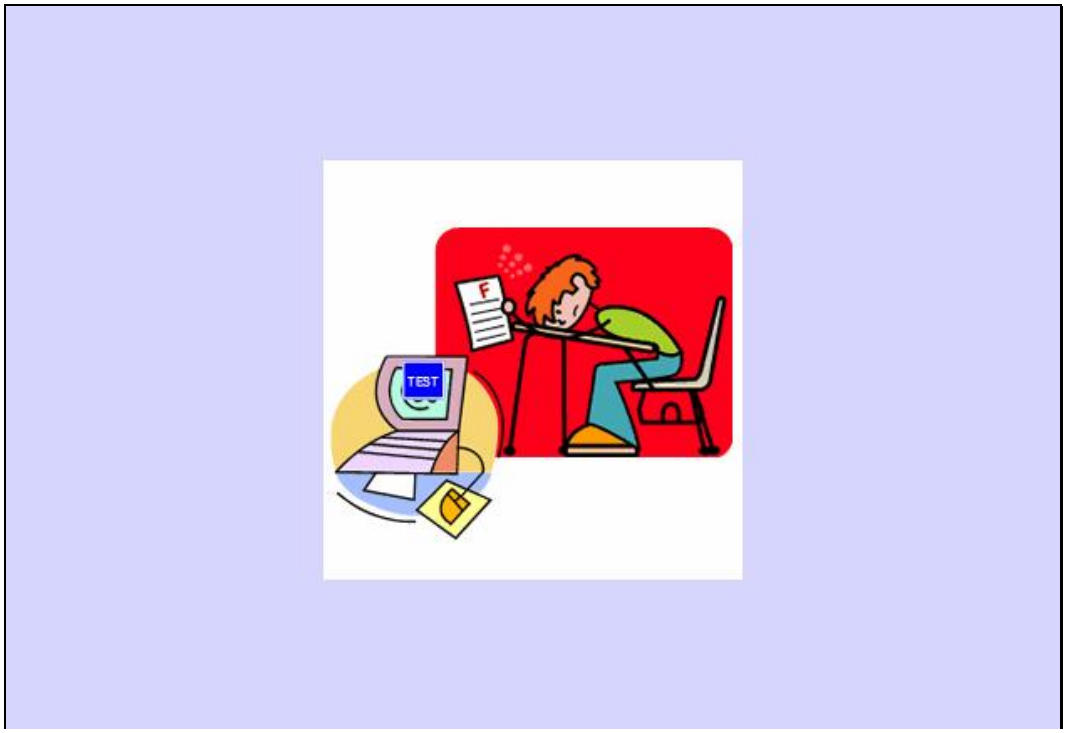
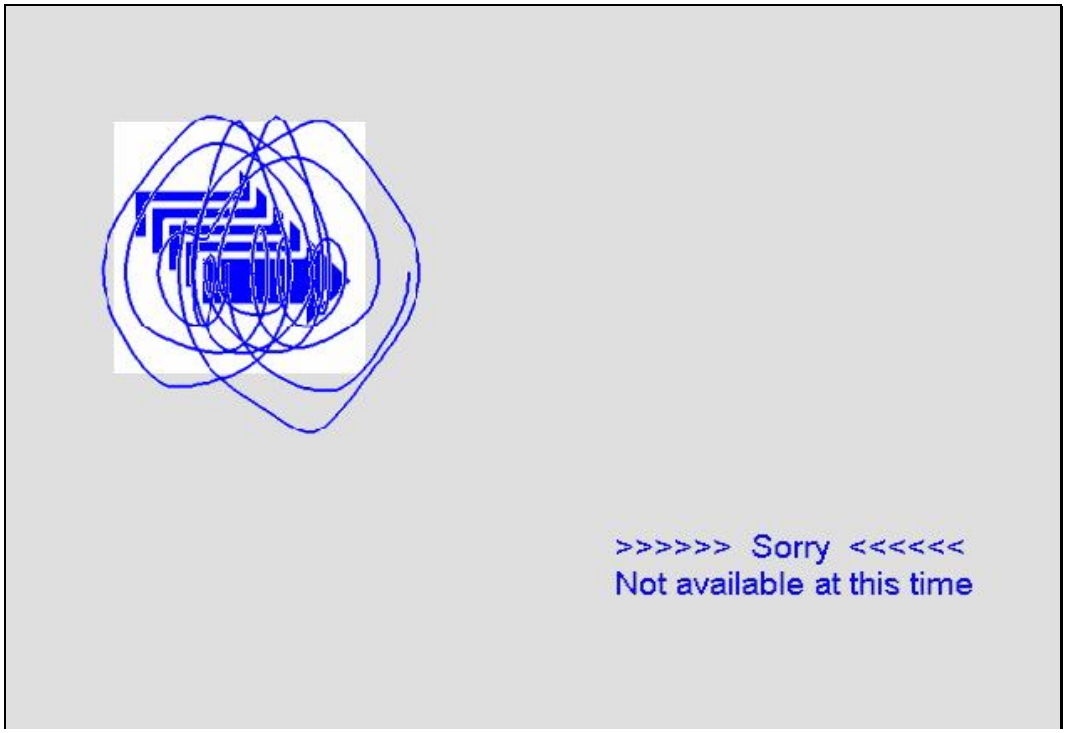
Readiness Selftest


Last
Home
Next
Chapter 38:
Objectives
Practice Questions
MCAT Study Guide
Physlet® Problems
Warm-Ups
Applications
Puzzles
Online Destinations
Netsearch
Practice Problems
Introductory Facultative Selftests
In order to check your readiness for the course you may try the following selftests :
http://www.prenhall.com/giancoli/
MORE TESTS
Click here
Giancoli D.C. :Physics for Scientists and Engineers with Modern Physics. 3rd Ed. Companion Website. Chapters 37, 38, 39
http://cwx.prenhall.com/bookbind/pubbooks/giancoli3/


F
TEST


Extented Syllabus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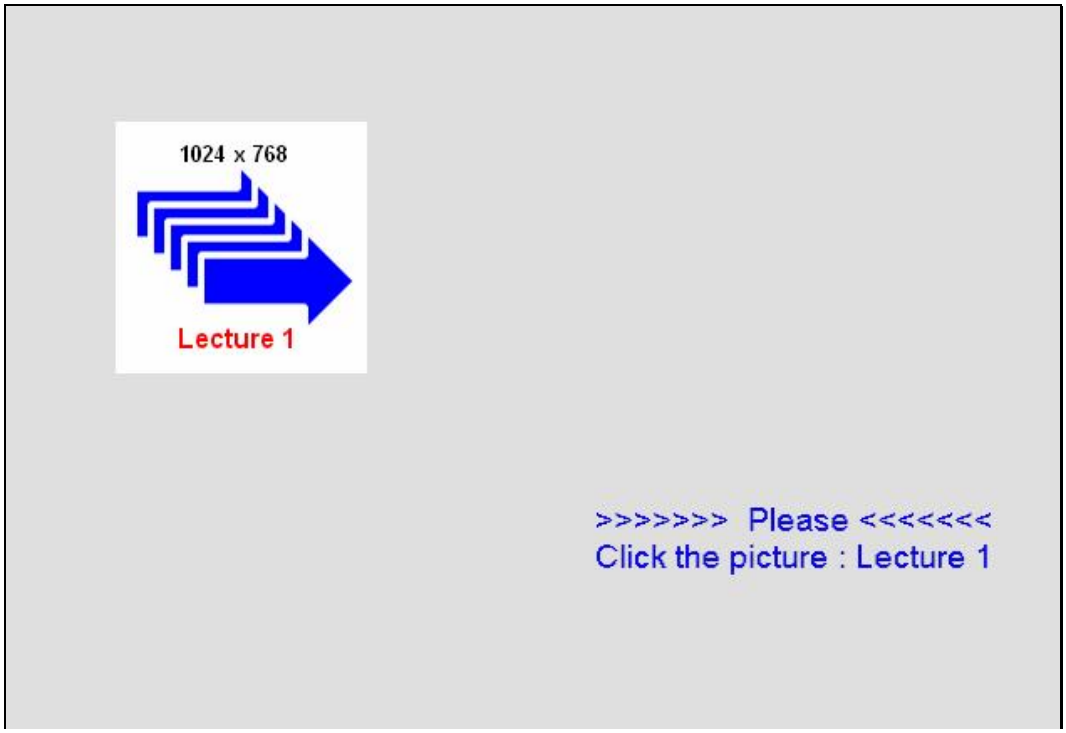
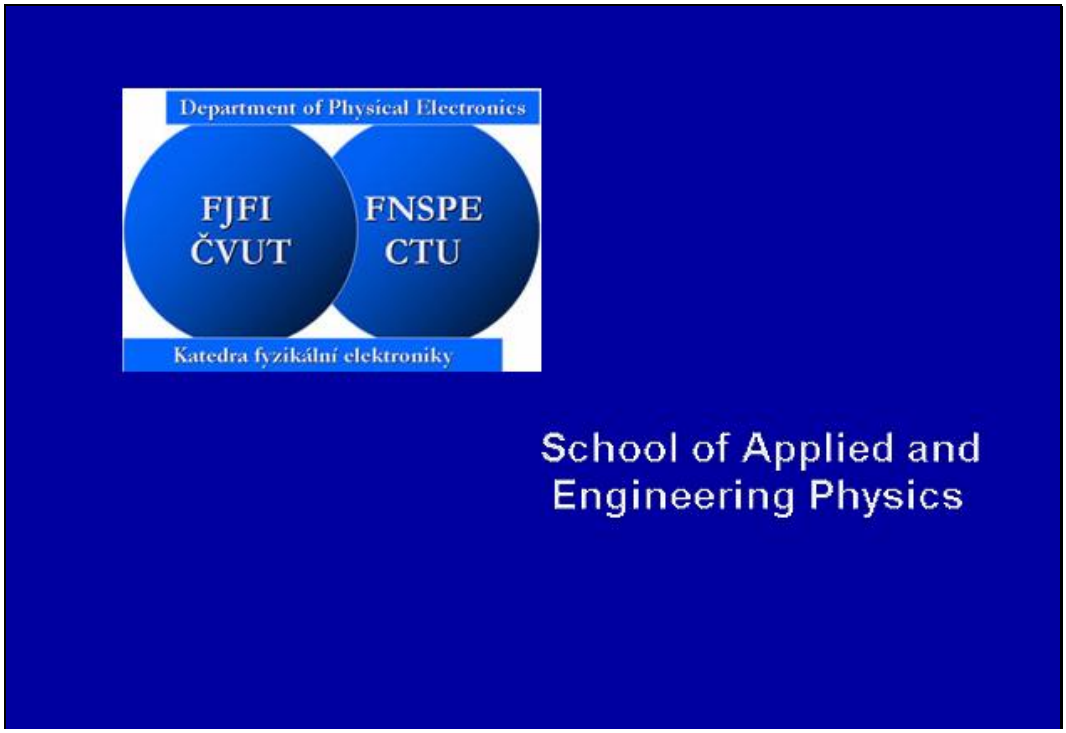
Not available at this time

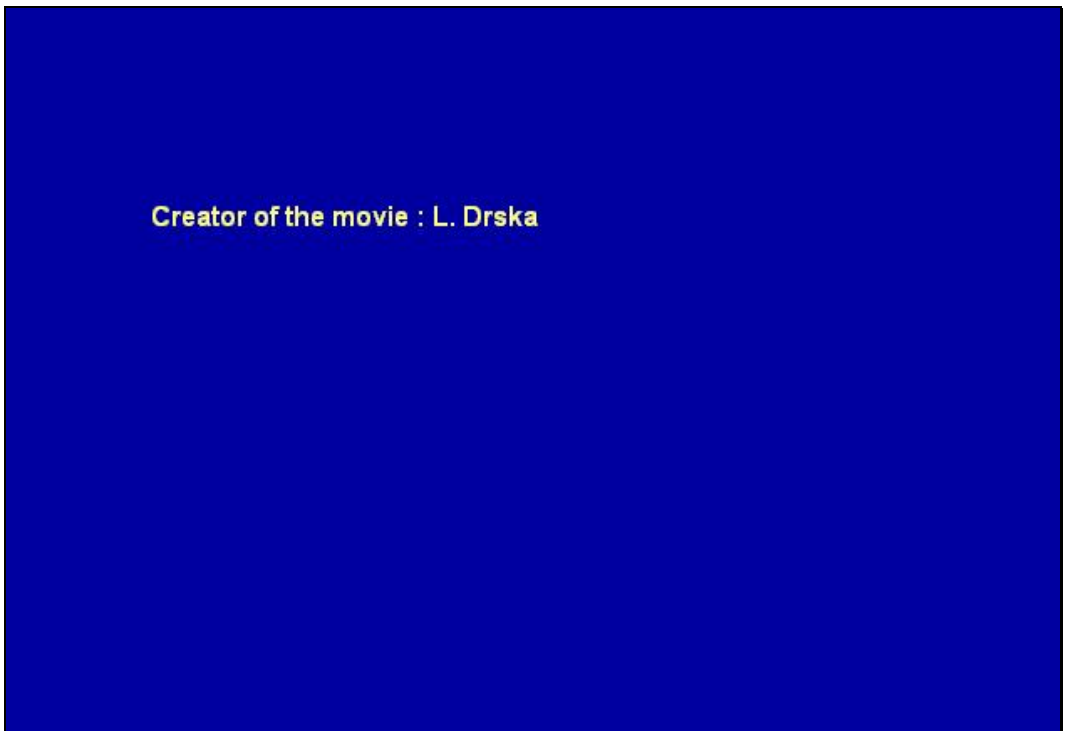

Sample Lecture


1024 x 768
Lecture 1
>>>>>>> Please <<<<<<<
Click the picture : Lecture 1


Thank you for your attention
Comment and suggestions are
welcome
drska@antu.fjfi.cvut.cz


http://antwrp.gsfc.nasa.gov/apod/


Department of Physical Electronics
FJFI
ČVUT
FNSPE
CTU
Katedra fyzikální elektroniky
School of Applied and
Engineering Physics


Creator of the movie : L. Drska