Pensum Modern Physics, Phys118

Forfatter og tittel	Forlag:
Artur Beiser, Concepts of Modern Physics (Kapittel 1-7)	**McGraw Hill**
David J. Griffith, Introduction to Quantum Mechanics(Kappitel 1,2,3 &5)	**Pearsons International Edition**

I tilleg : Four Vectors (without algebra) http://lipniack.home.cern.ch/lipniack/four-vectors-without-algebra.pdf
Litt algebra: Howard and Anton, Elementary Algebra, Kapitel 1.3-1.4 http://lipniack.home.cern.ch/lipniack/HowardAntonELA1.3-1.4.pdf

Mål og innhald

Emnet gir ei innføring i Einsteins spesielle relativitetsteori (Beiser Kappitel 1) ei innføring i fenomener som leia til den klassiske fysikken sitt samanbrot og utviklingen av kvanfefysikken(Beiser 2.2, 2.3, 2.4, 2.7,3.1,4.2). Vidare gis ei innføring i grunnleggjande kvantemekanikk (3.5-3.9 Beiser, Beiser 5.1, Griffith 1), Schrødingers likning (Beiser 5.3-5.7, Griffith 1.1,) og løysing av denne for enkle modellproblem (Beiser 5.8-5.11, Griffith 2.1,2.3,2.4,2.6) og for hydrogenatomet (Beiser, Kapittel 6, Griffith 4.1,4.2,4.3). Til slutt innføres omgrepet spin (Griffith 4.4 , Beiser 7.1) Pauliprinsippet (Beiser 7.2, Griffith 5.1) og oppbygjinga av det periodiske system (Beiser Kappitel 7)

Relevante Kapittel fra Griffith.

1. The Wave Function

1.1 The Schroedinger Equation, 1.2 The Statistical Interpretation 1.3 Probability 1.4 Normalization 1.5 Mometum 1.6 The Uncertainty Principle

2 Time-Independent Schroedinger Equation

2.1 Stationary State 2.2 The Infinite Square Well 2.3 The Harmonic Oscillator 2.4 The Free Particle 2.6 The Finite Square Well

4. Quantum Mechanics in Three Dimensions

4.1 Schroedinger Equation in Spherical Coordinates 4.2 The Hydrogen Atom 4.3 Angular Momentum 4.4 Spin

5. Identical Particles

5.1 Two particle systems (5.1.1 Bosons and Fermions) 5.2 Atoms

Relevante Kappitel fra Beiser:

0)Introduction:

1 19TH CENTURY PHYSICS

1.1 The Industrial Revolution

1.2 Unification of Electricity & Magnetism

Chapter 1, Relativity

SPECIAL RELATIVITY

All motion is relative; the speed of light in free space is the same for all observers

THE LORENTZ TRANSFORMATION

Prospective perception from different reference frames

ELECTRICITY AND MAGNETISM

Relativity is the bridge

LENGTH CONTRACTION

Faster means shorter

TIME DILATION

A moving clock ticks more slowly than a

clock at rest

TWIN PARADOX

A longer life, but it will not seem longer

RELATIVISTIC MOMENTUM

Redefining an important quantity

MASS AND ENERGY

Where E = mc**2 comes from

ENERGY AND MOMENTUM

How they fit together in relativity

SPACETIME

How space and time are related

DOPPLER EFFECT

Why the universe is believed to be expanding

Chapter 2, Particle Properties of Waves:

ELECTROMAGNETIC WAVES

Coupled electric and magnetic oscillations that

move with the speed of light and exhibit typical

wave behavior

BLACKBODY RADIATION

Only the quantum theory of light can explain its

origin

PHOTOELECTRIC EFFECT

The energies of electrons liberated by light

depend on the frequency of the light

WHAT IS LIGHT?

Both wave and particle

Chapter 3, Wave properties of particles:

Chapter 4, Atomic structure

4.1 THE NUCLEAR ATOM

An atom is largely empty space

4.2ELECTRON ORBITS

The planetary model of the atom and why it

fails

4.3ATOMIC SPECTRA

Each element has a characteristic line spectrum

4.4THE BOHR ATOM

Electron waves in the atom

4.5ENERGY LEVELS AND SPECTRA

A photon is emitted when an electron jumps

from one energy level to a lower level

4.6 CORRESPONDENCE PRINCIPLE

The greater the quantum number, the closer

quantum physics approaches classical physics

4.7 NUCLEAR MOTION

The nuclear mass affects the wavelengths of

5.8 PARTICLE IN A BOX

How boundary conditions and

normalizationdetermine wave functions

5.9 FINITE POTENTIAL WELL

The wave function penetrates the walls, which

lowers the energy levels

5.10 TUNNEL EFFECT

A particle without the energy to pass over a

potential barrier may still tunnel through it

5.11 HARMONIC OSCILLATOR

Its energy levels are evenly spaced

APPENDIX: THE TUNNEL EFFECT

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6. Quantum Theory of Hydrogen Atom

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7. Many electron atoms

7.1ELECTRON SPIN

Round and round it goes forever

7.2 EXCLUSION PRINCIPLE

A different set of quantum numbers for each

electron in an atom

7.3 SYMMETRIC AND ANTISYMMETRIC

WAVE FUNCTIONS

Fermions and bosons

7.4 PERIODIC TABLE

Organizing the elements

7.5 ATOMIC STRUCTURES

Shells and subshells of electrons

7.6 EXPLAINING THE PERIODIC TABLE

How an atom’s electron structure determines its

chemical behavior

7.7 SPIN-ORBIT COUPLING

Angular momenta linked magnetically

7.8 TOTAL ANGULAR MOMENTUM

Both magnitude and direction are quantized

7.9 X-RAY SPECTRA

They arise from transitions to inner shells

APPENDIX: ATOMIC SPECTRA

Læringsutbyte

Ved fullført emne PHYS118 skal studenten kunne

- bruke spesiell relativitetsteori på utvalde problem.

- gjere greie for sammenbruddet til klassisk fysikk og utviklingen av kvantefysikken

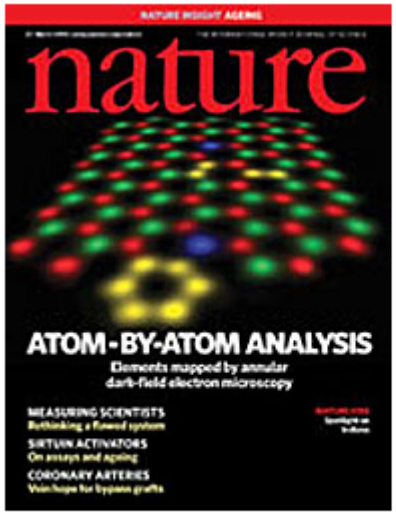
- gjere greie for sentrale omgrep i elementær kvantefysikk som Schrödingerlikninga, partikkel-bølgedualisme (39.1) og Heisenbergs

uvissesrelasjon, tunnelering og fortolkning av bølgjefunksjonen

- kunne bruke Schrödingerlikninga til å løyse enkle problem , bundne og ikkje-bundne tilstander, og hydrogenatomet .

- gjere greie for atomenes oppbygging og det periodiske system

Atomic structure



Krivanek, et al., "Atom-by-atom structural and chemical analysis by annular dark-field electron microscopy," Nature 464, 571 (2010). Letter