

Methoden moderner Röntgenphysik I + II: Struktur und Dynamik kondensierter Materie

Vorlesung zum Haupt/Masterstudiengang Physik

WS 2008/9 + SS 2009

G. Grübel, M. Martins, E. Weckert et al.

1

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9, G. Gruebel und M. Martins

Methoden moderner Röntgenphysik II: Struktur und Dynamik kondensierter Materie

Vorlesung zum Haupt/Masterstudiengang Physik

SS 2009

G. Grübel, M. Martins, E. Weckert, W. Wurth,

O. Seeck, W. Caliebe, R. Röhrsberger, W. Drube, H. Franz et al.

Location: SemRm 5, Physik, Jungiusstrasse

Tuesdays 14.00 – 15.30

Thursdays 10.15 – 11.45

2

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9, G. Gruebel und M. Martins

Methoden moderner Röntgenphysik II: WS 2009

Struktur und Dynamik kondensierter Materie

Hard X-Ray Science:

- 7.04. Introduction (GG)
- 9.04. – 21.04. Liquid- and Solid Surfaces (OS)
- 23.04. - 5.05. Trends in Spectroscopy (WC,RR,WD)
- 7.05. - 19.05. Materials Science (HF, MZ)
- 26.05. - 16.07. Solid State Spectroscopy (WWW)

G.Grübel (GG), O. Seeck (OS), W. Caliebe (WC),
R. Röhlberger (RR), W. Drube (WD), H. Franz (HF),
M. v. Zimmermann (MZ), W. Wurth (WWW)

3

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9 G. Gruebel und M. Martins

Literature

Basic concepts: [Elements of Modern X-Ray Physics](#)

J. A. Nielsen and D. McMorrow, J. Wiley&Sons (2001)

[X-Ray Diffraction](#)

B.E. Warren, DOVER Publications Inc., New York

[Principles of Optics](#)

M.Born and E. Wolf, Cambridge University Press, 7th. ed.

and others to be announced

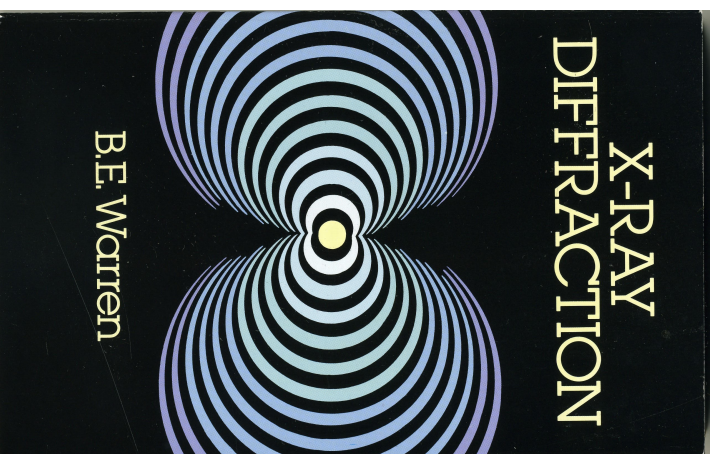
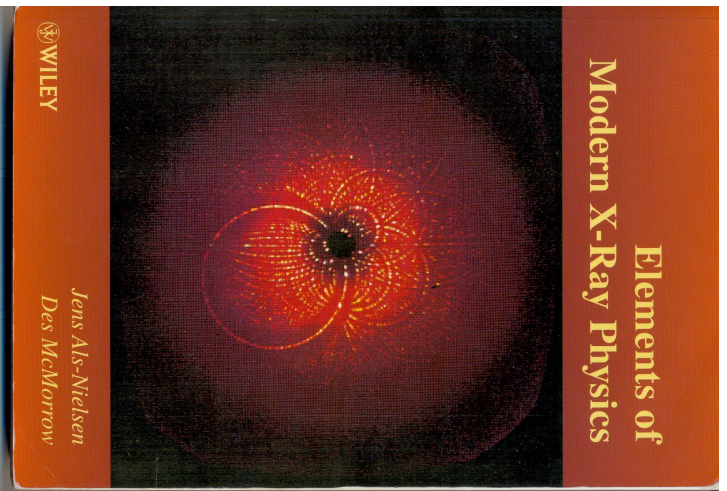
Lecture Notes

<http://hasylab.desy.de/science/studententeaching/lectures>

also: [exercises](#)
[Proseminar literature](#)

4

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9 G. Gruebel und M. Martins



5

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9, G. Gruebel und M. Martins

Methoden moderner Röntgenphysik II: Struktur und Dynamik kondensierter Materie

- | | | |
|--------------|--|----------|
| 7.04. | Introduction | (GG) |
| 9.04. | Scattering at surfaces and interfaces (basics) | (OS) |
| 14.04. | X-ray reflectivity | (OS) |
| 16.04. | Grazing Incidence Diffraction | (OS) |
| 21.04. | Diffuse Scattering | (OS) |
| 23.04. | Inelastic X-ray scattering I | (WC) |
| 28.04. | Inelastic X-ray scattering II | (WC) |
| 30.04. | Nuclear Resonant Scattering | (RR) |
| 5.05. | X-ray Photoemission Spectroscopy | (WD) |
| 7.05.–19.05. | Materials Science | (HF, MZ) |

6

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9, G. Gruebel und M. Martins

Coherence of light and matter II: from basic concepts to modern applications

Scattering at surfaces- and interfaces: 9.4.-21.4.

Scattering at surfaces- and interfaces (basics)

Cut-Off of the bulk leads to a surfaces function (convolution in the scattering signal)
Crystal Truncation rods (in Born approximation only)and examples(s)

X-ray reflectivity

X-ray reflectivity as a special case of the 000-CTR (Born approximation)

X-ray reflectivity (exact formalism): roughness, anomalous scattering

Examples, instrumentation, experimental procedures, examples

Grazing Incidence Diffraction

Depth profiling using GID

Example: surface phase transition

Diffuse scattering

surface roughness, auto correlation functions, power spectral density

Scattering in Born approximation, liquid scattering

7

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universitat Hamburg, WS 2008/9. G. Gruebel und M. Martins

Proseminar

Format: Oral presentation (45 minutes) of a proseminar topic

Procedure: Choose topic from the Proseminar list (website)

Mark your choice in Proseminar list (lecture dates)

Contact supervisor (start-up meeting + e-mail)

Prepare topic with help of supervisor

(receive literature, discuss content, discuss presentation,..)

Oral presentation

Start-up meeting:

Date to be announced

Meet your supervisor

Time: Wednesday or Thursday afternoon

preferentially at the DESY/Bahrenfeld Campus

8

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universitat Hamburg, WS 2008/9. G. Gruebel und M. Martins

Proseminar

- | | |
|--|--------------|
| 1) Sources of synchrotron radiation – characterisation | H. Franz |
| 2) Quality assessment of surfaces and interfaces with x-ray reflectivity | O. Seeck |
| 3) Statistical properties of interfaces determined by diffuse x-ray scattering | O. Seeck |
| 4) Structure determination of thin polymer- und nano composite films | S. Roth |
| 5) Characterizing of production processes using x-ray small angle scattering | S. Roth |
| 6) Coherent Diffraction Imaging | C. Gutt |
| 7) X-ray Photon Correlation Spectroscopy | C. Gutt |
| 8) Challenges of magnetic x-ray scattering | J. Stempffer |
| 9) Metallic glasses – structure, mechanics, glass transition | H. Franz |
| 10) Introduction in x-ray absorption spectroscopy | W. Caliebe |
| 11) Dichroism and other methods in spectroscopy | W. Caliebe |
| 12) Fluorescence spectroscopy | W. Caliebe |

9

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9. G. Gruebel und M. Martins

Exercises

2 h. Tuesday 16-17:30h SemRm 5

First exercises : 21. April

Exercise sheets available on website each Tuesday in the week before.

10

Methoden moderner Röntgenphysik I - Vorlesung im Haupt/Masterstudiengang Physik, Universität Hamburg, WS 2008/9. G. Gruebel und M. Martins

End