UiO : Department of Physics
University of Oslo

Inelastic form factors

FYS5310/FYS9320
Lecture 4

09.02.2017

FYS5310 teaching schedule

Preliminary schedule only! You should keep the class-times on Wednesdays and Thursdays open unless notified by email (or in this schedule) that there is no class

References to the textbook to Fultz & Howe unless stated otherwise.

Date		Time	Lecture/lab	Topic	Chapters	Homework
Wednesday	18.01.2017	14:15-16:00	Lecture	Introduction to the course. Derivation of the structure factor (01)	4.1, 4.3.1, 6.1	Exercise set 1 (handout)
Thursday	19.01.2017	12:15-14:00	Lecture	No class (SMN seminar)		
Wednesday	25.01.2017	13:15-16:00	Lab/Colloquium	Going through exercise set 1 + Lecture: The atomic form factor (02)	4.3	Excercise set 2 (handout)
Thursday	26.01.2017	12:15-14:00	Lecture	No class		
Wednesday	01.02.2017	14:15-16:00	Lab/colloquium	Going though exercise set 2		
Thursday	02.02.2017	12:15-14:00	Lecture	Uses of EELS and EELS instrumentation (03)	5.1, 5.2; W&C 37	Exercise set 3 (handout)
Wednesday	08.02.2017	14:15-16:00	Lab/colloquium	Going though exercise set 3		
Thursday	09.02.2017	12:15-14:00	Lecture	Inelastic form factors (04)	5.4.1-5.4.3 + primer on Dirac notation	
Wednesday	15.02.2017	12:15-16:00	Lab/colloquium	No class		
Thursday	16.02.2017	12:15-14:00	Lecture	Inelastic form factors, scattering cross sections, dipole selection rules (05)	5.4.4-5.4.7, W&C 39, plus Brehm and Mullin on parity and dipole selectrion rules	
Wednesday	22.02.2017	12:15-16:00	Lab/colloquium	No class		
Thursday	23.02.2017	12:15-14:00	Lecture	Core losses: Quantification and electronic structure (06)	5.4, W&C 39+40	Exercise set 4 (handout)

Overview of today's lecture

- The inelastic form factors and scattering cross sections
- In papers and textbooks expressions like these are usually just presented without explanation

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INVITED REVIEW

Electron energy-loss near-edge structure – a tool for the investigation of electronic structure on the nanometre scale

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the Schrödinger equation for the potential in the solid. The ejected electron makes a transition from an initial state, $\psi_i(\mathbf{r})$, to a final, originally unoccupied, state, $\psi_f(\mathbf{r})$, and the probability for the transition, and hence the intensity in the ionization edge at a given energy loss and scattering angle, $I(E, \theta)$, follows from Fermi's Golden Rule[1]

$$I(E,\theta) \propto \frac{4\gamma^2}{a_0^2 q^4} \left| \int \psi_i \exp(i\mathbf{q}\cdot\mathbf{r}) \psi^*_f d^3\mathbf{r} \right|^2 \rho(E) \qquad (3)$$

where a_0 is the Bohr radius (0.053 nm) and $\rho(E)$ is a quantity known as the density of states (DOS) – essentially the number of electron states within a small energy

- Later in the course we will use expressions that are usually just presented in papers and textbooks.
- All of this is work on the blackboard, but lecture notes will be available online.

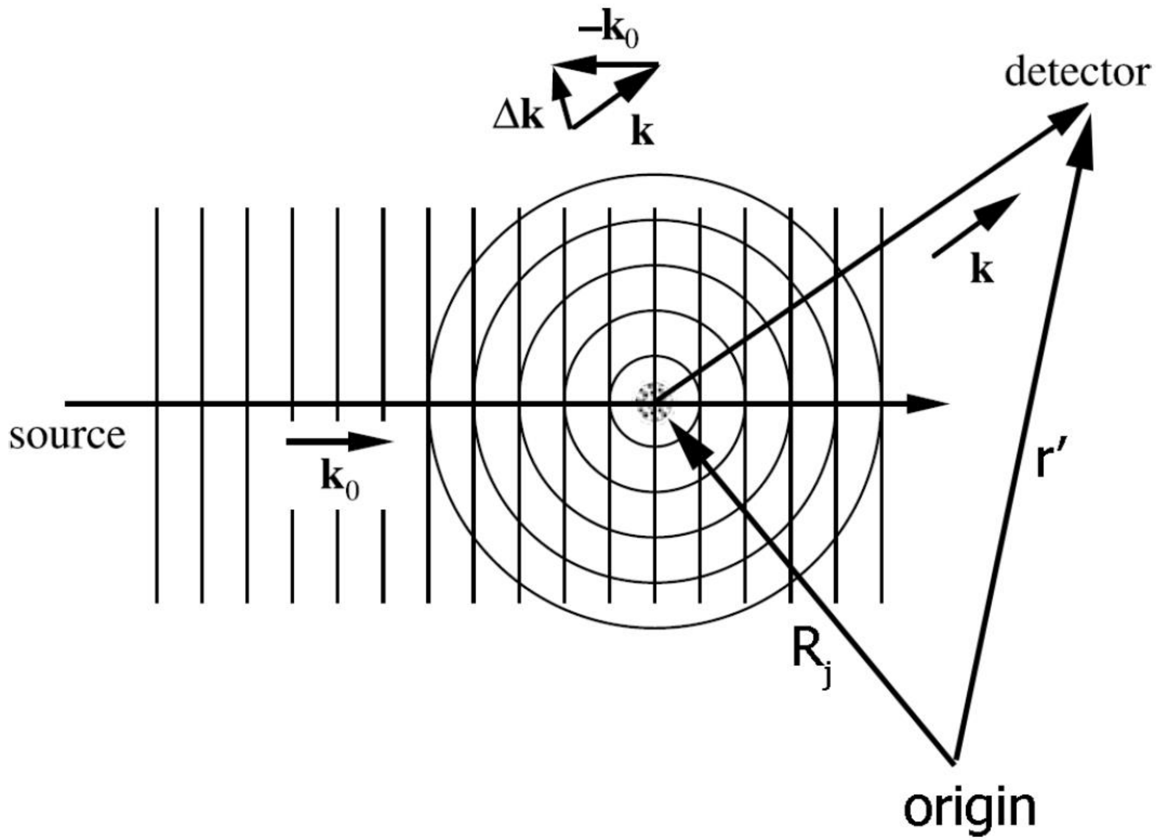

Figure 1: Sketch showing a plane wave scattered by atom in $\mathbf{R}_j$.