Karlsruhe Institute of Technology

FAKULTÄT FÜR PHYSIK
Praktikum Moderne Physik

Praktikum: P4 Gruppe: 22 ■ Mo □ Mi **WS20/21**

Zutreffendes bitte ausfüllen

Namen: Paul Filip useba[at]student.kit.edu

Namen: Janic Beck

Versuch: Mößbauer-Effekt

Betreuer: Paras Koundal Durchgeführt am: 29.11.20

Wird vom Betreuer ausgefüllt.

1. Abgabe am:

Rückgabe am: Kommentar:

2. Abgabe am:

Ergebnis: + / 0 / - Handzeichen:

Datum: Kommentar:

Contents

1. Theory & Preparation

1.1 Mössbauer effect

The process of **resonant absorption** in nuclear physics describes the phenomenon of subsequent de- and excitation of two equal atoms to the same energy levels via one γ-quant. Consider for example an excited state of ^{57}Fe, that emits a photon with energy (roughly) 14.4 keV during its transition to the ground state.

$$^{57}\mathrm{Fe}^{*} \longrightarrow {}^{57}\mathrm{Fe} + \gamma$$

In principle, one could use this emitted photon to excite another ^{57}Fe atom to the higher energy state. The photon is absorbed resonantly by the atom during this process.

In reality, resonant absorption such as the Na-D-line only occurs under certain circumstances. Due to conservation laws the energy E_γ of the emitted photon does not exactly equal the transition energy E_0, but is instead shifted downward by the nuclear recoil energy. A similar analysis finds that the energy for absorption of the same atom is shifted upwards.

$$\underbrace{E_\gamma = E_0 - \frac{p_\gamma^2}{2m}}_{\text{Emission}} \qquad \underbrace{E_\gamma = E_0 + \frac{p_\gamma^2}{2m}}_{\text{Absorption}} \tag{1.1}$$

With the photon impulse p_γ and atom mass m. If the line width introduced by natural broadening, Doppler broadening or other effects does not exceed the gap $\frac{p_\gamma^2}{m}$ resonant absorption cannot occur. This is visualised in **??**.

1.2 Mössbauer spectroscopy

Es war einmal ...

2. Experiment & Evaluation