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ADVANCED LABORATORY COURSE

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**K221: Mößbauer Effect**

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**Abstract**

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# **Chapter 1**

## **Introduction**

## Chapter 2

# Theory

# Chapter 3

## Experimental Set-Up and Procedure

### 3.1 Experimental Set-Up

To measure the Moessbauer spectrum, we placed a Co-57 radioactive source onto a table with a moving absorber that has a maximum displacement of  $25.1 \pm 0.2$  mm. A photodetector is placed behind the absorber that detects the number of photons that are not absorbed via this process. The speed of the absorber is controlled by a motor that uses the voltage as an input. See Fig. ?? for the Moessbauer source apparatus.

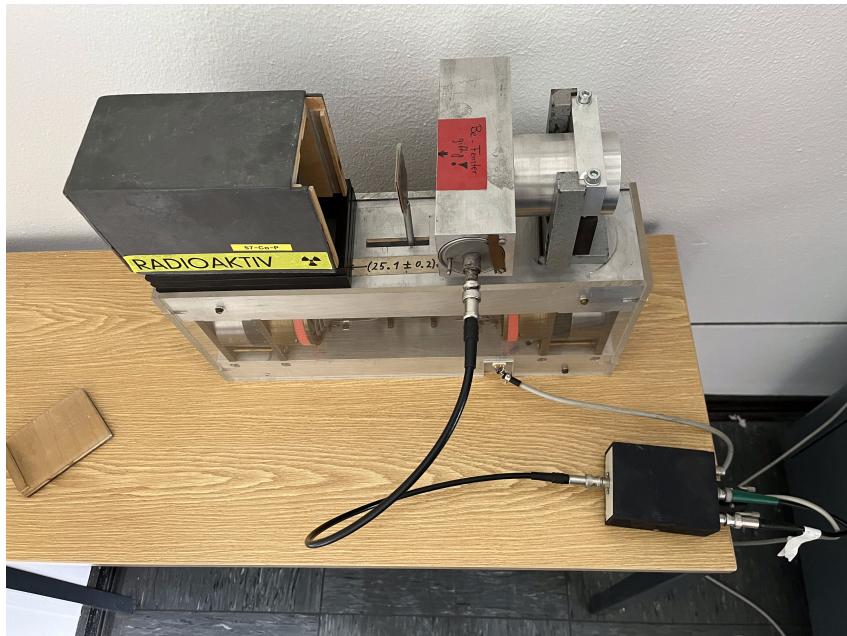
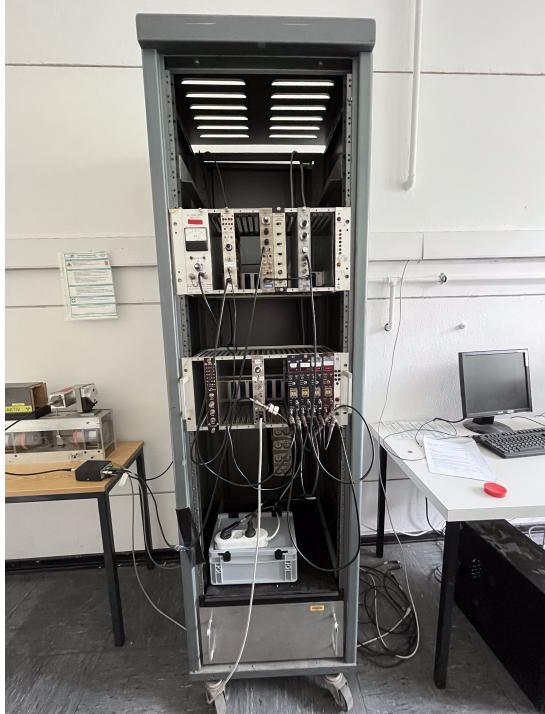
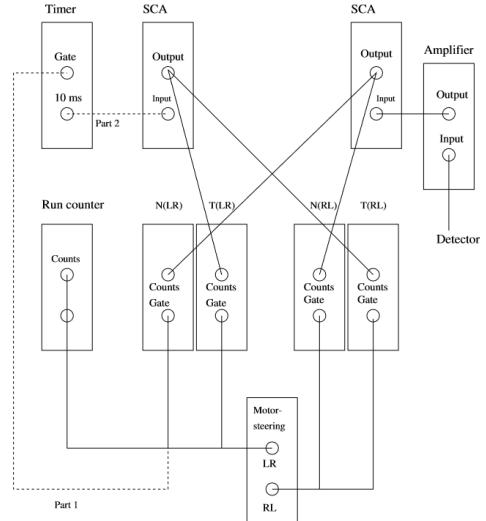


Figure 3.1.1: The set-up of the Moessbauer source. *Left:* The Co-57 source. *Middle:* The moving absorber. *Right:* The photodetector which is connected to the detector apparatus.

The photodetector is then connected to a single channel analyzer (SCA), which determines the number of counts detected in a given time range and maximal and minimal width to observe the counts. The SCA has 2 main parameters that should be modified: the Upper Level Discriminator (ULD) and the Lower Level Discriminator (LLD), which controls the binsize and the lower limit for photodetection respectively. The modes of the ULD can be set to measure with a higher resolution by detecting counts with 10 % of the binsize. The SCA was then connected to a display in which the number of counts obtained in a specific time interval was shown. The photodetecting apparatus consisted of two such setups to consider for measurements with positive and negative velocity of the absorber as the offset voltage between the two can allow the measurements in the LR and RL direction to differ. A separate run counter that tracks the number of turns that the absorber had is also contained in the apparatus. A timer that controls the time interval of measurement is also placed which is used for the calibration process. See Fig. 3.1.2 for the apparatus used for the photodetection as well as the schematic of the apparatus.



(a)



(b)

Figure 3.1.2: (a) The photodetector apparatus used in this experiment. (b) The schematic of the apparatus. Obtained from Ref. [1].

## 3.2 Procedure

### 3.2.1 Calibration of SCA

Before we took any measurements, we determined the optimal values for the LLD in order to ensure that we are detecting counts from the 14.4 keV transition. In order to do so, we modified the LLD from 0 to 4 and determined the number of counts obtained at each value. The ULD and time interval was fixed to be 10 for all measurements. Once the data was obtained, we plotted the count rate  $N/T$  against the LLD values and compared our results to the Fe-57  $\gamma$ -spectrum as seen in Fig. add reference here. Fig. ?? shows the obtained spectrum from our experiment.

We identified the 14.4 keV transition line as the third peak on Fig. .

## **Chapter 4**

# **Results and Discussion**

## **Chapter 5**

# **Conclusion and Outlook**

## Chapter 6

# Acknowledgements

# Bibliography

- [1] P. A. L. Course, *K221 mößbauer effect*, Jul. 2016.

# Chapter 7

## Appendix