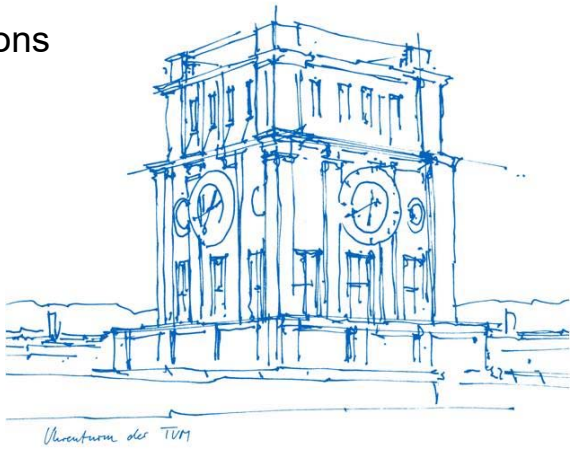
Lecture

Electricity and Magnetism

- Chapter 3: Magnetostatics – Introduction
- Magnetism in daily live
- Observations; phenomenological derviation of some physical relations
- What is the content of chapter 3?



3.Magnetostatics – Introduction

Magnetism in daily life: fixation by magnets, magnetic forces

Neodym magnets

Magnets of carrying loads

loudspeaker:

https://www.connect.de/ratgeber/magnetismus-im-lautsprecherbau-1489943.html

compass:

Foto: © Calsidyrose, Lizenz: Creative Commons CC BY 2.0 , Quelle: Wikimedia Commons

- fasteners
- toys
- ….

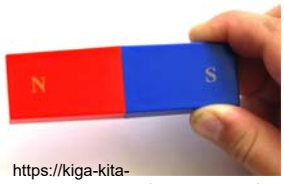
Brio: ©

Magnetostatics – Phenomena and Observations

https://www.youtube.com/watch?v=Mp0Bu75MSj8
https://www.youtube.com/watch?v=V-Gus-qIT74

3.Magnetostatics – Introduction

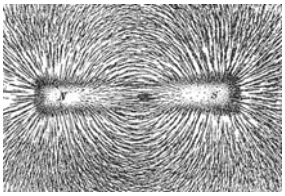
Phenomena, observations:



https://kiga-kita-kindergartenbedarf.blogspot.com/2011/08/rot-blaue-dauermagnete-mit.html

- Permanent magnets:
  - are made of specific materials
  - suitability: depends of structure of materials
- Force acts on specific materials, e.g. iron particles, iron nails, not all materials
- There are two poles (north/south pole
  - north/south pole attract eachother
  - north/north and south/south pole repel eachother
- Can be described by force field (anaolg to electric field)
  - force depends on location and direction
  - described by vector field (field lines)
  - force decreases with ($\sim \frac{1}{r^2}$)

https://de.wikipedia.org/wiki/Dauermagnet



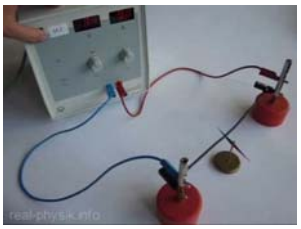
https://commons.wikimedia.org/wiki/File:Magnet0873.png

Magnetostatics – Phenomena and Observations

https://www.youtube.com/watch?v=V-Gus-qIT74

3.Magnetostatics – Introduction

Phenomena and Observations:



- Oersted (1820):
  - Experiment: deflection of compass needle in vicinity of a current-carrying wire
  - $\Longrightarrow$ magnetic field around ~~wird~~ wire; there is a a relation between electric and magnetic phenomena („electromagnetic interaction“

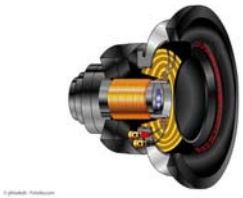
(see video)

- observation: moving electric charge experiences a force in a magnetic field; deflected from original curve (Lorentz force)

Lautsprecher-
Magnet

3.Magnetostatics – Introduction

Applications/examples: electromagnetic interaction and magnetism

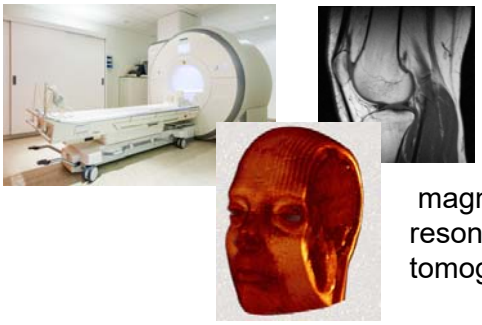


loudspeaker

electromagnets

particle accelerator (e.g. CERN)

electro motors



magnetic resonance tomography (

Klinkum Ingoldstadt und MRT Magnet-Resonanz-Tomographiehttps:// de.wikipedia.org/wiki/Magnetresonanztomographie

3.Magnetostatics – Content of Chapter 3

- magnetostatics = magnetism & static = time-invariant magnetic phenomena (see chapter 1: electrostatics)
- Not treated: force between two permanent magnets or magnets itself, or magnetizeable materials

Topics covered:

- What is the physical origin of magnetism/of (electro-)magnetic interaction?
- Why are some materials magnetic, why are others not?
- How are magentic fields generated?
- What is the connection between electrostatics and magnetostatics and how can we describe this?
- Structural similarities and differences between electrostatic and magnetostatic phenomena