The Fascination of Crystals and Symmetry

Unit 1.1

by Frank Hoffmann & Michael Sartor
Crystals...

Structures...

Length scales...
Structure – Length scales

- Milky way: 100,000 light years
- Earth: 13,000 km
- House: 10 m
- Football: 22 cm
- Lady bird: 1 cm
- Paper: 0.1 mm
- Red blood cells: 1 µm
- Virus: 100 nm
- DNA: 10 nm
- Atom: 0.1 nm (1 Å)
- Atomic nucleus: 10⁻¹⁴ m
- Proton: 10⁻¹⁵ m

Powers of Ten (1977)
Structure of the Universe...
Giant Crystals – The Naica Mine

cueva de los cristales

- temperature: 45 - 50 °C
- humidity: 90 - 100%
- largest Selenite ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) crystals are
  - 14 m long
  - 2 m diameter
- approx. age of the crystals: 100,000 – 1,000,000 years

discovered in April 2000

(Alexander Van Driessche / CC-SA 3.0)
green Fluorite ($\text{CaF}_2$) crystal, surrounded by white Calcite ($\text{CaCO}_3$) crystals, from the Naica mine

$5 \times 5 \text{ cm}$
Typical size of single-crystals in research

Single-crystal of a Metal-Organic Framework (MOF)

0.03 mm edge length

→ Chapter “Topology and Networks”
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