

# Synchrotron Radiation — Exercises 2

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## 1 Applications

Why are synchrotrons important for science?

## 2 Orbit Correction

Which devices are used to measure and correct the orbit inside a synchrotron?

## 3 Instrumentation

How would you measure the bunch length in a synchrotron?

## 4 Detection

What possibilities exist to detect X-Rays?

## 5 Monochromators

What dispersive element is used to monochromatize X-Rays? What differences exist to monochromators for visible light?

## 6 Refractive Index

The passage of electromagnetic radiation can be described classically by an index of refraction. What are the properties of the index of refraction of most materials at X-ray wavelengths?

## 7 DLSRs

How do longitudinal gradient bends contribute towards the goal of achieving a lower horizontal emittance in a diffraction limited storage ring?

## 8 Diffraction

Why is diffraction often used in place of imaging when using X-rays?  
What is the *phase problem* in X-ray diffraction?

## 9 Crystals

Which of the following are crystalline? More than one answer is possible.

- The glass on the screen of my mobile phone
- The sapphire glass on an expensive watch
- Asbestos
- Icing sugar

## 10 Absorption and Diffraction

A scientist wants to record a diffraction pattern of a silicon crystal at a photon energy of 8 keV. What is the optimum thickness of the crystal, that maximizes the intensity of the diffracted spot?

Hint: you can find the mass absorption coefficient of silicon on page 1-41 (page 49 in the PDF) of the X-Ray Data Booklet, and the density on page 5-5 (page 153).