Aldo Craievich

Institute of Physics - University of São Paulo.
São Paulo, Brazil

Synchrotron Radiation I.
History of particle accelerators. Synchrotron radiation sources. Electron storage rings. General structure and basic components. Insertion devices. Main features of wigglers and undulators. Emittance, photon flux, brightness and critical energy. Characteristics of the radiation spectra emitted by bending magnets, wigglers and undulators. Synchrotron radiation sources in operation around the world. Relevant features of the Brazilian synchrotron source (LNLS, Campinas).

Synchrotron Radiation II.
Synchrotron radiation beam lines. General geometry and beam path. Vacuum systems. Optical components: mirrors and monochromators. Photon and electron detectors. Typical features of the components and instrumentation of beam lines for X-ray diffraction, X-ray fluorescence, small-angle X-ray scattering, X-ray absorption, photoelectron spectroscopy and VUV spectroscopy. Radiation safety.

SAXS: Theory and Instrumentation.
Small-angle X-ray scattering (SAXS) intensity produced by nano-heterogeneous materials. General equation for the scattering intensity from materials with arbitrary structures. Systems of particles embedded in homogeneous matrices. Guinier equation. Porod equation. Modeling of the scattering intensity produced by dilute and by concentrated systems of nanoparticles. Instrumentation of SAXS beamlines: beam paths, mirrors, monochromators, detectors, sample conditioning components. Examples of experimental SAXS studies of nanostructures and structure transformations. Characterization of mechanisms of aggregation: in situ studies of the scattering intensity produced by growing fractal nano-objects. Nucleation and growth of nanocrystals embedded in a glass matrix. Melting and freezing of confined nanoparticles. Dynamical scaling properties in complex structure transformations.