Main Facilities of SPring-8

Accelerator Complex and Synchrotron Radiation Source

The accelerator complex is composed of an injector linac, a booster synchrotron and a low emittance storage ring. The linac is a linear accelerator. It generates electrons with an electron gun, and accelerates them to an energy of 1 GeV. The accelerated electron beam is transported to the synchrotron, which then accelerates it to 8 GeV. Next, the beam is injected into the storage ring and stored with the energy of 8 GeV. The stored electron beam emits synchrotron radiation at bending magnets and at insertion devices (undulators or a wiggler). The emitted radiation is transported through beamlines to brushes in the experimental hall and used for experiments.

Research Methods Used in the SR Science

X-ray Diffraction and Scattering

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<td>Macromolecular crystallography</td>
<td>Atomic structure and function of proteins.</td>
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<td>X-ray diffraction under extreme conditions</td>
<td>Structural phase transition at high pressure / high or low temperature.</td>
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<td>X-ray powder diffraction</td>
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<td>Surface diffraction</td>
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Spectroscopy and Spectrochemical Analysis

- Photoelectron spectroscopy: Electronic structure of advanced materials.
- Atomic and molecular spectroscopy: Photoionization, photoabsorption and photoelectron spectra of neutral atoms and simple molecules.
- Compton scattering: Momentum distribution of electrons in materials and magnetic electrons.
- XAFS (X-ray absorption fine structure): Atomic structure and electronic state around a specific atom.
- Photon correlation spectroscopy: Specie from disordered systems. Dynamics of atomic-scale disorder.

X-ray Imaging

- Refraction-contrast imaging: Imaging of low absorbing specimens.
- Phase-contrast imaging: Imaging of biological samples with an X-ray interferometer or gratings.
- X-ray microtomography: Three-dimensional imaging.
- X-ray fluorescence microscopy: Imaging of trace elemental distribution with a scanning X-ray microscope.
- X-ray tomography: Static and dynamic processes of crystal growth, phase transition and 3-D deformation in crystals.

Radiation Effect

- Radiation biology: Radiation damage of biological substances.

Experimental Stations

Experimental Station in Experimental Hall

Synchrotron radiation from a bending magnet or an insertion device is modified with optics and led to the experimental station. A sample is studied by measuring X-ray scattering/diffraction, X-ray absorption, fluorescence, X-rays, secondary electrons, and so on.

Synchrotron Radiation Source and Beamlines

- **Undulator**
  - There are two types of light sources in SPring-8. Those are insertion device source and bending magnet source. Insertion devices are classified into an undulator and a wiggler.
  - SPring-8 Beam Ports
    - insertion device beamlines: (straight section 4.6m) max. 34
    - Undulator beamlines: (long straight section 28m) max. 4
    - Bending magnet beamlines: max. 24
  - An undulator and a wiggler are composed of magnet arrays and produce periodic magnetic fields that wiggle electron beam and emit synchrotron radiation. In vacuum-type undulators developed at SPring-8, seal magnet arrays in a vacuum chamber. This arrangement results in a smaller gap between arrays. Therefore, synchrotron radiation with shorter wavelength and higher power can be generated.
  - Other than standard in-vacuum type, in-vacuum revolver undulator, invacuum figure-8 undulator, twin vertical undulator, elliptical wiggler, and others are installed in SPring-8. These insertion devices generate various polarized radiations.

- **Bending Magnet**
  - A bending magnet is a part of the storage ring that bends the electron orbit and emits white X-rays with the characteristic photon energy of 26.9 keV.