

# Lecture course on the Structure of Matter

(2x45 min each lecture, 2 days in a week), Institute of Physical Chemistry PAS , Kasprzaka 44/52 .

The first lecture Tuesday 19th October 14:00 – 15:30

Schedule: Tuesdays 14:00 – 15:30 (via ZOOM)

Fridays 12:15 – 13.45 (via ZOOM ) until further notice.

Interested students shall register via e-mail: [zkaszkur@ichf.edu.pl](mailto:zkaszkur@ichf.edu.pl)

Starting 15 hours of lectures will be delivered by dr hab. Z. Kaszukur:

Physical optics and diffraction; X-ray, electron and neutron diffraction; Elements of crystallography, point symmetry groups, space groups (Hermann-Mauguin), crystallographic systems, Miller indices and reciprocal space; Diffraction by matter, Bragg's and Laue formula, Solving the crystal structure; Close packed and loose packed structures; Powder diffraction, structural characterization, crystal size, strain, crystallographic databases, structure refinement (Rietveld method). Powerful x-ray beams for science: synchrotrons and Free Electron Lasers (FEL). Selected structural synchrotron methods; Magnetic and electric properties of matter, Clausius-Mossotti and Debye equation, Curie equation, dielectricity and dispersion of light, metamaterials; Allotropic forms of carbon.

The next 15 hours will be delivered by prof.dr hab. R. Nowakowski:

Surface (definition, thermodynamic approach, description): surface energy, vicinal surfaces, adsorbate-substrate systems (matrix and Wood notations); Real surface: crystal shapes (Wulff construction), relaxation and reconstruction, faceting, surface defects, surface superstructures; Electronic structure of surfaces (density functional theory, jellium model), surface states, surface electrical conductivity, work function; Elementary processes: intermolecular interactions (self-organization), adsorption (physical, chemical, adsorption isotherms, kinetics), desorption (thermal and non-thermal), diffusion (Fick laws) including surface diffusion (atomic mechanisms), Growth of islands and thin films: growth modes, homo and heteroepitaxy, experimental techniques; Surfactants; Surface analysis: spectroscopy (IR, XPS, UPS, AES, EELS, SERS), microscopy (FEM, FIM, TEM, SEM, LEEM, PEEM, STM, AFM)