Advanced Fluorescence Spectroscopy(C568)

Phenomena of Fluorescence and Instrumentaion for Fluorescence Spectroscopy: Introduction. Jablonski Diagram, Characteristics of Fluorescence Emission, Fluorescence Lifetimes and Quantum Yields. Spectrofluorometers, Light Sources, Monochromators, Optical Filters, Photomultiplier Tubes, Polarizers. (5)

Fluorophores: Intrinsic or Natural Fluorophores; Fluorescence Enzyme Cofactors, Extrinsic Fluorophores; Protein-Labeling Reagents, Membrane Probes, Red and Near-Infrared (NIR) Dyes, DNA Probes, Chemical Sensing Probes, Viscosity Probes, Green Fluorescent Proteins, Long-Lifetime Probes. Quantum Dots. (4)

Life-Time Measurements: Time-Domain and Frequency- Domain Measurements. Time-Correlated Single-Photon Counting; Principle and Instrumentation, Alternative Methods for Time-Resolved Measurements; Streak Cameras, Upconversion Methods. Data Analysis. (6)

Some Important Photo-processes: Dynamics of Solvent and Spectral Relaxation: Measurement of Time-Resolved Emission Spectra (TRES), Theory for Time-Dependent Solvent Relaxation, Fluorescence Quenching: Theory, Fractional Accessibility to Quenchers, Applications of Quenching to Proteins; Fluorescence Anisotropy: Origin of the Definitions of Polarization and Anisotropy, Measurement of Fluorescence Anisotropies, Causes of Depolarization, Biochemical Applications. Energy Transfer: Theory of Energy Transfer for a Donor–Acceptor Pair, Distance Measurements Using Resonance Energy Transfer (RET), Biochemical Applications of RET. (12)

Multiphoton Excitation: Introduction to Multiphoton Excitation, Two-Photon Absorption Spectra, Cross Section for Multi-photon Absorption. (3)

Single-Molecule Detection(SMD): Delectability of Single Molecules, Instrumentation for SMD, Single-Molecule Photophysics, Biochemical Applications of SMD. (3)

Fluorescence Correlation Spectroscopy(FCS): Principles of Fluorescence Correlation Spectroscopy, Theory of FCS, Examples of FCS Experiments. (3)

Fluorescence-Lifetime Imaging Microscopy(FLIM): Early Methods for Fluorescence-Lifetime Imaging, Laser Scanning TCSPC FLIM, Lifetime Imaging of Cellular Biomolecules. (3)

Radiative Decay Engineering: Introduction to Radiative Decay Engineering, Review of Metal Effects on Fluorescence, Surface Plasmon-Coupled Emission(SPCE), Applications of Metal-Enhanced fluorescence, Application of SPCE. (3)

Recommended Books

1. Principles of Fluorescence Spectroscopy, Joseph R. Lakowicz, 3rd Edition, Springer, 2006.
2. Advanced Time-correlated Single photon Counting Techniques, W. Becker, Springer, 2005.
3. Molecular Fluorescence Principles and Applications, B. Valeur, WILEY-VCH, 2002.
4. Single-Molecule Detection in Solution. Methods and Applications, C. Zander, R. A. Keller, and J. Enderlein, WILEY-VCH, 2001.