TEMPORAL STRUCTURE OF SR – APPLICATION TO STUDY BIOMOLECULES IN UV AND VISIBLE RANGE

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Keywords: fluorescence lifetimes, biomolecules, FLIM, confocal microscope, imaging

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SR is delivered to the stations as a set of bunches with temporal resolution, depending on the properties of the storage ring, ranging from tens of ps to ns. This property has been used to study kinetic and dynamic properties of biomolecules and biological processes.

Due to stability and tunability of SR the **time-resolved fluorescence spectroscopy lifetimes and anisotropy** on biological and non-biological samples were measured at different excitation and resolution.

Figure 1 shows an example of application of temporal structure and spectral properties of SR to simultaneously (in one measurement) study all the spectroscopic properties of biomolecules like fluorescence emission, lifetimes and polarization.

Both the spectral and temporal calibrations of the fluorescence analyzer are independent of the polarization of the fluorescence. The ~100 ps temporal resolution of the resistive-anode detector is well matched to the ~1 ns FWHM pulses of light produced by the synchrotron storage ring at NSLS taken at U9B with Omnilyzer.

Temporal structure of SR was also applied to such techniques as fluorescence lifetime correlation spectroscopy or time-resolved UV circular dichroism.

The development of imaging techniques has significantly extended the area of possible application of time resolved studies. Observed dynamic development of techniques is leading to **visualization of biological structures and processes in situ** where imaging and spectroscopy information is obtained simultaneously.

To obtain three-dimensional fluorescence images, **fluorescence lifetime imaging microscopy (FLIM)** was used with spectrally and spatially resolved imaging.

Confocal Fluorescence Microscopy is a powerful technique that can be used to reveal fine details of many important biological processes. Scanning microscope combines synchrotron and laser light with confocal microscopy, FLIM, and spectroscopy giving a flexible, wavelength-tunable fluorescence microscope able to produce high resolution data.

This unique combination may help to reveal the fine details of metabolism in cells. Better knowledge of such properties of cell membranes in understanding crucial processes such as transport of substances in and out of cells may be achieved with **Time-resolved Confocal Fluorescence Lifetime** microscope.

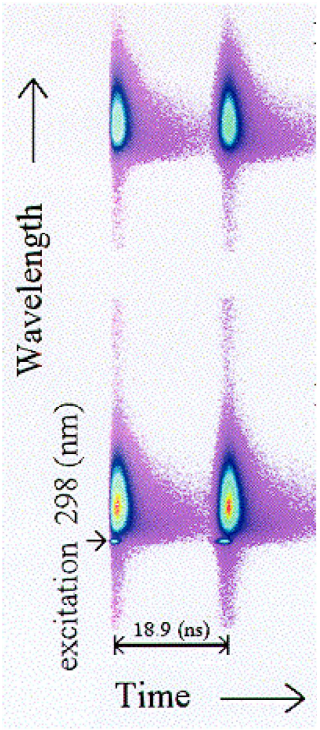

Figure 1.

[L.A. Kelly, J.G. Trunk, K. Polewski, J.C. Sutherland, Simultaneous resolution of spectral and temp-oral properites of UV and visible fluores-cence using single-photon counting with a position-sensitive detector. *Rev. Sci. Instrum.* **66** (1995) 1496-1498].

Multidimensional single-molecule visualization microscope provides the only direct way to investigate signaling events involved with a high spatial and temporal resolution and allows the visualization of the dynamic behavior of individual transmembrane molecules.

The optical system which allows collection of two fluorescence images using vertically and horizontally polarized light gives detailed information on the fluidity of samples such as cell membranes or the viscosity of the environment.

This presentation indicates that application of temporal structure of SR to study biological processes posses great potential which, hopefully, will be explored by many beamlines in the nearest future to deliver important data of biological significance.