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Ultrasensitive time-resolved random laser spectroscopy: Excited state relaxation of dye molecules embedded in hybrid materials

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The understanding of energy transfer processes in biological systems occurring among optical centres which exhibit in homogeneously broadened spectral bands is of paramount importance to determine time constants and spatial distribution of energy flow. Here we report a new time resolved-spectroscopy based on the own random laser generation of the optical probes. As an example, we experimentally investigate the excited state relaxation of rhodamine B molecules in an organic-inorganic hybrid material. We demonstrate that even in the case of spectral overlap between donor and acceptor (monomer and dimer) emissions, this kind of spectroscopy may resolve not only the spectral features of the system but also provide a high speed picture of the energy transfer and excited state relaxation of the involved optical probes. Our results can be easily applied to any kind of efficient interacting chromophore pairs embedded in inhomogeneous scattering structures such as biological tissues.

Biography

Joaquín Fernández is full Professor of Physics at the University of the Basque Country (Spain) since 1983. His field of specialization embraces light-matter interaction processes including among others: Laser and Photothermal spectroscopy, photonic devices, interionic interaction and energy transfer, laser cooling of solid state materials, and laser generation in inhomogeneous hybrid photonic materials. He is author of more than two hundred fifty publications in peer reviewed journals and member of various international scientific committees.

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Luminescent lanthanide complexes and composites for time-resolved bio-imaging

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Lanthanide chelate complexes have been used as luminescent tags for time-resolved bio-imaging. In time-resolved imaging, undesired autofluorescence of tissues can be eliminated and only true signals are measured. A time-resolved microscopy with a gated CCD camera and a He-Cd laser was developed in our group to image cells and tissues stained with lanthanide tags. Comparison of a time-resolved image using Eu^{3+} tags with a normal image using conventional organic dyes in cell actin staining, showed that several bright spots existed in normal image, which were not present in time-resolved image. In spite brightness is slightly lost in time-resolved mode, compared to normal one, quantitative digital analysis of images proved notably higher reliability in time-resolved image. The time-resolved imaging system was also applied to DNA microarray, and high sensitivity was proved. As a new class of nano-particle tags, TTF (thenoly trifluoroacetone)-Eu^{3+} complex was adsorbed onto nanocarbon particles. The particles have multiple surface functional groups for tagging, and are stably dispersible in water, strongly luminescent, and they are not toxic. These properties seem to be suitable as luminescent tags. Further properties will be introduced in the talk.

Biography

Kazuko Matsumoto has completed her PhD at the age of 27 years from the University of Tokyo and served as research associate at the same university. She is professor at Sophia University, and the director of Vision Development Co., Ltd. She has published more than 230 papers in reputed journals and more than 10 books from major publishers, and served as vice president of IUPAC.

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