POLYTECHNIQUE MONTRÉAL

LE GÉNIE EN PREMIÈRE CLASSE

SÉMINAIRE DU DÉPARTEMENT DE GÉNIE PHYSIQUE

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Coherent Raman Microscopies: from Biophotonics to Geophotonics

Nonlinear Raman Spectroscopies such as Coherent Anti-Stokes Raman Scattering (CARS) and Stimulated Raman Scattering (SRS) have been developed over several years into powerful Coherent Raman Microscopies with broad applications in biology and medicine.

Their utility lies in their ability to provide label-free yet chemical- or material-specific imaging. This is based on the use of Raman vibrational resonances ("fingerprints") which are used to 'label' to molecule of interest. We review modern approaches to Coherent Raman Microscopy, emphasizing methods which reduce or remove background signals that reduce contrast [1,2]. To date, the vast majority of applications of Coherent Raman Microscopies have been in Biophotonics (i.e. biomedical imaging). Recently, we demonstrated that many of these approaches also apply to key problems in Earth Sciences, Mineralogy, and Petroleum Engineering. In order to emphasize this new area, we introduce the term "Geophotonics" and offer examples of problems addressable by Coherent Raman Microscopy [3-5].

References:

[1] A.F. Pegoraro et al , "Hyperspectral multimodal CARS microscopy in the fingerprint region". Journal of Biophotonics 7, 49 (2014)

[2] M. Andreana et al, "Amplitude and polarization modulated hyperspectral Stimulated Raman Scattering Microscopy" Optics Express 23, 28119 (2015)

[3] R.C. Burruss et al "Unraveling the complexity of deep gas accumulations with 3D multimodal CARS microscopy". Geology 40, 1063 (2012)

[4] M-A. Houle et al, "Rapid 3D chemical-specific imaging of minerals using Stimulated Raman Scattering". Journal of Raman Spectroscopy 48, 726 (2017)

[5] M-C. Kao et al, "Direct mineralogical imaging of economic ore and rock samples with multi-modal nonlinear optical microscopy" Nature Scientific Reports 8, 16917 (2018)

Albert Stolow *is the Canada Research Chair in Molecular Photonics and Professor of Chemistry & Physics at the University of Ottawa. He founded the Molecular Photonics Group within the National Research Council Canada where he maintains an ongoing collaborative research program. He is Adjunct Professor of Chemistry and of Physics at Queen's University in Kingston. He is also a Fellow of the Max-Planck-uOttawa Centre for Extreme and Quantum Photonics. His research interests include ultrafast molecular excited state dynamics and quantum control, strong field physics of polyatomic molecules, and coherent non-linear optical microscopy.*

Vous êtes tous les bienvenus.

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Albert Stolow studied Chemistry and Physics at Queen's University and then obtained his Ph.D. degree in Chemical Physics from the University of Toronto in 1988, studying under Nobel Laureate John C. Polanyi. Stolow was an NSERC postdoctoral fellow at the University of California, Berkeley from 1989-1992 where he worked with Nobel Laureate Yuan T. Lee. In fall 1992, Stolow joined the National Research Council in Ottawa and in 2014, he assumed the Canada Research Chair in Molecular Photonics at the University of Ottawa. Stolow is a Fellow of both the American Physical Society and the Optical Society of America. He has won several national prizes including the Earle K. Plyler Prize of the American Physical Society, the Polanyi Award of the Canadian Society for Chemistry, the Queen Elizabeth II Diamond Jubilee Medal (Canada), the Laidler Award of the Canadian Society for Chemistry and the Barringer Award of the Spectroscopy Society of Canada. Stolow sits on the editorial boards of numerous international journals and on the Advisory Boards of several international research institutions. Stolow was a Member of the Executive Committee of the American Physical Society's Division of Laser Science (DLS) and is currently Chair-Elect of its Division of Chemical Physics (DCP).