

## 3. Nonresonant chemical processes (laser thermo-chemistry)

By

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Date: 29 October 2018 (Monday)

Time: 4.30 pm - 5.30 pm

Venue: MAS Executive Classroom 1 (SPMS-MAS-03-06)

Host: Assoc Prof. Cesare Soci

### **Abstract**

The characteristic features of the kinetics and dynamics of processes occurring on laser heating of chemically reactive media are analysed in this talk. Attention is concentrated on effects due to the macroscopic disequilibrium and the feedback between various degrees of freedom of thermochemical systems. Processes stimulated by laser radiation in homogeneous media, the phenomena occurring on laser heating of metals, and the physicochemical processes occurring on laser heating of liquids are considered. Examples of certain technological applications of laser thermochemistry are presented: laser-induced precipitation of a substance from the gas phase, etching and modification of surfaces, synthesis of compounds, etc. We also discuss the structures associated with laser oxidation of metals. The dynamic features of thermochemical processes occurring in a laser radiation field are dictated by a combined effect of the chemical state of the medium and the space time distribution of the thermal energy introduced into the medium on absorption of the laser radiation. The new (compared with classical macrokinetics) feedback channels are formed in the laser radiation field between chemical and thermal degrees of freedom of the system. By varying the parameters of the laser radiation (intensity, wavelength, etc.) it is possible to control the type of feedback and to form in a directed manner trigger, free-oscillatory, etc. active properties in a chemical medium which in the absence of laser radiation does not have such properties. Many self-organization phenomena can be modeled and studied experimentally more easily in such nonequilibrium chemical media than in other types of media.

### **Short Biography**

Boris Lukiyanchuk received his PhD (Physics and Mathematics) from P. N. Lebedev Physical Institute, Academy of Sciences of USSR in 1979 and his Doctor of Sciences from the General Physics Institute, Academy of Sciences of USSR in 1991. From 1970 to 1980, he was affiliated to the Scientific Research Institute at Moscow, Russia. He was also a Professor, Scientific Advisor and Principal Scientist at Data Storage Institute, A\*STAR, Singapore from 1999-2018. Currently he is the Professor, Head of the Nonlinear and Extreme Nanophotonics Laboratory, Lomonosov Moscow State University and Visiting Professor at SPMS, NTU. His research interests include interaction of laser radiation with matter, chemical processing with lasers, nonlinear phenomena, self-organization, laser-ablation, theory of nanocluster formation, photomodification in polymers, laser cleaning, plasmonics, metamaterials, nanoscopy, Nanophotonics and nanoparticles with high refracted index. He is a Honorary Professor at Johannes Kepler University, Austria, a recipient of the IES Prestigious Engineering Achievement Awards (2004), President's Science Award, Singapore (2013). He is a member of the Scientific Counsels of Russian Academy of Sciences, SPIE (2000) and OSA (2010). He has supervised >30 PhD students. He has authored 5 monographs and over 300 original research papers till date.