

NANOBIOPHOTONICS AND LASER MICROSPECTROSCOPY CENTER

Laboratories:

- Nanoparticles Synthesis and Functionalisation,
- Confocal Raman Microscopy,
- Fluorescence Spectroscopy

Research topics:

The research of the Nanobiophotonics And Laser Microspectroscopy Center is focused on the fabrication and self-assembly of noble-metal, semiconductor and polymer nanoparticles (colloids, nanocrystals) that perform novel function in nanophotonics and plasmonics and enable ultrasensitive spectroscopic methods for molecular detection.

- The gold and silver nanoparticles of controllable size (ranging from 3 to 100 nm) and shape (ranging from nanosphere, nanorod, and nanoprism are produced) and deposit them on to (bio)functionalized solid substrates to form self-assemblies with distinct nano-features.
- The interaction between (bio)molecules and metallic nano-features are studied by Raman (Surface Enhanced Raman Spectroscopy SERS), IR (Surface Enhanced IR Absorption SEIRA), fluorescence (Metal-Enhanced Fluorescence MEF) and optical absorption spectroscopy (Localized Surface Plasmon Resonances LSPR). Structural, chemical and spectroscopic information about our metal surfaces and adsorbed molecules were obtained via Confocal Raman Microscopy and Atomic Force Microscopy.
- Biocompatible, stable, and optically tunable gold nanosensors to be inserted in cells and biological matrices are produced. For testing the molecules placed on as fabricated nanostructures are used fluorescence, Raman and AFM measurements.

Research team:

- Simion ASTILEAN, PhD, professor, sastil@phys.ubbcluj.ro
- Dana MANIU, PhD, assist. prof., dmaniu@phys.ubbcluj.ro
- Simona PINZARU, PhD, assist. prof., scinta@phys.ubbcluj.ro
- Monica BAIJA, PhD, assist. prof., mbaia@phys.ubbcluj.ro
- Felicia TODERAS, Ph D Student,
- Cosmin FARCAU, Ph D Student,
- Monica IOSIN, Ph D Student,

- Valentin CANPEAN, Ph D Student,

Main equipments /Facilities:

- **Confocal Raman microscope system Alpha 300 R from Witec with:**

1. Microscope
2. color video-camera
3. Holographic and edge filter (532 and 633 nm)
4. Multi-mode fibers with connector

NdYag laser 532 nm and He-Ne laser 633 nm, motorized focusing system, manual sample positioning in x- and y-direction, piezo-driven scanning platform, CCD detector, UHTS 300 spectrometer

- **Atomic Force Microscope system Alpha 300 A from Witec with following:**

- mounted on the same platform with Alpha 300 Raman described above
- operation modes: contact mode/lateral force, pulsed force, phase imaging, magnetic force, nanolithography, nanomanipulation
- measurement medium: air or liquid medium

The scanning area is 100x100x20 microns

- **Spectrophotometer UV/VIS Jasco V-530** with measurements in absorption, reflection, transmission and spectral range: 190-1100 nm, as light sources are: lamps with deuterium (190-350 nm), tungsten (330-1100 nm);

- **Drying oven Raypa DO-50** up to 300⁰C;

- **Centrifuge Hettich Mikro 22** with processed volume: 0.2 – 2 ml, rotation speed: 500 – 18000 rpm;

- **Ultrasonic bath Elma, Transsonic T420** with adjustable ultrasonic frequency 35 kHz.



Confocal Raman Microscope system
Alpha 300



Spectrophotometer UV/VIS Jasco
V-530

Research Projects:

- Nobel metal nanostructures and nanoparticles with multifunctional plasmonic properties for relevant applications in nanophotonics, biodetection and laser spectroscopy (Project supported by the Romanian National Authority for Research, Project CEEEX No. 71/ 2006)
- Plasmonic nanostructures with application in biophotonics (Project supported by the Second National Program for Research, Development and Innovation, PNCDI II “Ideas”)
- The detection and characterization of biological molecules on novel nanostructured SERS active surfaces (joint research project, partner: University of Instabul, Tukey – under examination)
- Nanocristaux organiques et métalliques fluorescents: de nouveaux colloïdes biphotoniques ultrasensibles pour l'imagerie biologique et la photothérapie Intravitale (joint research project, partner: University Joseph Fourier, Grenoble, France – under examination)

Partners and collaborators:

The Nanobiophotonics Center coordinates a network of 4 national laboratories in the frame of the program called “Excellence in Research” (CEEEX) : Technical University Cluj-Napoca, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, „Raluca Ripan” Chemical Research Institute Cluj-Napoca and ICPE SA Bistrita and collaborate with 2 foreign laboratories from Joseph Fourier University Grenoble, France and Friedrich Schiller University, Jena, Germany, respectively.

The Nanobiophotonics Center takes part in the Nanoscience Consortium (NNC), an intra-university network which houses the nanoscience related research efforts at Babes-Bolyai University.

Technical Assistance:

We offer technical assistance to perform standard spectroscopic characterization of materials by Raman, fluorescence, and reflectivity with high performance instrumentation based on confocal Raman microscope (Alpha 300, two excitation wavelengths at 532 nm and 633 nm, detection between 100 – 3500 wavenumbers and lateral resolution better than ~ 250 nm) which is integrated with an atomic force microscope (AFM) of high spatial resolution and different operation modes. We are able to characterize, identify and image non-destructively chemical components and their molecular structure existing in heterogeneous materials, thin inorganic films, polymers, semiconductors, glasses, etc. in nanotechnology, life science, geology, pharmaceutical and food industry.

Additionally, we provide a large variety of nanostructured substrates (highly organized, regular arrays of noble-metal nanoparticles and films) with distinct optical properties and bio-chemical functionalities to operate as optical probe in bio- and chemical- sensing platform in the field of molecular biology, medicine and environment monitoring.

Publications:

1. M. Baia, S. Astilean, T. Iliescu,
Raman and SERS Investigations of Pharmaceuticals,
Ed Springer-Verlag, Berlin Heidelberg (2008)
2. Monica Iosin, Patrice Baldeck And, Simion Astilean,
Plasmon-enhanced fluorescence of dye molecules,
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, doi:10.1016/j.nimb.2008.10.018 (in press 2008).
3. V. Canpean, S. Astilean
Interaction of light with metallic nanohole arrays,
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.054, (in press 2008).
4. F. Toderas, M. Iosin, S. Astilean
Luminescence properties of gold nanorods,
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, doi:10.1016/j.nimb.2008.10.055 (in press 2008)
5. Sanda C. Boca, Cosmin Farcau, Simion Astilean
The study of Raman enhancement efficiency as function of nanoparticle size and shape
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.020 (in press 2008)
6. E. Vințeler, C. Farcău, S. Aștilean
Disorder effects in reflectance spectra of colloidal photonic crystals,
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.031 (in press 2008)
7. A.R. Tomșa, E.J. Popovici, A.I. Cadiș, M. Ștefan, L. Barbu-Tudoran, S. Aștilean,
Ultrasound-assisted synthesis of highly disperse zinc sulphide powders,
Journal Of Optoelectronics and Advanced Materials 10(9), 2008, 2342-2345

8. M. Iosin, F. Toderas, P. Baldeck, S. Astilean
In vitro biosynthesis of gold nanotriangles for Surface- Enhanced Raman spectroscopy,
Journal Of Optoelectronics and Advanced Materials 10(9), 2008, 2285 – 2288.
9. F. Toderas, M. Baia V, Farcau, S. Ulinici, S. Astilean
Tuning of gold nanoparticles plasmon resonances by experiment and simulation
Journal Of Optoelectronics and Advanced Materials 10(12), 2008, 3265 – 3269.
10. C. Farcau, E. Vinteler And S Astilean
Experimental and theoretical investigation of optical properties of colloidal photonic crystal films
Journal Of Optoelectronics and Advanced Materials 10 (12) (2008) 3165 - 3168
11. E. Vinteler, C. Farcau, S. Astilean,
Designing the colour of photonic crystals for sensor applications,
J. Optoelectron. Adv. M., 10 (2008) 2298-2302
12. C. Farcau, V. Canpean, M. Gabor, T. Petrisor Jr., S. Astilean,
Periodically nanostructured noble-metal thin films with enhanced optical properties,
J. Optoelectron. Adv. M., 10 (2008) 809-812.
13. S. Cinta Pinzaru, L. M. Andronie, I. Domsa, O. Cozar, S. Astilean,
Bridging biomolecules with nanoparticles: surface-enhanced Raman scattering from colon carcinoma and normal tissue,
Journal of Raman Spectroscopy, 39(3), p. 331-338, 2008
14. S. Boca, I. Lupan, O. Popescu, S. Astilean,
Colorimetric detection of single- and double stranded DNA on gold nanoparticles
Studia Physica Universitaea Babes-Bolyai LIII, 1, 2008
15. Monica Potara, Dana Maniu, Cosmin Farcau And Simion Astilean,
A rapid, straightforward method for synthesis of bio-compatible gold nanoparticles,
Studia Physica, Studia Physica Universitaea Babes-Bolyai, LIII, 1, 2008
16. D.S.Tira, M.Potara, F. Toderas, S.Ulinici And S.Astilean,
Detection of Zn⁺ ions in water by surface plasmon resonance sensors
Studia Physica, Studia Physica Universitaea Babes-Bolyai LIII, 1, 2008

Abstracts:

Monica Iosin, Patrice Baldeck And, Simion Astilean,

Plasmon-enhanced fluorescence of dye molecules,

Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, doi:10.1016/j.nimb.2008.10.018 (in press 2008).

Enhanced fluorescence from Rhodamine 6G (R6G) mixed with gold colloids has been observed. We used fluorescence microscopy to correlate the fluorescence intensity of the dyes with the localized surface plasmon resonance (LSPR) spectra of the gold nanoparticles to which they are attached. Spectroscopic studies show that a 2.8-fold amplification of the fluorescence signal in presence of colloidal Au nanoparticles (GNP) was observed in resonance with plasmons. Such fluorophore-metal complex presents a unique opportunity for developing a new class of contrast agents for optical imaging and fluorescence based sensing, having a great potential for applications in the fields of medical diagnostics and biotechnology.

V. Canpean, S. Astilean

Interaction of light with metallic nanohole arrays,

Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.054, (in press 2008).

In this work we study the way light interacts with thin gold films perforated with periodic arrays of holes with diameter smaller than the wavelength of the incident light. This structure exhibits sharp peaks in transmission spectra, at wavelengths larger than the array period, with efficiencies of orders of magnitude greater than predicted by standard aperture theory. The effect is highly dependent upon the structural film parameters like hole diameter and film thickness.

F. Toderas, M. Iosin, S. Astilean

Luminescence properties of gold nanorods,

Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, doi:10.1016/j.nimb.2008.10.055 (in press 2008)

In this work we report on the luminescence properties of gold nanorods synthesized by a seed growth method in the presence of cetyltrimethylammonium bromide (CTAB) solutions. We have found that the emission intensity is dependent on the aspect ratio and the degree of dispersivity of the gold nanorods. The observed emission is explained in the term of the enhancement effect of the electric fields via coupling to the surface plasmon resonance in the rods.

Sanda C. Boca, Cosmin Farcau, Simion Astilean

The study of Raman enhancement efficiency as function of nanoparticle size and shape

Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.020 (in press 2008)

This work is focused on studying the dependence of Raman enhancement of p-aminothiophenol molecules adsorbed on self-assembled gold monolayers as function of nanoparticle size and shape. Gold nanoparticles of different sizes (ranging from 18 nm to 100 nm) and shapes (round and ellipsoidal) were synthesized by reduction of tetrachloroauric acid (HAuCl₄) in aqueous medium by varying the ratio between the reducing agent (trisodium citrate) and gold salt, and were immobilized on functionalized glass substrates. The optical properties of the prepared samples were investigated by absorbance measurements taken before and after the adsorption of the molecule. We found that the Raman enhancement of probe molecules measured under 633 nm laser line strongly depends on the sizes of self-assembled gold nanoparticles.

E. Vințeler, C. Farcău, S. Aștilean

Disorder effects in reflectance spectra of colloidal photonic crystals,

Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, doi:10.1016/j.nimb.2008.10.031 (in press 2008)

This work is focused on studying the dependence of Raman enhancement of p-aminothiophenol molecules adsorbed on self-assembled gold monolayers as function of nanoparticle size and shape. Gold nanoparticles of different sizes (ranging from 18 nm to 100 nm) and shapes (round and ellipsoidal) were synthesized by reduction of tetrachloroauric acid (HAuCl₄) in aqueous medium by varying the ratio between the reducing agent (trisodium citrate) and gold salt, and were immobilized on functionalized glass substrates. The optical properties of the prepared samples were investigated by absorbance measurements taken before and after the adsorption of the molecule. We found that the Raman enhancement of probe molecules measured under 633 nm laser line strongly depends on the sizes of self-assembled gold nanoparticles.

A.R. Tomșa, E.J. Popovici, A.I. Cadiș, M. Ștefan, L. Barbu-Tudoran, S. Aștilean,

Ultrasound-assisted synthesis of highly disperse zinc sulphide powders,

Journal Of Optoelectronics and Advanced Materials 10(9), 2008, 2342-2345

Highly disperse zinc sulphide powders have been synthesized using an ultrasound-assisted reaction between zinc acetate and thioacetamide in aqueous solution. The synthesis was performed at 70°C, at different pH values, using variable reagent concentrations. All samples were characterized by infrared absorption spectroscopy (FT-IR), thermal analysis (TGA-SDTA), scanning electron microscopy (SEM) and photoluminescence spectroscopy (PL). A correlation between the preparation conditions and zinc sulphide characteristics was established.

M. Iosin, F. Toderas, P. Baldeck, S. Astilean

In vitro biosynthesis of gold nanotriangles for Surface- Enhanced Raman spectroscopy,

Journal Of Optoelectronics and Advanced Materials 10(9), 2008, 2285 – 2288.

Gold nanoparticles of triangular shape were bio-synthesized by reduction of aqueous chloroaurate ions in pelargonium plant extract. Optical properties and morphology of gold nanotriangles were analyzed by UV-VIS absorption spectroscopy, X-ray diffraction, Electron Diffraction and Transmission Electron Microscopy (TEM). The possibility of using as bio-synthesized gold nanotriangles in surface enhanced Raman scattering (SERS) applications was demonstrated with p-aminothiophenol as probe molecule. The biosynthesis method can be considered safe and ecological for nanomaterials fabrication.

F. Toderas, M. Baia V, Farcau, S. Ulinici, S. Astilean

Tuning of gold nanoparticles plasmon resonances by experiment and simulation

Journal Of Optoelectronics and Advanced Materials 10(12), 2008, 3265 – 3269.

We demonstrate, both experimentally and theoretically, the tunability of surface plasmon resonances of gold nanoparticles as function of their size and shape (spheres, rods). Transmission electron microscopy and UV-VIS absorption were employed for experimental characterization. The discrete dipole approximation (DDA), in which the nanoparticle is discretized into a cubic array of polarizable elements, with each element representing the polarizability of a discrete volume of material, is used for simulation of surface plasmon resonances. From simulated and experimental spectra, it is clearly deduced that changes in size and shape of nanoparticle as well as in their local environment can introduce marked changes in their optical properties. The comparison with experiments shows that classical electromagnetic theory works well, provided that we have size distribution values of particle dimensions and provided that the dielectric environment is properly characterized and modeled.

C. Farcau, E. Vinteler And S Astilean

Experimental and theoretical investigation of optical properties of colloidal photonic crystal films

Journal Of Optoelectronics and Advanced Materials 10 (12) (2008) 3165 - 3168

We studied the experimental and calculated transmission and reflectivity spectra of a monolayer and a bilayer of periodic array of polystyrene spheres (triangular lattice) on finite glass substrate at normal incidence. We also investigated the nearfield intensity $|E_x|^2$ at different relevant wavelengths for a sampling plane that crosses the monolayer of spheres at equator. We find that transmission and reflectivity minima are related to near-field coupling between neighbouring spheres, forming waveguide photonic modes of the array.

E. Vinteler, C. Farcau, S. Astilean,

Designing the colour of photonic crystals for sensor applications,

J. Optoelectron. Adv. M., 10 (2008) 2298-2302

We present experimental and numerical studies of the color observed from polystyrene colloidal photonic crystals made of 1-4-layers of polystyrene spheres. Simulations allow us to explain the origin of the color we observe under the optical microscope. We show that different colors can be associated unambiguously with different number of layers and type of stacking

C. Farcau, V. Canpean, M. Gabor, T. Petrisor Jr., S. Astilean,
Periodically nanostructured noble-metal thin films with enhanced optical properties,
J. Optoelectron. Adv. M., 10 (2008) 809-812.

We present results on fabrication and characterization of a large variety of metallic and metallo-dielectric periodic nanostructures obtained by using a colloidal lithography technique. Their optical properties are dominated by surface plasmons excitation and can be tuned at the desired wavelength. Furthermore we show that the prepared nanostructures can be used to enhance the fluorescence signal of thionine dye molecules placed in their nanoscale vicinity.

S. Cinta Pinzaru, L. M. Andronie, I. Domsa, O. Cozar And S. Astilean,
Bridging biomolecules with nanoparticles: surface-enhanced Raman scattering from colon carcinoma and normal tissue,
Journal of Raman Spectroscopy, 39(3), p. 331-338, 2008

In order to get insight into the chemical heterogeneities of solid tumors, here we report the first surface enhanced Raman scattering (SERS) experiment from normal and altered epithelial layer in human colon carcinoma tissues. The Ag colloidal nanoparticles that can be incorporated into the interstitial space in solid tumors or those penetrating into cytoplasm or nucleus of many cells allowed high quality SERS signal. Different tissue structures of tumor and normal colon have characteristic features in SERS spectra. Prominent SERS features of malignant tissue spectra are related to the strong enhancement of the bands preponderant attributable to the DNA or RNA bases. The preliminar studies demonstrate that is possible to probe Ag colloidal nanoparticles adsorption onto the tissue resulting a strong molecular signaling with high specificity and rapid acquisition time using visible laser line excitation.

S. Boca, I. Lupan, O. Popescu, S. Astilean,
Colorimetric detection of single- and double stranded DNA on gold nanoparticles
Studia Physica Universitatea Babes-Bolyai No 1/2008 (in press)

In this work we report the use of gold nanoparticles (AuNPs) for optical detection of single and double-stranded DNA. The linkage of DNA sequences to gold nanoparticles was demonstrated by the modification of spectral position and intensity of plasmon resonance band and the chemical stabilization that DNA confers to gold particles against a standard aggregation test.

Monica Potara, Dana Maniu, Cosmin Farcau And Simion Astilean,
A rapid, straightforward method for synthesis of bio-compatible gold nanoparticles,
Studia Physica, Studia Physica Universitatea Babes-Bolyai, No 1/2008 (in press)

In this study we present a clean, non toxic, environmentally friendly procedure for both the synthesis of gold nanoparticles and their surface modification for biological applications. We use chitosan, a biocompatible, biodegradable, natural polymer as a reducing and protecting agent, due to its unique structural and physicochemical characteristics. The produced hybrid nanoparticles were characterized by UV-vis absorption spectroscopy and transmission electron microscopy (TEM).

D.S.Tira, M.Potara, F. Toderas, S.Ulinici And S.Astilean,
Detection of Zn⁺ ions in water by surface plasmon resonance sensors
Studia Physica, Studia Physica Universitatea Babes-Bolyai No 1/2008 (in press)

In this work we develop sensitive and specific sensors for Zn²⁺ ions detection, based on local surface plasmon resonance (LSPR) of gold nanoparticles, without using any chelating ligands.

Conferences:

1. Monica Iosin, Felicia Toderas, Patrice Baldeck and Simion Astilean
Study of Protein – Gold Nanoparticle Conjugates by Fluorescence and Surface Enhanced Raman Scattering
XXIX European Congress on Molecular Spectroscopy, 31 August – 5 Septembrie, 2008, Opatija, Croatia.
2. F. Toderas, M. Baia, L. Baia, S. Astilean
Investigation of annealed gold nanoparticles self-assembled on solid surface for surface enhanced Raman spectroscopy
XXIX European Congress on Molecular Spectroscopy, 31 August – 5 Septembrie, 2008, Opatija, Croatia.
3. V. Canpean, S. Astilean
Subwavelength metallic nanohole arrays as multifunctional plasmonic substrates for SPR and SERS sensors
XXIX European Congress on Molecular Spectroscopy, 31 August – 5 Septembrie, 2008, Opatija, Croatia.
4. S. Astilean, M. Baia, D. Maniu, F. Toderas, C. Farcau, M. Iosin, V. Canpean
Multifunctional plasmonic nanostructures for surface enhanced spectroscopies
XXIX European Congress on Molecular Spectroscopy, 31 August – 5 Septembrie, 2008, Opatija, Croatia.
5. C. Farcau, S. Astilean
3-rd Conference on Advanced Spectroscopies on Biomedical and Mapping the Plasmonic Field on Nanostructured Gold Film by Surface Enhanced Raman Scattering
Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania
6. Felicia Toderas, Monica Iosin and Simion Astilean
Gold nanorods as LSPR sensors for biological applications
3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania
7. M Iosin, F. Toderas, S. Astilean, I. Ardelean, C. Craciun
Synthesis, Uptake and Biological Effects of Gold Nanoparticles on Cyanobacteria

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

8. M. Iosin, F. Toderas, P. Baldeck and S. Astilean

Tryptophan-assisted synthesis of gold nanoparticles

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

9. V. Canpean, S. Astilean

Extending nanosphere lithography for the fabrication of periodic arrays of subwavelength metallic nanoholes

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

10 S. Boca, I. Lupan, C. Farcau, O. Popescu and S. Astilean

Colorimetric and SERS Detection of Single and Double-Stranded DNA on Gold Nanoparticles

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

11. M.Potara, D.Maniu, C.Farcau, S.Astilean

Chitosan-Assisted Synthesis and Biofunctionalization of Gold Nanoparticles

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

12. M.Potara, F.Toderas, D.S.Tira, S.Ulinici, S.Astilean

Local Surface Plasmon Resonance (LSPR) Sensors for Detection of Heavy Metal Ions in Water

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

13. T. Iliescu, D. Maniu, V. Chis, C. Paisz, F.D, Irimie

Surface enhanced raman spectroscopy and band assignment by DFT calculations on non-natural amino acids

3-rd Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems, 7-10 Septembrie, 2008, Cluj-Napoca, Romania

14. M. Iosin, P.L. Baldeck and S. Astilean

Plasmon-enhanced fluorescence of dye molecules

Conference on Elementary Processes in Atomic Systems Cluj-Napoca, Romania, June 18-20, Romania

15. V. Canpean, S. Astilean,

Interaction of light with metallic nanohole arrays

Conference on Elementary Processes in Atomic Systems Cluj-Napoca, Romania, June 18-20, Romania

Invited Conferences (S. Astilean):

1. *Plasmonic Nanostructures: from Fabrication to Characterization by Raman and Atomic Force Microscopy*

International Workshop: Combining High Resolution Optical and Scanning Probe Microscopy, 19 November 2008 Bucharest, Romania.

2. *Plasmonic Nanostructures Characterization by Combining Confocal Surface-Enhanced Raman Scattering and Atomic Force Microscopy*

International Workshop: Introduction to Confocal Raman Microscopy 7 - 8 October 2008 Ulm, Germany.

3. *Plasmonics – a new paradigm of photonics for guiding light and enabling novel biomedical applications at nanoscale*

The 2nd European Young Investigator Awardees Symposium “Ind EURYIAS-2008” “Self-organization and Selection in Evolution of Matter, Molecules and Life”, April 29- May 3, 2008 International Centre of Biodynamics, Bucharest, Romania