

## Lista de lucrari

### a) Lista lucrarilor cele mai relevante obtinute ulterior conferirii titlului de doctor in fizica

1. Infrared absorption, Raman, and SERS investigations in conjunction with theoretical simulations on a phenothiazine derivative,

M. Bolboaca, T. Iliescu, W. Kiefer, Chem. Phys., 298, 87-95, 2004.

2. Surface-enhanced Raman scattering and density functional theoretical study of anthranil adsorbed on colloidal silver particles

M. Baia, L. Baia, W. Kiefer, J. Popp, J. Phys. Chem. B, 108(45), 17491-17496, 2004.

3. A Raman spectroscopic study of the diclofenac sodium-beta-cyclodextrin interaction,

T. Iliescu, M. Baia, V. Miclaus, Eur. J. Pharma. Sci, 22, 487-495, 2004.

4. Raman and SERS investigations of potassium benzylpenicillin,

T. Iliescu, M. Baia, I. Pavel, J. Raman Spectrosc., 37, 318-325, 2006.

5. Gold nanostructured films deposited on polystyrene colloidal crystal templates for surface-enhanced Raman spectroscopy,

M. Baia, L. Baia, S. Astilean, Chem Phys. Lett., 404, 3-8, 2005.

6. Surface-enhanced Raman scattering efficiency of truncated tetrahedral Ag nanoparticles arrays mediated by electromagnetic couplings,

M. Baia, L. Baia, J. Popp, S. Astilean, Appl. Phys. Lett. 88, 1431211-1431213, 2006.

7. Gold films deposited over regular arrays of polystyrene nanospheres as highly effective SERS substrates from visible to NIR,

L. Baia, M. Baia, J. Popp, S. Astilean, J. Phys. Chem. B, 110, 23982-23986, 2006.

8. Probing the enhancement mechanisms of SERS with p-aminothiophenol molecules adsorbed on self-assembled gold colloidal nanoparticles,

M. Baia, F. Toderas, L. Baia, J. Popp, S. Astilean, Chem. Phys. Lett. 422, 127-132, 2006.

9. Multilayer Structures of Self-Assembled Gold Nanoparticles as a Unique SERS and SEIRA Substrate,

M. Baia, F. Toderas, L. Baia, D. Maniu, S. Astilean, ChemPhysChem, 10, 1106-1111, 2009.

10. Porous nanoarchitectures based on TiO<sub>2</sub> aerogels and Au particles as potential SERS sensor for monitoring of water quality,

M. Baia, V. Danciu, V. Cosoveanu, L. Baia, Vib. Spectrosc., 48 (2), 206-209, 2008.

Conference: 4rd International Conference on Advanced Vibrational Spectroscopy (ICAVS-4)

Location: Corfu, GREECE Date: JUN 10-15, 2007

### **b) Teza de doctorat**

Vibrational characterisation of coordination and biologically active compounds by means of IR absorption, Raman and surface-enhanced Raman spectroscopy in combination with theoretical simulations

### **c) Carti si capitole de carti**

1. Indrumator de lucrari de optica,

D. Maniu, M. Baia, Universitatea Babes-Bolyai, Cluj-Napoca, 2005.

2. Vibrational characterisation of coordination and biologically active compounds by means of IR absorption, Raman and surface-enhanced Raman spectroscopy in combination with theoretical simulations.

Monica Baia, Presa Universitara Clujeana, ISBN: 978-973-610-546-3, Cluj-Napoca, pp. 136, 2007.

3. Raman and SERS investigations of pharmaceuticals,

M. Baia, S. Astilean, T. Iliescu, Springer-Verlag GmbH, Berlin/Heidelberg, Germany, pp 214, 2008.

4. Microscopul Raman confocal,

Monica Baia, capitol aparut in: Metode Experimentale Avansate pentru studiul si analiza bio-nano-sistemelor, Editori: M. Aluas, S. Simon, Casa Cartii de Stiinta, Cluj-Napoca , 2012, pp. 101-133.

### **d) Articole publicate in reviste cotate ISI**

1. Vibrational behavior of transition metal cupferronato complexes: Raman studies on cobalt(II) cupferronato derivatives,

M. Bolboaca, S. Cinta, M. Venter, A. Deak, I. Haiduc, O. Cozar, T. Iliescu, P. Roesch, W. Kiefer, Spectrosc. Lett., 33(6), 857-865, 2000.

2. The iminophosphorane  $\text{PhP}_3=\text{NSiMe}_3$  as a synthon for M-Caryl s bonds (M = In, Fe, Ge) implementing imino sidearm donation,

S. Wingerter, M. Pfeiffer, T. Stey, M. Bolboaca, W. Kiefer, V. Chandrasekhar, D. Stalke, *Organometallics*, 20, 2730-2735, 2001.

3. Fourier transform Raman and surface-enhanced Raman spectroscopy of some quinoline derivatives,

M. Bolboaca, W. Kiefer, J. Popp, *J. Raman Spectrosc.*, 33, 207-212, 2002.

4. Raman, infrared and surface-enhanced Raman spectroscopy in combination with ab initio and density functional theory calculations on 10-isopropyl-10H-phenothiazine-5-oxide,

M. Bolboaca, T. Iliescu, Cs. Paizs, F. D. Irimie, W. Kiefer, *J. Phys. Chem. A*, 107(11), 1811-1818, 2003.

5. Vibrational spectroscopic investigations and density functional theory calculations of trans-diaqua-bis(piccolinato)zinc(II) dihydrate complex,

P. K. Sinha, M. Bolboaca, S. Schlucker, J. Popp, W. Kiefer, *J. Raman Spectrosc.*, 34, 276-281, 2003.

6. P-N bond length alterations monitored by infrared absorption and FT-Raman spectroscopy in combination with DFT calculations,

M. Bolboaca, T. Stey, A. Murso, D. Stalke, W. Kiefer, *Applied Spectrosc.*, 57(8), 970-976, 2003.

7. Raman spectroscopy, surface-enhanced Raman spectroscopy and density functional theory studies of 2-formylfuran,

T. Iliescu, M. Bolboaca, R. Pacurariu, D. Maniu, W. Kiefer, *J. Raman Spectrosc.* 34, 705-710, 2003.

8. Spectroscopic studies on the structure of vanadium tellurite glasses,

L. Baia, M. Bolboaca, W. Kiefer, E. S. Yousef, C. Ruessel, F. W. Breitbarth, T. G. Mayerhoefer, J. Popp, *Phys. Chem. Glasses*, 45(3), 178-182, (2004).

9. FT-Raman, surface-enhanced Raman spectroscopy and theoretical investigations of diclofenac sodium,

T. Iliescu, M. Baia, W. Kiefer, *Chemical Physics*, 298, 167-174, 2004.

10. Raman, IR and surface-enhanced Raman spectroscopy of papaverine. An automatized setup for in situ synthesise of the silver substrate and recording of the SER spectra,

N. Leopold, J. R. Baena, M. Bolboaca, O. Cozar, W. Kiefer, B. Lendl, *Vib. Spectrosc.*, 36, 47-55, 2004.

11. Raman and surface-enhanced Raman study of thiamine at different pH values

N Leopold, S Cinta-Pinzaru, M. Baia, E. Antonescu, O. Cozar, W. Kiefer, J. Popp, *Vib. Spectrosc.*, 39, 169-176, 2005.

12. Structural and morphological properties of silver nanoparticles-phosphate glass composites, L. Baia, M. Baia, W. Kiefer, J. Popp, S. Simon, *Chem. Phys.* 327, 63-69, 2006.

13. Structural properties of silver nanoclusters-phosphate glass composites, L. Baia, D. Muresan, M. Baia, J. Popp, S. Simon, *Vib. Spectrosc.*, 43, 313-318, 2007.

14. Controlling Gold Nanoparticle Assemblies for Efficient Surface Enhanced Raman Scattering (SERS) and Localized Surface Plasmon Resonance (LSPR) Sensor, F. Toderas, M. Baia, L. Baia, S. Astilean, *Nanotechnology*, 18(25), 255702, 2007.

15. Photocatalytic and structural properties of mixed titania and zirconia aerogels, V. Danciu, L. Baia, V. Cosoveanu, M. Baia, F. Vasiliu, L. Diamandescu, C.M. Teodorescu, M. Feder, J. Popp, *Optoelectronics and Advanced Materials, Rapid Communications*, 2 (2), 76-80, 2008.

16. Synthesis, structural characterization, and photocatalytic properties of iron-doped TiO<sub>2</sub> aerogels, M. Popa, L. Diamandescu, F. Vasiliu, C.M. Teodorescu, V. Cosoveanu, M. Baia, M. Feder, L. Baia, V. Danciu, *J. Mater. Sci.* 44 (2), 358-364, 2009.

17. Photo-catalysts based on gold - Titania composites, A. Peter, M. Baia, F. Toderas, M. Lazar, L. B. Tudoran, V. Danciu, *Studia Universitatis Babes-Bolyai Chemia*, 3, 161-171, 2009.

18. Efficient dual functionality of highly porous nanocomposites based on TiO<sub>2</sub> and noble metal particles, L. Baia, L. Diamandescu, L. Barbu-Tudoran, A. Peter, G. Melinte, V. Danciu, M. Baia, *Journal of Alloys and Compounds*, 509 (6), 2672-2678, (2011).

19. Vibrational spectroscopic studies of germanium-high bismuthate glasses and vitroceramics, O. Ponta, L. Baia, M. Baia, S. Simon, *Zeitschrift fur Physikalische Chemie*, 225 (6-7), 647-659, (2011).

20. Photocatalytic activity of highly porous TiO<sub>2</sub>-Ag materials, D. Georgescu, Z. Pap, M. Baia, I. C. Fort, V. Danciu, G. Melinte, L. Baia, S. Simon, *Studia Universitatis Babes-Bolyai Chemia*, 3, 51-58, (2011).

21. Morpho-structural characterization of TiO<sub>2</sub> nanosized powders with photocatalytic potential,

M. Baia, M. Scarisoreanu, I. Morjan, I. P. Morjan, L. Baia, V. Cosoveanu, R. Alexandrescu, V. Danciu, *Studia Universitatis Babes-Bolyai Chemia*, 3, 5-13, (2011).

22. Chitosan-coated anisotropic silver nanoparticles as a SERS substrate for single-molecule detection,

M. Potara, M. Baia, C. Farcau, S. Astilean, *Nanotechnology*, 23 (5), Article number 055501, (2012).

23. Experimental assessment of the phonon confinement in TiO<sub>2</sub> anatase nanocrystallites by Raman spectroscopy,

D. Georgescu, L. Baia, O. Ersen, M. Baia, S. Simon, *J. Raman Spectrosc.* doi: 10.1002/jrs.3103, (2012).

#### **e) Publicatii in extenso aparute in lucrari ale unor conferinte internationale**

1. Vibrational spectroscopic investigations of 5-(4-fluor-phenyl)-furan-2 carbaldehyde,

T. Iliescu, F. D. Irimie, M. Bolboaca, Cs. Paisz, W. Kiefer, *Vib. Spectrosc.*, 29, 235-239, 2002.

Conference: 1st International Conference on Advanced Vibrational Spectroscopy Location: TURKU, FINLAND Date: AUG 19-24, 2001

2. Raman study of B<sub>2</sub>O<sub>3</sub>-SrO-CuO glasses,

D. Maniu, T. Iliescu, I. Ardelean, R. Ciceo-Lucacel, M. Bolboaca, W. Kiefer, *Vib. Spectrosc.*, 29, 241-244, 2002.

Conference: 1st International Conference on Advanced Vibrational Spectroscopy Location: TURKU, FINLAND Date: AUG 19-24, 2001

3. Surface enhanced Raman spectroscopy of 5-(4-fluor-phenyl)-furan-2 carbaldehyde adsorbed on silver colloid,

T. Iliescu, F. D. Irimie, M. Bolboaca, Cs. Paisz, W. Kiefer, *Vib. Spectrosc.*, 29, 251-255, 2002.

Conference: 1st International Conference on Advanced Vibrational Spectroscopy Location: TURKU, FINLAND Date: AUG 19-24, 2001

4. Synthesis and nanostructural characterization of TiO<sub>2</sub> aerogels for photovoltaic devices,

L. Baia, A. Peter, V. Cosoveanu, E. Indrea, M. Baia, J. Popp, V. Danciu, *Thin Solid Films*, 511-512, 512-516, 2006.

Conference: Symposium on Thin Film and Nanostructured Materials for Photovoltaics held at the 2005 EMRS Meeting Location: Strasbourg, FRANCE Date: MAY 31-JUN 03, 2005

5. Iron doped and undoped TiO<sub>2</sub> catalysts for advanced water treatment,  
V. Danciu, M. Popa, Z. Pap, L. Baia, M. Baia, V. Cosoveanu, F. Vasiliu, L. Diamandescu, M. Feder, R. Alexandrescu, e-Proceeding of the 1<sup>st</sup> International Conference Environmental Applications of Advanced Oxidation Processes (EAAOP-1), Chania, Grecia, 2006, P041-49.
6. Tunable Surface-Enhanced Raman Scattering (SERS) from Noble Metal Films Deposited on Polystyrene Colloidal Crystal and Nanoparticle Arrays Fabricated by Nanosphere Litography,  
S. Astilean, M. Baia, L. Baia, C. Farcau, D. Maniu, Meeting Digest of the EOS Topical Meeting on Molecular Plasmonic Devices, Engelberg, Elvetia 2006, pp. 74-76.
7. Self-assembled multilayers of gold nanoparticles as versatile platforms for molecular sensing by Fourier transform-surface enhanced scattering (FT-SERS) and surface enhanced infrared absorption (SEIRA),  
F. Toderas, S. Boca, M. Baia, L. Baia, D. Maniu, S. Astilean, S. Simon, J. Opto. Adv. Mater., 9(3), 625-628, 2007.  
Conference: International Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems Location: Cluj Napoca, ROMANIA Date: SEP 03-06, 2006
8. Evaluating the thermal treatment parameters effect on the anatase nano crystallites size of titania aerogels,  
L. Baia, M. Baia, A. Peter, V. Cosoveanu, V. Danciu, J. Opto. Adv. Mater., 9(3), 668-671, 2007  
Conference: International Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems Location: Cluj Napoca, ROMANIA Date: SEP 03-06, 2006
9. Density functional theory investigation of p-aminothiophenol molecules adsorbed on gold nanoparticles,  
D. Maniu, V. Chis, M. Baia, F. Toderas, S. Astilean, J. Opto. Adv. Mater. 9, 733-736, 2007.  
Conference: International Conference on Advanced Spectroscopies on Biomedical and Nanostructured Systems Location: Cluj Napoca, ROMANIA Date: SEP 03-06, 2006
10. Structural properties of some transition metal highly doped carbon aerogels,  
L.C. Cotet, M. Baia, L. Baia, I.C. Popescu, V. Cosoveanu, E. Indrea, J. Popp, V. Danciu, J. Alloys & Comp. 434-435, 854-857, 2007.  
Conference: 12th International Symposium on Metastable and Nano-Materials (ISMANAM-2005) Location: Paris, FRANCE Date: JUL 03-07, 2005
11. Probing the Interaction of Bovine Serum Albumin (BSA) and Gold Nanoparticle,

F. Toderas, M. Iosin, M. Baia, S. Astilean, Progress in Nanoscience and Nanotechnologies, din Series in Micro and Nanoengineering, Ed. Academiei Romane, editori Irina Kleps, Alina Catrinel Ion Si Dan Dascalu, Bucuresti 2007, ISBN 978-973-27-1576-5, pp. 215-221.

12. Synthesis, morpho-structural and photocatalytic properties of TiO<sub>2</sub> aerogel–Au colloidal particle composites

A. Peter, L. Baia, F. Vasiliu, L. Diamandescu, M. Baia, V. Cosoveanu, I. C. Popescu, M. Feder, V. Danciu, Proceedings of the 5th Conference New Research Trends in Material Science ARM-5, Sibiu, Romania, 2007, pp. 799-803.

13. Multiwalled carbon nanotubes in carbon aerogel highly doped with iron,

M. Baia, L. C. Cotet, L. Baia, L. Barbu-Tudoran, V. Cosoveanu, V. Danciu, J. Popp, JOAM-Symposia, Proceedings of The International Conference Advanced Spectroscopies On Biomedical And Nanostructured Systems, September 7-10, p 9-12, 2008, Cluj-Napoca, Romania

14. Type I collagen-TiO<sub>2</sub> aerogel based biocomposites,

L. Baia, M. Baia, V. Danciu, M.G. Albu, V. Cosoveanu, D. Iordachescu, V. Trandafir, J. Opto. Adv. Mater. 10 (4),933-936, 2008.

Conference: 5th International Conference on New Research Trends in Materials Science  
Location: Sibiu, ROMANIA Date: SEP, 2007

15. Tuning the plasmon resonances of gold nanoparticles by controlling their size and shape,

F. Toderas, M. Baia, D. Maniu, S. Astilean, J. Opto. Adv. Mater. 10, 2282-2284, 2008.

Conference: 5th Conference on Isotopic and Molecular Processes Location: Cluj Napoca,  
ROMANIA Date: SEP 20-22, 2007

16. Zirconia Aerogel - Polyxometalate Composites Synthesis with Applications in Solid Oxide/Acid Fuel Cells,

A. Nicoara, V. Cosoveanu, I. Ladiu, L. Baia, M. Baia, L. Muresan, I. Stamatina, V. Danciu, CLEAN TECHNOLOGY 2008: BIO ENERGY, RENEWABLES, GREEN BUILDING, SMART GRID, STORAGE, AND WATER, 298-301, 2008.

Conference: Clean Technology and Sustainable Industries Conference and Trade Show Location: Boston, MA Date: JUN 01-05, 2008

17. Photocatalytic Activity Assessment of Some Transition Metal Doped Titania Aerogels via Morpho-Structural Analysis,

M. Popa, L. Baia, C. Ghica, M. Baia, E. Indrea, V. Danciu, CLEAN TECHNOLOGY 2008: BIO ENERGY, RENEWABLES, GREEN BUILDING, SMART GRID, STORAGE, AND WATER, 388-391, 2008

Conference: Clean Technology and Sustainable Industries Conference and Trade Show Location: Boston, MA Date: JUN 01-05, 2008

18. TiO<sub>2</sub>-Ag Porous Nanocomposites for Advanced Photocatalytic Processes,

L. Baia, M. Baia, F. Vasiliu, L. Diamandescu, A. Peter, V. Cosoveanu, V. Danciu, CLEAN TECHNOLOGY 2008: BIO ENERGY, RENEWABLES, GREEN BUILDING, SMART GRID, STORAGE, AND WATER, 683-686, 2008

Conference: Clean Technology and Sustainable Industries Conference and Trade Show Location: Boston, MA Date: JUN 01-05, 2008

19. Highly porous nanocomposites based on TiO<sub>2</sub>-noble metal particles for sensitive detection of water pollutants by SERS,

M. Baia, G. Melinte, L. Barbu-Tudoran, L. Diamandescu, V. Iancu, V. Cosoveanu, V. Danciu, L. Baia, Journal of Physics: Conference Series 304 (2011) 012059 doi:10.1088/1742-6596/304/1/012059.

Conference: Nanosafe2010: International Conference on Safe Production and Use of Nanomaterials

19. The Influence of the Au Nanoparticles Dimension on the Photocatalytic Performances of TiO<sub>2</sub>-Au Porous Composites,

G. Melinte, M. Baia, D. Georgescu, L. Baia, V. Iancu, L. Diamandescu, T. Popescu, L. C. Cotet, L. Barbu-Tudoran, V. Danciu, S. Simon, S., ACTA PHYSICA POLONICA A 121(1), 208-210, 2012,

Conference: 1st International Congress on Advances in Applied Physics and Materials Science (APMAS) Location: Antalya, TURKEY Date: MAY 12-15, 2011

#### **f) Alte lucrari publicate necotate ISI**

1. Raman and SERS studies on cobalt(II) cupferronato complexes,

M. Bolboaca, S. Cinta-Pinzaru, O. Cozar, T. Iliescu, P. Rösch, W. Kiefer, Studia UBB Cluj-Napoca, Physica, XLVI, 1, 67-77, 2001.

2. Vibrational study of thiamine,



- N. Leopold, S. Cinta-Pinzaru, M. Bolboaca, O. Cozar, W. Kiefer, J. Popp, *Studia UBB Cluj-Napoca, Physica*, XLVI, 1, 79-87, 2001.
3. Adsorption on silver surface of 5-(3-nitro-4-methyl-phenyl)-furan-2-carbaldehyde,  
T. Iliescu, F. D. Irimie, M. Bolboaca, Cs. Paizs, W. Kiefer, *Studia UBB Cluj-Napoca, Physica*, Special issue, XLVI, 197-203, 2001.
4. Structure and vibrational frequencies of 5-(4-brom-phenyl)-furan-2-carbaldehyde. Density functional theory studies,  
T. Iliescu, F. D. Irimie, M. Bolboaca, Cs. Paizs, I. Bratu, R. Pacurariu, W. Kiefer, *Studia UBB Cluj-Napoca, Physica*, XLVII, 2, 19-25, 2002.
5. Surface-enhanced Raman spectroscopy of 5-(4-brom-phenyl)-furan-2-carbaldehyde on silver sol,  
T. Iliescu, F. D. Irimie, M. Bolboaca, Cs. Paizs, I. Bratu, R. Pacurariu, W. Kiefer, *Studia UBB Cluj-Napoca, Physica*, XLVII, 2, 13-18, 2002.
6. Optical and structural investigations of ordered metallic nanostructures for SERS experiments, M. Bolboaca, L. Baia, I. Chicinas, T. Iliescu, S. Astilean, *Studia UBB, Physics, Special Issue*, XLVIII 2, 357-359, 2003.
7. Surface-enhanced Raman spectroscopy and theoretical investigations of diclofenac sodium,  
T. Iliescu, M. Bolboaca, S. Aștilean, D. Maniu, W. Kiefer, *Studia UBB, Physics, Special Issue* XLVIII 2, 357-359, 2003.
7. Ordered metallic nanostructures for surface-enhanced Raman spectroscopy,  
S. Astilean, M. Bolboaca, D. Maniu, T. Iliescu, *Romanian Reports in Physics*, 56(3), 346-351, 2004.
8. IR absorption, FT-Raman and SERS investigations together with DFT calculations on a furan-2-carbaldehyde derivative,  
T. Iliescu, F. D. Irimie, M. Baia, Cs. Paizs, I. Bratu, *Asian Chem. Lett*, 7(4), 213-220, 2003.
9. pH dependence of the free and adsorbed papaverine molecular species. Vibrational approach,  
N. Leopold, S. Cinta-Pinzaru, M. Baia, C. Lehene, O. Cozar, W. Kiefer, *Studia UBB Cluj-Napoca, Physica*, XLIX, 1, 9-19, 2004.
10. Raman characterization of carbon nanostructures obtained by CCVD method,  
M. Baia, C. Popa, T. Iliescu, D. Lupu, A. R. Biris, A. Weidenkaff, C. Diecker, W. Kiefer, *Studia UBB Cluj-Napoca, Physica*, XLIX 3, 245-250, 2004.

11. Self-assembled gold nanoparticles on solid substrate,  
F. Toderas, A. M. Mihut, M. Baia, S. Simon, S. Astilean, Studia UBB Cluj-Napoca, Physica, XLIX 3, 89-94, 2004.
12. Infrared absorption, Raman and SERS investigations of 2,1-benzisoxazole,  
M. Baia, L. Baia, Studia UBB Physica L 2, 113-122. 2005.
13. Synthesis and morpho-structural investigations of titania-collagen aerogels based biocomposites,  
L. Baia, V. Trandafir, V. Danciu, M. Baia, V. Cosoveanu, J. Popp, Asian J. Phys., **15**(2), 201-207, 2006.
14. Surface-enhanced and Raman spectroscopy of carbon nanotubes obtained by CCVD method,  
M. Baia, D. Lupu, A. R. Biris, Asian J. Phys., 15(2), 215-220, 2006.
15. Raman and surface enhanced Raman spectroscopy on molecules of pharmaceutical and biological interest,  
T. Iliescu, M. Baia, D. Maniu, Rom. Rep. Phys., 60 (3), 829-855, 2008.
16. Synthesis and morpho-structural analysis of TiO<sub>2</sub>-Au composites  
V. Iancu, G. Melinte, L. Baia, L. Barbu-Tudoran, C. Cotet, V. Danciu, V. Cosoveanu, M. Baia, Studia Universitatis Babes-Bolyai, Physica, LVI, 2, (2010), 69-78.
17. Annealing induced textural particularities on TiO<sub>2</sub>-Au nanocomposites,  
G. Melinte, M. Baia, V. Danciu, L. Baia, Studia Universitatis Babes-Bolyai, Physica LVI, 2, 2011.