

Salem Marhaba

Associate Professor of Nano-Sciences

Salem Marhaba received his Ph.D. degree in Physics from University of Lyon I in 2008. After that, He was employed as a Non-Permanent Assistant Professor at the University of Pierre and Marie Curie (Paris VI) in 2009 and at the University of Littoral Cote d'Opale in 2010. He was an Assistant Professor in the Department of Physics at Beirut Arab University from February 2011 to July 2015. Currently, he is Associate Professor in the Department of Physics at Beirut Arab University since August 2015. He has already published more than fifteen publications in scientific reviews, as well as, he has presented some of his works in the international conferences. He has provided practical and theoretical work to make the connection between theory and experiments, which is fundamental in physics. Moreover, this allowed him not only to help students in difficulty but also to answer questions from curious students. He feels it is his responsibility to improve the knowledge of students and then encourage them to work up to their potential. In addition to classroom instructor, he has advised students on appropriate research topics. Throughout his career, he has acquired an important knowledge in the domain of nanotechnology. He has a solid experience in the far-field optical techniques. Also he has a good experience in the transmission electron microscopy (TEM) for characterization of nanoparticles. In addition to his responsibilities as a coordinator of Physics Department at Beirut Arab University, he continues his research on the optical response of metallic nanoparticles and the properties of superconductor materials.

Teaching

Teaching Experience

Before joining BAU, Dr Salem Marhaba taught Waves & Vibrations, Geometric Optics and Mechanics at University of Pierre and Marie Curie (Paris VI) and University of Littoral Cote d'Opale. At BAU, he taught Principles of Physics I, Principles of Physics II, Elementary Physics, Thermal Physics, Physical Optics, Matter & Energy, Modern Physics, Classical Mechanics, Electromagnetism, Circuit Analysis, Electronics, Quantum Physics I, Quantum Physics II, Nuclear Physics I, Solid State Physics I, Solid State Physics II, Advanced Atomic Physics, Molecular Physics, Nanoparticles, Physics & Technology of Thin Films, Materials Science (Master), and Advanced Experimental Techniques in Physics (Master)..

Fall 2016-17 Courses

- Introduction to Physics (PHYS120)
- Physics for Life Science (PHYS231)
- Principles of Physics (PHYS241)
- Quantum Mechanics II (PHYS443)
- Electronics (PHYS452)

Spring 2016-17 Courses

- Physical Optics (PHYS244)

- Senior Projects (PHYS444)
- Introduction to Physics (PHYS120)
- Solid State Physics (PHYS442)
- Statistical Physics (PHYS446)

Fall 2015-16 Courses

- Principles of Physics (PHYS241)
- Classical Mechanics and Waves (PHYS341)
- Quantum Physics I (PHYS303)
- Research Topics (PHYS401)
- Solid State Physics I (PHYS405)
- Advanced Atomic Physics (PHYS407)

Spring 2015-16 Courses

- Physical Optics (PHYS244)
- Quantum Physics I (PHYS342)
- Quantum Physics II (PHYS304)
- Statistical Physics (PHYS301)
- Solid State Physics II (PHYS406)
- Senior Research in Physics (PHYS499)

Research

Research Interests

My research interests are in the area of optical properties of nanostructures, from a single nanoparticle to ensembles. In particular, the metallic nanoparticles (noble metal, especially Au) display potential for such applications as enhancing the fluorescence of biological molecules. The optical properties of noble metal nanoparticles are dominated by their surface plasmon resonance (SPR), which is known to closely depend on the size, shape and dielectric environment of the particle, and also on their chemical composition in the case of composite systems. In order to study the electronic and optical response of a single nanoparticle (or an isolated composite system, as a pair of particles) I used a high sensitive spectroscopic technique in far field: Spatial Modulation Spectroscopy (SMS). The SMS technique enables the absolute extinction cross-section of the nano-system to be determined on condition that the light spot profile in the focal region is known. We can deduce from the measured optical response the quantitative information on their size, shape and environment. For more information about these nanoparticles, I used the direct observation of the nanoparticles by Transmission Electron Microscopy (TEM). The coupling of SMS technique with TEM turns out to be essential to get an unambiguous description of their optical response in relation with their exact morphology. In addition, I'm interested in studying the linear optical response of 2D gold nanoparticle arrays using the spectrophotometer technique. During the last three years, my research has been mainly focused on studying the physical properties of superconductor materials by adding varieties of nanoparticles. Several types of techniques are required to obtain results as X-Ray powder Diffraction (XRD), Energy Dispersive X-ray emission (EDX), Proton Induced X-ray Emission (PIXE), Rutherford Backscattering Spectrometry (RBS) and Scanning Electron Microscopy (SEM).

Publications

- « Thermoelectric power of (Cu_{0.5}Ti_{0.5})₁₋₂₂₃ superconducting phase added with BaSnO₃ nanoparticles » A Srour, W Malaeb, S Marhaba, R Awad Journal of Physics: Conference Series 869 012017 (2017)
- « Electrical and mechanical properties of (Bi,Pb)-2223 substituted by holmium » W. Abdeen, S. Marhaba, R. Awad, A. I. Abou Aly, I. H. Ibrahim, M. Matar Journal of Advanced Ceramics 5 54 (2016)
- « Structural, Optical and Room Temperature Magnetic Study of Mn-Doped ZnO Nanoparticles » M. Sharrouf, R. Awad, S. Marhaba, D.E. Bakeer Nano 11 1650042 (2016)
- « Study of the Irreversibility Line of GdBa₂Cu₃O_{7-δ} Added with Nanosized Ferrite CoFe₂O₄ » H. Basma, R. Awad, M. Roumie, S. Isber, S. Marhaba, A. I. Abou Aly Journal of Superconductivity and Novel Magnetism 29 179 (2016)
- « Ion Beam Analysis and Electric Properties of GdBa₂Cu₃O_{7-δ} Added with Nanosized Ferrites ZnFe₂O₄ and CoFe₂O₄ » Hadi Basma, Mohamad Roumié, Ramadan Awad, Salem Marhaba, Mohamad Albast, Ali Abualy Materials Sciences and Applications 6 828 (2015)
- « Structural, Optical and Room Temperature Magnetic Study of Mn₂O₃ Nanoparticles » Majed Sharrouf, Ramadan Awad, Mohamad Roumié, Salem Marhaba Materials Sciences and Applications 6 850 (2015)
- « Gold Nanoparticle Arrays Spectroscopy: Observation Of Electrostatic And Radiative Dipole Interactions » S. Marhaba Nano 10 1550007 (2015)
- « Investigation of Temperature Dependence of the Irreversibility Line of GdBa₂Cu₃O_{7-δ} Added with Nanosized Ferrite ZnFe₂O₄ » R. Awad, M. Roumié, S. Isber, S. Marhaba, A. I. AbouAly, H. Basma Journal of Superconductivity and Novel Magnetism 28 535 (2015)
- « Improvement of superconducting parameters of Bi_{1.8}Pb_{0.4}Sr₂Ca₂Cu₃O_{10+δ} added with nano-Ag » R. Mawassi, S. Marhaba, M. Roumié, R. Awad, M. Kork and I. Hassan Journal of Superconductivity and Novel Magnetism 27 1131 (2014)
- « Effect of Fe₂O₃ Nano-Oxide Addition on the Superconducting Properties of the (Bi,Pb)-2223 Phase» M. Roumié, S. Marhaba, R. Awad, M. Kork, I. Hassan, R. Mawassi Journal of Superconductivity and Novel Magnetism 27 143 (2014)
- « Absolute optical extinction measurements of single nano-objects by Spatial Modulation Spectroscopy using a white lamp» P. Billaud, S. Marhaba, N. Grillet, E. Cottancin, C. Bonnet, J. Lermé, N. Del Fatti, F. Vallée, J. L. Vialle, M. Broyer, and M. Pellarin Review of Scientific Instruments 81 043101 (2010)
- « Quantitative size dependence of the surface plasmon resonance damping in single Ag@SiO₂ nanoparticles » H. Baida, P. Billaud, S. Marhaba, D. Christofilos, E. Cottancin, A. Crut, J. Lermé, P. Maioli, M. Pellarin, M. Broyer, N. Del Fatti and F. Vallée; A. Sánchez-Iglesias, I. Pastoriza-Santos and L.M. Liz-Marzán Nano-Letters 9 3463–3469 (2009)
- « Surface plasmon resonance of single gold nanoparticle pairs near the conductive contact limit » S. Marhaba, G. Bachelier, C. Bonnet, M. Broyer, E. Cottancin, N. Grillet, J. Lermé, J. L. Vialle, and M. Pellarin Journal of Physical Chemistry C 113 4349-4356 (2009)
- « Optical response of metal or dielectric nano-objects in strongly convergent light beams » J. Lermé, C. Bonnet, M. Broyer, E. Cottancin, S. Marhaba, and M. Pellarin Physical Review B 77 245406 (2008)
- « Optical response of a single spherical particle in a tightly focused light beam: application to the spatial modulation spectroscopy technique » J. Lermé, G. Bachelier, P. Billaud, C. Bonnet, M. Broyer, E. Cottancin, S. Marhaba, and M. Pellarin Journal of the Optical Society of America A 25 493-514 (2008)
- « Correlation between the extinction spectrum of a single metal nanoparticle and its electron microscopy image » P. Billaud, S. Marhaba, E. Cottancin, L. Arnaud, G.

Bachelier, C. Bonnet, N. Del Fatti, J. Lermé, F. Vallée, J. L. Vialle, M. Broyer, and M. Pellarin *Journal of Physical Chemistry C* 112 978-982 (2008)

- « Organization of size-selected platinum and indium clusters soft-landed on surfaces » R. Alayan, L. Arnaud, M. Broyer, E. Cottancin, J. Lermé, S. Marhaba, J. L. Vialle, and M. Pellarin *Physical Review B* 76 075424 (2007)

Books

- « Linear optical properties of single metallic nanoparticles » Salem Marhaba European University Publishing Germany (2010)

Conferences

- « Localized surface plasmon resonance of dimer copper nanoparticles » S. Marhaba, A. El Chakik LAAS 21 – Université Saint-Joseph de Beyrouth - Beirut - Lebanon (2015)
- « Study of the irreversibility line of GdBa₂Cu₃O_{7- δ} added with nanosized Ferrites ZnFe₂O₄ and CoFe₂O₄ » H. Basma, S. Marhaba, M. Roumié, S. Isber, R. Awad LAAS 21 – Université Saint-Joseph de Beyrouth - Beirut - Lebanon (2015)
- « Optical response of copper nanoparticle using Mie theory and coupled dipole approximation » S. Marhaba, LAAS 20 – Lebanese University - Beirut - Lebanon (2014)
- « Effect of size and shape of single silver nanoparticles on the optical response » S. Marhaba, H. Miari, S. Abboudy, LAAS 19 - Lebanese American University - Beirut - Lebanon (2013)
- « Optical properties of core/shell Ag-Au nanoparticle » S. Marhaba, I. Haddad, S. Abboudy, LAAS 19 - Lebanese American University - Beirut - Lebanon (2013)
- « Optical Properties of Core-Shell Bimetallic Au-Ag Nanoparticles » S. Abboudy, S. Marhaba, R. Yassine, LAAS 18 – Notre Dame University - Beirut - Lebanon (2012)
- « Optical properties of core/shell Ag-Au nanoparticle » S. Abboudy, I. Haddad, S. Marhaba CSM8-ISM5 - Beirut - Lebanon (2012)
- « Linear Optical Response of 2D Arrays of Gold Nanoparticles » S. Marhaba, S. Abboudy EMCME 1 - Marrakech - Morocco (2011)

Activities

Conferences

- « Plasmonic coupling of gold and platinum nanoparticles over a broad spectral range » S. Marhaba LAAS 22 – Holy Spirit University - Kaslik - Lebanon (2016)
- « Optical properties of core/shell Ag-Au nanoparticle » S. Abboudy, I. Haddad, S. Marhaba CSM8-ISM5 Beirut - Lebanon (2012)
- «Single metal nanoparticles in interaction: effect of coupling on the Surface Plasmon Resonance» N. Grillet, S. Marhaba, C. Bonnet, F. Bertorelle, M. Broyer, E. Cottancin, J. Lermé, J.L. Vialle and M. Pellarin GDR OR NANO - Dijon - France (2009)
- « Optical extinction studies on single supported metallic nanoparticles related to their transmission electron microscopy images » S. Marhaba, N. Grillet, C. Bonnet, G. Bachelier, F. Bertorelle, M. Broyer, E. Cottancin, J. Lermé, J.L. Vialle and M. Pellarin ISSPIC XIV - Valladolid - Spain (2008)

- « Small size-selected clusters deposited on a surface: model systems for electron-phonon interactions » C. Bonnet, M. Broyer, E. Cottancin, N. del Fatti, P. Langot, J. Lermé, S. Marhaba, M. Pellarin, J.L. Vialle, and F. Vallée TRANSALP'NANO - Lyon - France (2008)
- « Optical and structural properties of bimetallic clusters » E. Cottancin, C. Bonnet, M. Broyer, J. Lermé, S. Marhaba, J.L. Vialle and M. Pellarin GDR Nano-Alliages – Oléron - France (2008)
- « Correlation between the extinction spectrum of a single metal nanoparticle and its electron microscopy image » S. Marhaba, C. Bonnet, M. Broyer, J. Lermé, E. Cottancin, J.L. Vialle and M. Pellarin GDR OR NANO - Lyon1 - France (2007)
- « Collective excitations in gold nanoparticles » J. Lermé, P. Billaud, Christophe Bonnet, M. Broyer, E. Cottancin, S. Marhaba et M. Pellarin GDR OR NANO - Paris - France (2006)
- « Localized surface plasmon resonance of dimer copper nanoparticles » S. Marhaba, A. El Chakik LAAS 21 – Université Saint-Joseph de Beyrouth - Beirut - Lebanon (2015)
- « Study of the irreversibility line of GdBa₂Cu₃O_{7-δ} added with nanosized Ferrites ZnFe₂O₄ and CoFe₂O₄ » H. Basma, S. Marhaba, M. Roumié, S. Isber, R. Awad LAAS 21 – Université Saint-Joseph de Beyrouth - Beirut - Lebanon (2015)
- « Optical response of copper nanoparticle using Mie theory and coupled dipole approximation » S. Marhaba, LAAS 20 – Lebanese University - Beirut - Lebanon (2014)
- « Effect of size and shape of single silver nanoparticles on the optical response » S. Marhaba, H. Miari, S. Abboudy, LAAS 19 - Lebanese American University - Beirut - Lebanon (2013)
- « Optical properties of core/shell Ag-Au nanoparticle » S. Marhaba, I. Haddad, S. Abboudy, LAAS 19 - Lebanese American University - Beirut - Lebanon (2013)
- « Optical Properties of Core-Shell Bimetallic Au-Ag Nanoparticles » S. Abboudy, S. Marhaba, R. Yassine, LAAS 18 – Notre Dame University - Beirut - Lebanon (2012)
- « Linear Optical Response of 2D Arrays of Gold Nanoparticles » S. Marhaba, S. Abboudy EMCMRE 1 - Marrakech - Morocco (2011)
- « Correlating the optical extinction of single nanoparticles or pairs of particles with their geometrical structure » S. Marhaba, N. Grillet, C. Bonnet, F. Bertorelle, M. Broyer, E. Cottancin, J. Lermé, J.L. Vialle and M. Pellarin Plasmonics Summer School - Porquerolles - France (2009)
- « Characterization of a single noble metal nanoparticle by comparing its electron microscopy image and extinction cross-section spectrum » S. Marhaba, E. Cottancin, C. Bonnet, J. Lermé, J.L. Vialle, M. Broyer et M. Pellarin GDR European Nanolum - Les Houches - France (2008)
- « Surface deposition of small nanoparticles size-selected in the gas phase: synthesis, morphology and experiments » C. Bonnet, M. Broyer, E. Cottancin, N. Grillet, J. Lermé, M. Pellarin, S. Marhaba, and J.L. Vialle ISSPIC XIV - Valladolid - Spain (2008)
- « Gold clusters preformed in gas phase: size selection and deposit on surfaces » R. Alayan, P. Billaud, C. Bonnet, A. Bourgey, M. Broyer, C. Clavier, E. Cottancin, J. Lermé, S. Marhaba, J.L. Vialle, and M. Pellarin GDR OR NANO - Paris - France (2006)
- « Nanoscale vision of a single noble metal nanoparticles » P. Billaud, S. Marhaba, J-R. Huntzinger E. Cottancin, J. Lermé, M. Pellarin, M. Broyer, N. Del Fatti, O. Muskens, and F. Vallée JMC 10 - Toulouse - France (2006)

Workshops

- Teaching Methodologies - Beirut (2011)
- Communication Skills – Beirut (2011)
- Classroom Management – Beirut (2012)
- Key Performance Indicators – Beirut (2015)
- Scientific Research – Beirut (2016)
- Critical Thinking – Beirut (2017)
- Introduction to COMSOL Multiphysics – Beirut (2017)

Others

- Articles written in Lebanese magazines: Al Bayan, Al Tamaddon, Al Jajr El Jadid.
- Member of the American Physical Society, European Optical Society, Optical Society of America.