

Pr. BOUCHENE Mohamed Aziz

Date of birth : October 24 1966

Married, 3 children

Professional address :

IRSAMC- LCAR

118 route de Narbonne

31062 Toulouse Cedex – France

E-mail : aziz@irsamc.ups-tlse.fr

Phone: 00 33 (0) 561 556 002.

Fax: 00 33 (0) 561 558 317

Academic and Research Career

- 1984** **Baccalaureate (Mathematics)**, Algiers.
- 1988** **D.E.S** in Physics (**Master 1, Bac + 4 years**), USTHB university (Algiers).
Speciality : Electrodynamics.
- 1988/1989** **D.E.A « Lasers et Matière » (Master 2, Bac + 5 years)**. Paris XI University.
- 1989/1992** **Phd Thesis** in « Aimé Cotton » laboratory (Paris XI university). Title:
“**Optical dipoles in strong stochastic fields**”.
- 1992** **Assistant professor (second class)**, Paul Sabatier University, Toulouse.
- 1996** **Assistant professor (first class)**, Paul Sabatier University, Toulouse.
- 2000** **Diploma : « Habilitation à Diriger les Recherches »**, Paul Sabatier
University, Toulouse, France (Title : « **Dynamics and interference of wave
packets in alkalis dimers and atoms** »).
- 2004** **Professor (second class)**, Paul Sabatier University, Toulouse.
- 2012** **Professor (first class)** Paul Sabatier University, Toulouse.

Teaching Activities

Summary of teaching activities (L stands for Licence the three first year of university):

- 1989/1992** Temporary teaching assistant (Paris XI): Laboratory classes (Waves, Atomic
Physics, L2 level), tutorial (Mechanics, L1 level).

Since 1992 Teaching in Paul Sabatier University (192 hours per year)

Lectures :

- 2011/... : - **Quantum Electrodynamics** (level : Master 2)
- 2003/2010 : **Quantum Optics** (level : Master 2)

- 2011/... **Contemporary physics:** recent developments in quantum mechanics and relativistic quantum theory (level: Master 1)
- Since 2004 : **Radiation-Matter Interaction,** (level : Master 1)
- 1996/2003: **Laser Physics and Non linear Optics** (level: Master 1)

Tutorial :

- Level L1 and L2: Mechanics, Electrostatic and Magnetostatic, Thermodynamics, Optics, Electromagnetism, Electrokinetics, Special Relativity.
- Level L3: Quantum Mechanics, Fourier Optics, Waves, Analytical mechanics
- Level Master 1: Quantum mechanics, Atomic Physics, Nuclear Physics, Waves and Vibrations .

Laboratory classes :

- Level L1 and L2: Electricity, Electronics.
- Level L3: Thermodynamics.
- Level Master 1: Spectrometry.

Teaching administration :

- Since 2004 : In charge of the Master 2 research degree ‘‘Physique de la mati re’’ Paul Sabatier University (web site: <http://master2pm.univ-tlse3.fr/>)

Research Activities

I am a specialist of the interaction between the light and the matter. Moreover, I am particularly interested in laser-atom and laser-molecule interaction, exploring transient and propagation effects in such systems. My special feature is that I am both an experimentalist and theoretician. I have published 60 papers: 48 in International Refereed Articles, 10 in Refereed Conference Proceedings and 2 Refereed Book’s Chapters.

Activities:

- **1989/1992:** PhD student in “Aimé Cotton” laboratory (Paris XI University).
- **1992/2006:** Member of the experimental “Femtogroup” in Toulouse (CAR laboratory).
- **Since 2006:** Member of the Theory group of the C.A.R lab., Toulouse, developing the theme “Atom-Laser Interaction and Quantum Optics”.

Main domains of expertise :

- Light-matter interaction. Quantum optics. Non-Linear Optics. Laser Physics. Quantum information. Quantum Electrodynamics. Atomic physics Molecular physics

Main research interests:

- Coherent control of atomic and molecular processes. Slow and fast light. Resonant propagation effects. Coherent transients in atoms and molecules. Wave packet Dynamics. Femtochemistry. Coherent femtosecond excitation of matter. Spin polarization processes. Atoms and Clusters irradiated by strong fields. Topological phases in optics. Photon in a cavity. Ion-trap physics. Transient effects in quantum optics....

Technical expertise :

- Femtosecond laser technology. Molecular beam technology. Non-Linear Optics techniques.

Selected publications

- ***Theoretical:***

1. F. A. Hashmi and M. A. Bouchene, "Coherent control of the effective susceptibility through wave mixing in a duplicated two-level system", *Phys. Rev. Letters* **101**, 213601 (2008).
2. F. A. Hashmi and M. A. Bouchene, "Slowing light through Zeeman Coherence Oscillations in a duplicated two-level system", *Phys. Rev. A* **77** 051803 (R) (2008).

- ***Experimental :***

3. J. C. Delagnes and M. A. Bouchene, “Coherent control of light-shifts in an atomic system: Modulation of the medium gain”, *Phys. Rev. Letters* **98**, 053602 (2007).
4. M. Wollenhaupt, A. Assion, D. Liese, Ch. Sarpe-Tudoran, T. Baumert, S. Zamith, M. A. Bouchene, B. Girard, A. Flettner, U. Weichmann, G. Gerber, “Interferences of ultrafast free electron wave-packets”, *Phys. Rev. Letters* **89**, 173001 (2002).
5. S. Zamith, J. Degert, S. Stock, B. de Beauvoir, V. Blanchet, M. A. Bouchene, B. Girard “Observation of coherent transients in ultrashort chirped excitation of an undamped two-level system”, *Phys. Rev. Letters* **87**, 033001 (2001)
6. V. Blanchet, C. Nicole, M. A. Bouchene and B. Girard, “Temporal coherent control in two-photon transitions: from optical interferences to quantum interferences”, *Phys. Rev. Letters* **78**, 2716 (1997).

Awards

The prize « Cino del Duca » of the science academy was awarded to the « Femtosecond Spectroscopy and Coherent Control » team in 2005. I was one of the founder members in 1992.

Publications

International Refereed Articles

- [A1] - M. A. Bouchene, A. Débarre, J.C Keller , J.L. Le Gouët, P. Tchénio, “ Observation of 0π pulse formation with incoherent light”, *Journal of Optical Society of America B* **9**, 281 (1992).
- [A2] - M. A. Bouchene, A. Débarre, J.C Keller , J.L. Le Gouët, P. Tchénio, V. Finkelstein, P. R. Berman. “Dark resonance and optical coherent transients”, *Europhysics Letters* **18**, 409 (1992).

- [A3] - M. A. Bouchene, A. Débarre, J.C Keller , J.L. Le Gouët, P. Tchénio, V. Finkelstein, P. R. Berman, “ Interaction of three-level atoms with stochastic fields”, *Journal de Physique II* **2**, 621 (1992).
- [A4] - V. Blanchet, M. A. Bouchene, O. Cabrol and B. Girard, “One color coherent control in Cs2 : observation of 2.7 fs beats in the ionization signal”, *Chem. Phys. Letters* **233**, 491 (1995).
- [A5] - V. Blanchet, C. Nicole, M. A. Bouchene and B. Girard, “Temporal coherent control in two-photon transitions: from optical interferences to quantum interferences”, *Physical Review Letters* **78**, 2716 (1997).
- [A6] - V. Blanchet, M. A. Bouchene and B. Girard, “Temporal coherent control in Cs2 : Theory and Experiment”, *Journal of Chemical Physics* **108**, 4862 (1998).
- [A7] - M. A. Bouchene, V. Blanchet, C. Nicole, N. Melikechi, B. Girard, H. Ruppe, S. Rutz, E. Schreiber and L. Wöste, “Temporal coherent control from wave packet interferences in one- and two-photon atomic transitions”, *European Physical Journal D* **2**, 131 (1998).
- [A8] - C. Nicole, M. A. Bouchene, S. Zamith, N. Melikechi and B. Girard, “Saturation of wave-packet interferences: Direct observation of spin precession in potassium atoms”, *Physical Review A* **60**, R1755 (1999).
- [A9] - C. Nicole, M. A. Bouchene, C. Meier, S. Magnier, E. Schreiber and B. Girard, "Competition of different ionization pathways in K_2 studied by ultrafast pump-probe spectroscopy : A comparison between theory and experiment", *Journal of Chemical Physics* **111**, 7857 (1999)
- [A10] - M. A. Bouchene, C. Nicole and B. Girard, “Wave packet interferometry with chirped pulses”, *Journal of Physics B* **32**, 5167 (1999).
- [A11] - E. Sokell, S. Zamith, M. A. Bouchene and B. Girard, “Polarization-dependent pump-probe studies in atomic fine-structure levels: towards the production of spin-polarized electrons", *Journal of Physics B* **33**, 2005 (2000).
- [A12] - M. A Bouchene, C. Nicole and B. Girard, “Interplay between wave packet interferometry and second harmonic generation”,*Optics Communications* **181**, 327 (2000).
- [A13] - S. Zamith, M. A. Bouchene, E. Sokell, C. Nicole, V. Blanchet and B. Girard, “ Pump probe experiment in atomic fine structure levels : observation of the oscillation of an angular wave packet”, *European Physical Journal D* **12**, 255 (2000)

- [A14] - M. A. Bouchene, S. Zamith, B. Girard "Spin polarised electrons produced by a sequence of two femtosecond pulses. Calculation of differential and global polarization rates", *Journal of Physics B* **34**, 1497 (2001).
- [A15] - S. Zamith, J. Degert, S. Stock, B. de Beauvoir, V. Blanchet, M. A. Bouchene, B. Girard "Observation of coherent transients in ultrashort chirped excitation of an undamped two-level system", *Physical Review Letters* **87**, 033001 (2001)
- [A16] - C. Nicole, M. A. Bouchene, B. Girard "Dynamics and interference of fine structure wave packets created by strong ultrashort pulses", *Journal of Modern Optics* **49**, 183-200 (2002)
- [A17] - M. Wollenhaupt, A. Assion, D. Liese, Ch. Sarpe-Tudoran, T. Baumert, S. Zamith, M. A. Bouchene, B. Girard, A. Flettner, U. Weichmann, G. Gerber, "Interferences of ultrafast free electron wave-packets", *Physical Review Letters* **89**, 173001 (2002)
- [A18] - J.C. Delagnes and M. A. Bouchene, "Compensation of electron wave packet spreading with linearly chirped pulses; theoretical analysis", *Journal of Physics B* **35**, 1819 (2002)
- [A19] - M. A. Bouchene, "Phase control of dispersion effects for an ultrashort pulse-train propagating in a resonant medium", *Physical Review A* **66**, 065801 (2002)
- [A20] - M. A. Bouchene, "Dynamique et interférences de paquets d'ondes dans alcalins", *Annales de Physique* **27**, n° 6 (2002)
- [A21] - F. Megi, M. Belkacem, M. A. Bouchene, E. Suraud, G. Zwicknagel, "On the importance of damping phenomena in clusters irradiated by intense laser fields" *Journal of Physics B* **36**, 273 (2003)
- [A22] - M. A. Bouchene, "Radial focalisation of electron wave packets using linearly chirped intense pulses", *Physical Review A* **68**, 023401 (2003)
- [A23] - M. Jacquy, S. Bonhommeau and M. A. Bouchene, "Experimental demonstration of phase control of dispersion effects for an ultrashort pulse-train propagating in a resonant medium", *Optics Letters* **28**, 1272 (2003)
- [A24] - J.C. Delagnes, V. Blanchet and M. A. Bouchene, "Role of the radiated field in the propagation of an ultra-short chirped pulse", *Optics Communications* **227**, 125 (2003)
- [A25] - J.C. Delagnes and M. A. Bouchene, "Effect of a transient light-shift on the propagation of an ultrashort pulse in an atomic resonant medium", *Physical Review A* **69**, 063813 (2004)

- [A26]- M. Belkacem, M. A. Bouchene , P. G. Reinhard, E. Suraud, “ Photodynamics of nanoclusters “, *Encyc. of Nanoscience and Nanotechnology* **8**, 575 (2004)
- [A27]- J. C. Delagnes, F. A. Hashmi and M. A. Bouchene, "Spectral and temporal modifications of a weak resonant ultrashort pulse propagating in a two-level system driven by a strong nonresonant field", *Physical Review A* **74**, 053822 (2006)
- [A28]- J.C. Delagnes, A. Montmayrant, P. Zahariev, B. Chatel, B. Girard and M. A. Bouchene, “Compensation of resonant atomic dispersion using a pulse-shaper”, *Applied Physics B* **86**, 573 (2007)
- [A29]- J. C. Delagnes and M. A. Bouchene, “Coherent control of light-shifts in an atomic system: Modulation of the medium gain”, *Physical Review Letters* **98**, 053602 (2007)
- [A30]- J. C. Delagnes and M. A. Bouchene, “Gain-dispersion coupling induced by transient light shifts in an atomic medium”, *Physical Review A* **76**, 023422 (2007)
- [A31]- F. A. Hashmi and M. A. Bouchene, "Phase Control of Medium Gain in a Double Two-level System: From Ultrashort to Long Pulse Regime", *Applied Mathematics & information sciences* **1**, 305 (2007)
- [A32] J. C Delagnes and M. A. Bouchene “Coherent control of light shifts in an atomic medium driven by two orthogonally polarized pulses: Effect of the pulse overlap”, *Physical Review A* **76**, 053809 (2007)
- [A33] J. C. Delagnes and M. A. Bouchene “Influence of wave-packet dynamics on the medium gain of an atomic system”, *Physical Review A* **76**, 045805 (2007)
- [A34] F. A. Hashmi and M. A. Bouchene, "Slowing light through Zeeman Coherence Oscillations in a duplicated two-level system", *Physical Review A* **77** 051803 (R) (2008)
- [A35] J.C. Delagnes and M. A. Bouchene, “ Beyond the pulse-area theorem: Role of the absorption and the dispersion in the propagation of weak ultrashort resonant pulses “, *Optics Communications* **281**, 5824 (2008)
- [A36] F. A. Hashmi and M. A. Bouchene, "Coherent control of the effective susceptibility through wave mixing in a duplicated two-level system", *Physical Review Letters*, **101**, 213601 (2008)
- [A37] F. A. Hashmi and M. A. Bouchene, "Phase control of non-adiabatic optical transitions", *Physical Review A* **79**, 025401 (2009)
- [A38] M. A. Bouchene and M. Abdel-Aty, “Phase control of the Pancharatnam phase” *Physical Review A* **79**, 055402 (2009)

- [A39] F. A. Hashmi, M. Abdel-Aty and M. A. Bouchene, "Slowing and storing light processes without a trapping dark state in a duplicated two-level system. Theoretical study" *Journal of Modern Optics* **56**, 1260 (2009)
- [A40] T. Crouzil, M.A. Bouchene, "Propagation of short and long pulses in a fast light medium. Interplay between gain and dispersion ", *Phys. Rev. A* **80**, 055802 (2009)
- [A41] M. S. Abdalla, M. A. Bouchene, M. Abdel-Aty, T. Yu, and A.-S. F. Obada "Dynamics of an atom coupled through a parametric frequency converter with quantum and classical fields", *Optics communication*, **283** 2820 (2010).
- [A42] M. Abdel-Aty, S. Mandal, M. A. Bouchene, "Sensitivity of the population dynamics and the Pancharatnam phase for a single trapped three-level ion" *Physical Review A* **82**, 023409 (2010)
- [A43] F. A. Hashmi and M. A. Bouchene "Non-adiabatic optical transitions as a 'turn-on' switch for pulse Shaping » *Physical Review A* **82**, 043432 (2010)
- [A44] M. A. Bouchene, M. Abdel-Aty, "Magnetic Flux sensitivity of the Population and the Pancharatnam Phase for a Single Cooper-Pair Box", *International Journal of Quantum Information* **9** 883 (2011)
- [A45] J. Gillot and M. A. Bouchene" Complete Population Transfer Induced by Transient Non Adiabatic Effects in a Strongly Detuned Micromaser" *Journal of the Optical Society of America B* **28** 1324 (2011).
- [A46] M.A. Bouchene, J-C Delagnes "Phase control of the temporal envelope of an ultrashort pulse propagating in a strongly driven atomic medium" *J. At. Mol. Sci.* **2** 377 (2011)
- [A47] M.A. Bouchene "Comment on "Realization of a bipolar atomic Šolc filter in the cavity-QED microlaser" **84**, 037801 (2011)
- [A48] S. Derouault, M.A. Bouchene "One-photon wavepacket interacting with a two-level atom in a waveguide: Constraint on the pulse shape" *Physical Letters A* **376**, 3491 (2012)

Phd Supervision

Main experimental thesis:

- [1]- *O. CABROL* (92 /96) : « Spectroscopy and dynamics of diatomic molecules ».

- [2]- V. *BLANCHET* (93/96) : "Femtosecond spectroscopy and coherent control in Cesium atom and dimer".
- [3]- C. *NICOLE* (95/98) : "Wave packet dynamics and temporal coherent control in alkali atoms and molecules"
- [4]- S. *ZAMITH* (98/2001): "Femtosecond dynamics in atoms and molecules".
- [5]- J. C. *DELAGNES* (2002/2005) : «Control of the propagation of ultrashort pulses. Light shifts effects »

Main theoretical thesis:

- [6]- F. A. *HASHMI* (2005/2009) « Propagation effects in atomic systems in the long and short pulse regime : control of the optical response»
- [7]- S. *DEROUAULT* (2011/...) "Interaction of quantized multimode pulses with atomic systems. Transient effects and application to quantum information"