

CURRICULUM VITAE

Roberta Zambrini



- **RESEARCH AREA**

My research in Optics and Photonics has been marked by the stimulating participation to the European projects “Quantum Structures” and “Quantum Imaging”, focusing on spatial or multimode quantum phenomena in optics. During my Master Thesis with Prof. L. Lugiato and my PhD studies with Prof. M. San Miguel I had the opportunity to study complex phenomena, instabilities and pattern formation in nonlinear optics, both in its classical and quantum aspects. I have acquired skills on statistical physics, master equations formalism, quasi-probability description of quantum mechanics and numerical simulation of stochastic partial differential equations. From 2003 to 2006 I have joined the project “Multi-dimensional quantum entanglement and high density information transfer” with the Computational Nonlinear and Quantum Optics group in Glasgow, top level in UK. My specific research in this project was on the orbital angular momentum of light, an exciting subject that is attracting the interest of several groups for its potential in quantum information and communications and in micro-manipulation. Examples of specific topics in which I have been working recently with Prof. S.M. Barnett are the mechanical effects of light in classical electromagnetism and angular uncertainties in quantum optics. In 2005 I have been awarded of a Ramon y Cajal fellowship for a 5 years post-doctoral position. In 2006 I have joined the Cross-Disciplinary Physics Department of the Instituto Mediterraneo de Estudios Avanzados (IMEDEA) a prestigious mixed center of the University of the Balearic Islands (UIB) and of the Spanish Council for Scientific Research (CSIC).

- **PERSONAL DATA**

Place of birth: Milan, Italy.

Date of birth: 19th June, 1973.

Nationality: Italian.

Place of work: Instituto Mediterraneo de Estudios Avanzados (IMEDEA) CSIC-UIB, Campus Universitat Illes Balears, E-07122 Palma de Mallorca, SPAIN.

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- **EDUCATION AND FELLOWSHIPS**

Master degree in Physics (8 February 1999) Università degli Studi di Milano, Italy.

Final qualification: 110 cum laude.

Master Thesis: *Kerr optical systems: study of noise in spatial structures.*

Supervisor: Prof. Luigi A. Lugiato.

PhD degree in Physics (8 April 2003) Universitat de les Illes Balears, Palma de Mallorca, Spain.

Final qualification: Excelent cum laude.

PhD Thesis: *Quantum fluctuations in nonlinear optical systems.*

Supervisor: Prof. Maxi San Miguel.

Fellowships (1993-)

1993-94 ISU scholarship; Università degli Studi di Milano, Italy.

1998 Erasmus scholarship; University of Balearic Islands, Spain.

1999 Fellowship of the European Commission through the TMR network QSTRUCT (FMRX-CT-96-0077); University of Balearic Islands, Spain.

2000-03 FPU PhD fellowship in Physics; University of Balearic Islands, Spain.

2003-06 Postdoctoral EPSRC fellowship; Department of Physics, University of Strathclyde, UK.

2006-11 Ramon y Cajal fellowship; IMEDEA, Spain.

- **RESEARCH EXPERIENCE**

Coordinated research project :

- *Quantum light in microdevices*, Govern Balear (2007-08).

Participation in research projects :

- European project *QSTRUCT* (Quantum Structures), FMRX-CT96-0077 (1996-2001), Coordinators: Prof. Stephen M Barnett and Prof. Gian-Luca Oppo
<http://cnqo.phys.strath.ac.uk/gianluca/QSTRUCT/>
- European project *QUANTIM* (Quantum Imaging), IST-2000-26019 (2001-04), Coordinator: Prof. Claude Fabre
<http://quantim.dipscfm.uninsubria.it/>
- *Ultra-high data density free-space optical communication*, Scottish Enterprise, Proof of concept (2003-05), Coordinator: Prof. Miles J. Padgett.
- *Multi-dimensional quantum entanglement and high density information transfer*, EPSRC (2003-06), Coordinator: Prof. Stephen M. Barnett.
- *Sistemas Complejos entre la Física y la Biología*, FIS2006-09966 (2007), Coordinator: Dr. M. Matias.

Teaching experience: Supervision of the (4th year Honours project: *A paradox for optical angular momentum*, Laura C. Thomson (BSc). Supervisors: S. M. Barnett and R. Zambrini (2003-2004).

Computer experience: User knowledge of UNIX and WINDOWS systems.

Programming language: Fortran.

Referee for: Physical Review Letter, Physical Review A, Optics Express, Optics Letters, European Physical Journal D, Optics Communications, Journal of the Optical Society of America B, Journal of Modern Optics, Journal of Physics A.

Spoken languages: Italian, Spanish, English, French, Catalan.

- **PUBLICATIONS**

Publications in refereed journals

1. *Quantum fluctuations in a continuous vectorial Kerr medium model*,
Roberta Zambrini, Miguel Hoyuelos, Alessandra Gatti, Pere Colet, Luigi Lugiato,
Maxi San Miguel,
Phys. Rev. A **62**, 63801 (2000).
2. *Macroscopic quantum fluctuations in noise-sustained optical patterns*,
Roberta Zambrini, Stephen M. Barnett, Pere Colet Maxi San Miguel,
Phys. Rev. A **65**, 023813 (2002).
3. *Analytic stochastic treatment of a nonlinear quantum model with negative diffusion*,
Roberta Zambrini, Stephen M. Barnett,
Phys. Rev. A **65**, 053810 (2002).
4. *Quantum properties of transverse pattern formation in second-harmonic generation*,
Morten Bache, Pierre Scotto, Roberta Zambrini, Maxi San Miguel Mark Saffman,
Phys. Rev. A **66**, 013809 (2002).
5. *Twin beams, non linearity and walk-off in Optical Parametric Oscillators*,
Roberta Zambrini, Maxi San Miguel,
Phys. Rev. A **66**, 023807 (2002).
6. *Non-classical behavior in multimode and disordered transverse structures in OPO. Use of the Q representation*,
Roberta Zambrini, Stephen M. Barnett, Pere Colet, Maxi San Miguel,
Eur. Phys. J. D **22**, 461 (2003).
7. *Multiphoton multimode polarization entanglement in parametric down-conversion*,
Alessandra Gatti, Roberta Zambrini, Maxi San Miguel, Luigi Lugiato,
Phys. Rev. A **68**, 053807 (2003).
8. *Polarization quantum properties in a type-II optical parametric oscillator below threshold*,
Roberta Zambrini, Alessandra Gatti, Luigi Lugiato, Maxi San Miguel,
Phys. Rev. A **68**, 063809 (2003).
9. *Photonic band-gap inhibition of modulational instabilities*,
Damià Gomila, Roberta Zambrini, Gian-Luca Oppo,
Phys. Rev. Lett. **92**, 253904 (2004).

10. *Local transfer of angular momentum to matter*,
Roberta Zambrini, Stephen M. Barnett,
J. Mod. Opt., 52, 1045 (2005).
11. *Momentum paradox in a vortex core*,
Roberta Zambrini, Laura C. Thomson, Stephen M. Barnett, Miles Padgett,
J. Mod. Opt., 52, 1135 (2005).
12. *Minimum uncertainties states of angular momentum and angular position*,
David Pegg, Stephen M. Barnett, Roberta Zambrini, Sonja Franke-Arnold, Miles Padgett,
New J. Phys. 7, 62 (2005).
13. *Resolution in rotation measurements*,
Stephen M. Barnett and Roberta Zambrini,
J. Mod. Opt. 53, 613 (2006) (Special Issue on "Quantum Imaging").
14. *Convective instability induced by nonlocality in nonlinear diffusive systems*,
Francesco Papoff and Roberta Zambrini,
Phys. Rev. Lett. 94, 243903 (2005) (see also nlin.PS/0503064).
15. *Convection-induced nonlinear symmetry breaking in Wave Mixing*,
Roberta Zambrini, Maxi San Miguel, Céline Durniak, Majid Taki,
Phys. Rev. E 72, 025603(R) (2005) (see also nlin.PS/0503063).
16. *Large-uncertainty intelligent states for angular momentum and angle*
Jörg B Götze, Roberta Zambrini, Sonja Franke-Arnold and Stephen M Barnett,
J. Opt. B: Quantum Semiclass. Opt. 7, S563 (2005); Special issue "Squeezed states: after Einstein".
17. *Angular momentum of optical vortex arrays*
Johannes Courtial, Roberta Zambrini, Mark R Dennis, Mikhail Vasnetsov,
Opt. Expr. 14, 938 (2006).
18. *Convective instability induced by two-points nonlocality*,
Roberta Zambrini and Francesco Papoff,
Phys. Rev. E 73, 016611 (2006).
19. *Quasi-intrinsic angular momentum and the measurement of its spectrum*,
Roberta Zambrini and Stephen M. Barnett,
Phys. Rev. Lett. 96, 113901 (2006). Also in April 2006 issue of Virtual Journal of Quantum Information.
20. *Angular minimum uncertainty states with large uncertainties*,
Jörg B. Götze, Paul M. Radmore, Roberta Zambrini and Stephen M. Barnett,
Journal of Physics B: Atomic, Molecular and Optical Physics, 39, 2791 (2006).
21. *Quantum Formulation of Fractional Orbital Angular Momentum*,
Jörg B. Götze, Sonja Franke-Arnold, Roberta Zambrini and Stephen M. Barnett,
to be published Journal of Modern Optics

22. *Signals amplification and control in optical cavities with off-axis feedback*,
Roberta Zambrini and Francesco Papoff,
submitted.

Refereed conference papers

1. "Quantum fluctuations in a continuous vectorial Kerr cavity model"
Zambrini, R.; Hoyuelos, M.; Gatti, A.; Colet, P.; Lugiato, L.; San Miguel, M.
International Quantum Electronics Conference, 2000, p 1.
2. "Quantum correlations in noise-sustained optical patterns"
Barnett, S.; Zambrini, R.; Izus, G.; San Miguel, M.; Colet, P.
International Quantum Electronics Conference, 2000, p 1.
3. "Macroscopic polarization entanglement in type II OPO"
Zambrini, R. ; Gatti, A.; Lugiato, L.; San Miguel, M.
European Quantum Electronics Conference. EQEC, 2003, p 332
4. "Multi-photon, multi-mode polarization entanglement in parametric down-conversion"
Gatti, A.; Zambrini, R.; San Miguel, M.; Lugiato, L.A.
European Quantum Electronics Conference. EQEC 2003, p 333
5. "Optical patterns sustained by quantum noise"
Roberta Zambrini, Stephen M. Barnett, Pere Colet, Maxi San Miguel,
Coherence and Quantum Optics VIII (Ed. Bigelow et al., Kluwer Academic/Plenum
Publishers) 2003, p. 525.
6. "Inhibition of pattern formation and novel localized structures using intracavity pho-
tonic crystals"
Gomila, D.; Zambrini, R.; Oppo, G.-L.
International Quantum Electronics Conference (IQEC), 2004, p 1.
7. " Convective instability and nonlocality in diffraction-free nonlinear systems"
R. Zambrini and F. Papoff
CLEO/Europe-EQEC Conference,2005
8. "Optical angular momentum in periodic arrays"
R. Zambrini, M. Vasnetsov, M. Dennis, J. Courtial
CLEO/Europe-EQEC Conference,2005
9. "Minimum uncertainty states of angular momentum and angular position"
R. Zambrini, D. T. Pegg, S. M. Barnett, S. Franke-Arnold, M. Padgett
CLEO/Europe-EQEC Conference,2005
10. "Convection induced nonlinear phase modulations in optical systems"
R. Zambrini, M. San Miguel, C. Durniak, M. Taki
CLEO/Europe-EQEC Conference,2005
11. "Local transfer of optical angular momentum to matter"
R. Zambrini, S.M. Barnett
CLEO/Europe-EQEC Conference,2005

12. "Convective instability induced by two-point nonlocality"
R. Zambrini¹ and F. Papoff
EOS annual meeting, 2006
13. "Resolution in rotation measurements"
S. M. Barnett and R. Zambrini
EOS annual meeting, 2006

Book chapters

- Chapter *Orbital angular momentum of light*, Stephen M. Barnett and Roberta Zambrini, in "Quantum imaging" edited by Mikhail I. Kolobov, Springer (2006).

• **CONFERENCE COMMUNICATIONS**

- **QSTRUCT 1998 Meeting** (european TMR, Training and Mobility of Researchers, network to investigate quantum features of self-organized systems and trapped ions). Kinlochard (Aberfoyle), Scotland, United Kingdom, September 18-21, 1998.
Talk presented by M. Hoyuelos: "*Classical and quantum correlations in patterns of a Kerr medium*", M. Hoyuelos, P. Colet, M. San Miguel, D. Walgraef, A. Sinatra, R. Zambrini, A. Gatti and L. Lugiato.
- **QSTRUCT 1999 Meeting**. Innsbruck, Austria, January 15-17, 1999.
Talk presented by M. Hoyuelos: "*Quantum correlations in Kerr media*", M. Hoyuelos, A. Sinatra, R. Zambrini, A. Gatti, L. Lugiato, P. Colet, and M. San Miguel.
- **Quantum Optics X**. Cala Viñas, Mallorca, Spain, October 2-7, 1999.
Poster presented by R. Zambrini: "*Quantum correlations in vectorial patterns in a Kerr cavity*", R. Zambrini, M. Hoyuelos, A. Gatti, L. Lugiato, P. Colet, M. San Miguel, A. Sinatra.
- **8th International Workshop on Instabilities and Nonequilibrium Structures**. Viña del Mar, Chile, December 13-17, 1999.
Poster presented by M. Hoyuelos: "*Fluctuation correlations in patterns of a Kerr medium*", M. Hoyuelos, P. Colet, A. Sinatra, R. Zambrini, M. San Miguel y L. Lugiato.
- **QSTRUCT 2000 Meeting** (european TMR). Les Houches, France, March 15-19, 2000.
Talks presented by R. Zambrini: "*Quantum fluctuations in a continuous vectorial Kerr cavity model*", R. Zambrini, M. Hoyuelos, A. Gatti, L. Lugiato, P. Colet, M. San Miguel; "*Quantum treatment of OPO's in convective regime*", S. Barnett, R. Zambrini, G. Izús, M. San Miguel, P. Colet.
- **7th Central European Workshop in Quantum Optics**. Balatonfüred, Hungary, April 28-May 1, 2000.
Poster presented by R. Zambrini: "*Quantum correlations in vectorial patterns in a Kerr cavity*", R. Zambrini, M. Hoyuelos, A. Gatti, L. Lugiato, P. Colet, M. San Miguel, A. Sinatra.

- **CLEO/Europe-IQEC 2000**. Nice Acropolis, Nice, France, September 10-15, 2000.
Talk of P. Colet: “*Quantum fluctuations in a continuous vectorial Kerr cavity model*”, R. Zambrini, M. Hoyuelos, A. Gatti, L. Lugiato, P. Colet, M. San Miguel.
Talk of R. Zambrini: “*Quantum correlations in noise-sustained optical patterns*”, S. Barnett, R. Zambrini, G. Izús, M. San Miguel, P. Colet.
- **Quantum Optics XI**. Cala Viñas, Mallorca, Spain, October 14-19, 2000.
Poster presented by R. Zambrini: “*Quantum correlations in noise-sustained optical patterns*”, S. Barnett, R. Zambrini, G. Izús, M. San Miguel, P. Colet.
- **QSTRUCT 2000 Young-researchers Meeting** (european TMR). Garching, Germany, November 23-25, 2000.
Talk presented by R. Zambrini: “*Quantum fluctuations in optical patterns: an introduction*”.
- **QSTRUCT 2000 Meeting** (european TMR). Munich, Germany, November 26-29, 2000.
Talk presented by R. Zambrini: “*Optical patterns sustained by quantum noise*”, S. Barnett, R. Zambrini, M. San Miguel, P. Colet.
- **International Workshop Coherent Evolution in Noisy Environment**. Dresden Germany, May 21-25, 2001.
Poster presented by R. Zambrini: “*Patterns sustained by quantum noise*”, R. Zambrini, S. Barnett, M. San Miguel, P. Colet.
- **QUANTIM 2001 Meeting**. Paris, France, May 14-16, 2001
Talks presented by R. Zambrini: “*Patterns sustained by quantum noise*”, R. Zambrini, S. Barnett, M. San Miguel, P. Colet.
“*Quantum fluctuations in SHG*”, M. Bache, R. Zambrini, P. Scotto, M. San Miguel.
- **Eighth Rochester Conference on Coherence and Quantum Optics (CQO8)**. Rochester, New York (USA), June, 13-16 2001
Poster presented by R. Zambrini: “*Optical patterns sustained by quantum noise*”, R. Zambrini, S. Barnett, M. San Miguel, P. Colet.
- **Workshop on dynamics of Lasers and OPO’s** (PICS Franco-Catalan). Les Houches, France, September 24-28, 2001
Talk presented by R. Zambrini: “*Patterns sustained by quantum noise in OPO’s*”, R. Zambrini, S. Barnett, M. San Miguel, P. Colet.
- **QUANTIM 2002 Meeting**. Besançon, France, May 29-31, 2002
Talk presented by R. Zambrini: “*Polarization entanglement in type II opo below threshold*”, R. Zambrini, M. San Miguel, A. Gatti, L. Lugiato
- **The Sixth International Conference on Quantum Communication, Measurement and Computing (QCMC’02)**. Cambridge, Massachusetts USA, 22-26 July, 2002.
Poster presented by A. Gatti: “*Macroscopic Polarization Entanglement in Spontaneous Parametric Downconversion*”, A. Gatti, R. Zambrini, M. San Miguel, and L. A. Lugiato

- **Workshop on Dynamics of Nonlinear Optical Systems (PICS Franco-Catalan).** Playa de Aro (Gerona), Spain, September 2-6, 2002.
Talk presented by R. Zambrini: *“Polarization entanglement in type II OPO below threshold”*, R. Zambrini, M. San Miguel, A. Gatti, L. Lugiato.
- **EuroConference on Quantum Atom Optics.** San Feliu de Guixols, Spain, 21-26 September, 2002.
Poster presented by R. Zambrini: *“Macroscopic polarization entanglement in OPO”*, R. Zambrini, M. San Miguel, A. Gatti, L. Lugiato.
- **QUANTIM 2003 Meeting.** Varenna, Italy, 5-8 March, 2003.
Talk presented by R. Zambrini: *“Nonclassical polarization properties of macroscopic light beams in type-II OPO”*, R. Zambrini, M. San Miguel, A. Gatti, L. Lugiato.
- **CLEO/Europe-EQEC 2003.** Munich, Germany, 23-27 June, 2003.
Talk presented by R. Zambrini: *“Macroscopic polarization entanglement in type II OPO”*, R. Zambrini, M. San Miguel, A. Gatti, L. Lugiato.
Talk presented by A. Gatti: *“Multi-photon, multi-mode polarization entanglement in parametric down-conversion”*, A. Gatti, R. Zambrini, M. San Miguel, L. Lugiato.
- **FISES Fisica Estadística 2003.** Pamplona, 23-25 octubre 2003.
Poster presented by P. Colet: *“Quantum correlations in spatially disordered structures”* R. Zambrini, S. M. Barnett, P. Colet, M. San Miguel.
- **QUANTIM 2004 Meeting.** Glasgow, UK, 4-7 April 2004.
Talk presented by R. Zambrini: *“Near field correlations in OPO above threshold”*, R. Zambrini, D. Gomila, P. Colet, M. San Miguel.
Talk presented by R. Zambrini: *“Non-classical behavior in multimode and disordered transverse structures in OPO.”*, Roberta Zambrini, Stephen M. Barnett, Pere Colet, Maxi San Miguel.
- **European Graduate College Workshop 2004.** Haus Sonnenberg, Harz, Germany 20-24 June 2004.
Talk presented by R. Zambrini: *“Local transfer of angular momentum to matter”*, Roberta Zambrini and Stephen M. Barnett.
- **The Seventh International Conference on Quantum Communication, Measurement and Computing.** Glasgow Strathclyde University, UK, 24-29 July 2004.
- **QEP-16 Photon04.** Glasgow Caledonian University, UK, 6-9 September 2004.
Poster presented by R. Zambrini: *“Local transfer of angular momentum to matter”*, Roberta Zambrini and Stephen M. Barnett.
- School **Quantum logic and Communications.** Institute of Etudes Scientifiques, Cargése, France, 23 August 2004.
Poster presented by R. Zambrini: *“Local transfer of angular momentum to matter”*, Roberta Zambrini and Stephen M. Barnett.
- **XX Trobades Científiques de la Mediterrània.** Fotónica: ciència i tecnologia de la llum. Mahon, Minorca, Spain, 26-28 September 2004.

- Poster presented by R. Zambrini: *“Local transfer of angular momentum to matter”*, Roberta Zambrini and Stephen M. Barnett.
- **Angular Momentum Meeting**. Aberfoyle, Scotland, UK, 12 November 2004.
Talk presented by R. Zambrini: *“Momentum continuity equations in dielectrics”*, Roberta Zambrini, Rodney Loudon and Stephen M. Barnett.
 - **New trends in nonlinear optics. A celebration of Willie Firth’s 60th Birthday**. University of Strathclyde, Glasgow, UK, 23 February 2005.
Poster presented by R. Zambrini: *“Local transfer of angular momentum to matter”*, Roberta Zambrini and Stephen M. Barnett.
 - **PHYSICS - A CENTURY AFTER EINSTEIN**. University of Warwick, UK, 10-14 April 2005.
Poster presented by R. Zambrini: *“Angular uncertainty principle”*, D. T. Pegg, S. M. Barnett, R. Zambrini, S. Franke-Arnold and M. Padgett.
Poster presented by L. C. Thomson: *“The frustrated transmission of helical beams through small apertures”*, L. C. Thomson, G. Gibson, R. Zambrini, S. M. Barnett and M. Padgett.
 - **Launch of SUPA: A partnership of excellence**. Heriot-Watt University, Edinburgh, UK, 25 April 2005.
Poster presented by R. Zambrini: *“Angular uncertainty principle”*, D. T. Pegg, S. M. Barnett, R. Zambrini, S. Franke-Arnold and M. Padgett.
 - **CLEO/Europe-EQEC Conference**, World of Photonics Congress 2005. International Congress Centre, Munich, Germany, 12-17 June 2005
Talk presented by R. Zambrini: *“Convection induced nonlinear phase modulations in optical systems”*, R. Zambrini, M. San Miguel, C. Durniak, M. Taki
Talk presented by R. Zambrini: *“Local transfer of optical angular momentum to matter”*, R. Zambrini, S.M. Barnett
Poster presented by R. Zambrini: *“Convective instability and nonlocality in diffraction-free nonlinear systems”*, R. Zambrini and F. Papoff
Poster presented by R. Zambrini: *“Optical angular momentum in periodic arrays”*, R. Zambrini, M. Vasnetsov, M. Dennis, J. Courtial
Poster presented by R. Zambrini: *“Minimum uncertainty states of angular momentum and angular position”*, R. Zambrini, D. T. Pegg, S. M. Barnett, S. Franke-Arnold, M. Padgett
 - **FisEs 2006**, XIV Congreso de Física Estadística. Facultad de Ciencias, Universidad de Granada, Spain, 14-16 September 2006.
Talk presented by R. Zambrini: *“Convective instability induced by nonlocality”*, R. Zambrini and F. Papoff
 - **EOS annual meeting 2006**. Paris Expo, France, 16-19 October 2006
Talk presented by R. Zambrini: *“Convective instability induced by two-point nonlocality”*, R. Zambrini and F. Papoff

Talk presented by R. Zambrini: *“Resolution in rotation measurements”*, S. M. Barnett and R. Zambrini

Poster presented by R. Zambrini: *“Quasi-intrinsic angular momentum”*, R. Zambrini and S. M. Barnett

- **Workshop PHASE-IPSSO 2007**. Supelec, Metz, France, 28-30 March 2007

Talk presented by R. Zambrini: *“Two-point nonlocality in nonlinear optical devices”*, R. Zambrini and F. Papoff

- **SEMINARS**

- *“Quantum correlations in noise sustained optical patterns”*.
Department of Physics, University of Strathclyde (Glasgow, UK).
July 2000.
- *“Quantum correlations in noise sustained optical patterns”*.
Instituto Mediterraneo de Estudios Avanzados, IMEDEA (Palma de Mallorca, Spain).
November 16, 2000.
- *“How to treat negative diffusion problems: the anharmonic oscillator in the Q-representation”*.
Instituto Mediterraneo de Estudios Avanzados, IMEDEA (Palma de Mallorca, Spain).
February 26, 2001.
- *“Quantum fluctuations in optical patterns”*.
Max-Planck-Institut für Physik komplexer Systeme (Dresden, Germany).
May 8, 2001.
- *“Non-linearity and quantum correlations in Optical Parametric Oscillators with walk-off”*.
Department of Physics, Università dell’Insubria (Como, Italy).
January 16, 2002.
- *“Transfer of light angular momentum to matter within the Maxwell formalism.”*.
Department of Physics, Strathclyde University (Glasgow, UK).
October 29, 2003.
- *“Optical angular momentum”*.
Instituto Mediterraneo de Estudios Avanzados, IMEDEA (Palma de Mallorca, Spain).
May 5, 2004.
- *“Minimum Uncertainty States of Angular Uncertainty Relations”*.
The Institute of Photonic Sciences, ICFO (Barcelona, Spain).
July 14, 2005.
- *“Quasi-intrinsic angular momentum”*.
Department of Physics, Strathclyde University (Glasgow, UK).
January 11, 2006.

- “*Quasi-intrinsic angular momentum*”. Instituto Mediterraneo de Estudios Avanzados, IMEDEA (Palma de Mallorca, Spain).
February 15, 2006.

- **VISITS TO OTHER INSTITUTIONS**

- Department of Physics, University of Strathclyde (Glasgow, UK).
1 June - 31 August 2000.
- Department of Physics, Università dell’Insubria (Como, Italy).
7 - 19 January 2002.
- Department of Physics, University of Balearic Islands (Palma de Mallorca, Spain).
4 - 12 May 2004.
- The Institute of Photonic Sciences, ICFO (Barcelona, Spain).
13 - 16 July 2005.

- **SCHOOLS**

- Seminar/School **Coherent Evolution in Noisy Environment**.
Max-Planck-Institut für Physik komplexer Systeme.
Dresden, Germany, 30 April-12 May 2001.
- **NATO-ASI Quantum Communication and Information Technologies**,
Bilkent University.
Ankara, Turkey, June 3-14, 2002.
- School **Quantum logic and Communications**.
Institute of Etudes Scientifiques.
Cargèse, France, 16 August-28 August 2004.