

Dr. Alejandro Turpin

PERSONAL INFORMATION

Date of birth: 02/01/1988
Born in: Sabadell (Spain)
Citizenship: Spanish
Civil status: Married
ResearcherID: K-4732-2013

CONTACT INFORMATION

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Ludwig-Erhard-Allee 2
Bonn, 53175 (Germany)

RESEARCH INTERESTS

Neuroscience, adaptive optics, super-resolution imaging, quantum optics, structured light.

EDUCATION

PhD in Physics. [Universitat Autònoma de Barcelona](#) (2012-2015).
Thesis director: Dr. Jordi Mompart. Thesis title: *Conical refraction: fundamentals and applications*. Grade: Excellent Cum Laude.
MSc in Photonics. [Universitat Politècnica de Catalunya](#) (2010-2011).
Thesis directors: Dr. Jordi Mompart and Dr. Todor K. Kalkandjiev. Master thesis title: *Cascaded conical refraction*. Grade: 9.15 / 10.
Degree in Physics. [Universitat Autònoma de Barcelona](#) (2006-2010).
Grade: 8.49 / 10. Final project advisor: Dr. Juan Campos. Final project title: *Pattern recognition with optical correlation*.
High School Bachelor in Technology. IES Ferran Casablanques. With Honors.

RESEARCH EXPERIENCE

[Max Planck Research Group - Neural circuits](#), [Center of Advanced European Studies and Research - caesar](#), Max Planck Society
Postdoc (01/2017-currently)
- Real-time imaging of neural circuits underlying sensorimotor behavior.
[Quantum and Atom Optics Group](#), [Universitat Autònoma de Barcelona](#)
Research Assistant (01/2016-07/2016)
- Theoretical studies on the dynamics of orbital angular momentum states in coupled optical waveguides.
[Quantum and Atom Optics Group](#), [Universitat Autònoma de Barcelona](#)
Research Assistant (11/2010-12/2011)
- Both theoretical and experimental studies on cascaded conical refraction.

PUBLICATION SUMMARY

As of March 2017, 23 peer-reviewed publications (17 as first author), including 1 Laser & Photonics Reviews, 2 Scientific Reports, 6 Optics Express, 8 Optics Letters, 2 Physical Review A, 2 Journal of Optics, 1 Applied Optics, and 1 Journal of the Optical Society A. h-index: 10 (WoK).

RESEARCH ACHIEVEMENTS

- *Blue-detuned optical potentials for BECs*: dipolar trapping of Bose-Einstein condensates (BECs) in blue-detuned ring geometries and optical bottle beams.
- *Photophoretic trapping of absorbing particles*: experimental photophoretic trapping and levitation of macroscopic ($\approx 100 \mu\text{m}$) absorbing particles in a reconfigurable three-dimensional optical bottle.
- *Extreme ultraviolet generation of vector beams*: both theoretical and experimental demonstration of the generation of EUV / soft X-rays vector beams in high harmonic generation for the first time.

- *Free space optical communications*: design and test of a polarization multiplexing and de-multiplexing system based on biaxial crystals with tenfold increased channel capacity.
- *Conical refraction*: both theoretical and experimental investigations of the phenomenon; demonstration of a theoretical formalism capable to reproduce light propagation in biaxial crystals, including crystals in cascade.

AWARDS

- **Journal of Optics Outstanding Reviewer 2016.**
- **Postdoctoral fellowship by the Ramón Areces Foundation** (2016, declined).
- **Outstanding contribution at the XI Optics National Meeting by the Optical Society of America** (2015).
- **Research stay grant from the Spanish government** (Ref. Est13/00538) to work with the Group of Prof. Miles J. Padgett at the University of Glasgow to study The orbital angular momentum of a conically refracted light beam and its applications in optical manipulation and telecommunications (September 2014 – December 2014)
- **Research grant from the DAAD** (Ref. 91526836) to work with the Group of Prof. Birkl at the Technische Universität Darmstadt to Develop novel potentials to trap Bose–Einstein Condensates using conical refraction (May 2014 – July 2014).
- **Finalist as the Best Innovation Project**, at the 1st Open Science and Innovation Forum, UAB for a Free space optical telecommunication system with tenfold increased data rate.
- **Predocctoral fellowship from the Catalan Government** (declined).
- **Predocctoral fellowship from the Spanish Government** (FPU Ref. AP2010-2310) 2012-2015.
- **Scholarship to collaborate** with the Quantum and Atom Optics Group at the Universitat Autònoma de Barcelona for a Full design of an advanced laboratory practice about Zeeman effect (2010).
- **Grant from the Fundació Caixa Manresa** for excellence in high school (2007).
- **With honors in High School.** Awarded with a 1st year degree scholarship at the Universitat Autònoma de Barcelona.

SELECTED PUBLICATIONS

1. **A. Turpin**, L. Rego, A. Picón, J. San Román, and C. Hernández-García, “Extreme Ultraviolet Fractional Orbital Angular Momentum Beams from High Harmonic Generation,” *Sci. Rep.* **7**, 43888 (2017).
2. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, and J. Mompart, “Conical refraction: fundamentals and applications,” *Laser Photon. Rev.* **10**, 1-22 (2016).
3. **A. Turpin**, J. Polo, Yu. V. Loiko, J. Küber, F. Schmaltz, T. K. Kalkandjiev, V. Ahufinger, G. Birkl, and J. Mompart, “Blue-detuned optical ring trap for Bose-Einstein condensates based on conical refraction,” *Opt. Express* **23**, 1638-1650 (2015).
4. **A. Turpin**, V. Shvedov, C. Hnatovsky, Yu. V. Loiko, J. Mompart, and W. Krolikowski, “Optical vault: A reconfigurable bottle beam based on conical refraction of light,” *Opt. Express* **21**, 26335-26340 (2013).
5. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, and J. Mompart, “Free-space optical polarization demultiplexing and multiplexing by means of conical refraction,” *Opt. Lett.* **37**, 4197-4199 (2012).

TEACHING EXPERIENCE	<p>Universitat Politècnica de Catalunya</p> <ul style="list-style-type: none"> – <i>Introduction to Photonics</i>, year 2015 Fundamentals of photonics. MSc in Photonics. <p>Universitat Autònoma de Barcelona</p> <ul style="list-style-type: none"> – <i>Fundamentals of Physics</i>, years 2013, 2014, and 2015. Electromagnetism for 1st year students. Telecommunications and Electrical Engineering. – <i>Supervision of Master Thesis project</i> of Damián Rodríguez (2016). – <i>Supervision of Master Thesis project</i> of Oscar Zabaco (2015). – <i>Supervision of the Bachelor's project</i> of Álvaro Rodríguez (2015). – <i>Supervision of the Bachelor's project</i> of Albert Parra (2013).
REVIEWERING FOR	Optics Express, Optics Letters, Journal of Optics, Applied Optics, Applied Physics B, JOSA A, Photonics Research, IEEE Photonics Journal.
RESEARCH STAYS	<ol style="list-style-type: none"> 1. University of Glasgow (20/09/2014–20/12/2014) at the Group of Prof. Miles J. Padgett. 2. Technische Universität Darmstadt(1/05/2014–31/07/2014) at the Group of Prof. Gerhard Birkl. 3. Technische Universität Darmstadt(11/11/2013–15/11/2013) at the Group of Prof. Gerhard Birkl. 4. Macquarie University (10/07/2013–12/07/2013) at the Group of Prof. Gabriel Molina-Terriza. 5. Australian National University (28/06/2013–10/07/2013) at the Group of Prof. Wieslaw Krolikowski. 6. Technische Universität Darmstadt(24/06/2013–26/06/2013) at the Group of Prof. Gerhard Birkl.
LANGUAGES	<p>Spanish: Native Catalan: Native English: Fluent (C1 CEFR) German: Beginner (B1 CEFR)</p>
SKILLS	<p>Microsoft Office, OpenOffice, \LaTeX, Adobe Illustrator, Gimp, 3D Modelling (Blender, Sketchup).</p> <p>Programming in C, Matlab, Mathematica, Derive, Labview, Python.</p>
IN-PREPARATION PUBLICATIONS	<ul style="list-style-type: none"> – C. Hernández-García, A. Turpin, J. San Román, A. Picón, R. Drevinskas, A. Cerkauskaite, P. G. Kazansky, C. G. Durfee, and I. J. Sola, “Extreme ultraviolet vector beams driven by infrared lasers,” submitted. – A. Turpin, F. Schmaltz, J. Küber, Yu. V. Loiko, J. Mompert, and G. Birkl, “Trapping of Bose-Einstein condensates in a three-dimensional dark focus generated by conical refraction,” in-preparation.
PEER-REVIEWED PUBLICATIONS	<ol style="list-style-type: none"> 1. A. Turpin, L. Rego, A. Picón, J. San Román, and C. Hernández-García, “Extreme Ultraviolet Fractional Orbital Angular Momentum Beams from High Harmonic Generation,” Sci. Rep. 7, 43888 (2017). 2. A. Turpin, J. Polo, G. Pelegrí, J. Mompert, and V. Ahufinger, “Engineering of orbital angular momentum supermodes in coupled optical waveguides,” accepted for publication in Scientific Reports. arXiv:1610.01359. 3. G. Pelegrí, J. Polo, A. Turpin, J. Mompert, and V. Ahufinger, “Single atom edge-like states via quantum interference,” Phys. Rev. A. 95, 013614 (2017). arXiv:1609.02729.

4. I. Estévez, Victor Sopo, A. Lizana, **A. Turpin**, and J. Campos, "Complete snapshot Stokes polarimeter based on a single biaxial crystal," *Opt. Lett.* **41**, 4566-4569 (2016).
5. A. Lizana, A. Vargas, **A. Turpin**, C. Ramírez, I. Estévez, and J. Campos, "Shaping light with split lens configurations," *J. Opt.* **18**, 105605 (2016).
6. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, and J. Mompart, "Conical refraction: fundamentals and applications," *Laser Photon. Rev.* **10**, 750-771 (2016).
7. A. Lizana, I. Estévez, **A. Turpin**, C. Ramirez, A. Peinado, and J. Campos, "Implementation and performance of an in-line incomplete Stokes polarimeter based on a single biaxial crystal," *Appl. Opt.* **54**, 8758-8765 (2015).
8. A. Peinado, **A. Turpin**, C. Lemmi, A. Márquez, T. K. Kalkandjiev, J. Mompart, and Juan Campos, "Interferometric characterization of the structured polarized light beam produced by the conical refraction phenomenon," *Opt. Express* **23**, 18080-18091 (2015).
9. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, R. Corbalán, and J. Mompart, "Conical refraction healing after partially blocking the input beam," *Phys. Rev. A* **92**, 013802 (2015). [arXiv:1505.04913](https://arxiv.org/abs/1505.04913).
10. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev and J. Mompart, "Light propagation in biaxial crystals," *J. Opt.* **17**, 065603 (2015). [arXiv:1502.06726](https://arxiv.org/abs/1502.06726).
Selected as Paper of the week by Journal of Optics.
See [Labtalk](#) in Journal of Optics
11. **A. Turpin**, A. Vargas, A. Lizana, F. A. Torres-Ruiz, I. Estévez, I. Moreno, J. Campos, and J. Mompart, "Transformation of vector beams with radial and azimuthal polarizations in biaxial crystals," *J. Opt. Soc. Am. A* **32**, 1012 (2015). [arXiv:1505.04906](https://arxiv.org/abs/1505.04906).
12. **A. Turpin**, Yu. Loiko, T. K. Kalkandjiev, H. Tomizawa, and J. Mompart, "On the dual-cone nature of the conical refraction phenomenon," *Opt. Lett.* **40**, 1639 (2015). [arXiv:1505.04933](https://arxiv.org/abs/1505.04933).
13. **A. Turpin**, Yu. V. Loiko, A. Peinado, A. Lizana, T. K. Kalkandjiev, J. Campos, and J. Mompart, "Polarization tailored novel vector beams based on conical refraction," *Opt. Express* **23**, 5704 (2015). [arXiv:1411.1606](https://arxiv.org/abs/1411.1606).
14. A. Peinado, A. Lizana, **A. Turpin**, C. Lemmi, T. K. Kalkandjiev, J. Mompart, and J. Campos, "Optimization, tolerance analysis and implementation of a Stokes polarimeter based on the conical refraction phenomenon," *Opt. Express* **23**, 5636 (2015).
15. **A. Turpin**, J. Polo, Yu. V. Loiko, J. Küber, F. Schmaltz, T. K. Kalkandjiev, V. Ahufinger, G. Birkl, and J. Mompart, "Blue-detuned optical ring trap for Bose-Einstein condensates based on conical refraction," *Opt. Express* **23**, 1638 (2015). [arXiv:1411.1587](https://arxiv.org/abs/1411.1587).
16. **A. Turpin**, Yu.V. Loiko, T. K. Kalkandjiev, H. Tomizawa, and J. Mompart, "Super-Gaussian conical refraction beam," *Opt. Lett.* **39**, 4349-4342 (2014). [arXiv:1410.3790](https://arxiv.org/abs/1410.3790).
17. **A. Turpin**, V. Shvedov, C. Hnatovsky, Yu. V. Loiko, J. Mompart, and W. Krolokowski, "Optical vault: a reconfigurable bottle beam based on conical refraction of light," *Opt. Express* **21**, 26335-26340 (2013). [arXiv:1409.1871](https://arxiv.org/abs/1409.1871).
Selected by the [Virtual Journal for Biomedical Optics](#) **9** issue 1.
18. Yu. V. Loiko, **A. Turpin**, T. K. Kalkandjiev E. U. Rafailov, and J. Mompart, "Generating a three dimensional dark focus from a single conically refracted light beam," *Opt. Lett.* **38**, 4648-4650 (2013). [arXiv:1409.1853](https://arxiv.org/abs/1409.1853).

19. A. Peinado, **A. Turpin**, A. Lizana, E. Fernández, J. Mompart, and J. Campos, "Conical refraction as a tool for polarization metrology," *Opt. Lett.* **38**, 4100-4102 (2013).
20. **A. Turpin**, Y. Loiko, T.K. Kalkandjiev, J. Trull, C. Cojocar and J. Mompart, "Type I and type II second harmonic generation of conically refracted beams," *Opt. Lett.* **38**, 2484-2486 (2013). [arXiv:1410.3782](#).
21. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, and J. Mompart, "Multiple rings formation in cascaded conical refraction," *Opt. Lett.* **38**, 9-11 (2013). [arXiv:1409.1864](#).
22. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, H. Tomizawa, and J. Mompart, "Wave-vector and polarization dependence in conical refraction," *Opt. Express* **21**, 4503-4511 (2013). [arXiv:1410.3775](#).
23. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev, and J. Mompart, "Free space optical polarization demultiplexing and multiplexing by means of conical refraction," *Opt. Lett.* **37**, 20-22 (2012). [arXiv:1301.1564](#).

PATENTS

1. A. Peinado, **A. Turpin**, A. Lizana, J. Mompart and J. Campos, "A polarimeter based on conical refraction and a method for determining the polarization state of an input electromagnetic radiation," GB1313866.4 the UK.
2. **A. Turpin**, Yu. V. Loiko, T. K. Kalkandjiev and J. Mompart, "System, method, transmitter and receptor for optical communications," P201230105 (A2 10/2012), Spain.

POPULAR ARTICLES

1. **A. Turpin** and A. Picón, "Un nuevo microscopio de rayos X," *Investigación y Ciencia* **480**, 16 (2016) (Spanish edition of Scientific American).
2. **A. Turpin** and J. Mompart, "Una cámara acorazada óptica," *Investigación y Ciencia* **463**, 14-15 (2015) (Spanish edition of Scientific American).

CONFERENCE PROCEEDINGS

1. I. Estévez, A. Lizana, **A. Turpin**, V. Sopo, C. Ramírez, A. Peinado, and J. Campos, "Snap-shot Stokes polarimeters based on a single biaxial crystal," *Proc. of SPIE Vol 10110*, 1011012-1 (2017).
2. I. Estévez, A. Lizana, A. Peinado, **A. Turpin**, C. Ramírez, L. Lobato, J. Vidal, F. Pi, A. Turpin, J. Campos and M. J. Yzuel, "Approaching optics to high-school students through a workshop in Physics," to appear in Proceedings of ETOP (2015).
3. A. Peinado, A. Lizana, **A. Turpin**, I. Estévez, C. C. Lemmi, T. K. Kalkandjiev, J. Mompart and J. Campos, "Snapshot polarimeter based on the conical refraction phenomenon," *Proc. SPIE 9526*, Modeling Aspects in Optical Metrology V, 952616 (2015).
4. Yu. V. Loiko, G. S. Sokolovskii, D. Carnegie, **A. Turpin**, J. Mompart and E. U. Rafailov, "Laser beams with conical refraction patterns," *Proc. SPIE 8960*, Laser Resonators, Microresonators, and Beam Control XVI, 8960-61 (2014).
5. Yu. V. Loiko, **A. Turpin**, T. K. Kalkandjiev and J. Mompart, "Conical refraction multiplexing for free space optical communications," *Proc. SPIE 8246*, Free-Space Laser Communication Technologies XXIV, 82460T (2012).

CONFERENCE TALKS

1. *Conical refraction: fundamentals and applications* (Invited), XXXI Trobades Científiques a la Mediterrània, Maó, (2015).
2. *Photophoretic trapping of absorbing particles with conical refraction* 11th Spanish national optical meeting (XIRNO), Salamanca, (2015).
3. *Reconstruction of conically refracted Gaussian beams after an obstruction*, 11th Spanish national optical meeting (XIRNO), Salamanca, (2015).
4. *Advances in optical trapping with conical refraction*, XXXV Biannual meeting of the Spanish Royal Society of Physics, Gijón (2015).
5. *The optical vault: a reconfigurable optical bottle beam for photophoretic trapping of absorbing macro-particles*, CLEO/EUROPE-EQOC 2015, Munich (2015).
6. *Laser beams with conical refraction patterns*, Yu.V. Loiko, G. S. Sokolovskii, D. Carnegie, SPIE Photonics West 2014, San Francisco (2014).
7. *Type I and type II second harmonic generated waves from a conically refracted beam*, XXXIV Biannual meeting of the Spanish Royal Society of Physics, Valencia (2013).
8. *Conical refraction: phenomenon and applications*, 1st interdisciplinary meeting of predoctoral researchers, Barcelona (2013).
9. *Type I and Type II SHG of conically refracted beams*, NLO50: 50 Years of Nonlinear Optics Symposium, ICFO Barcelona (2012).
10. *Multiplexado y de-multiplexado para comunicaciones ópticas en espacio libre mediante refracción cónica*, 10th Spanish national optical meeting (XRNO), Zaragoza, (2012).
11. *Conical refraction multiplexing for free space optical communications*, SPIE Photonics West 2012, San Francisco (2012).

OTHER TALKS

- *Conical refraction: theory and applications*, Optics Group, University of Glasgow, Glasgow, (2014).
- *Conical refraction as a trapping tool*, Atoms-Photons-Quanta, Technische Universität Darmstadt, Darmstadt (2013).
- *Conical refraction as a photophoretic tool*, Laser Physics Center, Australian National University, Canberra (2013).
- *New trapping potentials using conical refraction*, 2nd TUD-UAB Workshop, Darmstadt (2013).

POSTERS

1. *Conical Refraction to Increase Channel Capacity in Free-Space Optical Communications*, **A. Turpin**, Yu. V. Loiko, T.K. Kalkandjev and J. Mompart, Workshop in Optics 2016, Barcelona (2016).
2. *Dipolar potentials Bose-Einstein condensates based on the conical refraction of light*, **A. Turpin**, J. Polo, V. Ahufinger and J. Mompart, 4th Half-day meeting in the BCN region, Barcelona (2016).
3. *Vector beams and optical singularities in conical refraction*, **A. Turpin**, Yu. V. Loiko, A. Peinado, A. Lizana, T. K. Kalkandjev, J. Campos, and J. Mompart, 11th national optical meeting (XIRNO), Salamanca (2015).
4. *Different Profiles of Fundamental Mode from Conical Refraction Lasers*, Yu. V. Loiko, A. Turpin, **G. S. Sokolovskii**, J. Mompart and E. U. Rafailov, [CLEO/Europe-EQOC 2015](#), Munich (2015).
5. *A mesoscopic blue-detuned light ring for Bose-Einstein Condensates based on conical refraction*, **A. Turpin**, J. Polo, Yu. V. Loiko, J. Küber, F. Schmaltz, T. K. Kalkandjev, V. Ahufinger, G. Birkl and J. Mompart, [CLEO/Europe-EQOC 2015](#), Munich (2015).

6. *Ring traps for Bose-Einstein condensates based on the conical refraction of light*, **A. Turpin**, J. Polo, V. Ahufinger and J. Mompert, 3rd Half-day meeting in the BCN region, Barcelona (2015).
7. *Coherent matter wave propagation with BECs in toroidal guiding potentials for atom interferometry and ATOMTROMICS based quantum simulators*, J. Küber, T. Lauber, F. Schmaltz, Yu. V. Loiko, A. Turpin, T. K. Kalkandjiev, J. Mompert, and **G. Birkl**, ICAP 2014, Washington (2014).
8. *Ring traps for Bose-Einstein condensates based on the conical refraction of light*, **A. Turpin**, J. Polo, V. Ahufinger and J. Mompert, Young atom opticians 2014, Barcelona (2014).
9. *Ring traps for Bose-Einstein condensates based on the conical refraction of light*, **A. Turpin**, J. Polo, V. Ahufinger and J. Mompert, 2nd Half-day meeting in the BCN region, Barcelona (2014).
10. *New trapping potentials using conical refraction*, **A. Turpin**, Yu. V. Loiko, T.K. Kalkandjiev and J. Mompert, Predoctoral School of Les Houches (2013).
11. *Free-space optical polarization demultiplexing and multiplexing by means of conical refraction*, **A. Turpin**, Yu. V. Loiko, T.K. Kalkandjiev and J. Mompert, [CLEO/Europe-IQEC 2013](#), Munich (2013).
12. *Conical-double refraction experiments*, A. Turpin, Yu. V. Loiko, T. K. Kalkandjiev and J. Mompert, IONS9, Salamanca (2011).

SEMINARS AND COURSES

- Manipulation of quantum degenerate gases, **École de Physique des Houches**, Les Houches, 16-27 September 2013.
- ICFO Frontiers of Quantum Physics and Quantum Information, **Institut of Photonic Sciences**, Castelldefels, 25-27 July 2013.
- 2nd Technische Universität Darmstadt - Universitat Autònoma de Barcelona workshop, Atoms-Photons-Quanta group, **Technische Universität Darmstadt**, 25-26 June 2013.
- Laser tweezers and applications, by Miles Padgett, CLEO Munich, 13 May 2013.
- Portfolio, freedom of operation and infraction of patents, PRUAB, 23 May 2013.
- Good practices. Strategies of protection and searching tools for patents, PRUAB, 16 May 2013.
- Software protection and patents in electronics and mechanics, PRUAB, 9 May 2013.
- 1st Europhotonics Spring School, **Institut of Photonic Sciences**, Barcelona, 25-31 March 2012.
- Introductory course to research in optics, Instituto Daza de Valdés, Madrid, 27-28 April 2011.
- 1st Technische Universität Darmstadt - Universitat Autònoma de Barcelona workshop, the Faculty of Science of the **Universitat Autònoma de Barcelona**, Cerdanyola del Vallès 12-13 January 2011.

OUTREACH

- *Talk, experiment and chat with a scientist from Barcelona*. Talks organized in public libraries to show how a scientist works and explain some optical phenomena.
- *Argó Programme*. Supervisor of a team of 4 pre-university students learning optics and how to become a scientist (2016).
- *Science area of the Catalan Education Exhibition*. Fira de Barcelona. Experiments of optics, electromagnetism and nanoscience for pre-university students from all over Catalonia (2011-2016) (>5000 visitors per year).
- *Saturday Physics*. Organizer. Universitat Autònoma de Barcelona. Experiments on fundamentals of optics and introduction to the research laboratories for pre-university students. (2013-2016) (around 150 visitors per year).
- *Science Tour*. Universitat Autònoma de Barcelona. Experiments on fundamentals of optics for pre-university students (2014).