Curriculum Vitae

Name:	Kestutis Staliunas
Academic degree:	Hab. Dr., Prof.
Birth date:	1963-06-05
Birthplace:	Inta, UdSSR
Nationality:	Lithuania
Institute:	Universitat Politecnica de Catalunya (UPC)
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Languages spoken:	Lithuanian (mother language) English, German, Russian, Spanish (good) Catalan (basic)

1969– 1980	School and Gymnasium in Ukmerge, Lithuania
1980	Abitur in Ukmerge, Lithuania
1980 – 1985	Vilnius University, Lithuania Faculty of Theoretical Physics
1985	Diploma in Vilnius University, “Space-time dynamics of laser pulses in stimulated Brillouin scattering”
1985 – 1989	PhD studies in Vilnius University, Faculty of Quantum Electronics
1989	PhD thesis in Vilnius University: “Regularisation and chaos of light pulses in processes of three-wave mixing.”
1989 – 1991	Scientific Employee in Vilnius University, Faculty of Quantum Electronics.
1991 – 1992	Alexander von Humboldt Fellow in Physikalisch-Technischen Bundesanstalt (PTB) Braunschweig
1993 – 1998	Scientific Employee in PTB Braunschweig
1998 – 2003	Scientific Employee in University Hannover
2001	Habilitation in Vilnius University: “Transverse Patterns in Nonlinear Optical Resonators”
since 2003	Research Professor of ICREA in Universitat Politecnica de Catalunya in Terrassa (Barcelona), Spain.

Publications:

- in refereed Journals: around 250

  among them in Phys. Rev. Letters: 14 and Nature Group: 12;
- patents: 4
- books: 2

Invited Professorships

- University Lille, France (1995: 1 month, 1998: 3 month)
- University of Valencia, Spain (1995: 3 month, 2004, 2005: 1 month)
- University Vilnius, Lithuania (1998, 2000, 2002, 2014, 1 month each time)
- Polytechnic University of Valencia (Gandia), Spain (2006, 2011, 1 month each time)
- University of Cape Town, South Africa (2007: 1 month)
- National University of Australia, Canberra, Australia (2008, 2 weeks)
- University of Sapporo, Sapporo, Japan (2009, 2 weeks)
- Aston University, Birmingham, UK (2016, 4 month)

Coordinated research projects and networks:

- Project of Spanish ministry of science: (DGESIC, FIS2004-02587): "Mid-band spatial solitons in nonlinear photonic crystal resonators" 2004-2005 (coordinator of the project).
- Project of Spanish ministry of science: (FIS2005-07931-C03-03) "Nonlinear Physics of Light Sound and Matter Waves" together with University of Valencia, and Politechnic University of Valencia (Gandia), 2006-2008 (coordinator of the UPC group).
- Network of Spanish ministry of sciences on "Nonlinear dynamics of light and matter waves", with 8 Spanish groups participating, 2005-2008 (coordinator of the UPC part).
- Bilateral project (Catalan France scientific collaboration program) with Laboratoire de Photonique et de Nanostructures, France "Nondifractive light in photonic-crystals and photonic-crystal resonators", 2005-2007 (coordinator of UPC part).
- Bilateral project (Acciones integradas with Italy) with University of Insubria, Como, Italy "Nondifractive light pulses in photonic-crystals" (HI2005-0304), 2006-2007 (coordinator of UPC part).
- Bilateral project (Acciones integradas with Germany) with University of Jena, Jena, Germany "Photonic-crystal resonators" (HA2006-0111), 2007-2008 (coordinator of UPC part).
- Bilateral project (Acciones integradas with South Africa) with university of Cape town, South Africa "solitons in modulated media" (HS2007-0010) 2008-2009 (coordinator of UPC part).
- Project of Spanish ministry of science: (FIS2008-06024-C03-02) "Ondas de luz en

medios lineales y nonlineales modulados en espacio" together with University of Valencia, and Politechnic University of Valencia (Gandia), 2009-2011 (coordinator of the UPC group).

- Bilateral project (Acciones integradas with Francia) with Laboratoire de Photonique et de Nanostructures, France "Optical switching and harmonic generation in semiconductor photonic crystals under non diffractive light propagation regime" (HF2008-0017) 2009-2010 (coordinator of UPC part).
- Bilateral project (Acciones integradas with Portugal) with Universidade de Lisboa, Lisboa, Portugal "Solitons in Modulated Optical Materials" (PT2009-0081) 2010-2011 (coordinator of UPC part).
- Project of Spanish ministry of science: (FIS2011-29734-C02-01-P) "Control de la Difraccion de la Luz en Medios Modulados" together with Politechnic University of Valencia (Gandia), 2012-2015 (global coordinator, and coordinator of the UPC group).
- NATO SPS Research grant (SPS 985048) "Nanostructures for Highly Efficient Infrared Detection", together with Shizuoka University, Japan; Swinburne University, Australia; Vilnius University, Lithuania; Ankara University, Turkey, 2016-2018 (global coordinator, and coordinator of the UPC group).
- Project of Spanish ministry of science: (FIS2015-65998-C2-1-P) "Ondas de luz y sonido en cristales, medios estructurados y metamateriales", SOLIWAVE, together with Politechnic University of Valencia (Gandia), 2016-2018 (global coordinator, and coordinator of the UPC group).
- EUREKA-EUROSTARS European project "HIP-Lasers", together with laser companies and institutions in Spain, Germany and Lithuania. 2016-2019 (coordinator of 2 work-packages, and coordinator of the UPC group).
- Horizon 2020 ITN Grant "MEFISTA" (H2020-MSCA-ITN-2019). 2020-2023 (coordinator of the UPC group).
- Project of Spanish ministry of science: (PID2019-1091756B-C21) "Control inteligente de ondas de Luz con Metamateriales, metasuperficies y medios no-Hermíticos" together with Politechnic University of Valencia (Gandia), 2020-2023 (global coordinator, and coordinator of the UPC group).
- Horizon 2020 ERA.NET-COFUND program project MiLaCo, Project No.S-M-ERA.NET-20-2, 2020-2023 (coordinator of the UPC group).

Teaching activities:

- Up to now directed 14 PhD thesis (other 5 directing/codirecting presently), and around 20 Masters projects.
- 3 credit Master course on "Photonic Crystals and Metamaterials" in "Masters of Photonics" of Catalunya.

Publications of last 5 years:

1. A. M. Perego, N. Tarasov, D. V. Churkin, S. K. Turitsyn, K. Staliunas, Pattern Generation by Dissipative Parametric Instability, Phys. Rev. Lett. **116**, 028701 (2016).

2. N. Tarasov, A. M. Perego, D. V. Churkin, K. Staliunas, S. K. Turitsyn,, Mode-locking via dissipative Faraday Instability, Nature Communications **7**, 12441 (2016);
3. Darius Gailevicius, Volodymyr Koliadenko, Vytautas Purlys, Martynas Peckus, Victor Taranenko, and Kestutis Staliunas, Photonic Crystal Microchip Laser, Scientific Reports **6**, 34173 (2016);
4. S. Kumar, A. Perego, and K. Staliunas, Linear and Nonlinear Bullets of the Bogoliubov-de Gennes Excitations, Phys. Rev. Letters, **118**, 044103 (2017).
5. Mirbek Turduev, Ibrahim H. Giden, Ceren Babayigit, Zeki Hayran, Emre Bor, Cicek Boztug, Hamza Kurt, and Kestutis Staliunas, Mid-infrared T-shaped photonic crystal waveguide for optical refractive index sensing, Sensors and Actuators B **245**, 765–773 (2017).
6. W. W. Ahmed, R. Herrero, M. Botey, and K. Staliunas, Self-collimation in PT -symmetric crystals, Phys. Rev. A **95**, 053830 (2017).
7. Zeki Hayran, Hamza Kurt, and Kestutis Staliunas, Rainbow trapping in a chirped three-dimensional photonic crystal, Scientific Reports, 7, 3046 (2017).
8. D. Gailevičius, V. Purlys, M. Peckus, R. Gadonas, K. Staliunas, Spatial Filters on Demand Based on Aperiodic Photonic Crystals, Ann. Phys. (Berlin) **529**, 1700165 (2017).
9. K.Staliunas, Multi-Longitudinal-Mode Micro-laser Model, Eur. Phys. J. D, 71, 257 (2017);
10. K. Staliunas, P. Markos, and V. Kuzmiak, Scattering properties of a PT dipole, Phys. Rev. A. **96**, 043852 (2017);
11. Yu-Chieh Cheng, Kestutis Staliunas, Flat focusing mirrors, Appl. Phys. Reviews, **5**, 011101 (2018).
12. Lluís M Garcia-Raffi, Luis J. Salmerón-Contreras, I. Herrero-Durà, V. J. Sánchez-Morcillo, Kestutis Staliunas, N. J. E. Adkins, A. Cebrecos, Noé Jiménez, Vicent Romero Garcia, Broadband reduction of the specular reflections by using sonic crystals: a proof of concept for noise mitigation in aerospace applications, Aerospace Science and Technology **73**, 300-308 (2018).
13. W.W. Ahmed, R. Herrero, M. Botey, Z. Hayran, H. Kurt, and K. Staliunas, Directionality fields generated by a local Hilbert transform, Phys. Rev. A **97**, 033824 (2018).
14. Zeki Hayran, Ramon Herrero, Muriel Botey, Hamza Kurt and Kestutis Staliunas, Selective optical cloaking via isotropic dielectric materials, ACS Photonics, **5** (5), pp 2068–2073 (2018). https://arxiv.org/abs/1708.00637
15. Z. Hayran, R. Herrero, M. Botey, H. Kurt, and K.Staliunas, Invisibility on demand based on a generalized Hilbert transform, Phys. Rev. A, **98**, 013822 (2018).
16. Auro Perego, Sergey Turitsyn and Kestutis Staliunas, Gain through losses in Nonlinear Optics", Light: Science & Applications, **7**, 43 (2018).
17. A.M. Perego, S.V. Smirnov, K. Staliunas, D.V. Churkin, S. Wabnitz, Self-induced Faraday instability laser, Phys. Rev. Letters, **120**, 213902 (2018).
18. Waqas Ahmed, Shubham Kumar, Judith Pardell, Muriel Botey, Ramon Herrero, and Kestutis Staliunas, Stabilization of Broad Area Semiconductor Laser Sources by index and gain-loss modulations, Optics Letters, **43**, 2511 (2018).
19. J. Medina, W.W. Ahmed, S. Kumar, M. Botey, R. Herrero, and K. Staliunas, Spatiotemporal stabilization proof of concept of Broad Area Semiconductor laser sources, https://arxiv.org/abs/1802.06256, (2018).
20. Noé Jiménez, Vicent Romero-García, Lluis Miquel Garcia-Raffi, Francisco Camarena, and Kestutis Staliunas, Strongly focused vortex beams by using flat Fresnel-spiral lenses, The Journal of the Acoustical Society of America **144**, 1932 (2018);
21. C. Brée, D. Gailevicius, V. Purlys, G.G. Werner, K. Staliunas, A. Rathsfeld, G. Schmidt, and M. Radziunas, Chirped photonic crystal for spatially filtered optical feedback to a broad-area laser, Journal of Optics, **20**, 095804 (2018).
22. Emre Bor, Ceren Babayigit, Hamza Kurt, Kestutis Staliunas, and Mirbek Turduev, Directional invisibility by genetic optimization, Optics Letters, **43**, 5781 (2018).

23. Lina Grinevičiūtė, Ceren Babayigit, Darius Gailevičius, Emre Bor, Mirbek Turduev, Vytautas Purlys, Tomas Tolenis, Hamza Kurt, Kestutis Staliunas, Angular filtering by photonic microstructures fabricated by physical vapour deposition, Applied Surface Science, **481**, 353 (2019);
24. Waqas Waseem Ahmed, Ramon Herrero, Muriel Botey, Ying Wu, and Kestutis Staliunas, Regularization of Vertical-Cavity Surface-Emitting Laser's emisson by periodic non-Hermitian potentials, Opt.Letters, **44**, 3948 (2019);
25. Carsten Bree, Volker Raab, Joan Montiel, Guillermo Garre Werner, Kestutis Staliunas, Uwe Bandelow, Mindaugas Radziunas, Beam combining scheme of high-power broad-area semiconductor lasers with Lyot-filtered reinjection: modeling, simulations, and experiments, JOSA B, **36**, 1721 (2019);
26. Florent Bessin, Auro M. Perego, Kestutis Staliunas, Sergei K. Turitsyn, Alexandre Kudlinski, Matteo Conforti, and Arnaud Mussot, Gain-through-filtering enables tuneable frequency comb generation in passive optical resonators, Nature Communications, **10**, 4489 (2019);
27. S. Gawali, D. Gailevičius, G. Garre-Werner, V. Purlys, C. Cojocaru, J. Trull, J. Montiel-Ponsoda, and K. Staliunas, Photonic Crystal Spatial Filtering in Broad Aperture Diode laser, Appl. Physics Letters, **115**, 141104 (2019);
28. Darius Gailevičius, Vytautas Purlys, and Kestutis Staliunas, Photonic Crystal Spatial Filters Fabricated by Femtosecond Pulsed Bessel Beams, Optics Letters, **44**, 4969-4972 (2019);
29. Judith Medina Pardell, Ramon Herrero, Muriel Botey, Kestutis Staliunas, Stabilized narrow-beam emission from broad-area semiconductor lasers, Phys. Rev. A **101**, 033833 (2020);
30. T. Moein, D. Gailevicius, T. Katkus, S. Hock, S. Lundgaard, D.J. Moss, H. Kurt, V. Mizeikis, K. Staliunas, M. Malinauskas, S, Juodkazis, Optically-thin broadband graphene-membrane photodetector, Nanomaterials, **10**, 407 (2020);
31. Igor V. Minin, Cheng-Yang Liu, Yu-Chih Yang, Kestutis Staliunas, and Oleg V. Minin, Experimental observation of flat focusing mirror based on photonic jet effect, Sci. Rep. **10**, 8459 (2020)
32. D. Gailevičius, M. Ryu, R. Honda, S. Lundgaard, T. Suzuki, J. Maksimovic, J. Hu, D.P. Linklater, E.P. Ivanova, T. Katkus, V. Anand, M. Malinauskas, Y. Nishijima, S.H. Ng, K. Staliūnas, J. Morikawa, and S. Juodkazis, Tilted black-Si: ~0.45 form-birefringence from sub-wavelength needles," Opt. Express **28**, 16012 (2020)
33. P.Y. Wang, R. Herrero, M. Botey, Y.C. Cheng, and K. Staliunas, Translationally invariant metamirrors for spatial filtering of light beams, PRA, **102**, 013517 (2020);
34. S. Gawali, J. Medina, D. Gailevičius, V. Purlys, G. Garre-Werner, C. Cojocaru, J. Trull, M. Botey, R. Herrero, J. Montiel-Ponsoda, and K. Staliunas, Spatial filtering in edge-emitting lasers by intracavity chirped photonic crystals, JOSA B, **37**, 2856 (2020);
35. W. W. Ahmed, R. Herrero, M. Botey, Y. Wu, and K. Staliunas, Restricted Hilbert transform for non-Hermitian management of fields, Phys. Rev. Applied, **14**, 044010 (2020);
36. L. Grineviciute, C. Babayigit, D. Gailevičius, M. Peckus, M. Turduev, T. Tolenis, M. Vengris, H. Kurt, and K. Staliunas, Nanostructured Multilayer Coatings for Spatial Filtering, *Adv. Optical Mater.*, 2001730 (2021);
37. Tetsu Magariyachi, Helena Arias, Ramon Herrero, Muriel Botey, and Kestutis Staliunas, PT-symmetric Helmholtz resonator dipoles for sound directivity, Phys. Rev. B **103**, 094201, (2021);
38. Lina Grineviciute, Julijana Nikitina, Ceren Babayigit, and Kestutis Staliunas, Fano-like resonances in nanostructured thin films for spatial filtering, Appl. Phys. Lett. **118**, 131114 (2021).
39. W. W. Ahmed, R. Herrero, M. Botey, Y. Wu and K. Staliunas, Inverse-design of non-Hermitian potentials for on-demand asymmetric reflectivity, Optics Express, **29**, 17001-17010 (2021);

40. R.A. Lymarenko, D. Gailevicius, I.Meskelaite, L. Grineviciute, M. Peckus, K. Staliunas, V.B. Taranenko, Super-collimation by axisymmetric diffractive metamirror, Opt. Lett., **46**, 3845 (2021).
41. D. Gailevičius, E. Aleksandravicius, V. Purlys, and K. Staliunas, Supercollimation of Light Beams by Axisymmetric Aperiodic Photonic Structures, Annalen der Physik. 2100235 (2021);
42. R. Grigutis, V. Jukna, M. Navickas, G. Tamosauskas, K. Staliunas, and A. Dubietis, Conical third harmonic generation from volume nanogratings induced by filamentation of femtosecond pulses in transparent bulk materials. Opt. Express **29**(24), 40633-40642 (2021)
43. Gabrielius Kontenis, Darius Gailevicius, and Kestutis Staliunas, Optical Drill, accepted (2021)
44. S.B. Ivars, M. Botey, R. Herrero, and K. Staliunas, Turbulence reduction through PT-symmetry, submitted, 2021

Most representative publications (Phys.Rev.Lett., Nature Group, Books and reviews):

1. K. Staliunas, G. Slekys, and C.O. Weiss, Nonlinear Pattern Formation in Lasers: Shocks, Domains of Tilted Waves, and Cross-Roll Patterns, Phys.Rev.Letts, **79**, 2658 (1997);
2. V.B. Taranenko, K. Staliunas, C.O. Weiss, Pattern Formation and Localized Structures in Degenerate Optical Parametric Mixing, Phys.Rev.Letts, **81**, 2239 (1998);
3. K. Staliunas, Three-dimensional Turing Structures and Spatial Solitons in Optical Parametric Oscillators, Phys.Rev.Letts, **81**, 84 (1998).
4. K. Staliunas, S. Longhi, and G. J. de Valcárcel, Faraday Patterns in Bose-Einstein Condensates, Phys. Rev. Letts. **89**, 210406 (2002);
5. K. Staliunas, Midband Dissipative Spatial Solitons, Phys. Rev. Letts, 91, 053901 (2003);
6. K.Staliunas, and V.J.Sanchez-Morcillo " Transverse Patterns in Nonlinear Optical Resonators" Springer Verlag, Springer Tracts in Modern Physics, Vol.183, 2003.
7. K. Staliunas, M. Tlidi, Hyperbolic Transverse Patterns in Nonlinear Optical Resonators, Phys. Rev. Letts, **94**, 133902 (2005);
8. K. Staliunas, O. Egorov, Yu. S. Kivshar, F.Lederer, Bloch Cavity Solitons in Nonlinear Resonators with Intracavity Photonic Crystals, Phys. Rev. Letts, **101**, 153903 (2008);
9. S. Kolpakov, A. Esteban-Martín, F. Silva, J. García, K. Staliunas, G. J. de Valcárcel, Experimental Demonstration of Hyperbolic Patterns, Phys. Rev. Letts, **101**, 254101, (2008);
10. K. Staliunas, J.M. Buldu, G.J. de Valcarcel and J. Garcia-Ojalvo, Noise-induced phase bistability via stochastic rocking, Phys. Rev. Letts, **102**, 010601 (2009);
11. G.J. de Valcárcel and K. Staliunas, Pattern formation through phase bistability in oscillatory systems with space-modulated forcing, Phys. Rev. Letts, **105**, 054101 (2010);
12. Germán J. de Valcárcel, and Kestutis Staliunas, Phase-bistable Kerr cavity solitons and patterns, Phys. Rev. A **87**, 043802 (2013). (research highlight 'Rocking phase bistability' in Nature Photonics, **7**, 423 (2013).)
13. Y.C. Cheng, S.Kicas, J.Trull, M.Peckus, C.Cojocaru, R.Vilaseca, R.Drazdys and K.Staliunas, Flat Focusing Mirror, Scientific Reports, **4**, 6326 (2014);
14. S. Kumar, R. Herrero, M. Botey, K. Staliunas, Taming of Modulation Instability by Spatio-Temporal Modulation of the Potential, Scientific Reports, **5**, 13268 (2015);
15. Lina Maigyte and Kestutis Staliunas, Spatial filtering with Photonic Crystals, Applied Physics Reviews, **2**, 011102 (2015).
16. A. M. Perego, N. Tarasov, D. V. Churkin, S. K. Turitsyn, K. Staliunas, Pattern Generation by Dissipative Parametric Instability, Phys. Rev. Lett. **116**, 028701 (2016);
17. N. Tarasov, A. M. Perego, D. V. Churkin, K. Staliunas, S. K. Turitsyn, Mode-locking via dissipative Faraday Instability, Nature Communications **7**, 12441 (2016);

18. Darius Gailevicius, Volodymyr Koliadenko, Vytautas Purlys, Martynas Peckus, Victor Taranenko, and Kestutis Staliunas, Photonic Crystal Microchip Laser, Scientific Reports **6**, 34173 (2016);
19. S. Kumar, A. Perego, and K. Staliunas, Linear and Nonlinear Bullets of the Bogoliubov-de Gennes Excitations, Phys. Rev. Letters, **118**, 044103 (2017).
20. Zeki Hayran, Hamza Kurt, and Kestutis Staliunas, Rainbow trapping in a chirped three-dimensional photonic crystal, Scientific Reports, **7**, 3046 (2017).
21. Yu-Chieh Cheng, and K. Staliunas, Flat focusing mirrors, Appl. Phys. Reviews, **5**, 011101 (2018).
22. A. Perego, S. Turitsyn and K. Staliunas, Gain through losses in Nonlinear Optics", Light: Science & Applications, **7**, 43 (2018).
23. A.M. Perego, S.V. Smirnov, K. Staliunas, D.V. Churkin, S. Wabnitz, Self-induced Faraday instability laser, Phys. Rev. Letters, **120**, 213902 (2018).
24. F. Bessin, A.M. Perego, K..Staliunas, S.K. Turitsyn, A. Kudlinski, M. Conforti, and A. Mussot, Gain-through-filtering enables tuneable frequency comb generation in passive optical resonators, Nature Communications, **10**, 4489 (2019).
25. I.V. Minin, Cheng-Yang Liu, Yu-Chih Yang, K. Staliunas, and O.V. Minin, Experimental observation of flat focusing mirror based on photonic jet effect, Sci. Rep. **10**, 8459 (2020).
26. L. Grineviciute, C. Babayigit, D. Gailevičius, M. Peckus, M. Turduev, T. Tolenis, M. Vengris, H. Kurt, and K. Staliunas, Nanostructured Multilayer Coatings for Spatial Filtering, *Adv. Optical Mater.*, 2001730 (2021);

27. 1. Jiménez González, Noé. Staliunas, Kestutis, Camarena, Francisco, Sistema y método de generación de haces acústicos confocales de vórtice con superposición espacio temporal, Spanish Patent P202030766 (2020), European Patent ES2811650 (2021),

Research group:

The research group now consists of theoretical part: assist. Prof. R. Herrero, M. Botey, experimental part: assist. Prof. C. Cojocaru and J. Trull; one postdoc, plus permanently 3-4 PhD students, and 1-2 Master students in average. Presently directing/codirecting 5 PhD projects: W. Gare (Monocrom). N. Akhter (Marie Curie), S. Benadouda (FPI), G. Kontenis (Vilnius University), and M. Plukys (Vilnius University).

Research lines of the last 5 years, and present:

1. Spatial filtering. Around 10 years ago, I proposed a new idea, that photonic crystals can provide efficient spatial (angular) filtering of light. Such filtering crystals, of several micrometer thickness, potentially could be very efficient in compact micro-lasers to provide intracavity spatial filtering and to enable a high brightness emission from such micro-lasers. A successful implementation of this idea could make a breakthrough in the field of micro-lasers. Already 4 PhD projects were successfully completed on different aspects on such spatial filtering: L. Maigyte 2014, UPC, theoretical/experimental aspects, V. Purlys 2015, Vilnius University, technological aspects (fabrication), D. Gailevicius, 2019 Vilnius University, integration into microchip laser, S. Gawali 2020, UPC, integration into semiconductor laser. In spite of the advance of conceptual understanding, the technological issues (high precision 3D gratings with micrometer period on total millimeter scale) prevented from successful implementation. Recently, in collaboration with Vilnius University, we achieved a

breakthrough in fabrication technologies, developing new fabrication techniques (thin film evaporation, on micro-modulated substrates) which enabled efficient spatial filtering both in reflections and transmissions [1,2]. Presently we are at the final stage of the integration of such filters into microlasers (M-Era project, project of Spanish Ministery) in collaboration with laser companies Monocrom (Spain) on semiconductor edge emitting lasers and Optogama (Lithuania) on microchip lasers. This is a very promising line, already well developed from the conceptual viewpoint (previous promotion period), well advanced from the technological viewpoint (present promotion period), and now entering into technological implementation stage. This line resulted in 14 published papers during last 5 years.

2. Non-Hermitian field dynamics. Around 5 years ago, I proposed and developed a powerful concept of Non-Hermitian management of the fields, by proposing and applying a Local Hilbert Transform. Mathematically the Local Hilbert Transform, is a systematic procedure to manipulate locally the field flows (to create directionality flows) by local modification of the refraction index/gain/loss profile. The elegant mathematical formulation of the conceptual idea (by a bad luck the article was finally downgraded to PRA [3]), with its modifications (restricted Local Hilbert Transform, multicolor Local Hilbert Transform), was a subject of thesis of W. Ahmed in 2018. However, apart from its mathematical beauty and elegance, the idea has very high potential to manage the flows of the electromagnetic fields in broad area micro-lasers, and eventually to enhance the brightness of such lasers. The subsequent thesis of J. Medina 2021 was devoted to the applications of the idea to real lasers. Presently we solve technological issues to apply this idea to semiconductor edge emitting lasers, together with technological partners (Glasgow University UK, Ferdinand Brown Institute, Germany). The ultimate goal is the smart micropatterning of the surface of the edge emitting lasers (modulation of gain – electrodes, and the index – thickness), to realize the well controllable field flows on demand. This line resulted in 10 published papers during the last 5 years. Moreover, the concept is being applied to the field of acoustics, to create "silenced" areas, which resulted in a publication in acoustics, and in a mini-contract with Sony company, Japan (larger contract in negotiations).

3. Gain through losses. We come to that idea, together with my previous PhD student A. Perego, by attempting to interpret counter-intuitive experimental results in Aston University, with whom we closely collaborate. The experimentally measured radiation from the fiber lasers with spectrally resolved asymmetric losses, displayed an anomalous spectrally resolved parametric gain. After long brainstorming we found a very unexpected gain mechanism – the (asymmetric) losses cause the overall gain. This concept was developed and its various aspects were published in high impact index journals [4,5]. Moreover, this concept proved itself to be useful as an efficient mechanism for the frequency comb generation. Based on that idea the frequency combs were recently demonstrated in collaboration with our partners in Lille University [6], and will be further explored in the near future, among others supported by our new Horizon ITN project Mefista (Aston and Lille Universities as partners). This line resulted in 6 published papers during the 5-years.

4. Turbulence control. The Non-Hermitian action in space and time (the Non-Hermitian spatio-temporally periodic potentials), showed itself as very promising mechanism to control the flow of the energy and of enstrophy through the spatial scales of turbulence, and can serve as an efficient tool to control (to enhance, or reduce, or even to suppress) the turbulence. This is a very fascinating issue from the fundamental physics viewpoint, as it faces a very old and fundamental problem of the origin of turbulence. This is also an issue of huge practical importance, as a Non-Hermitian action can help to control the optical turbulence in micro-laser system. The Non-Hermitian turbulence control is a fundamental issue, applicable in principle to the turbulence control in general, including hydrodynamical systems. However most promising and technically realistic is the control of optical systems, as only in optics the

coherent gain is obtainable relatively easily). This line makes a basis of the thesis of new PhD students S. Benadouda (turbulence control in lasers) and N. Akhter (turbulence control in multimode fibers). Up to now this line resulted in recently submitted publications [7], and several publications being prepared.

5. Other research lines. Apart from these above main research lines on which I was focusing during the last promotion period (which also will be continued I the near future) there were several occasional studies on different issues. The collaboration with Politechnico of Valencia (common research project of Spanish Ministery) resulted in series of articles and in one patent [8] on acoustic systems on exotic beams in acoustics (acoustic drills). Collaboration with Tomsk university lead to a study on flat lensing. Collaboration with Novosibirsk led to the study on Non-Hermitian laser mode-locking. Collaboration with Vilnius University led to the study on supercontinuum generation. Around 10 articles have been published on such "occasional" studies. In particular I consider these studies as a search of new research lines, which if proven promising, to be adapted into my research group in the UPC.

The future work of my research group will basically rely on these above described research lines. The research line 1 will require coordination of technical issues, The lines 2 and 3 will require mostly experimental/technical work, of the experimental section of the group, also of the partner institutes and companies involved in the projects (Vilnius University along the 1 and 2 lines, Aston and Lille Universities along the line 3). The Non-Hermitian Turbulence control (line 4), will be first developed conceptually at the UPC, as it is somewhat still far from the direct technological applications. The acoustic part of line 2 will be developed in collaboration with Valencia Politecnica (collaborative Spanish project), and also in our experimental lab, following the mini-contract (and prepared larger contract) with Sony company.

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