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Optics in South America: introduction

Gustavo S. Wiederhecker,[1,*] S. B. Cavalcanti,[2] Adriana Fontes,[3] Jorge Garcia-Sucerquia,[4] Dario Perez,[5] Esteban Vera,[6] Andrea Bragas,[7] Christiano de Matos,[8,9] Alejandro Fainstein,[10] Daniel Felinto,[11] Debora M. B. P. Milori,[12] and Stephen P. Walborn[13,14]

[1]Gleb Wataghin Physics Institute, University of Campinas, Campinas, SP, Brazil
[2]Instituto de Física, Universidade Federal de Alagoas, Maceió AL, Brazil
[3]Departamento de Biofísica e Radiobiologia, Universidade Federal de Pernambuco, Recife, PE, Brazil
[4]Universidad Nacional de Colombia Sede Medellín, School of Physics, A.A: 3840-Medellín-050034, Colombia
[5]Instituto de Física, Facultad de Ciencias, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile
[6]School of Electrical Engineering, Pontificia Universidad Católica de Valparaíso, Valparaiso, Chile
[7]Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Física, Instituto de Física de Buenos Aires (IFIBA), CONICET-UBA, 1428 Buenos Aires, Argentina
[8]School of Engineering, Mackenzie Presbyterian University, São Paulo, SP, Brazil
[9]MackGraphe, Mackenzie Presbyterian Institute, São Paulo, SP, Brazil
[10]Centro Atómico Bariloche and Instituto Balseiro, Comisión Nacional de Energía Atómica (CNEA)-Universidad Nacional de Cuyo (UNCUYO), 8400 Bariloche, Argentina
[11]Departamento de Física, Universidade Federal de Pernambuco, Recife, PE, Brazil
[12]Brazilian Agricultural Research Corporation (Embrapa), Embrapa Instrumentation, Sao Carlos, SP, Brazil
[13]Departamento de Física, Universidad de Concepción, 160-C Concepción, Chile
[14]Millennium Institute for Research in Optics, Universidad de Concepción, 160-C Concepción, Chile
*gsw@unicamp.br

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South American optics research has seen remarkable growth over the past 50 years, with significant contributions in areas such as quantum optics, holography, spectroscopy, nonlinear optics, statistical optics, nanophotonics and integrated photonics. The research has driven economic development in sectors like telecom, biophotonics, biometrics, and agri-sensing. This joint feature issue between JOSA A and JOSA B exhibits cutting-edge optics research from the region, fostering a sense of community and promoting collaboration among researchers.

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Over the past half-century, South American optics research has flourished, with the number of articles published annually in optics-focused journals growing more than a hundredfold, exceeding 4,700 articles annually. This remarkable expansion reflects the dedication to high-quality scientific research and the growth of higher education systems across the region.

Initially guided by pioneering researchers, South American optics research now spans the entire spectrum, from quantum optics and holography to spectroscopy and integrated photonics. While optical research has taken root across the majority of the region's 13 countries, it is primarily concentrated in Argentina, Brazil, Chile, and Colombia, with other countries such as Peru and Uruguay also making great strides. As a testament to the thriving field, the biennial Latin American Optics and Photonics Conference (LAOP) has experienced consistent growth over the past decade, attracting between 200 and 300 contributions per event.

The scientific progress in optics has not only impacted academia but also stimulated local economies. Companies in sectors such as telecom, biophotonics, biometrics, and agri-sensing have played significant roles in economic development, driving the demand for highly skilled human resources in optics and photonics.

This joint feature issue between JOSA A and JOSA B showcases cutting-edge optics research from South America, covering a wide range of topics through research, tutorial, and review articles. To engage and inspire newcomers, this issue features a tutorial article on super-resolution microscopy by Fernando Stefani and coworkers [1], a tutorial article on laser-induced breakdown spectroscopy by Débora Milori and coworkers [2], and a review article on quantum spectral correlations by Marcelo Martinelli [3], reflecting the multifaceted nature of South American optics research.

This issue also presents four notable review articles on femtosecond fiber lasers [4], 2D materials infrared spectroscopy [5],

2D materials nonlinear optics [6], and the integration of plasmonics and nanomechanics [7]. In the case of femtosecond fiber lasers, it is important to recognize the contributions of various South American scientists during the golden age of Bell Labs. They played significant roles in the development of ultra-short laser pulses [8–11]. Some of these pioneers, in collaboration with emerging talents, have provided a comprehensive historical overview of ultrashort fiber lasers [4]. Another noteworthy development in the region is the recent establishment of the fourth-generation synchrotron light source, Sirius. This facility has made a significant impact on optics research by enabling the use of bright and broadband infrared light to investigate polariton dynamics in 2D materials. This advancement is detailed in a review article led by Raul Freitas and Ingrid Barcelos [5]. The exciting applications and underlying physics of the interaction between plasmonics and nanomechanics are reviewed by Andrea Bragas and coworkers [7]. The region has also played a significant and pioneering role in the area of nonlinear optics in 2D materials, which is reviewed in another paper by Christiano de Matos *et al.* [6]. Seminal work on second harmonic generation in transition metal dichalcogenides, by Leandro Malard *et al.* [12], and on 2D material saturable absorbers for laser mode locking, by Thoroh de Souza *et al.* [13], are among the reviewed developments. In addition, contributions from notable women scientists like Bragas, Milori, Barcelos, and others provide valuable insights into the breadth and depth of South American optics research, overcoming cultural barriers and promoting growth in STEM fields.

In addition to reviews and tutorial articles, the issue encompasses a diverse array of regular articles covering biophotonics, quantum and nonlinear optics, sensing, coherent light properties, spectroscopy, optical communications, imaging, integrated photonics, and more, each revealing how photonics strength is spread throughout our community.

This joint special issue aims to showcase ongoing research in South America and foster a strong sense of community among researchers, an essential aspect considering the limited investments in science and technology across the continent. This way, working in isolation is not an option, and this issue can serve as a roadmap for strengthening local bonds, promoting researcher exchanges, and highlighting the diverse areas of optics and photonics. The upcoming Latin American Optics and Photonics Conference will undoubtedly benefit from the momentum generated by this impactful special issue, encouraging collaboration and unity among the research community.

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