

## MILLENIUM INSTITUTE FOR RESEARCH IN OPTICS, **MIRO**

Impact Area: Materials for new technologies.  
Speciality: Optics.

Since the dawn of humanity, light has been an object of fascination and curiosity. Galileo, with his first telescopes, expanded our world by studying the light coming from the planets of the solar system and the most distant stars. Einstein gave us the basis of the laser, an indispensable tool in today's science, medicine and engineering, and Dirac showed us the quantum world inside light, the source of the most advanced technologies.

The Millennium Institute for Research in Optics (MIRO) aims to answer fundamental questions: what is light? What are the properties of light? Can we manipulate these properties? Can light be a source of new applications and technologies? How does light interact with matter? Can we control matter with light and vice versa?

The applications of the results are varied. Using individual photons it is possible to enter the quantum world and implement quantum cryptography schemes for inviolable communications. Likewise, light beams can be generated that bend in space and allow communication to be established through free space without distortions. New light sources can also be generated with properties that allow ultra-precise measurements to be made.

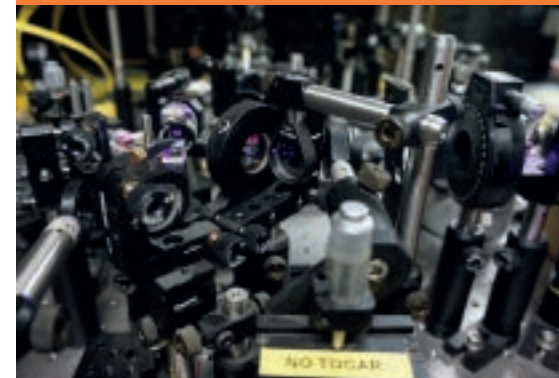
Through a network of laboratories established throughout the country and with state-of-the-art equipment, challenging experiments are carried out at the MIRO Institute and the training of new generations of scientists at the frontier of knowledge is promoted.

The results of these investigations appear in the best specialty journals in the world.

### **Research lines:**

- Quantum light.
- Optical Communications.
- New Light Sources.
- Optical Networks and Pattern Formation.

**Millennium** Institute



>> **SCIENTIFIC PRODUCTIVITY:**

ISI-WOS: 206

Books or chapters: 1





>> CONTACT:

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>> OUTREACH ACTIVITIES:

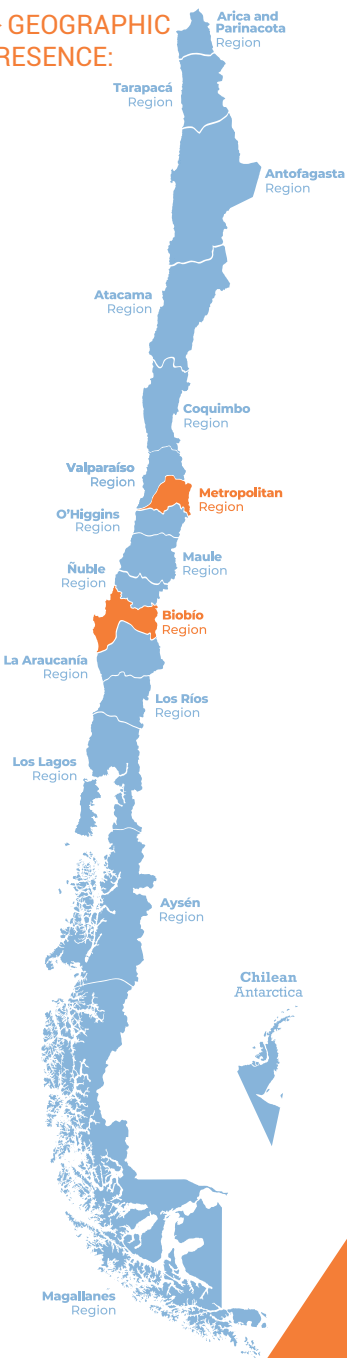
- The quantum box, journey through light: an exhibition that unites art and science to raise community awareness about the quantum nature of light. Inaugurated in April 2024, the exhibition merges with the architecture of the emblematic Biobío Theater in Concepción.
- Online Introduction to Optics Course: free, asynchronous, online course that introduces students and professionals with an interest in the area of optics.
- Stories under the light: literary contest that invites adults and high school students to write stories using light phenomena as elements of the dramatic structure of each story.
- Optics in your hands: series of tutorials on YouTube for girls and boys with focus on teaching how to do simple optics experiments, with materials found at home.

>> RESEARCHERS:

**Associate Researchers:**  
Carla Hermann, Stephen Walborn, Dinesh Patrap Singh, Felipe Herrera, Rodrigo Vicencio, Birger Seifert, Jaime Anguita, Gustavo Moreira, Marcel Clerc, Aldo Delgado.

**Junior Researchers:**  
Leonardo Vivas, Gustavo Cañas, Esteban Sepúlveda, Bastián Real, Juan Manuel García, Robert Wheatley, Daniel Uzcategui, Gabriel Saavedra, Johan Triana, Gustavo Funes, Diego Guzmán, Eduardo Peters, Pablo Solano, Rubén Fritz, Marco Rivera.

>> GEOGRAPHIC PRESENCE:



>> MAIN ACHIEVEMENTS:

- Synthesis of a metal-organic network crystal capable of generating second and third harmonics, with potential uses in quantum technologies and optics laboratories.
- Equipment for quantum information laboratories to generate, measure and control quantum light. This has made it possible to generate new protocols to transmit and encrypt information in multicore fibers, with results of interest for telecommunications and cybersecurity.
- Equipment for a laboratory that generates its own photonic networks where new ways of locating and controlling light are discovered. In the same line of research, another laboratory dedicated to the study of patterns, turbulence, chaos and other phenomena in liquid crystals was implemented.
- Implementation of an optical communications laboratory in open space with coverage of one kilometer.

**Host institutions**  
University of Concepción  
University of Chile  
University of Santiago de Chile  
University of los Andes  
Pontifical Catholic University of Chile

