

Press release

Decoding the secrets of distant worlds: Swiss collaboration to help elevate exoplanet research to new heights

- The University of Geneva (UNIGE) partners with CSEM to advance the Near Infra Red Planet Searcher (NIRPS) spectrograph, an instrument known as an exoplanet planet hunter
- CSEM develops a laser frequency comb to boost NIRPS accuracy, helping to unlock the details of distant Earth-like exoplanets
- CSEM installed the laser frequency comb in November 2023, alongside the NIRPS spectrograph at the European Southern Observatory's (ESO) La Silla Observatory in Chile
- The collaboration drives exoplanet science forward, revealing origins and habitability

Neuchâtel, December 12, 2023 – The quest to unravel the universe's mysteries takes a leap forward as the [Near Infra Red Planet Searcher \(NIRPS\) consortium](#), jointly managed by the [University of Geneva's \(UNIGE\) Department of Astronomy](#) and the [University of Montreal](#), has received a cutting-edge boost from CSEM's laser frequency comb technology. This laser frequency comb, a precise and stable light source, has now joined the instrumentation lineup at the [European Southern Observatory's \(ESO\) La Silla Observatory](#) in Chile. Its mission: to help the NIRPS consortium unlock distant planets' hidden details, including the possibility of finding traces of extraterrestrial life. Through this collaborative endeavor, humanity's grasp on the cosmos is poised to expand beyond imagination.

Delving into the mysteries of distant worlds, the NIRPS consortium is on a mission to discover the details of telluric (Earth-like) exoplanets orbiting stars beyond our reach. These “cosmic nomads” have intrigued astronomers for nearly three decades. How can we gauge their weight, measure their temperatures, and decode their atmospheres? These are the questions that drive the NIRPS consortium. As a sophisticated and highly advanced spectrograph, [NIRPS](#) analyzes the light emitted from distant stars and detects tiny variations caused by the gravitational pull of planets in their orbit.

Enhancing NIRPS with a laser frequency comb

In a seamless stride towards innovation, the NIRPS spectrograph now has a new partner: a laser frequency comb developed by CSEM, the Swiss technology innovation center. Commissioned by UNIGE, this device generates light with an exceptionally steady frequency spectrum, characterized by evenly spaced lines. It serves as an optical benchmark, aiding the measurement of a star's radial velocity—a crucial metric for understanding the speed at which stars move towards or away from us. CSEM's laser frequency comb, installed at ESO's La Silla Observatory in Chile, will now meticulously calibrate the NIRPS spectrograph to unprecedented levels of accuracy and precision. As a result, NIRPS will gain a heightened ability to determine the behavior and characteristics of Earth-like exoplanets, heralding a new era of discovery and understanding.

A triumph in high-precision spectroscopy

“CSEM's laser frequency comb technology stands as the epitome of spectroscopic accuracy and stability. This system produces a stream of equidistant laser lines locked to a molecular transition and spaced by exactly 15 GHz using electro-optic modulation—far surpassing the scope of competing technologies,” illuminates Christopher Bonzon, Manager for Laser Technologies at CSEM. “The frequency comb acts exactly like ruler in the spectral domain, providing the NIRPS spectrograph a reference to match data over the years,” Bonzon adds.

Collaborating for the future of exoplanet science

Prof. François Bouchy, Co-Principal Investigator of the NIRPS consortium, and within the Exoplanet Team at the Department of Astronomy at UNIGE, says: “We are very proud to collaborate with CSEM on this exciting project. Their laser frequency comb technology is essential for achieving the high performance and long-term reliability that we need for the NIRPS spectrograph. Together, we hope to make new discoveries and contribute to the advancement of exoplanet science.”

A milestone in the quest for life beyond Earth

The collaboration between CSEM and UNIGE represents an important milestone in the quest to comprehend exoplanets and unlock the mysteries of what lies beyond Earth. These distant worlds are not only fascinating and complex, but also reveal new insights into the origins and diversity of planetary systems. Moreover, they inspire us to think about habitable worlds and the possibility of finding signs of life.

Additional information

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About NIRPS—Near Infra Red Planet Searcher

The University of Geneva (UNIGE) is a pioneer in the search for exoplanets. It shares the role of Co-Principal Investigator (PI) of the Near Infra Red Planet Searcher (NIRPS) project with the University of Montreal. The NIRPS project is a collaboration between several international institutions to develop a near-infrared spectrograph to equip the 3.6m telescope of the European Southern Observatory (ESO) in La Silla, in the Atacama Desert in Chile. The project is an extension of the [HARPS \(High Accuracy Radial Velocity Planetary Searcher\) project](#), which was co-developed by the Geneva Observatory and several major international institutes and has discovered hundreds of exoplanets. In [2019 the Nobel Prize in Physics](#) was awarded to [Michel Mayor](#) and [Didier Queloz](#) “for the discovery of an exoplanet orbiting a solar-type star”. Mayor and Queloz were both involved in the HARPS project as members of the scientific team.

About UNIGE—University of Geneva

The University of Geneva was founded in 1559 by Jean Calvin and Théodore de Bèze and it ranks amongst the top 1% of universities in the world. It enjoys worldwide recognition and develops an ever-strengthening international network, building upon its unique situation at the heart of International Geneva, a world capital for multilateralism. As a research-intensive institution, UNIGE has been awarded numerous prizes, including Nobel prizes and Fields medals, and is an active member of the European League of Research Universities (LERU). UNIGE focuses on multidisciplinary approaches to face today’s challenges such as the digital revolution and the sustainable development goals. UNIGE welcomes about 19’000 students coming from nearly 150 different countries in its nine faculties and thirteen interdisciplinary centers embracing Sciences, Medicine, Humanities, Economics and Management, Social Sciences, Law, Theology, Psychology and Educational Sciences, as well as Translation and Interpreting. UNIGE fulfils three missions: education, research, and knowledge sharing. www.unige.ch

About CSEM—Facing the challenges of our time

CSEM is a Swiss technology innovation center developing advanced technologies with a high societal impact, which it then transfers to industry to strengthen the economy. The non-profit orientated, public-private organization is internationally recognized, and works to support the disruptive activities of companies in Switzerland and abroad. CSEM operates in the domains of precision manufacturing, digitalization, and sustainable energy. To accomplish its mission as gateway between research and economy, CSEM's 550 employees from 44 countries collaborate with leading universities, scientific institutions, research institutes, and industrial partners. With its six sites in Allschwil, Alpnach, Bern, Landquart, Neuchâtel and Zurich, CSEM is active all over Switzerland. www.csem.ch

