UNIVERSITÉ DE GENÈVE

PRESS RELEASE

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A laser will track lightning on the Säntis

Starting 18 May, a high-powered laser will be installed on the summit of Säntis. It aims at evaluating the feasibility of a laser lightning rod.

Many sensitive sites, such as nuclear power plants, power stations and other critical infrastructure may have insufficient lightning protection and their electronic systems suffer damages due to direct or nearby lightning strikes. Similarly, thunderstorms paralyze airports every year, causing delays and requiring flights to be rerouted. A European consortium now plans to investigate and develop a new type of lightning protection using a high-power laser that will create ionized channels in the atmosphere and redirect lightning away from sensitive areas. The laser will be installed on the summit of the Säntis in the canton of Appenzell (Switzerland) and it will enter a test phase from June to September, during the peak thunderstorm season. On May 18, 2021, important elements of the experiment will be installed by helicopter. The École polytechnique (Paris, France), the University of Geneva (UNIGE, Switzerland), TRUMPF Scientific Lasers (Munich, Germany), André Mysyrowicz Consulting (AMC, France), the EPFL (Switzerland), the Haute école d'ingéniérie et de gestion du canton de Vaud – HEIG-VD (Switzerland) and HES-SO (Switzerland) have joined forces to set up this European consortium.

Lightning is a fascinating but destructive manifestation of nature. The average number of persons killed by lightning every year ranges from 6000 to as many as 24000 worldwide. Lightning is also the cause of power outages, forest fires and damages to electronics and infrastructure amounting to billions of euros, making it a major societal concern. Although lightning protection techniques have seen improvements in the past, the best external lightning protection to date is still based on the lightning rod invented by Benjamin Franklin almost 300 years ago, which is an earthed metallic pole. A European consortium has set up the Laser Lightning Rod (LLR) project, which aims to explore the use of a virtual lightning rod: a high-powered laser which, by ionizing the air, creates a conductive channel aiming at deflecting lightning away from the site to be protected.

The Applied Optics Laboratory (LOA, a joint research unit CNRS, École polytechnique – Institut Polytechnique de Paris, ENSTA Paris – Institut Polytechnique de Paris), the Physics Section of the UNIGE Faculty of Science and AMC specialize in lasers, their use and the creation of ionized channels. They joined forces with the EPFL's Electromagnetic Compatibility Laboratory and HEIG-VD/HES-SO, experts in lightning diagnostics and storm protection and with TRUMPF Scientific Lasers, which developed and built the laser. Finally, the telecom operator Swisscom provides the logistics and infrastructure needed to install the laser on site in order to carry out the tests. Swisscom has a 124-meter tall transmitter on the top of the Säntis (Appenzell/St. Gallen in Switzerland), a 2502-meter tall mountain surrounded by numerous mountain lakes. The tower is one of the structures with the most lightning strikes in Europe.

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Part of the many optics of the multipass amplifier passing the laser at 800 mJ (photo taken through an infrared telescope).

High resolution pictures

A two-stage installation

The consortium has carried out its initial horizontal distance tests of this special laser, capable of creating ionized channels about a hundred metres long. After having measured its intensity in a closed hall, the laser will now be tested under real conditions.

As the summit of the Säntis can only be accessed by a limited-size cable car, the laser pointing system will have to be transported by helicopter, on May 18. The laser itself is 8-meter long and two meters wide, not including its external telescope, which allows the laser to be focused at the right distance. It will be installed inside Swisscom's facilities, in a dedicated, air-conditioned, waterproof tent.

A summer to conduct the research

From June to the end of September – the peak season for thunderstorms – researchers will direct the laser at thunderstorms and evaluate its ability to guide lightning through the heating and ionization of the local air. The laser will be directed to the top of the 124-metre high tower to guide the lightning and create a laser lightning rod that extends far into the sky beyond the conventional lightning rod at the top. Lightning measurement instruments operated permanently at Säntis by EPFL and HEIG-VD/HES-SO, together with an interferometric lightning mapping array and high-speed cameras, will provide lightning diagnostics.

If successful, the developed system will constitute a major breakthrough in lightning research with potentially profound impact on future lightning protection systems.

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