Contact: Katherine Foster
Mobile: +41 76 247 0872
Email: katherine.foster@epfl.ch

For Immediate Release

NEW CO2 TRACKER ON JUNGFRAUJOCH:

The Jungfraujoch hosts a new laser system to discern the level of human activity on greenhouse gasses.

What is the contribution of human activities on the level of carbon dioxide emissions, the main greenhouse gas? Scientists at the Empa (Swiss Federal Laboratories for Materials Testing and Research) have developed a new instrument and have since this summer been investigating this crucial question on the Jungfrau because of its unique location.

The experiment, conducted at high altitude, allows for the first time the continuous measurement of the isotopic signature of CO_2s characteristic of the main sources of carbon dioxide. This continuous 'stream measurement' is now possible because of a newly developed quantum cascade laser, which was developed by the Neuchâteloise company Alpes Lasers, a partner in the National Centre of Competence in Research – Quantum Photonics (NCCR-QP).

Transportable apparatus allows for continuous 'real-time' measurement:
Empa has created a robust and transportable apparatus to house this laser, which allows for continuous measurement on site with results automatically read and processed remotely in 'real time'. "We can evaluate our measurements made at Jungfraujoch at anytime from our laboratory situated in Zurich," said Lukas Emmenegger, a researcher at Empa. "The research we conduct will be useful to climatologists and researchers worldwide, who until now have had to rely on limited individual samples and tedious laboratory analysis. The continuous measurement of all major CO2 isotopes measurement was not possible before this new measurement technology was developed."

Jungfrau unique:

As for choosing the Jungfrau as the field location for this dexterous invention, Emmenegger states that there were two advantages: first, measurements at high altitude reflect the anthropogenic or biogenic activity on a large scale because the air mass being measured has traveled across the continent; and second, the Jungfrau already serves as a station for the National Network for Monitoring Air Pollutants (NABEL) and for the Atmospheric Research of the Global Atmosphere Watch (GAW) of the World Meteorological Organization (WMO).

Discerns isotopic signatures:

Carbon dioxide is the main gas responsible for climate change. As CO_2 is emitted by various sources – both man-made and biogenic (e.g. bacterial, animal and plant respiration) – an accurate understanding of the quantity produced by different sources is essential to developing measures to reduce emissions.

Fortunately, nature provides us with a valuable, although relatively enigmatic tool: the isotopic signature. Depending on its origin, the isotopic composition of CO_2 is slightly altered. Plants and bacteria are able to "filter" certain isotopes of carbon or oxygen in CO_2 during photosynthesis or respiration. This "selection" is also found in oil and other fossil fuels and therefore in the CO_2 produced in burning these fuels. The instrument developed by Lukas Emmenegger's group of researchers at Empa jointly with a commercial partner in the U.S. (Aerodyne Research), is capable of measuring this minute difference. Since 2007, five units have already been sold by Aerodyne research. The Empa team is also maintaining a close collaboration with Professor Leuenberger of the University of Bern who has been analyzing the isotopic composition of individual samples of CO_2 at Jungfraujoch for several years. The project was supported financially by the National Centre of Competence in Research - Quantum Photonics, Alpes Lasers SA, and the Federal Office of Environment (FOEN).

For further information or to schedule a visit or an interview please contact: Katherine Foster at +41 76 247 0872
or via email: katherine.foster@epfl.ch

New CO2 Tracker on Jungfrau: The Jungfrau is host to a new laser measure which can discern the real level of human activity on greenhouse gasses. (Images at: http://www.empa.ch/bilder/2008-11-18_Jungfraujoch/)

Supporting Documents

Profile Dr. Lukas Emmenegger

Lukas Emmenegger is a researcher and group leader at the Laboratory for Air Pollution and Environmental Technologies of Empa, the Swiss Federal Laboratories for Materials Testing and Research. His main field of research focuses on analytical methods for measurement of the composition of air pollution. He participated in the development of several spectroscopic instruments for the rapid and highly accurate detection of greenhouse gases based on the quantum cascade laser. The general aim of his research is the reduction of anthropogenic pollution based on a profound understanding of the corresponding processes and sources. Lukas Emmenegger is a member of the Swiss Chemical Society and the European Committee for Standardization (CEN). He is reviewer for several journals and funding agencies. His work is published in numerous scientific papers and regularly presented at international conferences.

On Empa

Empa is an interdisciplinary research and service institution within the ETH Domain covering selected fields of materials science and technology development including important environmental issues. Empa's R&D activities focus on the requirements of industry and the needs of society, therefore bridging the gap from sci-ence to engineering and from research to industry and society. As a result, Empa is capable of providing its partners with customized services and solutions that not only enhance their innovative edge, but also help to improve the quality of life for the public at large. Safety, reliability and sustainability of materials and systems are cross-sectional topics and a hallmark of all Empa activities. As such, Empa plays a key role in Switzerland's research and innovation landscape.

Further information can be found on the following websites:

- Home page of the Empa: www.Empa.ch
- Home page of the Laboratory for Air Pollution and Environmental Technologies at Empa: www.Empa.ch/abt134
- Home page of the research station Jungfraujoch: www.hfsjg.ch
- On the Global Atmosphere Watch (GAW) program: www.Empa.ch / gaw
- On the climate of the University of Bern: www.climate.unibe.ch

New CO2 Tracker on Jungfrau: The Jungfrau is host to a new laser measure which can discern the real level of human activity on greenhouse gasses. (Images at: http://www.empa.ch/bilder/2008-11-18_Jungfraujoch/)

On NCCR-QP

The twenty-first century is just the dawning of the age of information. Every day, new technologies appear, allowing people to communicate faster, better, and with more security. Light and quantum phenomena are critical components of these rapidly evolving developments. The mission of the National Center for Research in Quantum Photonics (NCCR-QP) a Swiss-wide network, is the basic research in areas of strategic interest for science and society, to promote education and training of photonics and to contribute to the transfer of technology to industrial partners.

Further information (in English) can be found on the following website:

- Home page PRN-QP: NCCR-qp.epfl.ch /

On Alpes Lasers

Alpes Lasers is a multinational company engaged in the manufacture and sale of semiconductor lasers for infrared telecommunications, chemical sensors and military applications. It employs 15 people in Neuchatel in Switzerland and 11 in Darmstadt in Germany, totaling more than 30 years experience in design and manufacture of quantum cascade lasers (QCL) and more than 20 years of expertise in semiconductor lasers drivers and advanced technology for epitaxial growth. It has also developed collaborations with the institutes of physical and microtech-nique of the University of Neuchatel and the Swiss Federal Institute of Zurich (ETHZ). Alpes Lasers has developed a worldwide network for representation and distribution in international markets (Europe, North America, Asia).

Further information (in English) can be found on the following websites:

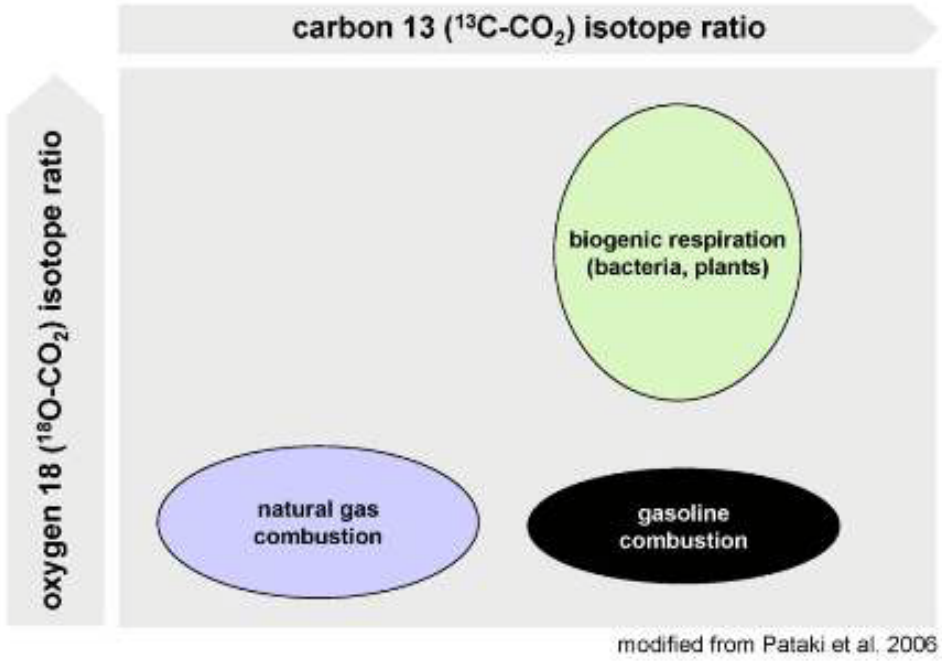
- Home Page de Alpes Laser: www.alpeslasers.ch/index.html#index_top
- Jerome Faist (Co-inventor of the laser with quantum cascade and cofounder of the Laser Alps) http://fm-eth.ethz.ch/eth/peoplefinder/FMPro?-db=whoiswho.fp5&-format=who_detail_en.html&-lay=html&-recid=36187&-findall=

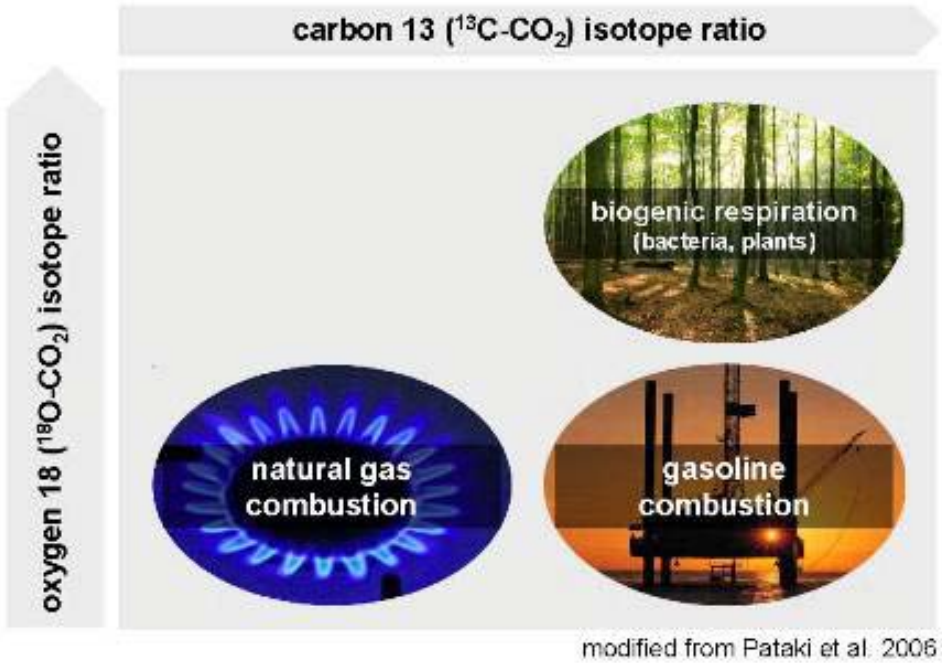
New CO2 Tracker on Jungfrau: The Jungfrau is host to a new laser measure which can discern the real level of human activity on greenhouse gasses. (Images at: http://www.empa.ch/bilder/2008-11-18_Jungfraujoch/)

Photos

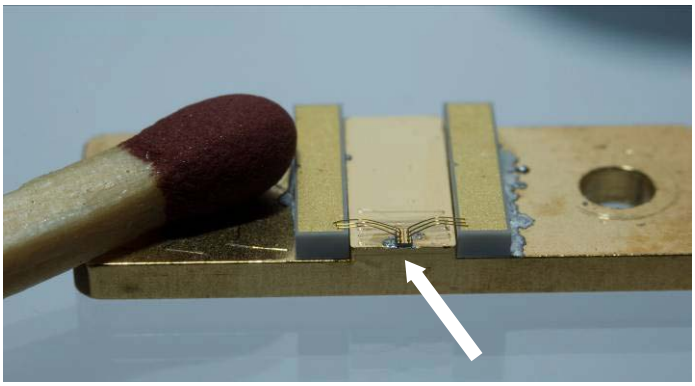
Note: The attached photographs are of low or medium resolution. Images of higher resolution in JPEG format (size 2 to 8 MB) can be downloaded at: http://www.empa.ch/bilder/2008-11-18_Jungfraujoch/.

1. Measurement location, the Jungfraujoch at 3450 m.

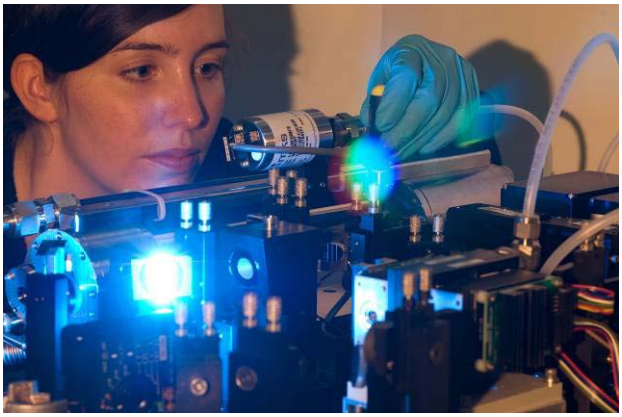




2. Typical ranges of stable carbon and oxygen isotope composition of CO_2 for important CO_2 sources (Microsoft photographs).

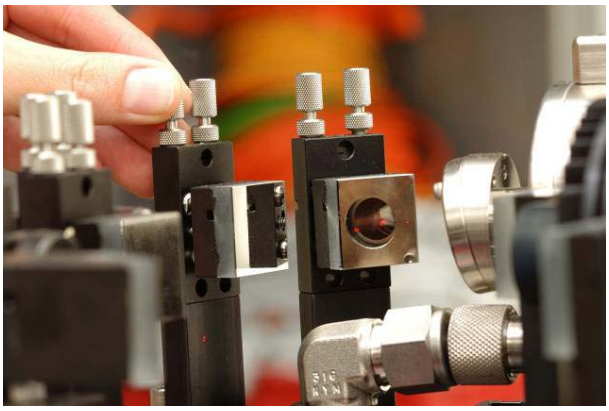


3. The quantum cascade laser (QCL). The laser beam is emitted by the divice indicated by the arrow.

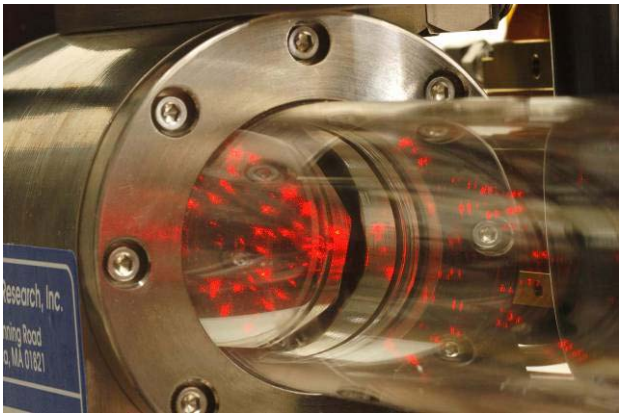


4. Alignment of the instrument's optics: this operation is critical because the sensitivity of measurement is dependent upon this alignment.

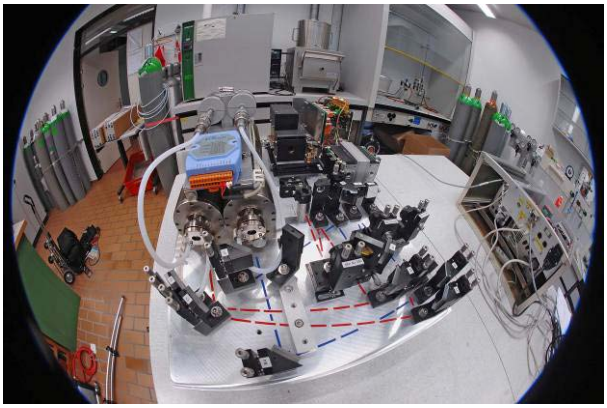
5. Assembly and adjustment of the optical system.



6. Precision alignment of the optics: The laser beam must be guided towards the measuring chamber, and then the signal is turned towards the detector. This requires a perfect control of the optical path using specialized mirrors and lenses.



7. Measuring chamber: The gas sample to be evaluated is introduced continuously (up to 10 liters/minute) and is measured through the absorption of the laser beam (visible in red on this image). The absorbed photons do not continue on the path towards the detector and are thus counted as "void", translating the presence of the corresponding gas molecule.



8. Other views of the optical instrument: the optical path is indicated by dotted lines on the optical table because the laser beam is in fact invisible (infra-red light)