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PRESS RELEASE

Seeing Infrared Differently: Frequency Upconversion Extends the Wavelength Range of Silicon Detectors

At this year's »LASER World of PHOTONICS«, Fraunhofer IPM will be presenting its systems for nonlinear-optical frequency conversion. This method enables tunable laser light sources to be built for wavelength ranges, for which no suitable laser materials have been available so far. A wavelength »range extender« will be introduced, which makes mid-infrared radiation visible by using fast silicon detectors. Visit Fraunhofer IPM at »LASER World of PHOTONICS« from June 26 to June 29 (Booth B3.327).

Experts at the German Fraunhofer Institute for Physical Measurement Techniques rely on years of experience in optical technologies to build systems based on the principle of nonlinear-optical frequency conversion for various applications. The most prominent example is tunable laser light sources, such as continuous-wave optical parametric oscillators, for wavelength ranges, for which no suitable laser materials have been available so far. Typical applications for such light sources are spectroscopy and process analytics.

6500 spectra per second in the mid infrared spectral range

Next to light generation Fraunhofer IPM is now tapping a new field of application for nonlinear frequency conversion in the area of light detection. To date, the detection of mid-infrared radiation, e.g. for the monitoring of chemical processes, requires expensive detectors with a need for cryogenic cooling. Nonlinear-optical frequency conversion allows to convert MIR radiation (e.g. in the range of 3–5 µm) into shorter near-infrared (NIR) wavelengths. NIR radiation can be detected by silicon-based detectors and cameras, which are less expensive, faster and more sensitive. This wavelength »range extender« for NIR spectrometers harnesses the advantages of simple silicon detectors for the MIR wavelength range. Of particular importance for the monitoring of highly dynamic chemical processes is the possibility to record infrared spectra with high acquisition rates. Here, classical MIR systems, such as grating and Fourier transform spectrometers, have proved to be far too slow, featuring merely 100 spectra per second.

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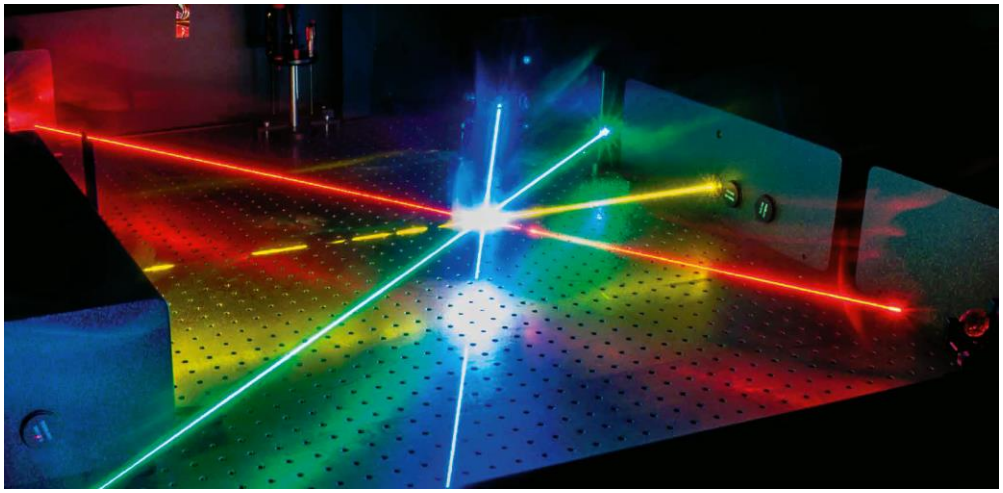
The »range extender« relies on upconversion of MIR light (3.7–4.7 µm) in a nonlinear-optical crystal with the help of a 1064-nm pump laser. From the analysis of the resulting NIR light the mid-infrared spectral information can be retrieved with high resolution (2 nm) and at a rate of 6500 spectra per second. This is fast enough to monitor in real-time the evolution of gas during the ignition of an airbag gas generator, to name an example.

Further topics

Next to nonlinear-optical frequency conversion, Fraunhofer IPM will be presenting further custom-built spectroscopy systems for process analytics, based on laser spectroscopy in the visible and mid-infrared spectral range (VIS to MIR), Raman spectroscopy or ATR spectroscopy. Talk to us at the »LASER World of PHOTONICS« fair from June 26 to 29, booth B3.327.



Nonlinear-optical frequency converters are the basis for tunable, continuous-wave laser light sources. © Fraunhofer IPM | www.ipm.fraunhofer.de/en

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