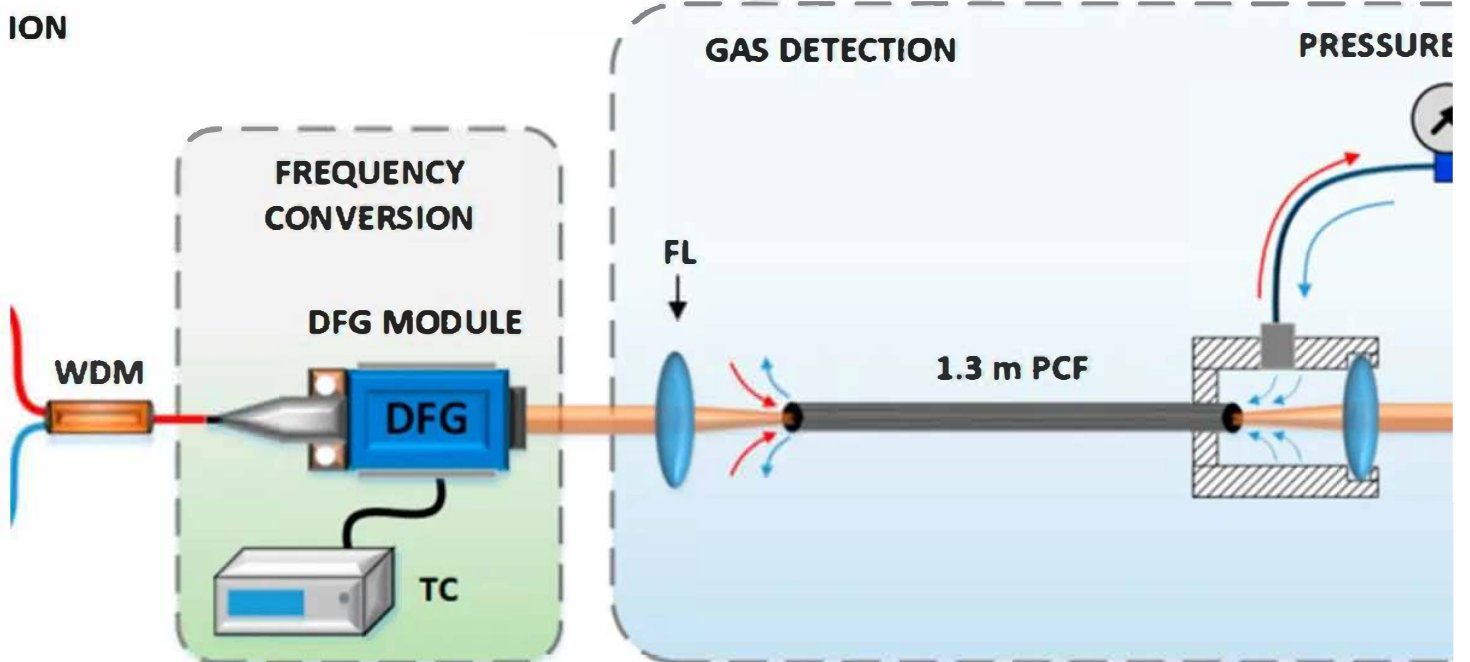




AUSTRALIA

Redefining Mid-IR Photonics: Breakthrough in Fiber-Based Ultrafast Light Source

By **Geeta Pillai** • 14 hours ago

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Redefining Mid-IR Photonics: Breakthrough in Fiber-Based Ultrafast Light Source

In a significant step forward for mid-infrared (mid-IR) photonics, researchers from Nanyang Technological University in Singapore and Australia have developed a

fiber-based ultrafast mid-IR light source. This pioneering invention addresses a critical gap in the industry, offering a compact, robust, and powerful ultrafast source in the mid-IR spectrum, thereby broadening horizons for applications in molecular detection, biomedicine, remote sensing, and telecommunications.

Unleashing the Potential of Antiresonant Hollow-Core Fibers

The groundbreaking aspect of this development lies in the utilization of antiresonant hollow-core fibers to generate record-breaking microjoule-level femtosecond pulses. These fibers, with their distinctive guiding properties, minimize transmission loss, paving the way for the production of **intense pulses** with high photon flux mid-IR supercontinuum sources. This ability to identify molecules with exceptional sensitivity elevates its worth for a range of applications, from molecular detection to biomedical analysis.

Shattering the Limits with Hollow-Core Fibers

Breaking away from conventional methods that rely on solid-core fibers, the use of hollow-core fibers sets this breakthrough apart. By accurately controlling the emission wavelengths and efficiently converting near-infrared laser pulses to the mid-IR region through the manipulation of the fiber's microstructures, the researchers successfully achieved femtosecond pulses centered at a wavelength of $3.16 \mu\text{m}$, with pulse energy exceeding $1 \mu\text{J}$. This monumental achievement places this technology at the forefront of mid-IR photonics.

Expanding Horizons: From Laboratories to Outdoor Environments

The fiber-based platform's compatibility with outdoor environments opens up possibilities for detecting harmful gases and chemicals or noninvasively monitoring an individual's health by analyzing their exhaled breath. This broadens the potential impact of the technology across industries and scientific research.

Moving forward, the researchers are set on enhancing the laser conversion efficiency and extending the mid-IR pulses to longer wavelength regions by modifying the fiber's cross-sectional geometry. This commitment to continual improvement and expansion of the technology's capabilities sets the stage for even wider applications and potential advancements in scientific research and innovation.

Overall, this breakthrough in fiber-based ultrafast mid-IR light source technology could significantly reshape various industries and contribute to significant advancements in scientific research and innovation. The compactness, robustness, and high power of this technology make it a transformative force in the mid-IR photonics field, with far-reaching implications for applications in molecular detection, biomedicine, remote sensing, and telecommunications.