

Pulse Picking Device for Sensitivity Improvement of Nonlinear Optical Imaging

Boosts chemical and biological microscopy sensitivity up to 1000× while reducing photodamage

Researchers at Purdue University have developed a pulse-picking device to improve the sensitivity of nonlinear microscopy technologies. When compared to conventional techniques, enhancements of sensitivity of up to 1000x for pure chemical samples and 250x for biological samples were demonstrated using the same input laser power. This approach is compatible with coherent anti-Stokes Raman scattering microscopy along with multiple other modalities. This technology can be integrated into most commercial or lab-built nonlinear optical microscopes. The primary applications of this innovation are in the chemical analysis of biological samples and label-free identification of chemicals in the pharmaceutical and biochemical industries.

Advantages

1000x sensitivity improvement for pure chemical samples using coherent anti-Stokes Raman scattering

250x sensitivity improvement for biological samples using coherent anti-Stokes Raman scattering

20x sensitivity improvement for two-photon excitation fluorescence and second harmonic generation microscopy

Reduction in photodamage to biological samples

Can be integrated into commercial or lab-built optical microscopes

Applications

Technology ID

2021-ZHAN-69513

Category

Digital Health & Medtech/AI in
Medical Imaging
Materials Science &
Nanotechnology/Nanomaterial
Characterization & Imaging Tools
Biotechnology & Life
Sciences/Analytical & Diagnostic
Instrumentation

Further information

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Nonlinear optical imaging via coherent anti-Stokes Raman scattering, second harmonic generation, sum-frequency generation, and multiphoton fluorescence microscopy modalities

Pharmaceuticals (label-free chemical identification)

Biochemistry (analysis of biological samples for biofunction or disease progression)

Technology Validation:

This technology has been validated by integrating the technology into an existing laser scanning microscope and comparing the performance to conventional approaches. This technology demonstrated a signal-to-noise (SNR) improvement of over 1000 times for the coherent anti-Stokes Raman scattering.

TRL: 4

Intellectual Property:

Provisional-Patent, 2021-09-24, United States

Utility Patent, 2022-09-26, United States

Keywords: Chemistry and Chemical Analysis, nonlinear optical imaging, Optical, Optical Microscopy, Optoelectronics, Pharmaceuticals, pulse picking device